Selected Translated Abstracts of Chinese-Language Climate Change Publications

Institute of Geography
Chinese Academy of Sciences

Atmospheric Sciences Research Center
State University of New York at Albany

Carbon Dioxide Information Analysis Center
Oak Ridge National Laboratory

May 1999
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Selected Translated Abstracts of
Chinese-Language Climate Change Publications

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中文气候变化研究论文选摘

中国科学院地理研究所
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编 辑

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Abstract


This report contains English-translated abstracts of important Chinese-language literature concerning global climate change for the years 1995–1998. This body of literature includes the topics of adaptation, ancient climate change, climate variation, the East Asia monsoon, historical climate change, impacts, modeling, and radiation and trace-gas emissions. In addition to the bibliographic citations and abstracts translated into English, this report presents the original citations and abstracts in Chinese. Author and title indexes are included to assist the reader in locating abstracts of particular interest.

葛全胜，张丕远，刘秀萍，张雪芹，陈缓，彭桂堂，郑景云，王维强，罗伯特·M·卡斯曼，马伟尔·D·博帝斯，1999，中文气候变化研究论文选摘，ORNL/CDIAC-117，
美国奥克瑞奇国家实验室CO₂信息分析中心，共369页。

本文摘收集了有关学者在1995-1998年间以中文发表的全球气候变化主要研究论文。内容涉及：古气候变化，历史气候变化，现代气候变化，东亚季风，气候变化的影响，气候变化的模拟，痕量气体排放与辐射，全球气候变化的适应对策等8个方面。本文摘以中英文对照形式编排，同时刊出这些论文的中英文摘要以及论文出处。为方便读者，本文摘的最后一部分还列出了作者与文章名的索引。
Introduction

On 19 August 1987, the U.S. Department of Energy and the People’s Republic of China’s Academy of Sciences signed Annex III to the Protocol on Fossil Energy Research and Development on Cooperation in the Field of Atmospheric Trace Gases. This formal agreement followed two years of informal scientific exchanges to further research on the global and regional climate changes that could result from fossil-fuel combustion. Research under the agreement comprises four tasks: (1) analysis of climate models; (2) preparation and analysis of paleo-, historical, and modern instrumental climate data; (3) comparisons between model output and data to study the relationship between large- and regional-scale climate; and (4) measurement of emissions to the atmosphere from rice paddy fields. The background to this agreement and progress resulting from the joint research program are described by Koomanoff et al.\textsuperscript{1} and Riches et al.\textsuperscript{2}

Whereas much of the Chinese literature on climate change, including that resulting from the bilateral agreement, is available in English to western researchers (e.g., Zhang\textsuperscript{3}), other important Chinese-language literature is not. The purpose of this compilation is to acquaint western climate researchers with the wealth of recent Chinese climate-change literature by providing translations into English of the abstracts of Chinese-language literature (published between 1995 and 1998), in the areas of adaptation, ancient climate, climate variation, the East Asia monsoon, historical climate change, impacts, modeling, and radiation and trace-gas emission.

On behalf of the Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory, the Atmospheric Sciences Research Center (ASRC) of the State University of New York at Albany, and the Institute of Geography of the Chinese Academy of Sciences, we thank Fred Koomanoff and Mike Riches of the U.S. Department of Energy, Office of Energy Research, who developed and directed the joint agreement on behalf of the United States; Zhao Jianping of the Chinese Academy of Sciences, who developed and directed the joint agreement on behalf of the People’s Republic of China; and Linda O’Hara of ORNL Publishing Services, who edited the English-language abstracts in this report.

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May 1999


1987年8月19日，美国能源部与中国科学院签署了《化石能源研究与发展协定》第三个附件“大气痕量气体领域合作研究备忘录”。其后两年，随着双方在化石燃料燃烧导致的全球与区域气候变化研究领域的交流与合作研究不断深入，双方签署了正式的合作研究协议。该协议的研究内容包括：（1）气候模式的诊断分析；（2）古气候资料、历史气候资料及现代气候资料的整理与分析；（3）全球与区域的气候关系及模式结果与资料之间的对比分析；（4）稻田排放监测。有关该协议的背景、细节与其它合作研究进展，Koomanoff等和Riches等已有另文论述。

虽然已有一些中文的气候变化研究文献，包括上述协议的合作研究成果，已被译成可供西方学者参阅的英文（如张学洪，1990），但其它的大部分同类研究仍主要以中文发表。编辑本文摘的主要目的是：通过编译1995年以中文发表的全球气候变化（特别是古气候变化，历史气候变化，现代气候变化，东亚季风，气候变化的影响，气候变化的模拟，痕量气体排放与辐射，全球气候变化的适应对策等）主要研究论文摘要，让西方的气候变化研究学者能够全面了解中国的气候变化研究进展，进一步促进中西间的学术交流。

在此，我们代表美国奥克瑞奇国家实验室环境科学部CO₂信息分析中心，美国纽约州立大学奥尔巴尼校区大气科学研究中心和中国科学院地理研究所，对美国能源部能源研究办公室的Fred Koomanoff和Mike Riches（倡议并签署上述合作协议的美国代表），中国科学院的赵剑萍（倡议并签署上述合作协议的中国代表），ORNL出版社的Linda O’Hara（本文摘的英文责任编辑）表示感谢。

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一九九九年五月


1. Acta Meteorologica Sinica*
   (started in 1925, quarterly)
   Sponsored by Chinese Society for Meteorology
   Published by Meteorological Press
   Domestic Periodical No. ISSN 0577-6619
   CN 11-2006/P
   International periodical No. Q329

2. Quarterly Journal of Applied Meteorology*
   (started in 1990, quarterly)
   Sponsored by Beijing Meteorological Research
   Center, Chinese Academy of Meteorological
   Sciences

3. Scientia Atmospherica Sinica*
   (started in 1976, bimonthly)
   Sponsored by Institute of Atmospheric Physics, Chinese
   Academy of Sciences
   Published by Science Press
   Domestic Periodical No. ISSN 0254-0002
   CN 11-1765/04
   International Periodical No. BM 56

4. Plateau Meteorology*
   (started in 1982, quarterly)
   Sponsored and published by Lanzhou Institute of
   Plateau Atmospheric Physics, Academia Sinica
   Domestic Periodical No. ISSN 1000-0534
   CN 62-1061
   International Periodical No. Q808

5. Agricultural Meteorology*
   (bimonthly)
   Sponsored by Institute of Agrometeorology, Chinese
   Academy of Agricultural Sciences
   Domestic Periodical No. ISSN 1000-6362
   CN 11-1999/S

6. Journal of Tropical Meteorology
   (started in 1985, quarterly)
   Sponsored by Guangzhou Inst. of Tropical Marine
   Meteorology
   Published by Meteorological Press
   Domestic Periodical No. ISSN 1004-4965
   CN 44-1326/P
   International Periodical No. Q4099
Journals Cited

7. *Environmentia Atmospherica Sinica* *(started in 1986, bimonthly)*
   Sponsored by National Bureau of Environmental Protection

8. *Meteorological Monthly* *(started in 1975, monthly)*
   Sponsored by the State Meteorological Administration
   Published by Meteorological Press
   Domestic Periodical No. ISSN 1000-0526
   CN 11-2282/P
   International Periodical No. M-432

9. *Acta Geographical Sinica* *(started in 1934, bimonthly)*
   Sponsored by Chinese Society of Geography
   Institute of Geography, Chinese Academy of Sciences
   Published by Science Press
   Domestic Periodical No. ISSN 0375-5444
   CN 11-856/P
   International Periodical No. BM81

10. *Geographical Research* *(started in 1982, quarterly)*
    Sponsored by Institute of Geography, Chinese Academy of Sciences
    Published by Science Press
    Domestic Periodical No. ISSN 1000-0585
    CN 11-1848
    International Periodical No. Q746

11. *Scientia Geographica Sinica* *(started in 1981, quarterly)*
    Sponsored by Changchun Institute of Geography, Academia Sinica
    Published by Science Press
    Domestic Periodical No. ISSN 1000-0690
    CN 22-1124/P
    International Periodical No. Q688
12. **Tropical Geography***
(started in 1981, quarterly)
Sponsored by Guangzhou Institute of Geography
Published by Guangdong Science and Technology Press
Domestic Periodical No. ISSN 1001-5221
    CN 44-1209/N
International Periodical No. Q896

13. **Arid Land Geography***
(started in 1978, quarterly)
Sponsored by Xinjiang Institute of Geography, Chinese Academy of Sciences
Published by the editorial staff of Arid Land Geography
Domestic Periodical No. ISSN 1000-6060
    CN 65-1104/P
International Periodical No. Q4667

14. **Quaternary Sciences***
(quarterly)
Sponsored by Chinese Committee for Quaternary Sciences Research & Institute of Geology, Chinese Academy of Sciences
Published by Science Press
Domestic Periodical No. ISSN 1001-7410
    CN 11-2703/P

15. **Journal of Glaciology and Geocryology***
(started in 1975, quarterly)
Sponsored by Chinese Society of Glaciology and Geocryology & Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences
Published by Science Press
Domestic Periodical No. ISSN 1000-0240
    CN 62-1072/P
International Periodical No. Q440

16. **Journal of Desert Research***
(started in 1975, quarterly)
Sponsored by Institute of Desert Research, Chinese Academy of Sciences
Domestic Periodical No. ISSN 1000-694X
    CN 62-1070/P
Journals Cited

17. Journal of Arid Land Resources & Environment
   (started in 1987, quarterly)
   Sponsored by Committee for Arid and Half-Arid
   Land Research, Chinese Society of Natural
   Resources, National Sand Promotion Fund Committee
   Domestic Periodical No. ISSN 1003-7578
   CN 15-1112

18. China Environmental Sciences*
   (started in 1989, bimonthly)
   Sponsored by Chinese Society for Environment
   Domestic Periodical No. ISSN 1000-6923
   CN 11-2201/X

19. Acta Scientiae Circumstantiae*
   (started in 1981, quarterly)
   Sponsored by the Committee of Environmental
   Science, Chinese Academy of Sciences
   Published by Science Press
   Domestic Periodical No. ISSN 0253-2468
   CN 11-1843
   International Periodical No. Q410

    (started in 1983, quarterly)
   Published by Science Press
   Domestic Periodical No. ISSN 1001-9332
   CN 21-1253/Q

21. Acta Oceanologica Sinica*
    (started in 1979, bimonthly)
   Published by Chinese Oceanology Press
   Domestic Periodical No. ISSN 0253-4193
   CN 11-2055/P
   International Periodical No. BM 361

22. Chinese Science Bulletin*
    (started in 1950, half monthly)
   Sponsored by the Chinese Academy of Sciences
   Published by Science Press
   Domestic Periodical No. ISSN 0023-074X
   CN 11-1784/N
   International Periodical No. M40B
23. Science in China*
(Started in 1950, monthly)
Sponsored by the Chinese Academy of Sciences
Published by Science Press
Domestic Periodical No. ISSN 1000-3134
CN 11-1788/N
International Periodical No. M40B

24. Earth Science Frontiers
(Started in 1994, Quarterly)
Sponsored by China University of Geosciences
Domestic Periodical No. ISSN 1005-2321
CN 11-3370/P

25. Scientia Meteorologica Sinica
(Started in 1982, Quarterly)
Sponsored by Jiangsu Society for Meteorology

*Core journals in Chinese

The relationship between zonal differences in river runoff and climatic index in monsoon-influenced China is analyzed. The analysis examines the regulation of runoff according to changes in latitude and longitude. Through the comparison of the influence and intensity of human activities on river runoff of different zones, it is concluded that water resources should be protected and that water-saving measures should be carried out in semi-arid regions.

Keywords: zonality of river runoff, influence of human activities on runoff, comparative study, China


On the basis of analyses of climatic factors that affect growth of walnuts, the paper provides suggestions for the reasonable utilization of the climatic resources.

Keywords: walnut, climatic resources, utilization
郭建平，1995．东北地区农业气候生产潜力及其开发利用对策，气象，21(2):3-9

本文根据东北地区100个气象台站1971—1990年气象和产量等资料研究了东北地区主要粮食作物的气候适应性和气候生产潜力。结果表明，东北地区中部平原区的气候生产潜力较高，50°N以北地区和东部长白山天池附近最低。文章还用线性规划对东北地区部分县的主要农作物结构提出调整意见。
关键词：东北地区 生产潜力 结构调整 对策


The climatic adaptability and potential productivity of main grain crops are studied using documents of meteorology and crop yield from 100 meteorological stations in Northeastern China between 1971 and 1990. The climatic productive potentiality is higher for the middle plain of Northeastern China and is lowest to the north of 50° N and in regions near Tianchi Lake of Changbaishan Mountain. Lastly, structural adjustments of main crops in some counties of Northeastern China are pointed out using linear programming.

Keywords: Northeastern China, productive potentiality, structural adjustment, countermeasure

胡斯权，黄大文，张儒林，1995．南海北部热带气旋向突变的气候特征，气象，21(8):23-25

本文根据1970－1990年进入预报研究区（15°－25°N，125°E以西）的热带气旋向变化情况，分析向发生突变的季节变化与地理分布等方面的气候特征。通过对热带气旋向的突变与副热带高压活动、海岸地形关系的研究得到一些有意义的结果，为寻找预报判据提供了气候特征的依据。
关键词：热带气旋 移向突变 气候特征


Based on data (1970 to 1990) of tropical cyclones with sudden changes in direction that entered the area of concern (15 to 25° N, Western of 125° E), climatic features, such as seasonal and geographical distributions, are shown. The relationships between the sudden change in track and the activity of a subtropical high and terrain factors are discussed. The results are helpful in forecasting sudden change in track of tropical cyclones.

Keywords: tropical cyclone, sudden change in track, climatic feature
The dual nature of the climatic resources of oases and their tendency to change are analyzed in the paper. The author discusses the great climate production, the latent capacity, and the fragile ecological environment of oases. According to the features of the oasis climatic resources, some strategies for oasis development are suggested.

Keywords: oasis, climatic resources, oasis construction

Ancient Climate Change


The paper presents an analysis of the ancient environment of lacustrine deposit formed in the Late Quaternary in Bihenyin, Qinglong County, southwest Guizhou Province. From 30 ka BP to 20 ka BP, the annual mean temperature was 1-6°C lower than that of today, mixed deciduous broadleaf and coniferous forests were growing on the hill land, with little variation between deciduous broadleaf forest and mixed coniferous forests. From 30 ka BP to 26 ka BP, the annual mean temperature was 2 to 6°C lower than that of today and there were mixed deciduous broadleaf and coniferous trees with a high proportion of Fagus. Around 23 ka BP, the temperature was 1-3°C lower than that of today, and there were mixed deciduous and evergreen trees. From 26 ka BP to 23 ka BP, and after 23 ka BP, the mixed broadleaf and coniferous forests were growing there. After that period, the climate turned dry and cold and pteridophyte grew widely. In the full glacial period, lacustrine deposition stopped and was replaced by the chaotic sediments of mud and gravel.

Keywords: Bihenyin, Late Quaternary system, Paleoenvironment, pollen and spore
Dong Guangrong et al. 1995. The desert and sandy land evolution and climatic changes in the north of China since 150 ka BP. Science in China (Series B) 25(12):1302-1312.

On the basis of the characteristics of the climate belt, level of dune moving, and deposit of stratum, the authors divide the desert and sandy land of the north of China into four regions. These are eastern part, western part, middle part, and northwestern part. The authors also discuss desert evolution, sandy land evolution, and climatic changes for 150 ka BP in the North of China in time and space.

Keywords: desert, sandy land evolution, climatic changes


The authors analyzed the variation feature of \(\delta^{18}O\) in the Qinghai-Xizang Plateau and the relationship between \(\delta^{18}O\) and regional weather factors. The results show that there are positive relations between \(\delta^{18}O\) and temperature. The amounts of \(\delta^{18}O\) are changeable with temperature and precipitation.

Keywords: Qinghai-Xizang Plateau, \(\delta^{18}O\), temperature, precipitation
Bai Guangrun. 1995. Humid and arid fluctuation during the last 10,000 years reconstructed from the peat formation in eastern China and Japan. Scientia Geographica Sinica 15(1):30-38.

Based on an analysis of the relationship between present peat distribution and the climatic condition of peat formation, a model was set up to explain the relationship between peat distribution and humid and thermal conditions: $Z = 5.7K + 12 - T$. Humid and arid fluctuations during the last 10,000 years are reconstructed according to the research.

Keywords: hydrothermal system index of peat formation, historical evolution of peat distribution, humid and arid fluctuation


According to data of grain-size variation, chemical element composition, pollen-spore assemblage, and rhinoceros fossils that were included in Holocene deposits of Otingdag sandy land, the climate of the Holocene is divided into eight cycles and three evolutionary stages, namely, a temperature-rising fluctuation period from 10 to 7.1 ka BP, and a warm period from 7.1 to 3.2 ka BP, and warm-dry and cool-dry fluctuation period from 3.2 ka BP to the present.

Keywords: Otingdag sandy land, Holocene, sandy paleosol, climatic cycle, environmental evolution

On the basis of the susceptibility-rainfall conversion function and data of the determination of the magnetic susceptibilities of typical Holocene loess-paleosol profiles in different areas of the Loess Plateau, the suitable climatic period of Holocene and the rainfall distribution of the Loess Plateau and Loess-Desert transitional areas were preliminarily reconstructed.

Keywords: Holocene, Paleoclimatic element, susceptibility, Loess


Affected by the shifting East Asia Monsoon, the Badain Jaran Desert has undergone a series of changes characterized by fluctuation. The tendency of evolution of the desert is governed by its glacier climate. The uplift of Qinghai-Xizang Plateau reduces humidity and makes the temperature lower in the area.

Keywords: Badain Jaran Desert, evolution, Late Pleistocene, eolian sand
崔之久等. 1995. 昆仑山垭口区新石器时代人类活动遗迹的发现及其环境意义，科学通报，40(7):624-627

本文依据昆仑山垭口区新石器时代人类活动遗迹的特点，研究了古代气候和环境变迁，得出气候变迁影响着人类活动。由此，作者认为，高山区冷期可能长而稳定，由冷变暖缓慢，暖期较短，转入冷期较快。
关键词：昆仑山垭口 古代人类灰烬层

施雅风，郑本兴等. 1995. 青藏高原中东部最大冰期时代高度与气候变化环境探讨，冰川冻土，17(2):97-112

本文应用多种资料推断出最大冰期出现时间相当与深海氧同位素18-16阶段（0.72-0.52MaBP），当时青藏高原低于现代1000m左右，在唐古拉山、阿尼玛卿山、果洛山与稻城海马子4个山区，冰川面积达4000Km²，为现代冰川面积的18倍，平衡线高度为3450-4250m，夏季平均温度为2.3-3.4℃，年降水量为1260-1960mm，是现代平衡线上降水量的1.8-3.2倍。
关键词：最大冰期 青藏高原抬升气候


Based on the characteristics of traces of human activities of the New Stone Age in Kunlun Pass, the authors studied ancient climate and environmental changes and believes that human activities were affected by environmental changes. On that basis the author concluded that the alpine cold period was long and steady and turned warm slowly; the warm period was short and turned more quickly to the cold period.

Keywords: Kunlun Pass, ancient human being, ashes layer


Based on various data, the authors analyzed the altitude and climatic environment during Quaternary maximum glaciation. The results indicate that the time of the appearance of the Quaternary maximum glaciation corresponds to the deep sea core oxygen isotopic stages 18-16 (0.72 to 0.52 MaBP). At that time the height of the Plateau was approximately 1000 m lower than that at present; the total glacierized area of Tanggular, A'nyemaqen, Gologrand, and Daocheng Haizi was 4000 km²; 18 times larger than that at present, the equilibrium line altitude varied from 3450 to 4250 m, the average air temperature in summer varied from 2.3 to 3.4° C, and the annual precipitation varied from 1260 to 1960 mm, 1.8 to 3.2 times more than that at present at the equilibrium line altitude.

Keywords: Quaternary maximum glaciation, climate, uplift of Tibetan Plateau

According to the pollen records from Zoige, the climate in this area fluctuated frequently between warm and cold, coinciding with global changes during the last 20,000 years. The authors analyze the roles of the climatic change from warm to cold in detail.

Keywords: pollen records, Zoige, climate change


Data suggest that the Tibetan Plateau was inundated by ice. The ancient ice sheet can be divided into two ages: early stadium (100 to 30 ka BP) and late stadium (20 to 10 ka BP) of the Last Glaciation. In addition, problems concerning the dividing method of the glacier and the formation condition of the ice-sheet are discussed.

Keywords: ice sheets landforms, coalescing ice-sheet, Last Glaciation, Tibetan Plateau
Climate Variation


The patterns of global temperature and sea level pressure during four special periods (1906-1915, 1936-1945, 1966-1975, and 1979-1988) are studied in the article. The results of harmonic analysis on zone temperature field show that the ultra-long wave was active during the warm winter period.

Keywords: sea-surface temperature, sea level pressure, harmonic analysis, temperature anomaly


The relationship between the Antarctic ice sheet and global change, including sea-level changes, was analyzed. The global change information derived from the ice sheet is unique because of its wide range of direct and proxy measures, long time-scale, and high resolution and fidelity. More widespread international and multidiscipline cooperation will be emphasized in future research programs.

Keywords: Antarctic ice sheets, global change, environmental climatic record, sea level change, atmospheric circulation
周震，1995，天山北坡中段气候垂直分异研究，干旱区地理18(2):52-60

本文根据天山北坡中段气候要素垂直分布差异、热量和水分指标以及植被和土壤的垂直分布差异，将天山北坡中段划分出四个垂直气候带：（1）山前冲积扇、冲积平原温带；（2）中低山寒温带；（3）亚高山－高山寒带；（4）高山冰雪带。关键词：天山北坡中段气候要素垂直分布 垂直气候带


On the basis of the outstanding differences in the vertical distribution of climatic elements, the indexes of heat and moisture, and vertical distribution of vegetation and soil, the middle part of northern slope of the Tianshan Mountains can be divided into four vertical climatic zones: (1) Front mountain-alluvial plain temperate zone; (2) low-middle mountain cold-temperate zone; (3) sub-high and high mountain frigid zone; and (4) high mountain snow-ice zone.

Keywords: middle part of northern slope of Tianshan Mountains, vertical distribution of climatic elements, vertical climatic zone

周子康，刘为伦，1995，浙江台风（热带风暴）灾害的若干特点，地理研究，14(2):56-63

本文根据1949－1992年的气象、水文和灾害资料分析了浙江台风灾害的五个特点：1、台风日期与天文大潮期相遇机率高，使得沿海地区潮灾严重；2、台风大风是浙江沿海城市台风灾害危害的主要之一，且其危害具有连锁反应倾向；3、直接和继发性灾害叠加是台风对浙江农业灾害的特点；4、台风灾区的地理分布具有山脉走向性；5、台风重灾年呈阶段性年际分布。

关键词：台风 灾害


From an analysis of the data of atmosphere, hydrology, and disaster during 1949-1992, the characteristics of the typhoon disaster in Zhejiang Province are as follows: (1) Typhoon often have a high coincidence with the astronomical spring tide and bring heavy tide damage to the coastal areas of Zhejiang Province. (2) Typhoon is one of the main causes of disasters of coastal city in Zhejiang. (3) The conjunction of direct damage and successive damage is the characteristic of the damages to agriculture caused by typhoons. (4) The distribution of typhoon disaster regions has the characteristics of paralleling to the mountain ranges. (5) The distribution of heavy disaster years caused by typhoons in Zhejiang has a periodic character.

Keywords: typhoon, disaster

Based on historical data, the authors considered that the conflict between the quick growth of population and the shortage of cultivated land, and climate change and its negative impact on agriculture played a special role in triggering the outbreak of the Taiping Rebellion (1851-1864).

Keywords: population pressure, climate change, Taiping Rebellion


According to the records of sunny and rainy days in Xu Xiake’s Travels, there was continuous heavy rain in 1638. No such extra-long autumn rains are recorded in the present meteorological records of the central part of Yunnan. This study provides materials for research of global changes.

Keywords: Xu Xiake, extra-long heavy rain

The authors discuss the regional characteristics and correspondence between periodical linkage and celestial activities. There is a close periodical correspondence between climate and celestial activities. There are also strong regional characteristics in both the impacts of celestial activities on Earth’s climatic system and in the responses of regional climate to celestial activities.

Keywords: climate periodicity, celestial activity, regional characteristics


According to the analysis of meteorological data in February and March from 1951 to 1990 at the 48 stations in South China, the authors discuss climate features of spring cool damage in detail. The results show that: (1) Spring low-temperature disaster is concentrated in February toward the south of China and increases with increasing latitude and height above sea level. (2) The interannual fluctuations of beginning and ending date of spring cool damage vary greatly. (3) The dominating pattern is moist-cool for spring cool damage and is a mixed pattern of moist-cool as well as dry-cool pattern in turn. (4) The peak values of pentad frequency of spring cool damage show an oscillation.

Keywords: South China, spring, low temperature with cool damage

There was plentiful precipitation in both south and north China in 1994, whereas the middle part was dry. There were two rainy belts in north and south China. The temperature of most of the country was higher than normal. In general, the climate of the year was a little worse than normal condition.

Keywords: weather/climate, climate of the year


The analysis of general circulation features over the Northern Hemisphere in 1994 shows that: (1) The subtropical high over the west Pacific extends west, is stronger than normal, and moves northward abnormally in midsummer. (2) It is dominated by Eurasian zonal circulation, and the Polar vortex in the Northern Hemisphere is weaker in strength than normal and shrank to the area of the pole. (3) In the mid-latitude of East Asia, high-pressure systems keep stable in summer, and the westerly frontal zone moves northward. (4) The South Asia high is stronger in summer, farther to the northward than normal and extents to the east. (5) An El Niño event is forming over the tropical Pacific. The abnormality of both the atmospheric circulation and the tropical ocean exerts a significant impact on the weather and climate in China.

Keywords: circulation, El Niño, weather and climate

本文分析了1994年世界气候概况。总的来说，这一年世界气候普遍偏暖，有些地区的平均气温比常年偏高0.5-1.0℃，北半球中纬度地区夏季受高温热浪冲击。年内全球旱、涝频繁，在澳大利亚和印度尼西亚等地区发生的干旱自1991年来已持续了4年，这与1991年来发生的长厄尔尼诺/南方涛动事件紧密相关。
关键词：世界气候 热浪 厄尔尼诺/南方涛动


The world climate was generally warmer than normal in 1994. Large sections of the middle latitudes in the Northern Hemisphere were hit by heat waves during this summer. Many regions experienced climate events such as severe drought or serious flood, frequently in some areas of the world. In Australia and Indonesia the persistent droughts were associated with the long El Niño Southern Oscillation (ENSO) events that have occurred several times since 1991.

Keywords: the world climate, heat wave, ENSO

赵振国, 陈国珍. 1995. 对流层月平均环流的持续性，气象，21(5):3-8

本文分析了北半球对流层环流持续性的时空变化规律及其影响持续性的各种因素。结果表明，环流的持续性，高纬度比低层好，低纬度比中高纬度好，东半球比西半球好，冬季比春秋季好。持续性还存在着准2年、4年和6.5年的周期变化，这些准周期分别与QBO及厄尔尼诺现象和太阳活动的周期振荡、火山爆发等相联系。
关键词：环流 持续性 时空变化 影响因素


The temporal and spatial characteristics of the persistence of monthly mean atmospheric circulation in the troposphere over the Northern Hemisphere are analyzed. The results show that the persistence is higher in the upper-troposphere than in the low-troposphere, in low-latitude than in high-latitude, in the Eastern Hemisphere rather than in the Western Hemisphere, and in winter and summer than in spring and autumn. It found persistent links with solar activities, Qiao-Biennial Oscillation (QBO), El Niño, and volcanic activities. Quasi-oscillations of 2 years, 4 years, and 6.5 years of the persistence are closely connected with the above-mentioned factors.

Keywords: atmospheric circulation, persistence, time and space feature, influencing factors

Based on the analysis of monthly rainfall data of 160 stations in China, the climate feature and the long-scale changes of rainfall in May are analyzed in the paper. The importance of rainfall forecasting of May is emphasized. The rainfall stage feature of South China-North China and their opposite phase are significant for long range-rainfall forecasting in May.

Keywords: rainfall of May, climate feature, long-scale changes


A short-term climate prediction system for monthly rainfall is introduced in this paper. The author mainly deals with the necessity and possibility of combining a climate model and artificial neural network to develop a Climate Prediction Support System. The structure of the systems also is discussed in detail. Then some views on the analysis of prediction results and further improvements are proposed.

Keywords: climate model, neural network, rainfall prediction system
王谦, 1995
黄淮海平原极限干旱历史概率特征研究，气象，21(6):9-12

本文根据相依水分序列、独立水分序列极限干旱历时确切概率密度函数及其特征，分析了黄淮海平原5个代表点30年逐月降水序列和逐年时段降水序列极限干旱历时概率分布特征。

关键词：相依序列 独立序列 极限干旱历时 黄淮海平原 概率分布


On the basis of the probability distribution function (PDF) of both dependent and independent series, the probability features of critical droughts, duration of precipitation for ten-day periods, and year-to-year seasonal periods were analyzed at five stations on the Huang-Huai-Hai Plain.

Keywords: dependent series, independent series, critical drought duration, probability features, Huang-Huai-Hai Plain

张家诚，张兆龙，魏凤英，1995，中国及邻近地区冬到夏的季节变化，气象，21(7):3-8

本文分析了北半球季节变化的敏感区——西亚地区在季节转变过程中的热力学与环流变化特征。为了更好地反映季节变化特征，文章设计计算了南支西风指数，并将副高面积指数分南北两区统计。结果表明，这个指数对梅雨与华北雨季有天气气候学意义。同时，作者还找到了这个指数对我国一些地区早涝的前期指标。

关键词：季节变化 环流指数 早涝预报


South Asia is a region in the Northern Hemisphere that is sensitive to seasonal change. Annual variations of thermal and atmospheric circulation peculiarities of South Asia are analyzed in this paper. For better representation of seasonal change, an index of the southern branch of westerly is proposed, and a new regional index of subtropical highs is analyzed for the northern and southern regions. The results show that there is a strong link between these indexes and the MeiYu and the rainy season of North China. A series of earlier indexes of serious drought and flood are also used with reference to long-range weather forecasting.

Keywords: seasonal variation, index of atmospheric circulation, drought/flood forecasting
孙寿全，魏文秀. 1995. 热带气旋与河北特大暴雨，气象，21(7):34-37

本文利用1965－1994年的资料分析了河北特大暴雨与太平洋热带气旋的关系，将热带气旋影响的河北特大暴雨分为三种类型，并对其中快速发展的型进行了进一步的分析和探讨。
关键词：特大暴雨 热带气旋 西风槽


Based on analysis of data from 1965 to 1994, the authors discuss the relationship between the heavy rainfall in Hebei Province and the tropical cyclones over the west Pacific. Three types of the tropical cyclones impacting on the heavy rainfall in Hebei Province are given, and their rapid development types are analyzed.

Keywords: heavy rainfall, tropical cyclone, westerly trough

李月洪. 1995. 我国干旱半干旱区降水场与其与北极海冰的关系，气象，21(9):11-15

用复经验正交函数（CEOF）方法将我国干旱半干旱区45个代表站1950－1992年间的月降水距平场划分为三种主要的分布类型并分析它们的分布特征。文章揭示了北极海冰状况与干旱半干旱区降水的密切关系，分析海冰与极涡、西太平洋副热带高压等大气环流的关系以了解其可能的天气学影响过程。
关键词：降水 干旱半干旱区 北极海冰


The temporal and spatial distribution of precipitation in the dry and semidry region of China are divided into three types by use of the complex empirical orthogonal functions (CEOF) analysis of data for 45 stations from 1950 to 1992. The relationship between the precipitation patterns and Arctic Sea ice is also analyzed. Finally, the possible influences of physical processes are discussed.

Keywords: precipitation, dry and semidry region, Arctic Sea Ice
张尚印，刘小宁，孙安健. 1995. 秋季华南低温冷害的气候特征，气象，21(9):21-24

本文根据1951－1990年9－10月华南48个气象台站资料分析了低温冷害天气气候特点。结果表明，低温冷害频率自北向南递减，从沿海向内陆增加。总数量由北向南递减，南北差别较大。灾害的持续时间和强度也有相应规律。强低温冷害年有9年，主要集中在1966－1980年。
关键词：低温冷害 气候特征 频率

李栋梁，姚辉. 1995. 中国西北夏季降水量与500hPa纬度场的特征分析，气象，21(11):22-26

利用西北五省129个测站30年6－8月的降水资料，以EOF方法分解，从不同方面分析其特征向量和载荷量的空间分布特征，将中国西北夏季降水量场分成5种空间分布型。利用相应的时间系数与同期欧亚500hPa纬度场进行相关及典型场的对比分析，给出中国西北夏季降水类型所对应的环流场特征。
关键词：自然正交函数分解 西北夏季降水 欧亚纬度场 遥相关


Based on analysis of data of 48 stations, from September to October 1951-1990, the paper analyzes the climatic character of chilling damage in autumn in South China. The results show that the mean frequency of chilling damage decreased from north to south and increased from coast to inland in South China. Continuous time of the chilling damage process shortens rapidly from the north to the south. There were 9 years of strong chilling damage, most of which happened during 1966-1980.

Keywords: chilling damage, climatic characters, frequency


With data from 129 representative stations of five provinces of Northwestern China from June to August for 30 years, the total precipitation is analyzed by the empirical orthogonal functions (EOF) method. The summer precipitation fields are classified into five patterns of spatial distribution. Comparison between teleconnection and typical field of the time coefficient and simultaneous Eurasian 500 hPa latitudinal deviation field indicates a circulation field that corresponds to the summer precipitation patterns in Northwest China.

Keywords: natural orthogonal function resolution, summer precipitation in northwest China, Eurasian latitudinal deviation field, teleconnection

Based on the area index data of sea ice from 1973 to 1986, the intermonthly sea ice variation in the southern oceans is analyzed. The results show that the inter-monthly variation pattern of sea ice area in the latitude belt north of 50° S is similar to that of 60-69.75° S. The variation of sea ice show a tendency of eastward (or westward) propagation in certain areas. Generally, the quantity of sea ice reaches the maximum in September and minimum in February. But at certain longitudes, the months extreme values occurred could move up or delay for one month.

Keywords: the southern ocean, sea ice, inter-monthly variation


The anomalous climatic characteristic of the subtropical high and the cause of its formation in the West Pacific in 1994 are analyzed. The seasonal northward jump of the subtropical high is earlier than normal with strong intensity, and its position is persistently farther north in midsummer. Such characteristics are associated with the climatic backgrounds and the ocean-atmosphere interaction. In addition, the sea surface temperature (SST) anomaly field that corresponds to the subtropical high anomaly is discussed.

Keywords: Subtropical high, climatic characteristic, anomalous change, analysis of formation cause

Groundwater resources are mainly formed in six main mountains in Northwestern China and include four types: snow, glacier, river, and lakes. The current climate is turning to warm/dry, the temperature in the northwestern mountain area will raise 1°C by the 2030s. The precipitation and vapor are both increasing, but the general trend of groundwater resources is decreasing.

Keywords: climate change, water resource, glacier, snow, lakes


The regional characteristics of glacier fluctuation are analyzed with the research on data of global glacier fluctuation for the last 40 years. There is a corresponding relationship between glacier fluctuation and climate change. The glacier fluctuation is 8 years behind climatic changes for long glaciers (>5km), and 2 years behind for short glaciers (≤5km).

Keywords: glacier fluctuation, climate change, material balance of glacier

本文论述了小冰期以来古里雅冰芯所反映的气候变化特征。400多年来，17世纪和19世纪是寒冷少雨期，18世纪和20世纪是温暖多雨期。温度和降水的对应关系与季风对本区的影响具有内在联系。

关键词：古里雅 冰芯 气候变化

Yao Tandong et al. 1995. The climatic change from the Little Ice Age represented by ice core of Guliya. Science in China (Series B) 25(10):1110-1114.

The climatic change from the Little Ice Age (LIA) that can be derived from the ice core of the Guliya Ice Cap is discussed in this paper. According to the 400 year record, the climate was cold and dry in the 17th and 19th century, and warm and humid in the 18th century and 20th century. The relationship between temperature and precipitation shows an inter-association with monsoons.

Keywords: Guliya, ice core, climatic change


本文利用我国东部及南部85个站点的旱涝资料对近500多年来我国的旱涝状况进行了分区，并对我国冷暖时期的旱涝分区变化状况进行分析。我国东部地区存在两条明显的旱涝分界线：不同的冷暖时期，旱涝分界线的位置有所不同，暖期北移，冷期南移。

关键词：冷暖变化 旱涝分区 影响


Based on drought/flood data of 85 stations in the east and south of China, the authors study the demarcations of drought/flood for the last 500 years. The regional divisions of drought/flood in China during cold and warm periods are discussed. There are two main demarcations of drought and flood in the east of China. In the cold or warm period, the demarcations of flood and drought in the east of China have marked differences. The demarcations and the regions of drought/flood shifted south in the cold period and moved north during the warm period.

Keywords: changes of warm or cold, regional division of drought/flood, impact

Through the research of the data series on climate and hydrology in the Qinghai Lake basin, the effects of climatic change on water balance for the last 30 years are discussed. The results show that there is a close relationship between average precipitation and temperature and water balance. The lowering of the Qinghai Lake level for the recent 30 years is related to the decrease of precipitation, and evaporation from ground and surface water is influenced by temperature changes. The climate tends to be wet and warm. The water balance in the Qinghai Lake basin can maintain its present condition, and the level of the lake may even rise slightly. The authors also deal with the effects of melting underground ice on the water balance.

Keywords: climatic change, precipitation, air temperature, water balance elements


The drought/flood distribution characteristics of the last 500 years in China are studied, and the period is divided into several alternately cold and warm periods according to Prof. Zhu Kezhen’s historical climatic division. The averages of flood/drought degree in the last 500 years are calculated. The results show that disastrous floods probably will increase in many parts of China under conditions of global warming.

Keywords: climate warming, disaster of flood and drought, disaster forecast

本文研究了太湖流域洪涝灾害的形成和演变，认为其成因除与充沛而集中的雨量和碟形洼地地势有关外，还与海平面的相对上升、长江三角洲的向海推进及人口激增有关。研究表明，下一世纪流域的降水量增加，洪涝的威胁呈增长趋势。

关键词：太湖流域 洪涝灾害 成因


The formation and evolution of floods in the Taihu Lake drainage area are discussed. Except for rainfall and relief, the formation factors of floods are associated with the rise of sea level, the advance of the Changjiang River delta to coastline, and the increasing population density. The rainfall of the drainage area will increase and the threat of flood will be aggravated in the next century.

Keywords: Taihu Lake drainage area, flood disaster, cause


本文分析了我国西北地区沙尘暴的时空分布特征和黑风暴天气发生的宏观气候背景及下垫面条件。以1993年5月5日发生的黑风暴天气过程为例，研究了造成黑风暴天气的大尺度环流形势、主要天气系统和中尺度系统，并提出预报着眼点和防灾、减灾对策。

关键词：西北地区 黑风暴 成因与对策


In the paper, the catastrophic sandstorm that happened in Northeast China on 5 May 1993 is studied in terms of the time and space characteristics, climate conditions, and underlying surface conditions. The authors also analyze large-range circulation, main atmospheric system, and middle-range system. Suggestions for a warning system are given and countermeasures for forecasting and preventing future disasters.

Keywords: Northwest China, catastrophic sandstorm, formative causes and countermeasures

This comparison between the meteorological data of the hinterland of the Taklimakan Desert and the fringe area of the desert shows that the temperature rises from the edge to the hinterland of the desert. Precipitation has no distinctive trend. But the humidity becomes lower and the evaporation becomes higher nearer to the hinterland of the desert.

Keywords: Taklimakan Desert, meteorological factor


The authors analyzed the possibility of using precipitation of a ten-day period to examine drought duration and the probability features of drought duration of the Huang-Huai-Hai Plain. They also deal with yearly probability distribution of seasonal drought duration in the Huang-Huai-Hai Plain by applying Sen’s method.

Keywords: drought duration, probability feature, Huang-Huai-Hai Plain

According to Sea Ice Grid (SIGRID) sea ice data provided by the U.S. Navy/National Oceanic and Atmospheric Administration (NAVY/NOAA) Joint Ice Center (JIC), the relationship between oscillations of sea ice of the two poles is studied. Through the analysis of the change cycle of sea ice of the two poles, it was concluded that there is intense interaction between sea ice of the two poles, which causes the oscillation both of altitude and longitude. The oscillations have high coincidence with oscillation in atmosphere because of the influence on climate by the cooling action of the two poles.

Keywords: Antarctic, Arctic, interaction between sea ice

Han Jiankang et al. 1995. Change trends of the mean annual air temperature in the last 100 years in the South Shetland Island, Antarctic. Journal of Glaciology and Geocryology 17(3):268-273.

The series of mean annual air temperature (MAAT) in the South Shetland Island since 1904 were set up. It indicates that an 0.8°C warming started in the 1950s according to the five-year moving average curves of the MAAT. The comparatively cold periods were in the middle of the 1910-1920s, the end of the 1920s, the end of the 1940s, and the end of the 1950s. The warmer periods were the mid-1950s and 1980s.

Keywords: South Shetland Islands, MAAT, change trend

Based on monthly 500 hPa height data in the Northern Hemisphere, the author studied the long-term change of the geopotential height over the Qinghai-Xizang Plateau in summer and its relationship with long-term oscillation of the subtropical circulation over the eastern Pacific and Atlantic. Additionally, the relationship of the geopotential height over the Qinghai-Xizang Plateau to the climate changes of China and the other regions in the world is also analyzed.

Keywords: geopotential height over the Qinghai-Xizang Plateau, long-term oscillation, climatic change


Based on the data provided from the European Centre for Medium-Range Weather Forecasts (ECMWF) from 1980 to 1988, the seasonal transition of angular momentum and Eliassen-Palm (EP)-flux for the easterly and westerly in the Northern and Southern Hemispheres are analyzed. It is found that there is a seasonal sudden change occurring to both the angular momentum and the EP-flux. The time of this seasonal sudden change is different in the easterly than in the westerly.

Keywords: angular momentum, EP-flux, seasonal transition
本文研究了本世纪中国年平均气温、年降水量的气候趋势和4个年代际的气候变化特征及差异。结果认为，20世纪中国西北、东北、华北明显变暖，降水趋势值不大，以负趋势为主。在数十年尺度的暖背景下，大部分地区降水偏少。相应的降水特征是，除了黄河以南及江淮流域降水比40年代多以外，其他大部分地区降水偏少。
关键词：气候变化 气候趋势系数


The variation of precipitation over 30 years is studied in this paper. West China is divided into six independent rainfall regions on the basis of annual rainfall during 30 years for 63 stations. Eight types of different spatial distribution of rainfall are divided by analysis for 3 areas in Northwest China. The results show that the control weather system in the arid area of Northwest China is mainly a westerly system. In the past 30 years, not all the northwest regions became arid; climate change was different in different areas.

Keywords: the northwest arid areas of China, annual rainfall
李栋梁等，1995，中国夏季月平均气温异常研究，高原气象，14(2):165-175

本文根据1951－1990年历年月平均气温标准化距平资料，研究了中国40年夏季温度异常的空间结构及时间演变特征。结果表明，中国夏季温度异常在空间上主要有6个类型：长江中下游、华南、东北、青藏高原、西北和华北。旋转主分量的时间变化趋势反映了中国各主要气候区夏季气温的异常特点。40年来的基本趋势是：长江中下游由热－凉；华南、西北由热－凉－热；东北、华北、青藏高原由凉－热。夏季月平均气温的持续性较好，但周期性较差。在同一相的短周期振动中西北、华北均比华南地区超前变化。
关键词：夏季气温异常 时空变化 旋转主成分分析 交叉谱


本文根据江淮主汛区深层(1.6m,3.3m)地温距平场资料，研究了下垫面热力异常与洪涝灾害的关系。结果表明，江淮流域特大洪涝对应前期地温持续异常高温，江南大旱对应前期地温持续异常低温。前期地温的持续异常高温对应汛期多雨，前期地温的持续异常低温对应汛期少雨。
关键词：地温距平 持续异常 降水距平百分率


The spatial structure and temporal feature of summer temperature anomalies are studied. Six types of summer temperature anomaly are classified as follows: the middle and lower reaches of the Yangtze River, South China, Northeast China, the Qinghai-Xizang Plateau, Northwest China, and North China. Analyzing the temporal tendency of rotated empirical orthogonal function (REOF) mirrors the anomalous features of summer temperature over the main climatic areas in China. The basic variation tendencies of 40 years are that the middle and lower reaches of the Yangtze River vary from warm to cool; South China and Northwest China from warm to cool to warm; Northeast China, North China and the Qinghai-Xizang Plateau, from cool to warm.

There is a good persistence in the summer mean temperature, but the periodicity is not obvious. In the short-period oscillations of the same phase, Northwest China appears to experience variation before other areas.

Keywords: summer temperature anomaly, temporal and spatial variation, rotated empirical orthogonal function (REOF), cross spectrum


The relationship between the thermal anomaly of underlying surface and flood disasters is studied by using the soil temperature data of seasonal mean soil temperature at the depths of 3.2 m and 1.6 m in the Yangtze-Huai River reaches. The results indicate that the range of floods corresponds to the long duration of high soil temperatures in the area, and that the range of strong drought corresponds to the long duration of low soil temperatures south of the Yangtze River. Meanwhile, the durable anomaly of high soil temperature at an early stage corresponds to an increase in rain in the same area, and the durable
马晓波. 1995. 50年来蒙古国与北半球的气温变化，高原气象，14(3):348-358

本文利用蒙古25个台站52年月平均气温资料分析了蒙古的气温变化趋势，并与北半球进行了比较。结果表明，52年来蒙古年平均气温呈上升趋势，50年代是蒙古相对较冷的时期。北半球自1940年以来年气候变暖，60年代和70年代为较冷时期，其余为暖期。蒙古气温分布主要有3种类型：全暖、西暖东凉和北暖南凉。气候变暖主要表现在冬季变暖。冬季变暖夏季变凉不仅是我国，也是蒙古及北半球50年来的气候特点之一。

关键词：蒙古国 北半球 气温变化

anomaly of low soil temperature at an early stage corresponds to drought in the same area.

Keywords: the departure of soil temperature, the durable anomaly, the percentage of precipitation departure


Monthly mean air temperature variations at 25 stations in Mongolia are studied and are compared with Northern Hemisphere air temperature (NHT). It is found that the annual mean air temperature of 52 years in Mongolia is increasing. The 1950s are the cool period in Mongolia, other periods are warm. But in the Northern Hemisphere, the period of the 1960s-1970s is cool, and other periods are warm. Three kinds of variation in Mongolia are: warm, west warm and east cool, and north warm and south cool. Climate warming mainly shows in winter. Warmer winter and cooler summer are one of the climate characteristics for the most recent 50 years not only in China but also in Mongolia and the Northern Hemisphere.

Keywords: Mongolia, the Northern Hemisphere, air temperature variation

The Asian high in winter was analyzed using the wind-conserved projection method. The result shows that the Mongolian Plateau, Tibetan Plateau, and Loess Plateau are under the control of high pressure with three centers in winter. The highest center is in the southern part of the Tibetan Plateau, and the other two centers are located in the northwest part of Mongolia and the Qilian mountain area, respectively. The writers believe that it is more reasonable to call the high an Asian high or Plateau high than a Mongolian high.

Keywords: Asian high, in winter, pressure analysis method


Abrupt changes of yearly air temperature series on China, the Northern Hemisphere, and the world are detected with a statistical test. The abrupt change indexes of the three temperature series are analyzed. The results show that the models of several periods, which are divided from the temperature series by the points of the abrupt changes, are far better than the model of the whole temperature series. It indicates that the modeling scheme based on integrating an extension series of the mean generating function is feasible for the simulation and prediction of the temperature series.

Keywords: abrupt changes, trend prediction, mean generating function

The distribution and variations in the winter mean air temperature during the last 30 to 40 years in Northwest China are studied by main component analysis using the data of five provinces of Northwest China. Results show that the mean temperature variations are spatially well consistent in winter and that differences in the spatial distributions of temperature variation also exist. Analysis indicates that the general trend of the winter temperature change in Northwest China has been a gradual warming with fluctuations for the last 30 to 40 years. In contrast, the Qinghai-Tibetan Plateau and very few mountain stations have experienced a different trend. The annual variation of the winter temperature in Northwest China had a quasi-eight-year periodic oscillation.

Keywords: Northwest China, air temperature variation, main component analysis, warm winter


Based on the analysis of the mean temperature data in China for the period of 1873-1990, the climatic variations of the temperature in the recent 100 years are discussed. It points out that the variations of the mean temperature over China are similar to those over the Northern Hemisphere. There are two periods in the last 100 years in which temperature was higher (i.e., the 1940s and 1980s). The mean temperature of the Northern Hemisphere in the 1980s is higher than that in the 1940s, but the mean temperature of China in the 1980s is lower than that in the 1940s.

Keywords: temperature series, climatic change

Data from the 1880-1991 annual surface temperature series of the Intergovernmental Panel on Climate Change (IPCC), Vinnikov, Jones, and Hansen for the hemisphere and the globe and that for China are analyzed. The climatic changes have a warmer tendency. And abrupt warming was found in the 1890s, the middle of 1920s, and the end of 1970s. Solar activity and concentration of CO₂ are closely correlated with the temperature variations. Volcanism also contributed to the warming. However, the abrupt warming in the 1890s and 1920s may have been caused by the cessation of volcanic eruptions, and the abrupt warming end of the 1970s seems to relate to the enhanced greenhouse effect, though the intensification of solar activity may also play a part.

Keywords: global warming, abrupt change of climate, greenhouse effect


Through the analysis of the variability of global atmospheric and tropical oceanic anomalies, the main cause for the world meteorological catastrophe in 1993 is confirmed. The anomalous variation of atmosphere circulation has an almost synchronous response to the eastward-transmitting ENSO events of 1991 and 1993. The two eastward-transmitting ENSO events of 1991 and 1993 within a short period caused the persistence of anomalous variation of the subtropical high and made the subtropical high the strongest one for about 40 years. They also caused variation of the trough and ridge of the westerly belt. The persistence of anomalous warm water in the central equatorial Pacific in 1992 is the effect factor that caused the
position of the subtropical high ridgeline in the western Pacific to move to the south and the westward stretch ridge point of the subtropical high to move to the west in 1993.

Keywords: meteorological catastrophe, ENSO event, correlation type of Pacific-North American (PNA), atmosphere circulation


The total and vortex available potential energy are studied using results of a numerical simulation. The causative factor of rain enhancement is revealed. It is found that the release and enhancement of potential energy are at their maximum when cold air from a typhoon causes the maximum enhancement of heavy rains. The enhancement of heavy rains is checked when cold air enters the eye thereby greatly reducing adiabatic heating.

Keywords: available potential energy, typhoon, heavy rains, enhancement


The northern winter 100-hPa teleconnection patterns are studied, and it is discovered that a Pacific-North American (PNA) flow pattern occurs at 100 hPa in northern winter. When El Niño is at the prime of the season (in winter), a vigorous PNA pattern occurs at 100 hPa at a better corresponding rate than at 500 hPa. In the spring of El Niño years, the 100 hPa height is lower over a large area than in La Niña years; similar significant features are seen in preceding winters.
Keywords: 100 hPa height field, PNA teleconnection, El Niño, circulation anomaly, intensity index


On the basis on historical data and rain gauge records of Hankou station and 160 stations of China during 1951-1990, an index series of mean year-to-year categories for drought and flood in the middle reaches of the Changjiang River Valley is reconstructed to study the variation characteristics. It is found that flooding mostly occurs in the early part of this century whereas drought dominates the latter half. There are 6 stages of drought and flood periods and quasi-periodic oscillations of 22 years, 5-6 years, and 2-3 years.

Keywords: climatic change, drought and flood, the last 100 years, middle reaches of Changjiang river valley


Some fundamental problems of intraseasonal oscillation in the atmosphere are studied based on a series of data analyses, numerical simulations, and theoretical studies. Topics include regional location, spatial scale and horizontal propagation, intraseasonal oscillation in the mid-high latitudes, the interaction between El Niño and tropical intraseasonal oscillation, and some dynamical mechanisms that excite tropical atmospheric intraseasonal oscillation.

Keywords: tropical atmosphere, intraseasonal oscillation, interaction with El Niño, dynamical mechanism

The variation of annual frequency of tropical cyclones (TC) and its relationship with sea surface temperatures (SST), the Southern Oscillation Index, sunspot relative number, and number of days for specific circulation patterns were studied using data from 1884-1988 of annual frequency for Northwest Pacific TC occurrence. It indicates obvious periods of 21, 31, 15, and 6 years and sustaining periods lasting 12 years in average in the variation of annual TC frequency. There are three well-defined processes of inflexion over the past hundred years: 1931, 1959, and 1977. The results also suggest that there is an insignificant statistical tendency of annual TC frequency decreasing (increasing) in winter/spring (summer/autumn) in the El Niño years. When the stratosphere was in the zonally westerly phase, the northern zonal circulation would abnormally develop and solar activity would enhance the generation and development of a TC.

Keywords: tropical cyclone, EL Niño, environmental variable

East Asia Monsoon


On the basis of various data analyses, this paper studies the impacts of past global warm/cold variations on the humidity changes along the low-latitudinal summer monsoon range in Asia and Africa. The regional climates respond differently to global changes at different time-scales. The summer monsoons are generally stronger during global warmer periods at a time-scale longer than 100 years, thus leading to wetter conditions. At short time-scales, the relationship between the summer monsoon and warm/cold variations becomes weaker.

本文研究了晚更新世以来冰期冬季风和间冰期夏季风对黄土高原地区的侵蚀，认为沙黄土和冻土覆盖的组合，使晋陕蒙接壤区成为黄土高原现代侵蚀最剧烈的地区。

关键词：晋陕蒙接壤区 季风 侵蚀

Keywords: global change, regional wet/dry alternation, summer monsoon


The paper focuses on the effect on the Loess Plateau of the winter monsoon in glacial period and summer monsoon in interglacial. During the interglacial period of Holocene, the combination of an erodible surface layer and high precipitation resulted in the current soil erosion in the Jin-Shan-Meng contiguous region which is the severest in the Loess Plateau.

Keywords: JinShanMeng contiguous region, monsoon, erosion

孙淑清，孙柏民，1995，东亚冬季风环流异常与中国江淮流域夏季旱涝天气的关系，气象学报，53(4):440-450

本文分析了长江淮河流域夏季旱涝各10年的资料，结果认为，旱涝年前冬东亚冬季风环流存在着差别，长江淮河流域夏季旱年前冬，欧亚中高纬呈经向型环流，寒潮活动频繁，东亚沿海低纬冷涌活动强烈，赤道气流加强，南海至菲律宾地区的对流活动活跃。涝年前冬基本上为相反形势。

关键词：季风 大气环流 旱涝


Data from ten cases of abnormal drought or flooding summers in the lower-middle reaches of the Yangtze River and Huaihe River valleys are analyzed. It is noted that there are two kinds of winter monsoon circulation with respect to summer drought and flooding. In winters preceding a drought year, the flow pattern in the mid-high latitudes shows a strong meridional circulation over Eurasia, a cold surge in middle and lower latitudes, and convective activity over the southern part of the South China Sea and the Philippines so that the cross-equatorial current towards the Southern Hemisphere is greatly strengthened. On the contrary, in winters

The relationship between the early summer flood periods of southern China and the activities of the summer monsoon is analyzed on the basis of thermodynamic characteristics of the summer monsoon and the change of the lower layer wind fields. The establishment processes of the summer monsoon circulation of East Asia are investigated. The establishment processes of the monsoon circulation from the very beginning of the arrival of the monsoon to the period of greatest of development are classified into four categories.

Keywords: first flood period of South China, the plum rains period, the summer monsoon circulation of East Asia, the establishment processes of the monsoon circulation, monsoon regime structure

本文对两次季节内西太平洋副高的异常进退进行了诊断研究。结论认为, 季节内西太平洋副高异常进退是整个北太平洋副高异常进退的结果, 表现为东太平洋副高的活动, 相应西太平洋副高也有一次活动过程。东太平洋副高的异常进退是被南亚季风区到太平洋信风区的异常加热造成的东太平洋对流层上部辐散风场相应下沉区的变化所激发。

关键词：副热带高压 异常进退 远相关系 诊断研究


The authors study two intraseasonal progressive and regressive processes of an anomalous subtropical high in the Western Pacific. The anomalous progression and retrogression of this high are the result of an anomalous subtropical high in the Northern Pacific and are intraseasonally teleconnected with one in the Eastern Pacific. The anomalous progression and retrogression of the subtropical high in the Eastern Pacific is the result of anomalous heating through the monsoon area in South Asia and the trade-wind zone in the Pacific Ocean.

Keywords: subtropical high, anomalous progression and retrogression, teleconnection, diagnostic study


采用赤道平衡模式及低阶谱方法, 建立了描写南亚冬夏季风的非线性方程, 分析了基本气流、一次切变流和二次切变流对南亚季风的形成、转换和强度的影响, 指出一次切变流对南亚季风影响与基本流及二次切变流对南亚季风的影响明显不同。

关键词：南亚季风 低阶谱方法 切变流


The nonlinear equation describing the winter and summer monsoon in South Asia is built by using equatorial balanced model and low-order spectral method. The effects of the basic flow, and first-order and second-order shear on the formation, transformation, and intensity of the monsoon in South Asia are discussed. The results show that there is an evident difference between the influence of first-order shear on monsoons in South Asia and that of the basic flow and second-order shear on monsoons in South Asia.

Keywords: monsoon in South Asia, low order spectral method, shear flow

Based on an analysis of European Centre for Medium-Range Weather Forecasts (ECMWF) data of 1980-1986, the average characteristic of the time evolution of the general circulation over the South China Sea is studied. The first transition occurs around 10 May, characterized by the sudden movement of the center of the South Asian High. It is found that the heating of the southeast of the Qinghai-Xizang Plateau may be important to the first transition over the South China Sea.

Keywords: summer monsoon over the South China Sea, burst, East Asia, transition of atmospheric circulation


Based on European Centre for Medium-Range Weather Forecasts (ECMWF) objective analysis data, the interaction characteristics of frequency wave and mean flow in the mid-latitude during the winter years 1983-1984 and 1986-1987 have been studied using a diagnostic analysis method. The authors point out that tropical convective activity has an important effect on the frequency wave/mean flow interaction process.

Keywords: tropical convection, low-frequency fluctuation, wave-mean flow interaction

Based on the daily rainfall data for 30 years in East China, the seasonal interlock characteristics of precipitation in the Yangtze-Huaihe River Reach and South China and their association with seasonal variations of the East Asian monsoon are analyzed. Both the Jianghuai Mei'Yu and South China summer monsoon rains have seasonal interlock characteristics; the former shows a single-peak distribution whereas the latter displays a double-peak distribution. Intraseasonal variations of precipitation in both areas show a periodic oscillation of 15 to 25 days. The peak value of precipitation in the Yangtze-Huaihe River Reach and the first peak value in South China are mainly affected by the subtropical monsoon. The second peak value of precipitation in South China is influenced by the South China Sea tropical monsoon and closely related to the tropical cyclone activities in the corresponding period.

Keywords: East China, precipitation, climatic characteristics, seasonal interlock, intraseasonal variation


The authors note that the vegetation in the upper reach of the Keriya River is mainly composed of the desert-steppe herb, such as drought-resistant *Ephedra*, *Chenopodiaceae*, and *Artemisia*, since the last glacial age. However, there are also traces of a sparse-tree steppe environment composed of *Picea*, *Abies*, and *Pinus*. It is suggested that relatively dry and humid fluctuations occurred in the persistent arid desert-steppe environment.

Keywords: upper reaches of Keriya River, loess sporo-pollens, desert-steppe vegetation, arid environment
**Impacts**


Based on the data of the past 30 years, the effects of global warming on phenological events of China are discussed. Atmospheric temperature is the most important factor influencing plant phenophase. The author establishes a linear model that contains only phenophase and annual mean temperature factors. The calculated result indicates that under a 1°C rise of annual mean temperature, phenological events of trees in spring in China will occur about 3 to 4 days earlier but may be postponed for 3 to 4 days in autumn. The greenleaf stage will be prolonged for 6 to 8 days. It also assumes the scenario of a doubled carbon dioxide content in the next century which carries a 1.0 to 1.8°C rise in the annual mean temperature in China, with the greenleaf stage prolonged for 10 to 12 days. Moreover, the time of phenological events in the northern part of China will increase more than that in the southern part.

Keywords: climate change, phenology, global warming, plant ecology
丁登山. 1995. 论气候在西非萨赫勒地带荒漠化中的作用—兼谈近期人类活动影响, 干旱区地理, 18(3):25-31

本文讨论了气候在荒漠化中的作用，认为气候在荒漠化中的作用具有复杂性，包括了直接作用和间接作用，在单独起作用的同时，又与人类过渡的经济活动因素相结合发挥作用。文章还认为，近几十年来，西非撒赫勒地带的迅速荒漠化，主要由人类过渡的经济活动造成。
关键词： 撒赫勒地带 荒漠化 气候


The effect of climate on desertification in the Sahel in West Africa is discussed in this paper. Climate has complicated effects on desertification, including both direct and indirect ones. Climate not only can play a role on the desertification by itself but also in conjunction with excessive human economic activities. The paper concludes that rapid desertification in the area for the last several decades was mainly caused by excessive human economic activities.

Keywords: Sahel, desertification, climate

温跨达. 1995. 未来气候对南疆东部的影响, 干旱区地理, 18(4):61-64

本文分析了南疆东部的气候变化趋势。气候变化呈变暖趋势，导致土壤湿度下降，冰川融化加剧。这将对南疆东部水资源和农业产生一定的影响。文章最后提出一些对策和建议。
关键词：未来气候 气候变化 南疆东部


With a rise in air temperature, the climate will warm in the eastern part of South XinJiang. Soil humidity will decrease and the melting of glaciers in the Eastern Kunlun Mountain and the Altan Mountain will become extreme. The climate change will affect the condition of water resources and growth period of crops. Countermeasures and suggestions are given.

Keywords: future climate, climate change, east part of South XinJiang

Based on the distribution and ecological characteristics of Korean Pine and the effects of environmental factors on tree growth, the author sets up a W-T model to analyze the influence of various climate changes on the growth and distribution and the annual growth of Korean Pine. The results show that the suitable area and the growth of Korean Pine will greatly decrease when temperature rises. In the currently predicted ranges of climate changes, the Korean Pine would not recede from northeast China.

Keywords: climate change, Korean Pine forest


Based on the data of surface wind during 1973-1981, 1980-1986, and the Antarctic sea ice data of surface wind during 1973-1978 as well as conventional data, the relationship between the genesis of the tropical cyclones over the northwestern Pacific and the interannual variation of the global atmospheric circulation as well as the northern edge of the Antarctic sea ice are studied. It concludes that, over the region of the Eastern Hemisphere, the annual frequency of the tropical cyclones of the two hemispheres is connected closely with the intensity of the cross equatorial-flow (Eastern Hemisphere), particularly with that at 45° E. At the same time, the frequency is closely linked to the interannual variation of the northern edge of the Antarctic sea ice. When there is a warmer winter and colder summer in the Antarctic, there will be a higher annual frequency of tropical cyclones over the northwestern Pacific.

Keywords: Cross-equatorial, Antarctic sea ice, tropical cyclone

On the basis of data on climate and flue-cured tobacco of Xiangcheng County, the paper analyzed climate factors related with quality of flue-cured tobacco. The result shows that precipitation is the most important factor that affects the quality of tobacco. The quality of the flue-cured tobacco is best when rainy days from the April to August are fewer than 41 days.

Keywords: flue-cured tobacco, climate quality, climate index


Using the basic principles of agroclimatology and agrometeorology, the authors analyze the climate characteristics of the cool summer in 1993 to diminish the disasters in agricultural production in recent research.

Keywords: cool summer, sunshine, impacts


The authors analyzed the tree-ring widths of forests of Changbai Mountain and meteorological data. The results show that the annual tree-ring width increases when the average annual air temperature increases. The accelerated growth is positively related to the temperature rise at night rather than at daytime. With the increase of the temperature, the proportion of deciduous tree species in the standing composition of the deciduous-Korean pine forest will increase.

On the basis of data on precipitation in the Gansu arid and semi-arid zone, the main characteristics of precipitation and their influences on agricultural production have been analyzed. Measures for making full use of rainfall resources to promote agriculture are suggested.

Keywords: Gansu arid and semi-arid zone, characteristics of precipitation, agricultural production, variability of precipitation


The authors studied the temporal and spatial effects on regional climate of protective shelterbelt system in northern coastlines of Jiangsu using the method of statistical regression. The results show that temperature increased and humidity decreased in the fall, and that temperature decreased and humidity increased in growing period of leaves. Wind velocity and evaporation also decreased conspicuously in the protective shelterbelt region.

Keywords: northern coastlines of Jiangsu, protective shelterbelt system, statistic regression, effect on regional climate

The effects on the tropical ocean caused by abnormal wind stress are studied on the basis of characteristics of Eastern Pacific trade wind change in Southern Oscillation (SO) circulation. It concludes that the high index of ENSO corresponds to La Niña and low index corresponds to El Niño. SO influences climate changes of the whole globe.

Keywords: tropical ocean, SO, abnormal wind stress, analogy


The authors analyzed characteristics of anti-El Niño between 1949-1987 and divided them into two sorts: east-middle and middle-east. The east-middle sort occupied the main position during last 40 years. Different low-latitude atmospheric circulation and abnormal climatic changes were also analyzed in the paper.

Keywords: Anti-El Niño, sea surface temperature, outgoing longwave radiation, air circulation

蒙贡—台加山是亚洲中心部位的独立冰川作用中心，拥有36条冰川，总面积达27.8km²，具有亚大陆型冰川特征，主要接收西风环流及地方性环流造成的降水补给。小冰期最盛以来，冰川面积已减少近半，雪线高度也升高了。近30年来，冰川退缩速度更快，冰川物质平衡有10年左右的波动变化，目前处于负平衡状态，但有两处山谷冰川在1992—1993年突然前进。与亚洲中部其他山系相比，本区冰川动态变化独特，说明不同地区冰川对于全球性气候的响应过程比较复杂。
关键词：冰川变化 物质平衡
蒙贡—台加山


The Mungun-Tayga is an independent glaciated region near the center of Asia. There are 36 glaciers with an area of 27.8 km². The glaciers have characteristics of subcontinent type of glaciers. The main supply comes from westerly and local circulations. Since the maximum of the little Ice Age, the area of glaciers has been reduced nearly by half, and the altitudes of terminal and snow line have increased. Over recent 30 years, the retreating rate of glacier has increased, there is a fluctuation of glacier mass balance with a period of about 10 years, and the glaciers are in negative balance now. However, two glaciers advanced suddenly from 1992 to 1993. It is found that the glacier change is distinctive in this region in comparison with those in other mountains in central Asia, which means that the response of glacier to global change is complicated in different regions.

Keywords: glacier change, mass balance, Mt. Mungun-Tayga

朱林楠等, 1995. 青藏高原东部的冻土退化，冰川冻土，17(2):120-124

本文从冻土与现代气候关系出发，理论上确定了青藏高原东部冻土的分区界限。以丰富的资料分析了不同冻土区内诸现象呈退化的一致性，结论认为，受气候变暖的影响，退化是青藏高原东部冻土变化的基本趋势。
关键词：青藏高原东部 冻土 退化


Based on the relationship between permafrost and modern climate, the zoning boundaries of permafrost east of the Tibetan Plateau are theoretically determined. Many phenomena in different regions have the same tendency to degeneration. It is concluded that corresponding to the warm trend of climate, the basic trend of the permafrost changing in the plateau is degeneration.

Keywords: the east of Tibetan Plateau, permafrost, degeneration
李培基. 1995. 高亚洲积雪分布，冰川冻土，17(4):290-298

关键词：高亚洲 积雪 分布 区划


Based on information concerning microwave-derived Pentad snow-depth chart employing data from the Scanning Multichannel Microwave Radiometer (SMMR)(1978-1987), operational National Oceanic and Atmospheric Administration (NOAA) digitized weekly snow cover extent charts (1973-1989), and daily records of snow depth and number of snow cover days at 60 primary synoptic stations (1957-1992), seasonal and regional distribution characteristics of snow cover over high Asia are presented. The results are valuable in studying the global changes, analyzing the interaction between snow and climate, and forecasting sea level.

Keywords: high Asia, snow cover, distribution, regionalization


本文利用华北地区2000多年的旱涝等级序列分析了历史旱涝变化的混沌性质。通过分析系统的局部Kolmogorov熵，发现偏旱涝和偏涝的可预测性基本相同，从较长时间尺度看，干旱期的旱涝预报比湿润期要更困难些。
关键词：历史气候 混沌 分数维 可预报性


Based on the historical wet/dry grade series of North China for 700 years, some nonlinear features of the regional wet/dry fluctuations are analyzed. Through the local Kolmogorov-entropy analysis, the $K$-entropy of the smoothed series is small, but that for those drier phase points seems much smaller. It implies that, at the long time-scale, climate prediction in the drier period is more difficult than that in the wetter one.

Keywords: historical climate, chaos, fractal dimension, predictability
王谦谦等，1995，1991年夏季江淮洪涝成因的数值试验—西太平洋海温异常的影响，气象学报，53（增刊）：595-603

本文利用海温距平分布和球面范围的初始方程模式，研究了1991年夏季江淮流域洪涝灾害与海温距平分布的关系。结果表明，西太平洋面积不大的海温距平是造成当年洪涝的重要因素之一。另外，作者对海温异常的影响机制也作了讨论。

关键词：洪涝 海面温度异常 数值试验


The relationship between the sea surface temperature anomalies and the floods in the Changjiang and Huaihe valleys in the summer of 1991 is studied using data of the sea surface temperature anomalies and a numerical primitive equation model with a zonal domain. Results show that the negative sea surface temperature anomalies with a moderate large area to the west coast of the Western Pacific are the important factors of the floods in that year. Additionally, the mechanism of the effects of sea surface temperature anomalies is discussed in detail.

Keywords: floods, sea-surface temperature anomalies, numerical experiments

胡增臻，1995，黄河中上游7月份旱涝成因的数值模拟，气象学报，53（增刊）：653-662

本文介绍了黄河中上游7月份旱涝数值模拟试验，将对旱涝成因诊断分析的结果加入到AGCM（大气环流模式）气候平均初始场中。模式成功地模拟出了黄河中上游的降水和大气环流的主要特征，证实了诊断分析得出的结论，也说明用AGCM做旱涝预报是可能的。

关键词：黄河中上游 旱涝成因 数值模拟


The numerical simulation experiment of droughts/floods in the upper-middle reaches of the Yellow River Valley in July is presented. The analysis of formation cause of droughts/floods was put into an Atmospheric General Circulation Model (AGCM). The main characteristics of general circulation and precipitation of droughts/floods in upper-middle reaches of Yellow River were simulated perfectly by the model. The numerical simulation, for one thing, proves the results from the diagnosis analysis and points out the possibility of doing droughts/floods prediction by AGCM.

Keywords: upper-middle reaches of Yellow River, cause of droughts/floods, numerical simulation

根据1983年7月至1990年6月青藏高原主体58个格点积雪资料，对高原主体积雪的分布特征进行EOF分析，认为青藏高原主体积雪分布以西部、南部为主，中部、北部和东部积雪相对较少。且西部、南部的积雪变化与中部、北部和东部的积雪变化趋势存在反位相关系。另外，还对积雪对高原地面反照率的影响作了简单分析。

关键词：青藏高原 积雪 地面反照率


Based on a 58-grid-point data set of snow cover on the Qinghai-Xizang Plateau for July 1983 to June 1990, the distribution characteristics of snow cover on the Plateau are analyzed by using the Empirical Orthogonal Function (EOF) method. The results show that the main of snow cover on the Qinghai-Xizang Plateau is in the west and south of the Plateau. There is an opposite variation of snow cover between the western, southern parts and the middle, northern, eastern parts of the Qinghai-Xizang Plateau. The authors also discussed the surface albedo of snow cover on the Plateau.

Keywords: the Qinghai-Xizang Plateau, snow cover, surface albedo

钱永芳，董良. 1995. 包络地形对气候模拟特征的影响，高原气象，14(2):129-140

本文应用p-σ混合坐标系球带模式用不同包络度的地形进行数值试验，研究了不同包络度地形对冬夏季气候模拟特征的影响。气候模拟特征有海陆和地形的共同作用决定，地形包络度的影响是次要的。但采用较大包络度的地形可在一定程度上改善气候模拟结果，尤其是在冬季。包络度要取得恰当，否则反而不利。不同地区可用不同的包络地形。

关键词：气候数值模拟 地形包络度


The authors carry out a numerical test of different envelope degrees of topography, using a primitive equation model with a zonal domain and a p-σ incorporated vertical coordinate system to study the effects of the envelope degrees of topography on the simulated properties of climate. Findings show that the effects of the land-sea and the topographic distributions primarily determine the simulated properties of climate and that the envelope degree of the topography has a secondary effect. However, the topography with a larger envelope degree can improve the simulations to some extent, especially in wintertime and should be taken into account in order to get better simulations. Otherwise, omission could lead to problems. Different envelope degrees of topography can be adopted in different areas.

Keywords: numerical modelings of climate, envelope degrees of topography

The characteristics of snow cover over the Qinghai-Xizang Plateau are analyzed and the important influences of snow cover over the Plateau in winter and spring on the climate formation and anomaly in East Asia in summer are revealed. The advances of diagnosis and numerical experiment on the effects of snow cover over the Plateau in winter and spring on general circulation in East Asia in summer are also summarized. The concept of a possibly effective analysis of snow cover over the Plateau on climate is proposed.

Keywords: the Qinghai-Xizang Plateau, snow cover, climate effect

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The authors analyze the characteristics of the ecological environment in China, the major scientific issues of ecological environmental changes caused by activities of nature, society, and economy; and their relationship with global change. Some proposals for the general framework, main objectives, and research tasks of global change studies in China are offered.

Keywords: global change, ecological environment, China

Seasonal precipitation and temperature in China during El Niño Southern Oscillation (ENSO) events in last 40 years are analyzed. The rainfall and temperature are lower than normal in an ENSO year and almost the opposite anomalies occur in the following year. The seasonal rainfall and temperature departures evolve with almost opposite phases. The seasonal rainfall anomalies in the middle and lower reaches of the Yangtze River with certain level of statistical confidence occur in spring and autumn of the ENSO year and in spring of the following year, rather than in summer. The most significant cooling in Northeast China also appears in autumn of the ENSO year through spring of the following year, rather than in the summers. In addition, some results on ENSO influence previously obtained are reappraised on the basis of the present analysis.

Keywords: ENSO, precipitation and temperature anomaly, seasonal variation, composite analysis


A basic equation governing the movement of a typhoon has been built. The role of several forcing factors that cause the current deviation of a typhoon from the steering are considered. It is shown that diabatic steering can accelerate or slow down a typhoon or turn its direction. And the region of cold air in a temperature field may speed up a typhoon.

Keywords: typhoon movement, local steering flow, diabatic steering, attracting of cold region


本文分析了影响海南的四类台风路径所对应的200hPa辐散风场和速度势场的特征。200hPa辐散风场对台风路径有一定的制约作用，它决定着台风路径的中期趋势。影响着台风未来的路径。从高层辐散风场诊断台风的移动方向有一定的可行性。

关键词：200hPa高度 辐散环流 台风路径 引导气流


Classification statistics are presented for the tropical cyclones in offshore Chinese waters based on data from 1970 to 1991. There are 8 to 9 tropical cyclones on average per year whose intensity changes abruptly as they move toward the offshore. Most of them abruptly weaken. The more intense ones occur in May through October and are seen over waters offshore of the Zhejiang and Fujian Provinces, the central South China Sea, waters from the Pearl River mouth across the Beibuwan Bay, and the eastern Bashi Channel. The weaker ones occur during May through December and appear over a vast area.

Keywords: offshore tropical cyclones, sudden intensity changes, climatic characteristics

本文用气候统计方法对1949—1992年影响我国的西太平洋台风资料进行分类并给出各类的时空分布特点及高低层平均环流场。结论认为，影响我国的突然加强的台风主要出现在每年的7-10月份，并集中在南海中部，可分为三类。台风突然加强主要受低纬环球流和天气系统的响。

关键词：台风 突然加强 环境流场 统计


Based on an analysis of the data of typhoons occurring in the western Pacific during 1949-1992, a classification is made using climatic statistics. The results show that the explosive intensification of typhoons mainly occurs in the South China Sea from July to September every year and concentrates in the middle of the South China Sea. This explosive development may be classified into 3 patterns. Their explosive mainly results from the circulation and weather systems in the low latitude.

Keywords: typhoon, explosive development, environmental flow field, statistics


本文分析了小地形（地形高度与台风系统的垂直厚度相比为小量）的抬升作用和边界层的摩擦作用对台风移动影响的定性特征。结果认为，较高地势和边界层摩擦辐合引起的艾克曼抽吸都有利于台风发展。

关键词：台风移动 地形强迫 艾克曼引导气流


The dynamic effects of small topography (in the sense of the characteristic height of the topography as compared with the vertical thickness of the system of motion) and the Ekman pumping caused by the frictional convergence in the boundary layer on the motion of a typhoon are qualitatively discussed. The results show that the topographical ridge and the Ekman pumping at the top of the boundary layer can prompt the development of a typhoon.

Keywords: typhoon movement, topographical forcing, Ekman steering current
吕克利，布和朝鲁，1995. 大尺度凝结加热与暖锋锋生，热带气象学报，11(2):170-175

在副湿绝热假定下，推导出简化的半地转湿锋生模式，并用该模式讨论了大尺度凝结加热对暖锋锋生过程的影响。研究结果表明，大尺度凝结加热对暖锋锋生过程具有明显的加强作用。

关键词： 半地转模式 大尺度加热 暖锋锋生


A simplified semigeostrophic frontogenesis model with inclusion of large-scale condensation latent heat is built. Based on this model, the effects of latent heat release on the frontogenesis of a warm front are discussed. It is believed that because of the large-scale condensation heating, the warm front is intensified and made more characteristic of a mesoscale system.

Keywords: semigeostrophic model, large-scale heating, warm front, frontogenesis


本文分析了流场半非对称台风的流入层和流出层与外界的水平动量交换影响台风移动的定性特征。作者认为，半非对称因素可以导致台风动量变化从而改变了台风的运动方向。主要流入通道或主要流出通道位于台风右（左）侧时，有利于台风加速、左折（减速、右折）；当主要流入通道或主要流出通道位于台风后部（前部）侧时，有利于台风加速、右折（减速、左折）。

关键词： 台风移动 水平动量交换 半非对称台风


Two semi-asymmetric flow patterns of typhoons are chosen to qualitatively determine the effect of the exchange of horizontal momentum between inflow layers on the motion of typhoons. The authors believe that the asymmetric flow component could cause a net momentum input into or output from a typhoon and change typhoon movements in respect to speed and direction. A typhoon with major inflow or outflow channels on its right (left) side would tend to accelerate and turn left (decelerate and turn right). On the other hand, a typhoon with major inflow or outflow channels in the front (rear) semi-circle would tend to accelerate and turn right (decelerate and turn left).

Keywords: typhoon movement, horizontal momentum exchange, semi-asymmetric typhoon
王良健. 1995. GM (1, 1)模型在湖南严重干旱预报上的应用，干旱区地理，18(1):83-86

本文利用湖南省解放以来的几次严重干旱资料，建立了GM (1, 1)模型。该预测模型精度为第一级“Good”，可以预测以后干旱年分的出现。
关键词：GM (1, 1)模型应用 干旱预报 湖南省


The author analyzes the data of several aridity disasters in Hunan Province since the Liberation and sets up models of GM (1,1). The precision of the model is excellent. The next arid disasters can be forecasted using calculation of the gray system.
Keyword: Model GM (1,1), aridity forecast, Hunan Province

吴祥定，刘洪滨，潘一民，1995，采用条件分位数调整法合并二类气候代用资料的初步分析，地理研究，14(3):52-68

本文采用条件分位数调整法，合并华山树木年轮年表和西安旱涝等级序列二类气候代用资料，最大限度地利用了在年轮资料中的连续变化信息，并使历史文献资料相互补充，从而使合并出来的序列更有助于对过去气候的重建。
关键词：条件分位数 气候代用资料


Based on two kinds of proxy data (tree-ring-width chronology at Huashan and the wetness/dryness grade series around Xi’an), the paper combines two types of proxy climate records. With comparison and correction of the two data sets, various statistical models can be developed from individual and combined series. Among them, the best-combined model produced by the conditional quantile adjustment method can be selected for reconstruction of ancient climate.
Keywords: conditional quantile, climate, proxy data
1995


The result of research on the spatial and temporal changes in temperature in Ningxia shows that the temperature in the south of Ningxia is lower than that in the north. The exactitude of reckoning temperature by using height, latitude, and longitude is very good. Year-to-year changes of temperature have 10 to 12 years and 2.2 to 2.5-year cycles.

Keywords: temperature, mathematical modeling, power spectrum, Ningxia

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Based on the method of multi-criterion fuzzy decision analyzed, a general appraisal on methods of long-term forecasting of dryness/wetness trends is made according to forecasting accuracy. As a result, an order of optimum forecast methods as a basic principle for the final forecast is obtained.

Keywords: multi-criterion, fuzzy decision, dryness/wetness trends, forecast
陈伟民，陈永卫等，1995. 微机实时气象资料应用支持系统，气象，21(2):43-47

本文介绍了实时气象资料支持系统的特点。该系统包括资料预处理、客观分析、物理量诊断及图形显示三部分。操作简便，分析质量高，省时省力且增大了预报信息量，是进行天气预报分析的有力工具。

关键词: 微机 实时资料分析 诊断 图像显示


The Real-Time Meteorological Data Application Supporting System is introduced. The system includes real-time meteorological data processing, objective analysis, and diagnosis. It is simple to operate and its analysis is accurate. As a useful tool for synoptic research, the system can increase information for operational forecasts.

Keywords: microcomputer, real-time data analysis, diagnosis/configuration display

罗勇，1995. 从时间序列中提取维数信息，气象，21(4):16-21

本文介绍了分形和维分的概论、性质和意义，重点讨论从一维时间序列中提取维数信息的方法。另外给出了分形与维分在天气和气候分析中的应用。

关键词: 分形与维分 ENSO系统时间序列


The conceptions and characteristics of fractals and fractal dimension are introduced. The computational method fractal dimension of a dynamic system from one variable time series is mainly discussed. The utilization of fractal dimension in weather and climate analyses is given.

Keywords: fractals and fractal dimension, ENSO, time series.

本文介绍了气候变化对作物产量的动态统计评价模式, 该模式用于探索作物生育期内以旬为时间单位的气候变化对作物产量形成的影响规律, 可及时连续地进行农业生产的气候影响评价。在建模过程中引用了三项式产量预报模型、特殊影响因子诊断分析和选取最佳积分回归方程等方法，并在使用中取得了较满意的结果。

关键词: 气候变化 作物产量 评价模式


A dynamic statistical model, developed to study the effects of climate change on crop yield in the time scale of 10 days, is introduced. The model is valuable for assessing the climatic effect on agricultural activities so that sustainable development and timely responses can be made. To make the model more suitable for practical use, the following methods were used during its development: three-term crop yield forecast model, diagnostic analysis for special factors, and choice of best integral regression equation. Satisfactory results were achieved in the test model.

Keywords: climatic change, crop yield, assessmental model

郑洪初. 1995. 用CAR模型作年旱涝长期天气预报的研究, 气象, 21(7):51-53

采用特殊的CARMA模型即带有控制项的自回归模型（CAR）对年旱涝时间序列的动态系统建模。得到用三个受控制量描述的安康市的年旱涝演变规律的CAR拟合，模型精度高。

关键词：旱涝 长期预报 CAR模型


Using the controlled auto-regression (CAR) model, a special Consortium for Applied Research on Market Access (CARMA) model, the dynamic system of the time series of annual drought and flood in Ankang Prefecture in Shaxi Province is modeled. The CAR prediction model of three controlled variables has been obtained, and it is applied to predict annual drought/flood tendency in the Ankang region. Its accuracy is good.

Keywords: drought and flood, long-term prediction, CAR model

Based on data of annual precipitation series from 1951 to 1990 for 400 stations in China, the inhomogeneity has been tested by using the ratio method. The results show that this method is effective to evaluate the inhomogeneity of annual precipitation series. Changes of stations and gauges are major cause of the inhomogeneity of the annual precipitation series.

Keywords: annual precipitation series, inhomogeneity, test


The author deals with the long-lead seasonal forecast, which has been issued by the National Weather Service of the United States since January 1995. The scientific basis, major methods, operational procedures for producing climate outlooks, and the forecast skill are introduced briefly.

Keywords: issuing climate outlooks, scientific basis, forecast methods, operational procedure, forecasting skill

Based on National Oceanic and Atmospheric Administration (NOAA)-advanced very high resolution radiometer (AVHRR) data, the land surface temperature of the Ordos Plateau and the surrounding area is calculated by means of a split-window method. The comparison between the computed results and the data from observations of local stations indicates that the difference is about 80% with 1°C in the nighttime, and 67% in the daytime with a maximum difference of -3.8°C. As a macro-monitoring measure, this method is acceptable in estimating land surface temperature.

Keywords: land surface temperature, split-window method, emissivity


The authors set up a prediction model for summer floods/droughts in the Nanjing-Zhenjiang region by fuzzy mean generating function. The model is satisfactory especially in case of severe floods/droughts.

Keywords: fuzzy mean generating function, floods/droughts, prediction

The article mainly deals with the problems of the arid index, a system of arid processes and systems for drought observation and prevention. The main subjects for the research of these systems are the environmental water status and the structure and dynamics of water supply-demand balance. The key problems for eliminating drought are observation, predication, and engineering control.

Keywords: arid index, index of drought, the systems of observation and prevention of drought


A two-dimension high-resolution model coupling with the Biosphere-Atmosphere Transfer Scheme (BATS) was used to simulate and research the influence of the planetary boundary layer of an oasis and underlying surface on precipitation and other factors. The oases have a cold-wet effect on the atmosphere, which causes a cold-wet air column above the oasis area. And the Gobi has a hot-dry effect on the atmosphere, which causes a hot-dry air column above it. The cold-wet air brings precipitation when it passes over the desert, and the hot-dry air makes the lower reach of the oasis dryer than the average level of the oasis.

Keywords: two-dimension numerical model, the planetary boundary layer, desert, oasis
刘树华等，1995，植被对近地面层水热交换影响的参数化模型，应用生态学报，6(2):149-154

本文提出了一个研究植被和土壤特性对近地面层水热交换和能量平衡的参数化模型，该参数化模型可应用于中尺度气象模拟、气候模拟和环境生态学的研究。

关键词：参数化模型

土壤—植被—大气系统 能量平衡


The authors advance a parameterized model to study the influence of vegetation and soil on the moisture-heat exchange at the near-ground layer and energy balance. The parameterized model can be used to study mesoscale meteorological modeling, climate modeling, and environmental ecology.

Keywords: parameterized model, soil-vegetation-atmosphere system, energy balance

喻本荣等，1995，用参数方程的方法计算氯氟碳化合物的臭氧消耗潜势，环境科学学报，15(2):129-134

本文根据同类氯氟碳化合物的臭氧消耗潜势（ODP）之间的差异和ODP与有关参数的内在联系建立了两类求算HCFCs、CFCs的ODP的参数方程。当ODP计算值小于0.05时，准确度较高，ODP值大于0.05时，误差较大，但数值本身仍有较好的参考价值。

关键词：臭氧消耗潜势 臭氧氯氟碳化合物 平流层化学


Two kinds of parametric equations are set up to calculate the ozone-depleting potential (ODP) of hydrochlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs) on the basis of a study on the differences in the ODP of some kinds of halocarbons and the relationship between ODP and relevant parameters. The equations are more accurate when the ODP is lower than 0.05. When ODP is higher than 0.05, the result is also valuable.

Keywords: ozone depletion potential, ozone, halocarbons, stratospheric chemistry

The sea temperature of the equatorial eastern Pacific, and sea-ice conditions in different regions of the Arctic and their effects on the summer circulation of the Northern Hemisphere are studied in the paper. The results show that each kind of abnormal change of sea ice or tropical sea temperature can affect atmospheric circulation remarkably. It is also proved that thermal difference between equator and arctic is a basic factor in determining atmosphere circulation.

Keywords: Pacific sea temperature, Arctic sea ice, thermal difference, numerical analogy


The authors deal with differences of meteorologic factors of El Niño and La Niña for the last 40 years in the equatorial Pacific region 11°S to 11°N and 120°E to 90°W. The authors consider that it is the interaction of positive and negative feedback mechanisms including dynamic, thermodynamic, and hydrologic processes that formed El Niño circulation.

Keywords: El Niño circulation, feedback mechanism, air-sea interaction cycle

The relations between climatic-factors and the equilibrium lines of the east and west branches of Glacier No. 1 in the headwaters of the Urumqi River in the Tianshan Mountains are analyzed by using the theory of gray relational analysis. The results suggest that summer mean air temperature is the leading climatic factor that dominates the fluctuation of the equilibrium line, and that there are differences in the influences of precipitation during different periods in a balance year on the changes of the equilibrium line.

Keywords: gray relational analysis, equilibrium line, climatic factors


The authors analyzed the climatic information from tree-ring chronologies in Ili prefecture using the analytical technique of response function. The results are useful in understanding the effect of climate on the prefectures' forest and to extracting the climatic information from the tree rings in warm and wet regions.

Keyword: tree-ring chronology, response function
林振山等，1995. 天津局地气候的反演建模及其实验，气象学报，53(1):115-121

本文在对天津月平均温度T、气压P和降水量R的时间序列资料分析的基础上，反演出一组近似描写天津（T－P－R）局地气候的动力方程，同时还对其演化特性及内部相互作用机制进行了研究。
关键词：时间序列 反演建模 演化特性 相互作用


The objective analysis scheme, which is used in the Global Data Assimilation system, running in real-time at the National Meteorological Center (NMC) of SMA, is described in the paper. Through the optimum interpolating statistical method, the scheme produces the global analysis values in numerical form for long-term and medium-term weather prediction and research. In the two years of operation, a better initial condition has been developed for the spectral forecasting model, with a wave spectral function of 42, in the medium-range numerical weather prediction.

Keywords: global optimum interpolation, statistical analysis, verification
刘玉宝等，1995，中尺度山脉对流群的动力和微物理数值模拟，气象学报，53(2):157-167

本文应用中国强风暴实验室MBG（Meso-Beta-Gamma）非静力模式模拟了该计划中1990年5月3日一次对流降水过程。模拟结果揭示了大山脉气流强迫与对流环流相互作用的一些基本特点。此外，作者还对采用细致的雹云微物理参数化和采用简单的暖云微物理参数化的方法进行对比试验。

关键词：非静力模式 中尺度云微物理结构


The May 3, 1990 precipitation processes over Asia Mountain are simulated in two dimensions by the MBG (Meso-Beta-Gamma) model of the Climate Anomaly Monitoring System (CAMS) of the People’s Republic of China (PRC). The results showed the basic features of interactions between the clouds and orographic forcing. In addition, the distribution, evolution, sizes, top heights, updrafts, and precipitation growth, etc. of the modeling cumulonimbus clouds were generally consistent with field observation of the Saudi Arabian Cloud Physics Experiment (SACPEX) projects.

Keywords: non-hydrostatic model, meso-scale, precipitation, microphysical structure of cloud

刘辉等，1995，北半球阻塞高压的维持1: 准地转和Ertel位涡分析，气象学报，53(2):177-185

本文从北半球不同地区的4个阻塞高压个例，研究了阻塞高压维持机制及其地域性差异。相对涡度输送的差异导致了300hPa位涡低值区的维持机制的地域性差异。等熵面Ertel位涡分析表明，阻高区域330K时平均等熵面位涡低值区的维持机制与300hPa时平均准地转位涡低值区的维持机制十分相似，从而表明以上等压面准地转位涡分析可以近似用来代表等熵Ertel位涡分析。

关键词：阻塞高压 位涡 北半球


The maintenance of blocking anticyclones is invested with four observed blocking anticyclones in different regions of Northern Hemisphere. The difference of potential vorticity (PV) transform causes the regional difference in the maintenance of blocking highs in the low PV regions of 300 hPa. Very similar results are obtained with respect to maintenance of the time-mean Ertel PV in 330K surface. Therefore, in the blocking cases, the quasi-geostrophic PV analysis can be used to represent the Ertel PV analysis.

Keywords: blocking anticyclone, potential vorticity (PV), Northern Hemisphere
丁裕国，江志红，1995，非均匀站网EOFs展开的失真性及其修正，气象学报，53(2):247-253

本文针对非均匀站网EOFs展开的失真性，提出了一种附加面积权重的修正方案用以弥补非均匀站网EOFs展开的失真现象。中国气温场（160站）经修正后，其气温变化主分量趋势与特征能更加客观地揭示中国地区增暖效应的局地差异。

关键词：经验正交函数（EOFs）
非均匀站网 面积权重


A revised scheme using area weighting is developed in connection with the finding that current empirical orthogonal functions’ (EOFs’) expansion results are not true to some extent over a heterogeneous network. Practically, the regional differences of the recent warming effect are more objectively revealed by using the revised EOFs technique and surface temperature field records (from the network of 160 stations) in response to the trends and features of China’s regions.

Keywords: empirical orthogonal functions (EOFs), heterogeneous network, area weighting

吕克利，徐亚梅，1995，不同季节实际气流上斜压波的发展和锋生过程，气象学报，53(3):328-336

本文利用三维半地转模式研究了四季基本气流上非线性斜压扰动的发展过程和锋面形成过程。结果认为，四季基本气流上，斜压扰动的发展以冬季最强，秋夏季最弱。扰动的发展能产生暖锋，所以，相依形成的锋也以冬季最强，秋夏季最弱。

关键词：斜压波 锋生 季节变化


The development process of nonlinear baroclinic waves and frontogenesis on the mean flows of the four seasons are studied using a three-dimensional semigeostrophic model. The results indicate that the disturbance development is the most intense in winter and is the weakest in summer and fall. They also indicate that the development of baroclinic waves on the mean zonal flows, which are functions of height and latitude, can cause cold and warm fronts. The fronts caused by baroclinic waves are strongest in winter and weakest in summer and fall correspondingly.

Keywords: baroclinic wave, frontogenesis, seasonal variation
刘辉等，1995。北半球阻塞高压的维持2：瞬变扰动强迫和平均流位涡平流的形成，气象学报，53(3):337-348

本文探讨了大西洋阻高和东亚阻高中瞬变扰动位涡输送强迫和太平洋阻高中平均流位涡平流的形成机制。阻高西南部西风分流产生的扰动，并不是扰动位涡输送强迫形成的必要因素。扰动相互作用在阻高（北）部非分流气流中十分显著，这一相互作用可能是扰动强迫作用形成的机理。青藏高原可能是太平洋阻高中平均气流的位涡平流形成的重要因素。
关键词：阻塞高压 位涡 北半球


The formation of the potential vorticity (PV) transfer by eddy forcing in the Atlantic and Asia blocking cases and the advection of PV by mean flow in the Pacific blocking cases are studied. It is noted that the propagation of an eddy in diffuent flow in the southwestern blocking case is not necessary for the formation of the eddy forcing. The interaction between mean flow and eddies is also strong in the non-diffuent flow of the northwestern part of the anticyclones. The interaction may be one of the formation factors of the eddy forcing. The Qinghai-Xizang Plateau may be the formation factor of the advection of mean flow in the Pacific blocking cases.

Keywords: blocking anticyclone, potential vorticity (PV), Northern Hemisphere

陈受钧，1995。厄尔尼诺与东亚暖冬的数值模拟，气象学报，53(3):380-384

本文根据实际观测的海面温度资料，应用全球大气环流模式（ECHAM3）长期积分一个物理过程比较完善的大气环流模式模拟了厄尔尼诺年的东亚暖冬和弱冬季风现象，并对模拟的结果进行了初步讨论。
关键词：厄尔尼诺 暖冬 数值模拟


On the basis of observed sea surface temperature data, the weak winter monsoon with warmer temperature over East Asia during El Niño events is simulated. A long-term integral of the European Centre for Medium-Range Forecasts (ECMWF)-Hamburg model (ECHAM3) global model on an atmosphere cycle that has a completed physical process is used. The preliminary results are discussed.

Keywords: El Niño, warm winter, numerical simulation

本文对赤道太平洋洋面上温、压、风、湿、云以及热量收支各分量进行了综合分析。在 El Nino过程中，赤道太平洋洋面上气压梯度减小，中、东太平洋洋面上空气中水汽和云量增加，洋面获净得的热量减少。在 La Nina过程中，情况相反。作者还概括了 El Nino-La Nina 循环的两种海一气耦合反馈机制。

关键词：EL Nino-La Nina 循环，海一气耦合，赤道太平洋


Data of the effects of temperature, pressure, zonal wind, special humidity, clouds, and the components of the heat budget on the equatorial Pacific surface are studied. It is believed that in the processes of El Niño, the pressure gradient and trade winds decreased in the equatorial Pacific, that vapor and clouds increased, and that the net gain of heat reduced in the central and eastern equatorial Pacific surface. In the processes of La Niña the circumstances are opposite. Lastly, the authors summarize two feedback mechanisms of the El Niño-La Niña cycle.

Keywords: El Niño-La Niña cycle, air-sea coupling, equatorial Pacific

张耀存，钱永芳. 1995. 陆地下垫面特征对区域能量平衡过程影响的数值试验，高原气象，14(3):325-333

本文主要进行了陆地下垫面特征变化对区域能量平衡过程影响的数值试验，利用三维地理耦合的区域气候模式模拟了我国华北部分地区的地面能量平衡过程。结果认为，不同的陆地下垫面性质的变化将会改变地气系统之间的能量平衡和转换过程，进而影响到区域气候环境。通过改变地表特征的方式可改善区域气候和生态环境。

关键词：陆地下垫面特征，区域能量平衡，数值试验


Numerical experiments of the effects of land surface characteristics on regulation energy balance are carried out. The surface energy budget is modeled in North China using a 3-D regional climate model. The results show that the different land surface characteristics would lead to large differences in exchanges of surface energy because they exert substantial influence on regional climate. Therefore it is possible to improve the climate condition and ecological environment on a regional scale by modifying the land surface characteristics.

Keywords: underlying surface characteristics of land, regional energy balance, numerical experiments

本文讨论了西北地区降水量的空间特征。对7-9月降水量分别进行EOF分解，并与500hPa高度场进行了对比。结果发现，7-9月降水量第一特征向量在青藏高原东北侧有一高值中心，该中心与有关学者计算的高值比高值中心和准3年周期高显著的区域一致，7-8月降水量第一特征向量与500hPa高度场在20-40°N，100-130°E和55-70°N，50-85°E两区域有较好的同期相关。
关键词：EOF 中国西北地区 降水量 青藏高原东北侧


The spatial characteristics of precipitation in Northwest China are discussed. The characteristics of monthly precipitation from July to September in Northwest China are analyzed using EOF method. The relationship between precipitation and the 500 hPa monthly mean height is also discussed. The results show that a strong precipitation center of monthly precipitation from July to September for the first eigenvector appears on the northeast side of Qinghai-Xizang Plateau and that simultaneous relationships between first eigenvector of precipitation in July and August and 500 hPa height field in 20-40°N, 100-130°E and 55-70°N, 50-85°E are better.

Keywords: EOF, Northwest China, precipitation, the northeast side of Qinghai-Xizang Plateau


本文在已经发展的土壤—植被—大气模式基础上，建立了包含雪盖问题的陆面过程模式，并用实测气象和辐射资料检验了模式对大气降雨和降雪的响应。结果表明，该模式描述的各种物理过程合理，一些可观测要素的演变特征与实况相当一致。
关键词：陆面过程模式 积雪变化参数化 HEIFE


A new version of the land-surface process model in which the snow-cover process is considered is developed on the base of the existing soil-vegetation-atmosphere model. A few experiments were designed using meteorological and the surface radiation data. The results show that the modeled processes forced by atmospheric precipitation (both rainfall and snowfall) are quite reasonable. Some modeling elements, such as the surface soil temperature and the surface net radiation, coincide well with the observations.

Keywords: land-surface process model, parameterization of snow-cover variation, Heihe River Field Experiment (HEIFE)

Numerical experiments were performed using a five-layer primitive equation model that is limited in certain areas. The experiments were composed of five parts: heights of 1000 m, 2000 m, 3000 m, 3500 m and 4000 m. The results show that the atmospheric heat source over the Tibetan Plateau and its southeast neighborhood strengthened with the rising of the plateau. The Asian summer monsoon circulation was changed obviously. When the mean height of the plateau is raised to 3500 m, the South Asian high in the upper troposphere appear, and the tropical easterly to the south of the high center strengthens considerably. Meanwhile, the low-level thermal low over the Asian continent moves westward over the plateau rapidly. When the plateau rises higher than 3500 m, the monsoon strengthens considerably. The rising of the plateau also causes variation of precipitation in regions around it.

Keywords: summer monsoon, the rising of the Tibetan Plateau


The dynamic mechanism producing the intraseasonal variability in the extratropical latitude is studied. Study indicates that the barotropic local instability rather satisfactorily accounts for the atmospheric 30-60-day periodic oscillation at the middle and high latitudes. The low-frequency oscillation is an intrinsic characteristic of the large-scale atmospheric motion’s interaction with the perturbation. Moreover, the basic currents accommodations to the triggering of the intraseasonal oscillation are discussed. The investigation of the initial value

The relationship between the anomalous thermal forcing of the Tibetan Plateau ground surface and the formation of heavy rain in the Yangtze-Huaihe basin is discussed by using the Oregon State University atmospheric general circulation model (OSU-AGCM). The anomalous thermal regime of the Tibetan Plateau’s ground surface caused persistent rainfall in the Yangtze-Huaihe basin during the summer of 1991. Similar to the character of the two-dimension of Rossby waves along the great circle route, the anomalous thermal forcing of the Tibetan Plateau can result in the distribution of anomalous cloud amount.

Keywords: Tibetan Plateau, anomalous thermal forcing, heavy rain in Jianghual basin, numerical experiment, distribution of anomalous cloud amount

本文讨论了夏季纬向不对称气候平均气流下通过正压大气内部动力过程建立遥相关型的问题，介绍了有利发展扰动型的概念。分析表明，最有利发展的扰动型的振幅增长率同实际大气遥相关型的增长率相一致。并且这些有利发展扰动型都将演变为同实际大气相一致的遥相关的型结构。至少部分实际大气遥相关型是只依赖于大气内部的正压过程即能量转换过程而建立起来。
关键词：正压大气 遥相关型 有利发展扰动 奇异值和矢量


An interactive model of the soil-vegetation-atmospheric surface layer has been built. It is shown that the model can obtain a reasonable simulation of the variations of temperature, moisture and different fluxes in the soil, vegetation, and atmosphere. It can be used in simulating climate in a mesoscale model.

Keywords: soil layer, vegetation layer, surface layer, interactive model


The problem whether the generation of teleconnection patterns can result solely from the internal barotropic processes of the zonally varying climatological flow in the northern summer is discussed. The conception of preferred perturbation of growth is introduced. The results of calculations show that the amplification rate of the leading preferred perturbations of growth is consistent with that of realistic teleconnection patterns. It is suggested that the formation of at least some teleconnection patterns can depend on the preferred perturbations of growth.

Keywords: barotropic atmosphere, teleconnection pattern, preferred perturbation of growth, singular value and vector

本文提出一种降水长期预测的新方案，用扩展经验正交函数（EEOF）方法展开降水场，寻找前期降水场与后期降水场分布趋势的关系，对未来降水场分布趋势和降水总量趋势作出预测。

关键词：扩展经验正交函数 月（季）降水 隔季相关


A new scheme for long-range forecasting has been proposed. The monthly (seasonal) rainfall distribution field is expanded by EEOF to find the relationship between the earlier rainfall distribution field and later rainfall distribution and prediction of rainfall tendency.

Keywords: extended empirical orthogonal function, monthly (seasonal) rainfall, relation of ever-successive seasons


本文应用并发展了Arnold方法（能量－Casimir方法），在非线性不稳定性方面研究大气运动取得了若干新进展。作者讨论了该领域理论深入发展的前景及其应用问题。

关键词：不稳定性 非线性


Arnold’s method (energy-Casimir method) is used and developed by the author. The nonlinear instability of atmospheric motions are studied and some recent advances are obtained. The prospects of the further development of the theory and its applications are also discussed.

Keywords: instability, nonlinearity

本文应用两层大气环流模式研究了夏季赤道东太平洋地区负的海温异常对全球及赤道东太平洋地区和东亚局地短期气候变化的影响，并对赤道东太平洋海温异常影响全球及赤道太平洋和东亚局地短期气候变化的物理机制进行了探讨。

关键词：海表温度异常 降水异常 短期气候变化


The influence of negative sea-surface temperature anomalies (SSTA) in the eastern equatorial Pacific in summer on global atmospheric circulation and regional short-range climate changes in the equatorial Pacific and East Asia is studied using the two-level atmospheric circulation model. The physical mechanism of regional short-range climatic changes that are affected by SSAT in the eastern equatorial Pacific in summer is also studied.

Keywords: sea-surface temperature anomalies, anomalous precipitation, short-range climate change


本文根据12年144个月全球各大洋的海温距平资料进行了分析，结果认为，赤道东太平洋海温的异常仅仅是全球变化的一个部分。地球自转首先引起纬向风的异常，然后作用于洋流和海温的异常。全球各大洋海温时空分布变化的变化特征可由一个简化的海洋浅水波模式模拟出来。

关键词：地球自转 海温异常 数值试验


Based on the global sea surface temperature anomalies (SSTA) of 144 months in 12 years, it is found that the East Pacific SSTA is just one part of the global temperature changes. The variation of the Earth’s rotation rate causes the anomaly of zonal wind and then the abnormal stress force of zonal wind will cause the anomaly of the current and the SSTA. All of these can be simulated by coupled ocean models.

Keywords: Earth’s rotation, sea surface temperature anomaly, numerical experiment
张勤等，1995。热带太平洋地区SSTA和风应力场的海气耦合模式，热带气象学报，11(1):43-50

本文使用EOF分析了20年热带太平洋地区风应力场资料和SSTA资料，对它们的空间分布特征模式和时间变化特征进行研究，确定了海洋和大气之间的耦合关系及其与ENSO之间的关系，揭示了大气和海洋相互作用的本质。

关键词：风应力 海温 海气耦合 相互作用


Twenty years of wind stress and sea surface temperature anomaly (SSTA) data for the tropical Pacific are studied by the empirical orthogonal function (EOF) method to reveal the characteristic modes of spatial distribution and features of temporal variation. The modes of air-sea coupling and its relationship with El Niño Southern Oscillation (ENSO) are found and the essence of the interaction between air and sea is summarized.

Keywords: wind stress, sea temperature, air-sea coupling, interaction

江志红，丁裕国，1995。我国下半年降水距平与北太平洋海温异常的奇异值分解法分析，热带气象学报，11(2):133-141

本文利用奇异值分解法分析了我国下半年各月降水距平与北太平洋月平均SSTA的相互关系。作者认为，秋冬季海温影响了我国春末至盛夏的降水量；秋冬季赤道东太平洋海温对次年4－5月江南东部和7月高原东侧、黄河中下游地区的降水有显著的影响；前一年6月黄淮地区及7月长江流域降水影响了次年盛夏至冬季的赤道中东太平洋海温。

关键词：奇异值分解法

下半年降水距平 北太平洋海温

江志红和丁裕国。1995。The singular value decomposition analysis between the sea surface temperature anomaly (SSTA) field over the northern Pacific and the precipitation anomaly field during the summer half year in China。Journal of Tropical Meteorology 11(2):133-141。

The relationship between sea surface temperature anomaly (SSTA) field over the northern Pacific and precipitation anomaly during the summer half year in China is studied using the singular-value decomposition method. The authors believe that the SSTA fields in autumn and winter affect rainfall for each month from the end of spring to midsummer in China. The SSTA field in the equatorial eastern Pacific during autumn and winter has a strong influence on the rainfall in the following July for the eastern Plateau and the middle-and-lower reaches of the Yellow River. The rainfall for the Yellow River Valley and the Hualhe River Valley in the preceding June or the Yangtze River Valley in July can affect the SSTA field in the middle and eastern equatorial Pacific from the prime of summer to winter.

Keywords: decomposition of singular value, precipitation anomaly during summer half year, sea surface temperature in northern Pacific
王兴宝，张维恒. 1995. 地形激发斜压波动的数值研究，热带气象学报，11(2):150-161

本文应用准地转和半地转两维模式研究了南北向长的山脊对过山斜压气流强迫产生扰动的过程，还把准地转模式和平地转模式的结果作了对比，并讨论了上述结果在实际天气过程中的意义。
关键词: 地形 斜压波动 激发


Processes of disturbance generation forced by baroclinic current overflowing a north-south mountain ridge are studied using two-dimensional quasi-geostrophic and semi-geostrophic models. The authors also discuss the comparison between the two models and the implications of the results achieved in real atmospheric processes.

Keywords: topography, baroclinic wave, excitation

吕克利. 1995. 大气中的位涡守恒和Rossby波的能量、波作用与拟能守恒，热带气象学报，11(2):258-268

本文推导得到普遍形式的位涡守恒方程。对准地转位涡方程，利用WKB近似，得到了空间换变基本气流和层结可变情况下的Rossby波的能量、波作用与拟能守恒条件。还给出了地形存在情况下的Rossby波的能量、波作用与拟能守恒条件。
关键词: 慢变基流 地形 守恒律


A general conservation law of potential vorticity is obtained by calculation. Use of the Wentzel-Kramers-Brillouin (WKB) approximation in a slowly varying basic flow and a variable stratification parameter derives the conservation laws of wave energy, action and entropy for Rossby waves. Finally, the effect of topography is mainly on the slope with an west-east direction and causes only the variation of wave action.

Keywords: slow-varying basic flow, topograph, law of conservation

本文对常用的四阶线性水平扩散的 A、B 两种方案进行了量纲分析和简化，并用有地形中尺度模式对两种方案作了详细的对比数值试验和分析。试验结果表明，在地形平缓区域，两种方案的预报差异较小，而在陡峭地形附近，则预报差异很大，这是因为方案 A 中出现了温度和湿度的虚假扩散，造成温度和湿度异常，进而引起不稳定层和对流发展的异常。方案 A 还造成了环流场异常，导致周围地区的降水量异常。方案 B 可以解决陡峭地形附近的预报异常问题，用方案 B 解决该问题是可行的。

关键词：两种水平扩散方案中尺度模式量纲分析对比试验


本文根据 Saltzman 海气随机气候模式就建立了海温脉动 0°的 Langevin 方程以及对应的 Fokker-Planck 方程。在给定参数条件下，概率密度函数 p (x, t) 具有多个极大值，并在 p(x, t) - p(x, t+τ) 相空间中呈现 Cantor 集合图象，表明该随机系统在上述参数条件下出现了混沌行为。

关键词：随机系统 Cantor 集合混沌行为


Dimensional analysis and reduction are made to the two commonly used schemes (A and B) of 4th-order linear horizontal diffusion. In addition, detailed control experiments between the two schemes are made using a topography-included mesoscale model. Experiments show that differences are small in smooth-terrain areas and very large in steep mountain areas. The reason for that finding is that temperature and humidity are falsely diffused in Scheme A, which causes abnormal temperature and humidity and results in the abnormalities of unstable layer and convective development. In addition, Scheme A causes circulation anomalies, which cause rainfall prediction deviations in the area. Analysis indicates that Scheme B, which can minimize the diffusion scheme involved in forecasting abnormalities in steep mountain and adjacent areas, is necessary and feasible.

Keywords: two horizontal schemes, dimensional analysis, mesoscale model, control experiments


Using the Saltzman sea-air stochastic climate model, the Langevin equation for sea-air fluctuation 0°, and the related Fokker-Planck equation were derived. The probability density curve p (x, t) is of a number of maximum, and a Cantor set image is shown in the phase space of p (x, t) and p (x, t+τ) in terms of specified parameters, indicating that the stochastic system produces chaos output with the defined parameters.

Keywords: stochastic system, Cantor set, chaos output
Radiation and Trace-Gas Emission


The article documents the development of a coupled energy balance model and a box diffusion model (EBM/BD) to study the greenhouse-gas-induced transient and time-dependent change on global mean temperature. The variations of the ground surface temperature of the next century are estimated using the coupled model.

Keywords: greenhouse effect, time-dependent climate change, ocean model


The variation of solar radiation in northwest China during the last 30 years is analyzed. The paper concludes with the regulation of the diffuse solar radiation in northwest China and the global solar radiation decreases in almost the whole area since 1978. In this research, three typical types of seasonal variation of solar radiation are obtained.

Keywords: variance analysis, solar radiation, seasonal variation type

The change in the organic carbon content of the desertified land is studied based on the area of desertified land, the organic carbon content in soil, and the rate of desertification, development, or adverse processes in China. The amount of carbon dioxide released to atmosphere is more than that assimilated from atmosphere. The net carbon dioxide released to atmosphere in China occupies 93.5% of the whole quantity of the temperate zone and the frigid zone in the last 40 years.

Keywords: China, land desertification, carbon dioxide content


The paper deals with association between the acute onset of coronary heart disease and stroke and factors of solar and geomagnetic activities. The analysis was done by statistical and simple correlation for a period of 8 years from 1984-1991. The result shows that there was certain correlation between the acute onset of coronary heart disease and stroke and some factors of solar and geomagnetic activities.

Keywords: coronary heart disease, stroke, solar activity, geomagnetic activity, correlation analysis, analysis of overlapping epoch
白建辉，王庆辰．1995．太阳辐射各因子的变化对太阳紫外辐射的影响，气象．21(9):3-6

本文根据1990年北京太阳分光辐射的观测资料计算影响太阳紫外辐射的臭气、水汽、气溶胶等因素的变化所引起的太阳紫外辐射的变化。当各因子分别减少5%时，到达地表的太阳紫外辐射将分别增加0.84%，0.27%，和1.90%。在分析太阳紫外辐射的变化趋势时，应全面考虑各个因子的影响。
关键词：太阳紫外辐射 香气 水汽气溶胶

Bai Jianhui and Wang Gengchen．1995．Effects of the change in factors affecting solar radiation on solar ultraviolet radiation．Meteorological Monthly 21(9):3-6．

The change of the solar ultraviolet radiation caused by changes in ozone, water vapor, and aerosol are calculated based on the observation of solar spectral radiation in 1990 over the Beijing area. The solar ultraviolet radiation will increase 0.84%, 0.27%, and 1.90% respectively as ozone, water vapor, and aerosol decrease 5%. The influence of all the factors affecting solar ultraviolet radiation should be considered comprehensively in analyzing the variation trends of solar ultraviolet radiation.

Keywords: solar ultraviolet radiation, ozone, water vapor, aerosol

白淑菊等．1995．长白山常绿针叶树越冬期间光合能力的抑制，应用生态学报，6(2): 138-142

本文探讨了长白山区红松及其它针叶树在冬季也存在光合抑制以及遮荫可减轻抑制的问题。推测在长白山地区或冬季气候与之相似的地区，常绿针叶树在冬季均可能表现光合抑制，释放CO₂。
关键词：针叶树 遮荫 光合能力 光合抑制 光氧化


There exists winter inhibition in photosynthetic ability of conifers. Shading can ameliorate the photosynthetic ability. It is suggested that all the evergreen conifers on Changbai Mountain and similar mountain regions suffer from photosynthesis inhibition and photooxidation stress during winter, and a large quantity of CO₂ is released as a result.

Keywords: conifer, shading, photosynthetic ability, photosynthesis inhibition, photooxidation
陈冠雄等，1995. 稻田CH₄和N₂O的排放及养萍和施肥的影响，应用生态学报，6(4): 378-382

本文用箱法研究了我国东北稻田CH₄和N₂O的排放情况，东北稻田的CH₄排放通量小于南方稻田，在淹水期稻田基本上不排放N₂O，非淹水期则释放大量N₂O。稻田施肥和养萍明显促进CH₄和N₂O排放，稻田CH₄和N₂O排放之间存在消长关系。关键词：稻田 CH₄和N₂O排放 养萍 施肥


By using chamber technique, the authors studied the characteristics of CH₄ (methane) and N₂O (nitrous oxide) emission from a rice field in northeastern China. CH₄ emission from a rice field in northeastern China is less than that in southern China. Rice fields emit almost no N₂O during the flooding period, but substantially emit it during the non-flooding period. CH₄ and N₂O emissions are greatly enhanced by azolla and fertilization. There is a trade-off relationship between CH₄ and N₂O emissions.

Keywords: rice field, CH₄ and N₂O emission, azolla, fertilization

于克伟等，1995. 几种旱地农作物在农田N₂O释放中的作用及环境因子的影响，应用生态学报，6(4): 387-391

本文根据几种旱田N₂O的排放通量的观测结果，研究了植物在农田N₂O释放中的作用及环境因子对N₂O通量的影响。结果表明，大豆田N₂O通量每天都两个释放高峰，而菠菜田和春小麦田每天只有一个释放高峰，裸地的N₂O释放很少。光照变化对植物N₂O通量影响很大，光弱时的N₂O释放通量较高。关键词：农田 作物 N₂O通量 N₂O的汇 光照


Based on data of observation of emissions of nitrous oxide from farmlands of upland crops, the role of upland crops in nitrous oxide emissions and the effect of environmental factors on nitrous oxide emissions are studied in this paper. The results show that there exist two emissions of diurnal nitrous oxide flux from soybean fields, but only one peak from spinach and spring wheat fields. Bare fields are a weak nitrous source. The variation of illumination has a significant influence on nitrous flux from crops. Higher emissions of nitrous oxide from crops occur under weak illumination.

Keywords: farmland, crop, nitrous flux, nitrous sink, illumination
陈万隆．1995．农作物对紫外辐射的反射与吸收，中国农业气象，16(2):9-12

本文研究了4种农作物对紫外辐射的反射与吸收，结果表明，农作物对紫外辐射的反射要比对太阳总辐射的反射率小得多，其吸收率随叶面指数增大而增大。作物对紫外辐射反射的日变化与太阳总辐射反射率的日变化一致。

关键词：紫外辐射 反射 吸收

Chen Wanlong．1995．Reflection and absorption for ultraviolet radiation (UV) of crops．Agricultural Meteorology 16(2):9-12．

The author investigates the reflection and absorption for ultraviolet radiation (UV) of four kinds of crops．The results indicate that the reflection of UV radiation on crops is much less than that of total solar radiation．The absorption rate increases with the increase of the index of leaf area．In addition，the daily variation in reflection of UV radiation coincides with the rate of solar radiation．

Keywords: UV, reflection, absorption

盛业华等．1995．工矿城市地面热场的遥感调查及其对大气污染的影响，环境科学，16(3):19-22

本文根据城市冬季清晨和中午两个时相的图像信息以及地面同步辐射温度数据，通过数字图像处理，得出城市地面热强度。研究发现，城市的热岛效应在清晨表现明显。作者还建立了低空气温和下垫面辐射温度之间的线性关系，并由此研究了地面热场对大气污染的不良影响。

关键词：红外遥感 地面热场 大气污染

Sheng Yehua et al．1995．Remote sensing survey and effects on atmospheric pollution of ground heat field in mining city．Environmental Sciences．16(3):19-22．

Ground heat intensity of a city is obtained through digital imagery with data of image information of morning and noon and ground synchronous radiant temperature．The result indicates that the heat effect of a city is more distinctive in the morning．The authors set up a linear relationship between low-altitude temperature and radiant temperature and studies the negative effects on the atmosphere of ground heat field．

Keywords: infrared remote sensing, ground heat field, atmospheric pollution

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根据1972年8月－1983年7月青藏高原地区地面辐射收支观测资料及同期NOAA－7辐射收支资料，用回归分析的方法研究了大气顶净辐射与地表净辐射之间的关系，并在此基础上分析了青藏高原地区月平均地表净辐射的时空分布特征。

关键词：青藏高原 大气顶净辐射 地表净辐射


Based on analysis of data of the simultaneous surface radiation and the National Oceanic and Atmospheric Administration satellite NOAA-7 radiation budget over Qinghai-Xizang Plateau during the period from August 1982 to July 1983, the relationships between surface net radiation flux and net radiation flux at the top of the atmosphere (TOA) are discussed through regression analysis. On the basis of this analysis, the spatial distributions of the monthly mean surface net flux are analyzed.

Keywords: Qinghai-Xizang Plateau, net radiation flux at the top of the atmosphere, surface net radiation flux

王尧奇，韦志刚，1995. 河西地区的太阳直接辐射和大气透明度，气象学报，53(3):375-379

本文根据河西地区民勤和敦煌两个日射站1981－1983年的资料，计算了太阳直接辐射在传输过程中的各种衰减。作者认为，该地区的环境具有干燥、荒漠和狭管地形的特点，这种特点使气溶胶衰减，影响直接辐射。

关键词：太阳直接辐射 大气透明度 云的辐射衰减 河西地区


Based on the analysis of data from 1981 to 1983 of the two solar radiation stations in Minqin and Dunhuang of the Hexi region, various kinds of attenuation of the direct solar radiation during the transmission process are calculated. The authors believe that aridity, desert, and narrow channel topography are characteristic of the Hexi region and their influence on direct solar radiation appears as an attenuation of aerosols.

Keywords: direct solar radiation, atmospheric transparency, attenuation of solar radiation of cloud, Hexi region

本文通过对北京地区晴天和实际天气条件下到达地面太阳紫外总辐射的计算, 分析了影响到达地面太阳紫外总辐射的各主要因子的主次贡献。重点讨论了大气中的水汽, 对到达地面的太阳紫外总辐射消光的可能机制.

关键词: 水汽 太阳紫外辐射 光化学反应


Based on the calculation of the ultraviolet radiation reaching the ground over the Beijing area, the primary and secondary contributions of dominant factors affecting the solar ultraviolet radiation reaching the ground surface under clear sky conditions and actual sky conditions are analyzed. The possible extinction mechanism by water vapor of the solar ultraviolet radiation reaching the Earth's surface, which operates in most atmospheric photochemical reactions, is emphasized.

Keywords: water vapor, solar ultraviolet radiation, photochemical reaction

王可丽, 钟强. 1995. 辐射传输模式中地表参数对大气长波辐射的影响. 大气科学, 19(5):606-614

本文分析了下垫面温度与地表温度两者不能合二为一的问题, 利用Liou-Ou一维宽带辐射传输模式, 对地表热力参数取值部分作了改进。同时, 还讨论了下垫面温度的日变化对大气长波辐射通量日变化的影响及地表比辐射率的变化对大气长波辐射通量计算结果的修正作用。

关键词：辐射传输模式 大气长波辐射 地表热力参数


The lack of an observed relationship between underlying surface temperature and surface air temperature is analyzed. The surface thermal parameters are improved by using the Liou-Ou one-dimensional atmosphere radiative transfer model. In addition, both the effect of the underlying surface temperature on the diurnal cycle of atmospheric long-wave radiative fluxes and the effect of the modulating of surface emissivity on the atmospheric long-wave radiative fluxes are discussed.

Keywords: radiative transfer model, atmospheric long-wave radiation, surface thermal parameters

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本文统计分析了1月份、7月份热带东太平洋海温与北半球大气臭氧层之间的季节性相互联系以及海温导致的臭氧层相关的空间结构。结果发现，热带东太平洋海温对北半球臭氧层的分布及其季节演变都具有重要作用。不同季节海温导致的臭氧层的遥相关型也相同；不同季节海温对臭氧层的影响效果产生叠加，使臭氧层对海温的响应表现出十分明显的波列结构。

关键词：臭氧层 海温 遥相关型 基点相关图


Seasonal interaction between sea surface temperature (SST) in the tropical eastern Pacific and the ozone layer in Northern Hemisphere and the teleconnection spatial structure caused by SST effects, for January and July, are statistically analyzed. The result indicates that SST in the tropical eastern Pacific is important to the northern ozone layer distribution and its seasonal evolution. The difference in the teleconnection pattern for the ozone layer is the result of the effects of SST in different seasons. And the persistent influence of SST on the ozone layer causes well-defined wave chains in the layer responding to SST.

Keywords: ozonosphere, sea-surface temperature, teleconnection pattern, one-point correlation map
刘东生，安芷生，陈明阳，1996，最近0.6Ma南、北半球古气候对比初探，中国科学，26（2）：97-110

本文将我国黄土高原最近0.6Ma夏季风加强以及35～25Ka BP和4～2.5Ka BP时段东亚夏季风增强的记录与澳洲干旱或沙漠化增强记录进行了对比，提出导致澳洲沙漠化的高压增强，通过穿越赤道的气流可能在过去增强东亚季风的论点；另外，本文还提出了另一论点：全新世气候适宜期东亚与澳洲气候记录所表明的同步变化，可能反映了与蒙古高压系统有关的东亚冬季风环流穿越赤道对澳洲夏季风环流增强的影响，南、北半球季风气候通过穿越赤道的气流相互作用可能自0.6 Ma BP开始表现明显。

关键词：0.6Ma BP气候转型

蒙古高压与澳洲夏季风

Liu Dongsheng, An Zhisheng, and Chen Mingyang. 1996. A correlation between Southern and Northern Hemispheres during the last 0.6 Ma. Science in China (Series D) 26(2):97-110.

A comparison of climate records between the Chinese Loess Plateau, which shows a strengthening of the summer monsoon in the last 0.6 Ma and a strengthening of the Asian summer monsoon during 35 to 25 and 4 to 2.5 ka BP intervals, and the Australian records, which show a strengthening of aridity or desertification, is analyzed. The results suggest that the Australian high pressure leading to desertification strengthened the Asian summer monsoon in the past through the cross-equator circulation. On the other hand, the synchronous variation in the Holocene Optimum, as indicated by Asian and Australian climate records, suggests that the cross-equator East Asian winter monsoon circulation related to the Mongolian high pressure might have influenced the Australian summer monsoon. The interaction of the monsoon climate between the Southern and Northern Hemispheres through cross-equator circulation probably started to be obvious since 0.6 Ma BP.

Keywords: change of climate type at 0.6 Ma BP, Australian high and East Asian monsoon, Mongolian high and Australian summer monsoon

王福保，韩辉有，吴育群，1996，青藏高原东北部30 Ka以来的古植被与古气候演变序列，中国科学，26（2）：111-117

本文利用孢粉分析并结合沉积学及14C测年等资料，阐明了青藏高原东北部若尔盖高原30Ka来的古植物与古气候演变系列及主要的气候事件。结果表明古植被经历了高寒荒漠、草甸、草甸等七个阶段；气候与植被相应发生了多次变化，冰后期和


Palynological study of two lacustrine suites by limnological and 14C dating reveals the local evolutionary history of the paleovegetation and the paleoclimate of the Zoige Plateau, northeastern Qinghai-Xizang Plateau in the last 30 ka. The evolution of territorial paleovegetationatain experienced seven stages, such as alpine desert vegetation, grassland, meadow, etc., and the inferred paleoclimate evolution shared similar corresponding variations. The major climatic
German, Wu Naiqin, and Liu Dongsheng. 1996. Seasonal climatic variation recorded by phytoolith assemblages from the Baoji Loess sequence in Central China over the last 150,000 years. Science in China (Series D) 26(2):131-136.

This paper presents the results of phytoolith assemblages from 153 modern surface soil samples of China and from the upper of 12-m loess layer of the Baoji loess-paleosol sequence to analyze the phytoolith types and to investigate seasonal climatic variation. The results show the variations in temperature and precipitation and evolution of vegetation pattern for the past 150,000 years in the Baoji loess section. The impact of changing monsoon intensity in different periods in this area is discussed.

Keywords: loess, phytoolith, paleomonsoon


Numerical simulation indicates that the future thermal regime of permafrost on Qinghai-Xizang Plateau will change as the air temperature (T) continuously rises at 0.04 °C/year. The calculated results show that when Ts are 0, -0.5, -1.5, -2.5,
变化趋势。计算结果表明，在计算
所假设条件下，当初始地面年平均
温度为0.0, -1.5, -2.5, -3.5和-
4.5°C时，14m
深度上的年平均地温分别为-0.11, -
0.59, -1.52, -2.45, -3.21和-
4.32°C，多年冻土厚度为16.8, 29.0, -
54.1, 79.7, 112.1和131.0m
时，经50a的环境持续升温后，14m
深度上的年平均地温分别升高为0.0
, 0.0, -0.36, -1.23, -2.16和-
3.07°C；初始年平均地温大于
-1.1°C时，多年冻土由衔接型变为不
衔接型，低于-1.1°C时，
多年冻土上限分别由初始的1.8, 1.6,
1.4和1.2m增大为2.2, 2.0, 1.8, 1.6m，
且多年冻土厚度不发生大的变化。
所以，如果未来气候以文中的速度
或低于该速度变暖，50a内我国青藏
高原多年冻土分布将不会发生大
的变化。

关键词：青藏高原多年冻土
气候变暖 年平均地温 数值模拟

Yao Tandong and Qin Dahe. 1996. Variations in
temperature and precipitation in the last 2000
years on the Xizang (Tibet) Plateau—Guliya Ice
Core record. Science in China (Series D)
26(4):348-353.

Past temperature and precipitation variations are
recorded precisely and continuously in δ18O and
glacial accumulation records in the Guliya ice
core. Eight warm periods and seven cold periods
can be distinguished in the past 2000 years. Of the
four most intensive cold periods, three are in the
Little Ice Age and one in the 11th to 12th century.
The variation of precipitation is relatively small
compared with that of temperature. Five humid
periods and four dry periods occurred in the
1996

时间上出现过5次相对高降水期和4次相对低降水期。古里雅冰芯所记录的温度和降水的长期变化趋势呈正相关，但降水变化滞后于温度变化。
关键词：古里雅冰芯 $\delta^{18}O$

冰川积雪量


The high-resolution and multi-proxy analysis of lacustrine sediments from the Gucheng Lake has revealed the palaeoclimate and palaeoenvironmental evolutionary process since 15 ka BP. The formation, expansion, and shrinkage of the lake are closely related to monsoon rain caused by the strength change of monsoon circulation which is controlled by orbital forcing. An abrupt decrease of temperature occurring from 11.3 to 11.0 ka BP can be correlated to a Younger Dryas event that truncated the monsoon climate cycle. It is known through correlation with adjacent regions that there were two northern shifts and two southern migrations of the polar front of monsoon rain.

Keywords: high resolution, environmental evolution, monsoon rain, Gucheng Lake

The Late Quaternary loess-soil in Xifeng, Luochuan, and Weinan are studied in order to investigate the micromorphology of both loess and paleosols. Many features have clear climatic implications and may be used as indications of morpho-stratigraphic and climatic correlation. The temporal and spatial variations of these features allow us to define 16 climatic events for the last 130 ka, which are highly consistent with the variations in paleo-weathering intensity. Part of these events are attributable to orbital forcing whereas others are more or less synchronous with the Heinrich events recorded in the North Atlantic Ocean. During the latter events, the Loess Plateau was characterized by sparse vegetation cover and strong winds whereas the climatic conditions between these events were considerably humid, resulting in a significant steppe cover.

Keywords: loess, paleosol, micromorphology, paleoclimate


Oxygen and carbon isotopes of carbonate in concretion and bulk samples collected from the Xifeng, Luochuan, and Weinan loess sections, China, have been analyzed. The carbon and oxygen isotopic ratios of concretion in paleosol, as useful paleoclimatic indicators, recorded temperature and humidity variation during their formation. Comparison of isotopic data from different locations can offer a spatial picture of past environmental changes. Isotopic data from the carbonate of a bulk sample also include useful environmental information. Carbonate isotopic records of carbon and oxygen isotopic curves of last 150 ka in Weinan reflect the fluctuations of the paleoclimate with different stratigraphical units. The curves correlate well with those of


From magnetic susceptibility data for 30 sections covering the Loess Plateau, contour maps of susceptibility are given for five time intervals: the last second glaciation (150 ka BP), the last interglaciation (130-74 ka BP), the interglacial of last glaciation (59-24 ka BP), the last glacial maximum (18 ka BP), and the Holocene Optimum (9 ka BP). The susceptibility value of the last glaciation maximum loess is regarded as the base value of pedogenic loess or paleosol. The susceptibility increment to the base indicates summer monsoon activity and its strength. On this assumption and susceptibility contour maps, the variation sequence of the summer regime is reconstructed for the last 150 ka. The extent and the northern boundaries of the summer monsoon front activity are also estimated for each stage. It suggests that the evolution history of the summer monsoon regimes revealed by the susceptibility contour maps not only provides information on the position, strength, and configuration of the climate members influencing the summer monsoon, but also provides some climatic signals from the polar and Southern Hemisphere.

Keywords: loess, paleomonsoon, magnetic susceptibility, paleoclimate reconstruction.
石宁, 1996. 上新世一早更新世云杉属和冷杉属在华北地区的发展及其气候指示意义. 第四纪研究, (4): 319-328

本文研究了上新世一更新世云杉属和冷杉属在华北地区的发展，并讨论了其气候指示意义。结论显示：（1）华北地区的云杉属和冷杉属自
4.4Ma BP
的上新世早期即开始大量发展，当时它们的生态习性与现代寒温带种类不同；（2）云杉属和冷杉属不适宜作为第四纪开始的标志；（3）云杉属，冷杉属和喜暖植物在上新世一更新世的演化和迁移导致它们今日相隔遥远的分布，这一过程反映了华北地区气候变化和季风气候发育的历程。东亚季风可能是上新世逐渐加强，而在2.3Ma BP
前后已形成了第四纪时期的基本特征。
关键词：上新世 云杉属 生态习性 冰期 东亚季风气候


Development of spruce and fir in North China during the Pliocene and the early Pleistocene is studied, and its paleoclimatic implications are discussed. The following conclusions can be made from the study: (1) *Picea* and *Abies* developed in North China from early Pliocene (4.4 Ma BP), and the Pliocene *Picea* and *Abies* have different ecological demands than most modern species. (2) The development of modern distribution patterns of *Picea* and *Abies* that are distantly separated from the thermophilous plant reflect formation of the monsoon climate in northern China. The monsoon climate was gradually strengthened in the late Pliocene and its Quaternary pattern may be formed around 2.3 Ma BP.

Keywords: Pliocene, *Picea*, habitat, glaciation, east Asian monsoon climate

王兆民, 李保华, Uwe Pflaumann. 1996. 西太平洋新世变冷事件, 中国科学, 26（5）：416-466

对取自冲绳槽和南海的3个重力柱状样（255, 170, 17940-2
柱状样）进行浮游有孔虫分析后发现：所有属种中，*Pulleniatina obliquiloculata*显示出对西太平洋暖第四纪冬季表层海水温度反应灵敏，其相对丰度的变化显著，且在各柱状样间可以对比，全新世最显著的变化是约4.2KaBP前的


Cores 255, 170, and 17940-2, raised from the Okinawa Trough and the South China Sea, have been studied for planktonic foraminifers. Among all the series, *Pulleniatina obliquiloculata* is shown to be sensitive to winter sea surface temperature in the late Quaternary in the western Pacific. The fluctuations in its relative abundance are significant and correlatable between the cores. The most conspicuous change during the Holocene is the *Pulleniatina obliquiloculata* minimum zone around 4.2 ka BP, which correlates to neoglacial cooling. The widespread occurrence of this cooling event in the western Pacific

Through pollen analysis of 27 samples collected from the Holocene stratum in the northern part of the Tarim Basin, the paleoenvironment in this region is analyzed. Because there were only obtuse changes in the composition of the dry and ultra-dry ecological desert vegetation zones in this region, except that of regional vegetation of the Tarim River Basin, it is suggested that the Holocene climate in this region was dry as a whole. But there were also small changes in the quantity of pollen family and abundance and in the quality of Artemisia, Chenopodicaeae, and Ephedra pollens etc. in the stratum, which indicates that there were small wet and dry fluctuations under the background of a dry climate. That is, the paleoclimate in this region was relatively cold and moist in the early and late stage, warm and dry in the middle stage, and during the Holocene Epoch, the period was a little wet at the Megathermal Maximum.

Keywords: northern part of the Tarim Basin, Holocene Epoch, pollen component, climate environment
赵英时，杨忆. 1996. 全新世海侵痕迹遥感信息特征提取方法研究. 地理研究 15(1):73-81

应用TM、MSS、NOAA等多平台、多波段、多时相遥感信息，并结合地貌、水文地质、岩相、历史考古学等地学信息进行综合分析，研究了华北平原全新世海侵痕迹信息特征的提取方法。研究中特别注重利用与海侵有着直接因果关系的地下咸水体及水化学特征变化所传递的信息。这些信息涉及到水、热、盐、土、植被等环境因子。通过多种图象处理方法，突出古海岸线两侧环境因子的综合差异，识别和勾绘古海岸线。
关键词：全新世海侵 遥感图象处理 专题特征提取


An integrated analysis of multispectral and multitemporal remote sensing image data (TM, MSS, NOAA/ AVHRR) and geoscience data (geomorphological, hydrogeological, lithofacies, archaeological) was carried out to identify paleo-coastal lines since the Holocene Epoch in the eastern part of the North-China plain. The emphasis of the study is on the utilization of information on the spatial distribution of salt groundwater and changes in the water’s chemical components, which are closely related to paleo-sea transgression and reflect some information on environmental factors, such as water, heat, salt, soil, and vegetation. Some image-processing methods are used to better reflect the combined landscape features of soil salinization (vegetation, land use, geomorphology). Furthermore, integrated processing of images concentrating thematic information has effectively enhanced the difference of landscapes for two sides of the transgression boundary in the Holocene Epoch. Finally, supported by the geographic information system (GIS), a variety of thematic maps are digitized. On the basis of spatial registration, an integrated data set is generated and used for defining and verifying the paleo-coastal lines.

Keywords: Holocene transgression, remote sensing image processing, extraction of thematic features

张伟强，黄锦国. 1996. 台湾晚更新世以来的环境考古，热带地理，16(4):291-298

从地形地貌、地层、孢粉、化石、古文化遗存等方面出发，结合构造运动及海平面变化，讨论了台湾晚更新世以来的环境变迁，并与邻区对比。台湾晚更新世的古


Through the study of landforms, strata, spore-pollen, fossils, ancient culture sites, tectonism, sea-level change, etc., the environmental change of Taiwan since the late Pleistocene is analyzed. In the late Pleistocene or before, the environment of Taiwan was mainly affected by tectonism and sea-level change during glacial stages, but mostly in the Holocene climate and sea-level changes affected the environment. The environment of
环境演变与台湾最重要的构造运动—
蓬莱运动之后余动及冰期、间冰期气候与海平面升降密切相关。进入全新世，
构造运动对台湾环境的演变已不扮演主要角色，
而气候因素及海平面变化则起重要作用。全新世早期，
台湾岛的环境与晚更新世晚期相同，
但气温已有所回升。中晚期更新世，台湾是一个波动的热带环境。
关键词：台湾　环境考古　晚更新世

张伟强，黄镇国，1996。　
台湾沿海全新世海平面波动，
热带地理，16(3)：226-235

根据海相沉积物样品的^{14}C年代、高程数据，
并以华南海平面变化曲线为参照系，
分析了台湾沿海全新世海平面变化。
结果显示：1) 在5000 aBP以前，海平面曾快速上升，约5190 aBP，出现全新世最高海平面，
超出现今海平面3.2m；2) 5000 aBP之后，海平面呈振荡性变化，
出现4次高峰面，且高度逐次减小；3) 通过对比台湾、福建及广东东部沿海的海平面变化，
台湾海峡两岸全新世可能存在8次海侵或海平面流动变化。
关键词：台湾　海平面　全新世

Taiwan in the early Holocene was similar to that
in the late glacial stage but much warmer. Taiwan
was a tropical environment in the middle and late
Holocene with some fluctuation.

Keywords: Taiwan, environmental archaeology,
Late Pleistocene

Zhang Weiqiang and Huang Zhenguo. 1996. 　
Holocene sea level changes along the coast of Taiwan. Tropical Geography 16(3):226-235.

The change of the sea level of Taiwan in the
Holocene was investigated, using data of altitude and
^{14}C dating for 99 samples from marine
deposits, and data along the coast of south China
as reference. The results indicate that (1) the sea
level rose quickly before 5000 a BP, the highest
stand of sea level occurred in 5190 a BP, with an
altitude of about +3.2 m. (2) The sea level has
been fluctuating around its present position since
5000 a BP. Four higher sea levels occurred in
4120 ± 120 a BP, 3250 ± 40 a BP, 1970 ± 40 a BP,
and 1300 ± 120 a BP, respectively, and the altitude
of sea level decreased gradually. (3) From the
calibrated data from the coast of Fujian and
eastern Guangdong, it is concluded that there were
eight cycles of sea-level changes of transgression
during the Holocene along the coasts of the
Taiwan Strait.

Keywords: Taiwan, Holocene, sea level

The oxygen isotope record from core RM in the Zoige Basin of the Qinghai-Xizang Plateau during the last interglacial period (the Eemian period) documents five climate fluctuations that are equivalent to substages 5a-5e. Moreover, there were five climate oscillations in the stage 5e record of the $\delta^{18}O$ of carbonate in the RM core, namely, 5e1 to 5e5, among which stage 5e5 was the warmest climate period. Substage 5e1 was an optimum episode of combined moisture and heat; 5e3 was a relatively weak warmer period, and 5e2 was colder. The results coincide with records from ice core of the Greenland Ice-core Project (GRIP) and European lake sediments. 5e1 was an optimum episode of moisture and heat, but in the whole interglacial period, 5a is an optimum substage. Moreover, the record of core RM also indicates that the cooling events lasted much longer than the warming one. This is similar to the GRIP record but different from the deep-sea and GISP2 record.

Keywords: the last interglacial period, climatic instability, the Eemian period, Zoige Basin


The results of Rb/Sr ratio and magnetic susceptibility obtained from the Luochuan loess-paleosol section are presented and the relationships between variation of Rb/Sr ratio and fluctuation of climate are discussed. The research found that Rb/Sr ratio in the loess-paleosol sequence is linked to and controlled by the intensity of the summer monsoon. Therefore, the Rb/Sr ratio can be used to reconstruct the variations of summer monsoon intensity in Central China during the late Quaternary. Moreover, the coincidence of Rb/Sr distribution with magnetic susceptibility distribution in the sequence might

The occurrence and nature of the Younger Dryas (YD) abrupt climatic event in the West Pacific marginal seas are discussed on the basis of 15 sediment cores. This YD event has been found in all these cores studied with high-resolution stratigraphy and has proven to be common to the West Pacific region. As shown by isotopic and micropaleontologic analysis, the YD, dated by C-14 at about 11,000 to 10,000 years BP, is a brief event of sea surface cooling in the winter season following a fresh-water pulse about 12,000 years BP. The "apparent regression" of the YD recorded in the Changjiang River delta and the Sea of Japan agrees with the interpretation that the YD is a period of slowed sea level rising between two phases of rapid rising. Both the winter surface water cooling and the increasing salinity in the YD imply a strengthening of the winter but not of the summer monsoon circulation. This major climatic event in the marginal seas must have had profound impacts on the adjacent continent.

Keywords: Younger Dryas, West Pacific, marginal sea, deglaciation, paleoceanography
孙继敏，刘东，丁仲礼，1996，
五十年来毛乌素沙漠的变迁，第四纪研究，(4): 359-367

通过对比陕西榆林石峁剖面(110°00′E，37°55′N)地层记录的研究，重建了毛乌素沙漠的环境演变。主要结论如下：(1) 沙漠－黄土边界带风成沉积序列中的埋藏古风成沙层，是第四纪时期毛乌素沙漠向其东南部的黄土高原入侵的证据；(2) 五十年来石峁剖面共记录了13层古风成砂，表明这段时间内至少有13次大规模的沙漠南侵；(3) 第四纪地质时期沙丘活化与固定的多次转变反映了东亚季风环流的变化；(4) 石峁剖面顶部现代沙层的累积很可能是历史时期土地不合理利用的结果。

关键词：五十年  毛乌素沙漠  环境变迁

冯起，陈广庭，朱震达，1996，塔克拉玛干沙漠北部全新世环境演变
(1)，环境科学学报，16(2): 238-244

本文分析了塔克拉玛干沙漠北部风蚀剖面的粒度和元素，讨论了剖面地层的沉积特征、古气候和环境变化。结论是，本区全新世以来的多风、高温、干燥的气候形成是以全球气候波动为背景，叠加内陆干旱封闭盆地影响而形成的，但在干燥气候条件下曾有过几次空气湿度较大的偏湿期；本区沉积相主要包括河流冲积作用形成的粒土层和风力作用下形成的风沙层，本区全新世以来共发生三次明显的河流泛滥期，可以同全新世以来的间冰期对应。


The evolution of the Holocene environment in the northern Taklimakan Desert and the characteristics of the sediment were revealed by analyzing the granular characteristics and changes in chemical composition of the Xiao Tang section and determining the layer ages. The cold-dry and warm-dry climate in the Holocene was created under the background of global climate with impact of local desert landscape. Also, the paper reveals that there were several short humid periods with high air-humidity during the period. The sediment consisted of clay and sand layers, and there were three fluvial flows in the study areas mainly affected by mountain rainfall and melting ice.

Keywords: Taklimakan, Holocene, layer, sediment, environment
关键词：塔克拉玛干 全新世 地层
沉积相 环境

王立江，1996，上新世末-更新世初西太平洋变冷事件及其古气候变化意义，第四纪研究，（4）：300-309

以浮游有孔虫目标转换方法，利用时间面与时间系列分析相结合，本文讨论了西太平洋上新世末2.6 Ma BP以来古温度场的变化。结果表明：上新世末至更新世初，西太平洋曾经历一次大幅度，不可逆降温过程。变冷事件集中发生于2.4-1.0 Ma BP间，亚热带水团冬、夏降温幅度达7-8°C和2-3°C，热带水团则相对稳定。西太平洋温度场巨变表明其在北半球冰川发展过程中的正负反馈作用，并由此奠定了中、晚更新世冰期旋回的全球气候模式。
关键词：西太平洋 古温度
上新世末-更新世初
古气候及古海洋学

王立江，1996。Major temperature decrease in the western Pacific during the late Pliocene to early Pleistocene and its paleoclimatic implications。Quaternary Sciences（4）：300-309。

The distribution and changes of paleotemperature for the last 2.6 Ma are discussed using a strategy of combined time-series and time-slice analyses based on the planktonic foraminifera (PF) faunal data from eight Deep Sea Drilling Project (DSDP) cores in the western Pacific (0-32°N, 124-159°E)。The estimated paleotemperature curves show a major cooling during the late Pliocene to early Pleistocene in the subtropical latitudes, with a temperature decrease reaching 7-8°C and 2-3°C stepwise and irreversible in nature。The results indicate that the feedbacks of the Northern Hemisphere glaciation both positive and negative played an important role in the cooling。

Keywords: western Pacific, paleotemperature, late Pliocene-earl y Pleistocene, paleoclimatology-paleoceanography

丛绍光，1996，北美东部威斯康星中晚期古环境与气候变化的甲虫化石证据, 第四纪研究, （4）：310-318

通过对北美东部威斯康星中、晚期的甲虫化石组合的描述，试图解释该区环境和气候变化。甲虫分析表

丛绍光，1996。Fossil beetle evidence for middle and late Wisconsinan paleoenvironmental and paleoclimatic change in eastern North America。Quaternary Sciences（4）：310-318。

Beetle assemblages of Middle and Late Wisconsinan age are summarized with an attempt to examine possible patterns of glacial climatic change。Fossil beetle studies suggest that cold
climatic conditions were dominant in eastern North American between ca. 45000-15000 years BP. During the Middle Wisconsinan time, three apparently short warm intervals occurred at ca. 42000 BP, 34000 BP, and 28000 BP. Middle Wisconsinan climatic changes in this area revealed by the fossil beetle record seem to correlate well with climatic records from the Greenland ice core and North Atlantic sediments.

Keywords: fossil beetle, paleoenvironment, climatic change, Wisconsinan, last glaciation

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The total organic carbon (TOC) and Rock-Eval pyrolysis of samples from the Weinan loess section (S0-L2), Shaanxi Province were analyzed. It is believed that the TOC variation might be affected by astronomical factor, because the variation in TOC in the last 0.14 Ma parallels other indicators of global climate change. In the research, two kinds of hydrocarbon were found to be influenced by climatic change, which can be a signal of climatic change. After identifying the reliability of the formula calculating humidity, the researchers found the range of future humidity variation is 47%-77%, and the tendency of humidity is increasing now.

Keywords: Weinan loess section, organic matter, climatic evolution, humidity
测定湖相沉积物中的氯离子含量可以反映当时流域的古气候状况。经古地磁等多种年龄测定，东山古湖是目前所知本段最高分辨率的湖相地层，是恢复六盘山以西古季风演化的关键。东山古湖沉积物（2.2-1.66 Ma BP）中氯离子含量变化表明，早更新世晚期亚洲季风已稳定建立，其变化较小。早期（2.2-1.85 Ma BP）较干；中期（1.85-1.7 Ma BP）出现大湿润期，氯离子含量最低；晚期（1.7-1.66 Ma BP）再度变干。每个阶段中，季风还存在约2×10^7 a 的短周期波动。早期季风的演化明显受青藏高原隆起与地球轨道参数变化的双重影响。关键词：东山古湖 氯离子 早更新世 季风演化


The Cl content in lake sediments can show the paleoclimate of the valley. Variation of Cl content in the high-resolution Paleo-Dongshan Lake sediments (2.2-1.66 Ma BP) shows that the Asian monsoon system was stably established in the Early Pleistocene with a mild change. During this time interval, the monsoon climate showed three obvious phases, namely, relatively dry from 2.2 to 1.85 Ma BP, very humid from 1.85 to 1.7 Ma BP with the lowest content of Cl, and dry again from 1.7 to 1.66 Ma BP. In addition, a 20-ka cycle of Cl variation is also evident in each phase. These phases indicate that the evolution of the early monsoon climate may have been caused by the uplift of the Tibetan Plateau and earth orbital forcing.

Keywords: Paleo-Dongshan Lake, anion chloride, Early Pleistocene, monsoonal evolution


The paleo-glaciation in the mountain area of the source of the Yellow River shows a relationship with the deposition environment of the lake basin area of the Yellow River. During the Cahaaxili Glaciation of the middle Pleistocene, there were glaciers developing in the Bayan Har, Zarijia, Buqingshan, and Anyemaqen Mountains and four big ice caps with a diameter of about 30-50 km. Up to the late stage of the middle Pleistocene penultimate glaciation, glaciers extended downward to the valleys and Ngoring Lake was a large glaciofluvial lake. During the last glaciation of the late Pleistocene, medium valley glaciers
developed in the mountains and the climate was
cold and dry with strong wind. The Yellow River
system became connected and a large amount of
water with sand from lake area of the source of the
Yellow River ran into the Zoige Lake area. In the
middle of the Holocene, the lake area greatly
shrank and a large lake bench and valley plain
with a dry grassland appeared and meanders in the
Yellow River were developing.

Keywords: paleoglaciers, paleoenvironment, source
area of Yellow River

Shen Yongping, Liu Guangxiu, Shi Yafeng, and
Zhang Pingzhong, 1996. Climate and
environment in the Tibetan Plateau during the
Younger Dryas cooling event. Journal of

The Younger Dryas cooling event was a global
event occurring in 11-10 ka BP. Field evidence
with well-dated and high-resolution data suggests
the occurrence of the event in the Tibetan Plateau.
During the event an abrupt and dramatic climatic
and environmental change also took place in the
plateau. The main changes in the plateau were
cooling, drying, dropping of lake level, extending
period of river and lake ice cover, and weakening
intensity of plateau monsoon. Ecological
conditions became more fragile, vegetation and
aquatic life vanished or decreased in species, and
glaciers readvanced. Because of the high altitude
and the fragility of the cryosphere, the sensitivity
and scope of the event were enhanced in the
plateau, and are more distinct than in other places
at the same altitude or globally.

Keywords: Tibetan Plateau, Younger Dryas event,
climate change, environment

Loess deposition in the plateau is quite sensitive to environmental and/or climatic changes. Because it is relatively thick and widely distributed in the Longxi Loess Plateau, the loess climate record has high resolution. There are 22 weak pedogenic layers in the Malan loess. They are records of interstades in the last glaciation. From pedogenic structures, magnetic susceptibility index, pollen and spore composition, and others it is known that climates in the interstades were relative warm and moist. The Malan loess record is quite coincident with the Greenland Ice Core Project (GRIP) ice core record, reflecting the generally unstable climate for whole globe during the Last Glaciation. In middle part of the Malan loess there is a thick interstadial pedogenic layer with three main paleosols. The climate in the period was quite moist and possibly as warm as at present in some periods especially as evident in the bottom paleosol formation. In Western China, the water level of inland lakes was higher than that of the present. The interstade in China appeared as a Mega-interstade.

Keywords: Last Glaciation, Malan loess record, paleosol sequence, Mega-interstade, climatic instability during the Last Glaciation


The Songnen Plain is located on the semiarid-semihumid fringe in northern China. The formation and development of this area have a long geologic and historic process. The sporo-pollen records of this region indicate that the vegetation in this area has a succession of semidesert, semidesert grassland, grassland, sparse woods grassland, and dry grassland, and the climate has been changing between cold (dry) and warm (wet), along with which the desertified land expanded or reduced since the Epi-pleistocene.
本文结合^{14}C测年、古冰缘现象和沉积物中化学元素SiO_{2}/Al_{2}O_{3}分子比值变化规律分析了查格勒布鲁剖面沉积物的粒度特征和孢粉组合特征。晚更新世以来巴丹吉林沙漠南缘地区的气候条件随全球冰期气候变化的波动经历了由晚更新世早期的相对湿润阶段、晚更新世晚期尤其是末次盛冰期的干冷阶段向全新世温嗳期的演化过程。东亚夏季风尾随晚更新世早期到达甚至越过分区影响到拐子湖一带，全新世以来东亚夏季风尾随又向本区推进，并于全新世中晚期对本区造成明显影响。

关键词：查格勒布鲁剖面 晚更新世 东亚季风 古风成沙 沉积

Keywords: Songnen Plain, Epi-pleistocene, pollen and spore record, paleoenvironment


Evidence of climatic stratigraphy can divide the climatic evolution in south of the Badain Jaram Desert into three stages since late Pleistocene. There are two warmer and moister ones in the early stage of Late Pleistocene (Q1/3) and in the Holocene (Q4), and a dry and cold stage in the late stage of the Late Pleistocene (Q2/3). During the late interglacial period (Q1/3), the fringe extended its range to Guaiizhu, which lies to the north 180 km away from Chagelebulu. During the last glacial period, the winter monsoon dominated the climate in this area; the summer monsoon fringe, however, retreated to the middle-lower reaches of the Changjiang drainage basin, and the landscape turned to temperate desert.

Keywords: Chagelebulu section, late pleistocene, East Asia monsoons, Eolian paleosands, deposition
管东红，聂晓霞，郝永祥等，1996，北坳剖面碳酸钙记录的末次间冰期气候不稳定性，冰川冻土，18（2）：119-124

最近格陵兰冰芯深孔GRIP提示末次间冰期早期（MIS-5e）气候急剧不稳定，但邻近的另一冰芯GISP2却表明这一时期气候是稳定的。其结论对将来气候的预测至关重要。由于CaCO₃在黄土和古土壤中含量的差异性及北坳特殊的地理位置和气候环境，决定了北坳黄土—古土壤序列中CaCO₃（%）记录与格陵兰冰芯δ¹⁸O（%）记录理论上可比性，连续CaCO₃记录表明，气候在MIS-5e期间曾发生3次显著的温暖时期和两次明显严寒的急剧大幅度波动，与格陵兰GRIP孔气候记录一致，证明MIS-5e气候不稳定性是存在的，并且其影响不是早先认为的局地事件，至少是北半球的一种普遍现象。
关键词：北坳，末次间冰期，冰芯深孔，气候波动


Recent Greenland Ice Core Project (GRIP) deep ice core records reveal that the climate experienced short shifts during the early stage of the Last Interglacial Age [Marine Isotopic Stage (MIS)-5e], but the later ice core from the Greenland Ice Sheet Project Two (GISP2) near the GRIP drill has not demonstrated such a phenomenon. The difference in calcium carbonate (CaCO₃) content between loess and paleosol and the special location and environment of the Beiyuan area theoretically make it possible to compare Beiyuan loess-paleosol CaCO₃ (%) to the Greenland ice core oxygen isotope record (δ¹⁸O) (%). The continuous loess-paleosol CaCO₃ (%) record from the Beiyuan section shows that the climate experienced three warm periods and two serious cold periods, which was a marked fluctuation and correlated well with the Greenland GRIP climate record. This correlation demonstrates the instability of climate existence during the MIS-5e and shows that this climate fluctuation was common at least over the Northern Hemisphere rather than being local as previously recognized.

Keywords: Beiyuan, the Last Interglacial Age, deep ice core, climate fluctuation

姚檀栋, 杨志红，1996，近2Ka来高分辨率的连续气候环境变化记录—古里雅冰芯近2Ka记录初步研究，科学通报，41（12）：1103-1106

根据古里雅冰芯的记录，恢复了该地区近2Ka的气候和环境变化的历史。结果显示：在过去近2Ka来，气候在不断的冷暖波动中逐渐变暖，而大气中尘埃在波动中逐渐减少。气侯突变事件在古里雅冰芯中的反应是很明显的，这些事件不但发生在


This paper reports the reconstruction of climatic and environmental change during the last 2000 years using the records from the Guliya ice core. The results show that the climate has been warming with continuous fluctuations of warm/cold and that dust has been decreasing. The abrupt climatic changes are notable, those events occurred not only in the fluctuation from cold to warm but also in the fluctuation from warm to cold.
气候由冷变热的时期，也发生在由热变冷的时期。
关键词：古里雅 冰芯 气候 环境

郭正堂、丁仲礼。
刘东生，1996，黄土中的沉积—成壤事件与第四纪旋回，
科学通报，41（1）：56-59

基于渭南剖面，用微形态学方法，结合游离铁（CBD法分离）和总铁比值、磁化率，对2.5Ma以来的成壤事件进行鉴别。2.5Ma以来的渭南黄土中至少记录了56个清晰的成壤期。如果把每个成壤期和相对于干的粉尘堆积期作为一个气候事件，则它们代表了112个以沉积—成壤事件为代表的古气候事件。
关键词：黄土—古土壤序列
成壤事件


The pedosedimentary events of the last 2.5 Ma are revealed in the Weinan loess section using a micromorphological method, together with Fe/Fet and magnetic susceptibility. At least 56 paleosols have been easily identified in the Weinan loess. If all pedogenetic stages and dust deposition stages are viewed as climatic events, 112 paleoclimatic events are expressed by those paleosols in the Weinan loess.

Keywords: loess-paleosol sequence, polycyclic soil, pedosedimentary event

杨守仁。
杨松，1996，中国10Ka来海滩岩时空分布与气候变迁，科学通报，
41（8）：723-727

基于海滩岩形成与热带气候条件的密切关系，中国全新世海滩岩的时空分布表明，在百年尺度上，中国全新世气候变化经历了升温期、高温期和降湿期三大阶段。高温期气候基本偏暖，气温比今高1.6-3.6℃，其间出现短暂的强低温事件（冷谷为4930+185aBP），降湿期气候前期（11KaBP前）尚暖，气温高于现在0.5-2.2℃，后期(11KaBP后)


Temporal distribution and spatial distribution of beach rock in China show that, on the scale of a century, climatic change has experienced warming periods, high temperature periods, and cooling periods during the Holocene. During warming periods, the climate was warmer and the temperature was 1.6 to 3.6°C higher than it is at present, and a cold event occurred at 4930 + 185 a BP. The cooling period has two stages: before 1.1 ka BP, temperature was 0.5 to 2.2°C higher than present; after 1.1 ka BP, the temperature had an abrupt drop. According to the data of beach rock since 6.5 ka BP, the major period of temperature fluctuation was 0.2 ka, and the rate of temperature variation is 0.5 to 1.7°C.

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陡降，气温比今高0-0.19℃。
根据6.5 Ka BP以来海滩岩数据，冷谷
变暖峰、暖峰变冷谷的时间间隔以0.
2 Ka 为主，为次，气温变化为每百年
0.5-1.7℃。
推断新暖峰将在未来0.1Ka 出现，在
一般情况下，那时气温将比今高约0.
5-1.7℃，也可能突然升高2.8℃。
关键词：中国海滩岩 时空分布
气候变迁

Wang Pinxian and Liu Zhiwei. 1996. The last
glacial maximum climate problem in the sea area
of the Nansha Islands, South China Sea.
Quaternary Sciences (3):193-201.

Judging from the results of oxygen-isotope and
micropaleontological analyses from more than ten
cores, this paper shows that the winter sea surface
temperature (SST) at the Last Glacial Maximum
(LGM) in the Nansha Islands sea area was about
22℃ and the summer SST was about 28℃,
resulting in a seasonality as high as 6℃. Thus the
glacial/postglacial difference in summer SST (0.9
to 1.8) there is within the range of standard errors
for the paleo-SST estimations using transfer
function, where the difference in winter SST (3.3
to 3.7) is much higher than in the open Western
Pacific at the same latitudes. The strengthened
seasonality in the Nansha area at the LGM can be
ascribed to intensified winter monsoon circulation.
This also provides a new explanation for the
apparent contradiction between the warm SST and
cool mountain temperature of the islands in the
tropics at the LGM.

Keywords: Nansha Islands area, sea surface
temperature, Last Glacial Maximum, winter
monsoon
聂高众，刘嘉麒，郭正堂. 1996. 渭南黄土剖面十五万年以来的主要地层界线和气候事件，第四纪研究，(3): 221-231

本文在渭南黄土剖面所测得的年龄结果和时间标尺的基础上，结合粒度、磁化率等气候曲线的分析，对该剖面十五万年以来一些主要地层界线和气候事件的年龄进行了初步讨论，结果如下：1) S1/L2界线位于剖面1180cm处，从时间标尺上可知其年龄为128800aBP，同末次间冰期起始的年龄一致；2) L1/S1的地层界线年龄为74220aBP，同SPECMAP曲线中末次间冰期的结束年龄吻合；3) 渭南剖面所指示的末次间冰期约在20000-18000aBP之间；4) 在20000-18000aBP之间的末次间冰期，有一段不足1000a的快速堆积期，其堆积速率是中国黄土平均堆积速率的10倍以上。

关键词：渭南剖面 年代学 地层界线 气候事件

Nie Gaozhong, Liu Jiaqi, and Guo Zhengtang. 1996. The major stratigraphic boundaries and climatic events in the Weinan Loess section since 0.15 Ma BP based on chronological evidences. Quaternary Sciences (3):221-231.

The American Meteorology Society (AMS) C and TL methods were used systematically to date the samples from the Weinan loess section since 0.15 Ma BP, and to tune the preliminary high-resolution time scale of this section. (1) The S1/L2 boundary was located at a 1180cm depth that has an age of 128800 a BP determined by the time scale, which was very consistent with the SPECMAP curve. (2) The boundary of L1/S1 at a 854-cm depth may suggest an age of 74200 a BP from the time scale. This age corresponds to the age of about 73000 a BP in the SPECMAP curve. (3) The maximum of the last interglacial stage had an age from about 20000 a BP to 18000 a BP. (4) There was a rapid deposit period in the Weinan loess section from 20000 a BP to 18000 a BP. The deposit rate of this segment was more than 10 times the average deposit rate of China loess.

Keywords: Weinan section, chronology, stratigraphic boundary, climatic event

赵骏辉, 于滕军. 1996. 晚更新世末期黄、渤陆架沙漠化环境的形成，第四纪研究，(1): 42-47

末次盛冰期气候寒冷，温度降低，冰川发育，海面下降，黄、渤陆架全部出露，东海的大部分裸露成陆，并成为亚洲大陆的一部分。根据多年来在陆架地区获得的浅地层剖面仪测量记录，陆架发生沙漠化的证据有：统一海相地层的解体、大面积的混杂堆积、漫长的风蚀基面、体止角型沉积


During the Last Glacial Maximum, the global climate was characterized by very low temperatures. Enlargement of the continental glaciers brought about the lowering of the East China Sea level for about 130 m. The entire Bohai Sea, Yellow Sea, and most of the East China Sea were exposed and became a part of the Asian continent. The evidence for the shelf desertification is summarized as follows: (1) Disintegration of the integrated marine stratum; (2) mixed deposits; (3) endless erosion surface;

Based on an analysis of nanofossils in core WC-F from the North Continental Slope of the South China Sea, the paleoenvironment during early and middle Pliocene is studied. The core from 490 m to 850 m belonging to sections NN12 to NN15 can be divided into two stages at 730 m. In the early stage, the climate is warmer, and sea level is higher; biological productivity is lower and the abundance of Discoster and Sphenolithusabies is higher. In the later stage, sea levels fall, and nutrients taken by terrigenous materials increase; biological productivity is enhanced and the abundance of Discoster and Sphenolithusabies decrease. There are ten secondary cycles of warm/cold according to the relative abundance of Discoster.

Keywords: South China Sea, nanofossil, paleoenvironment


The differences of transgression, paleovegetation, paleoclimatic, and paleoenvironment during the Holocene between the southern and northern coasts of the Shandong peninsula are analyzed on the basis of the altitude of deep-sea sediment, dating data, and pollen analysis. Those differences
北岸全新世时期海侵，古植被与古气候及古地理环境有显著差异，其形成原因主要归结于新构造运动背景和地理纬度差异等因素。关键词：山东半岛 全新世海侵 古地理环境

谢传礼，
蔚知纬，1996，末次盛冰期中国海古地理轮廓及其气候效应，第四纪研究，（1）:1-10

本文用101个站位14C的测年和22个站位的氧同位素资料编制了末次盛冰期(20000-15000aBP)资料图，古地理图和古海洋图等三张图件。末次盛冰期低海平面时中国海轮廓发生重大改观：陆架出露约1.55X105平方公里；表层海流改组以及表层海水温度剧降（比现代低3.5-6℃）。海区面积和表层海水温度下降使中国海蒸发量大大降低。根据海陆蒸发速率差异和表层海水温度和蒸发的关系，估算出末次盛冰期中国海年蒸发量比现代降低约12X1011-20X1011立方米/年，或相当现代中国年降水量的1/5-1/3。同时，末次盛冰期陆架暴露、地表反照率增高使地表对太阳辐射吸收作用减弱。
关键词：末次盛冰期 古地理 中国海 反照率

are chiefly contributed to tectogenesis and the difference of latitude.

Keywords: Shandong peninsula, transgression in Holocene, paleoenvironment


Over one-hundred sites with 14C datings and 22 sites oxygen isotope data have been collected to compile paleogeographic maps of the China Seas during the Last Glacial Maximum (LGM) of 20000-15000 a BP. A series of 3 draft maps (data map, paleogeographic map, and paleoceano- graphic map) were made. The paleogeographic map at the Last Glacial Maximum revealed two major changes of the China Seas caused by the low sea-level stand. (1) The exposure of vast continental shelves in a total area of about 1.55 million km²; and (2) the reorganization of surface circulations and remarkable decrease of sea surface temperature (SST). Both the reduction of sea area and decline of SST must have caused a decrease in evaporation from the sea surface. On the basis of the difference between evaporation rates from sea and land and the relationship between evaporation and SST, the authors draw the following results. It is estimated that the total annual evaporation from the China Seas at the LGM might be 12X1011-20X1011 m³/a less than at present, or 1/5 to 1/3 of the annual total precipitation in the whole of China now. On the other hand, the exposure of shelves at the LGM must have increased the albedo from the surface and hence decreased the absorbed solar radiation.

Keywords: the Last Glacial Maximum, paleogeography, the China Seas, albedo
**Climate Variation (season and year)**


The days, hours, and amount of fog in the Xishuangbanna region are analyzed using observation data for the last 40 years. It is found that the fog of Xishuangbanna is decreasing as a result of increasing air temperature and decreasing precipitation. The paper points out that the reduced vegetation and an enhanced city heat-island effect are the artificial causes of fog decrease in the Xishuangbanna region.

Keywords: fog decreasing, Xishuangbanna, human action

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Through comparison of simulation with observation, the daily and yearly variations of the radiation balance in different seasons in the Taklimakan Desert are studied, and major factors that affect radiation balance are discussed. The results show that the lowest center of annual radiation balance in Xinjiang is at the center of the Taklimakan Desert and its value is about 1100 MJ·m⁻²·a⁻¹.

Keywords: Taklimakan Desert, radiation balance

Empirical orthogonal function (EOF) and power spectral analysis show that the interannual variability of the time coefficients of the second and the third eigenvectors of the Arctic sea ice cover in Region 1 has a period of approximately 40 months. At this frequency band, EU and EA teleconnection patterns can be excited by the thermal forcing of the variation of the sea ice cover. By comparison it is confirmed that the influence of the Arctic sea ice cover on the mid-latitude general circulation in the Northern winter parallels sea surface temperature (SST) over the central-eastern equatorial Pacific. Sea ice cover and SST are the important factors in the short-term climatic change.

Keywords: Arctic sea ice cover in Region 1, EU and EA atmospheric teleconnection patterns, short-term climatic change


The changing processes and tendencies of temperature and precipitation in Qinghai-Xizang Plateau from the 1950s to the early 1990s are analyzed on the basis of monthly mean temperature and precipitation. The change of temperature in the last 40 years is almost unanimous on the spatial scale. The first area to become warmer is the southeastern Tibetan Plateau. The Plateau is divided into five parts according to the change of temperature and nine parts according to the change of precipitation. During the 40 years some areas have been warmer and drier, others warmer and wetter.

Keywords: spatial characteristics of temperature and precipitation change, Qinghai-Xizang Plateau, 1950s to early 1990s

Characteristics of climatic variation and anthropogenic actions in the Mu Us Desert are analyzed by using statistical data of climate and the national economy for about 30 years from ten climatological stations. Research results show that over these years, temperature has gone up and precipitation has gone down, but the stability of precipitation has strengthened and average wind speed has decreased. Countermeasures for these changes are proposed. Changing agriculture and animal husbandry from extensive farming into intensive farming and increasing the production capacity are the main measures to prevent the agricultural ecological environment from degeneration.

Keywords: climatic variation, artificial action, ecological environment


The carbon isotope $\delta^{13}C$ in the tree rings of conifers correlates with nearby temperature. The $\delta^{13}C$ climatic response is analyzed using a single-year discrimination chronology detrended from a $\delta^{13}C$ chronology from Chinese pine (Pinus tabulaeformis) tree rings and meteorological data. The results show that high-frequency $\delta^{13}C$ is significantly related to both the average temperature of June (with $r = -0.65$) and the total precipitation of May, June, and July ($r = -0.46$).

Keywords: Shanxi Huangling, $\delta^{13}C$ of tree rings, East Asia summer monsoon, temperature departure reconstruction

A sensitivity study on the climatic effect of surface albedo change is completed with a two-level General Circulation Model, and the results are compared with the data from observation in the last 40 years. The results show that the increase of the surface albedo in the main part of the Tibetan Plateau is one of the important factors in controlling China’s short-term climatic variation. When the surface albedo increases in the Tibetan Plateau, the summer monsoon becomes remarkably weak, and the temperature rises in the northern part and falls in the southern part of eastern China, and monsoonal rainfall also decreases generally.

Keywords: Tibetan Plateau, surface albedo, climatic variation

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The secular variation of the winter atmospheric circulation teleconnection pattern is studied. The Western Atlantic (WA) and Pacific/North American (PNA) patterns showed yearly trends and interdecadal change, that were a significant negative trend for the WA intensity index and a positive trend for the PNA intensity index. This interdecadal change of the intensity indices of the atmospheric teleconnection pattern may be an important sign of climatic warming over China in winter.

Keywords: winter teleconnection, interdecadal change, abrupt change, climate change
谭友邦, 谢利娟. 1996. 内江市近40年日照变化的统计特征.
气象, 22 (10): 27-30

利用1960-1995年内江市各测站的逐月日照时数资料，分析了内江近40年来日照的变化特征。发现，区域平均年总日照时数正以-46.98小时/10年减少，四季均有减少的趋势，但主要表现在冬、夏两季：区域平均年日照数在1980年附近存在突变现象。
关键词: 日照、气候变化、减少、突变

谢庄, 曹鸿兴. 1996. 北京最高和最低气温的非对称变化.
气象学报, 54 (4): 501-507

运用1940年以来北京历年各月份平均气温资料，对最高、最低气温的非对称特性进行了研究，结论是：1940年以来，北京最低气温呈明显上升趋势，而最高气温反而下降，40年代北京的增温主要在白天，而80年代则在夜间。
关键词: 北京、增温、非对称性

张名立, 曾昭美, 季幼钧. 1996. 全球增暖过程中亚洲东部区域气候的特点.
地理学报, 51 (6): 518-526

采用Jones等人的100年全球陆地气温格点资料集，分析亚洲东部（70—


The changing characteristics of sunshine from 1960 to 1995 in Neijiang are analyzed using the data of the monthly sunshine in Neijiang. The average hours of sunshine in the area is decreasing at the trend rate of -46.98 hours/10 years, and this tendency appears mainly in winter and summer. There were abrupt changes of amount of sunshine hours in the area around 1980.

Keywords: sunshine, climatic change, decrease, sudden change


The asymmetric characteristic of the maximum and minimum temperature is studied using the data of mean temperature in Beijing since 1940. (1) Since the 1940s, the minimum temperature increases but the maximum temperature decreases in Beijing; and (2) the temperature increases mainly in the day time in the 1940s but in night time in the 1980s.

Keywords: Beijing, temperature increase, asymmetric character


The gridded temperature data from 1891-1990 over East Asia (70-140°E, 20-55°N) from Jones et al. was been analyzed. It found that the temperature variations within the region were
140°E，20°-55°N）的气温时空变化。发现100年来在全球增暖的过程中，该区的气温变化有明显的区域特色。主要特点为冬季变暖，夏季略变冷。高纬度增温明显，中国的东部和中亚至新疆一带降温，导致这种变化的原因可能与控制因子不同有关，高纬度的变化与温室气体的增加有较大的关系，而副热带纬度的变化可能与副热带大型的环流有关。

关键词：区域气候
全球增暖与东亚气候
温室效应
季风区
温度距平


Historical data of total cloud amounts over the global oceans during 1890-1990 are analyzed. The amount of cloud over the global oceans has increased in company with global warming since the end of the 19th century. The growing warming of the climate and the general circulation systems has influenced the variation of cloudiness. The variation of cloud amounts lagged behind global mean air temperature about 1 to 4 years, but lagged behind the sea surface temperature about 1 to 2 years. The correlation between cloud and temperature has opposite signs in different climate zones, mainly as a result of the difference of dominant cloud types in different climate zones.

Keywords: global warming, ocean cloud amounts, sea surface temperature

A study on the variation of annual frequency of tropical cyclone (TC) and its relation with sea surface temperature (SST), Southern Oscillation Index, sunspot relative number, and number of days for specific circulation patterns was made using 1884-1988 data of annual frequency for Northwest Pacific TC occurrence. Preliminary results indicate that there are obvious variations in annual TC frequency for periods of 21, 31, 15, and 6 years and sustaining periods of 12 years on average. Three well-defined processes of inflexion were observed in 1931, 1959 and 1977 over the past hundred years. Results also suggest an insignificant statistical tendency of annual TC frequency decreasing (increasing) in winter/spring (summer/autumn) in the El Niño years. When the stratosphere was in a zonally westerly phase, the Northern zonal circulation would abnormally develop and solar activity would enhance the generation and development of TC.

Keywords: tropical cyclone, El Niño, environmental change


The climate change impact of blocking highs is investigated using the daily 500 hPa historical synoptic charts from 1965 to 1990. It found that there were two active regions of blocking highs in the Northern Hemisphere. The number of blocking highs had a decreasing trend from 1965 to 1990. The frequency of blocking highs decreased when the temperature was higher than normal and increased in the cold year. The regional distribution of blocking highs for the two typical years has an obviously inverse

Analyses of seasonal anomalies of sea surface temperatures (SST) for the oceans across the globe revealed four major features of variation over the past hundred years. First, the period from 1860 to 1930 was marked by almost monotonous negative anomalies of SST, with the maximum temperature drop (-0.4°C) taking place in 1900-1910. Second, SST rose during the period from the 1910s to the 1960s, and the amplitude of the temperature rise was generally larger in the 1940s than that in the 1960s. Third, the second significant SST falling in this century occurred in the 1970s with weaker intensity and shorter duration than that in the first. Up to now, the global SST has been generally in a stage of persistent rise. Fourth, in a global range, the SST for all of the oceans performed perfect simultaneity at the scales of dozens of years.

Keywords: globe, past hundred years SST, evolving features
1996

周陆生，汪春生。1996。青海湖水位年际变化规律的分析和预测，高原气象，15(4):478-484

利用青海湖沙陀寺水文站1959-1992年的水位资料，分析了前期气候类型，纬度差异对青海湖水位年际变化的影响，得到了一些有预报价值的因子，并采用贝叶斯逐步判别法对次年水位变化的3种状态进行了预测。

关键词：水位年际变化 前期气候类型 青海湖水位 高原气象


The influence of antecedent climatic type, sea surface temperature (SST) of the North Pacific Ocean, Arctic sea ice, and El Niño on the interannual variation of the Qinghai Lake's water level are analyzed on the basis of Shatuosi hydrologic station's data from 1959 to 1992. The results are to be used to forecast the three states for next year's water level variation using Bayers successive discrimination method.

Keywords: water level interannual variation, climatic type, SST of North Pacific Ocean, Arctic sea ice

张寅生，姚檀栋，蒲健辰。1996。唐古拉山冬克玛底冰川平衡线高度附近的能量平衡，冰川冻土，18(1):10-19

本文以连续的、至少一年的观测资料对唐古拉山冬克玛底冰川平衡线高度附近的辐射平衡及能量交换特征进行了计算分析。冰川表面独特的下垫面性质使其净辐射值全年有5个月左右为负；潜热交换量基本与净辐射呈反向的季节变化；感热交换全年均为正值而成为该冰川表面主要热源之一；传导热交换量对能量平衡的贡献很小。该冰川表面的能量交换水平季节变化明显，冰川表面气温季节变化与净辐射关系密切。冰川表面气温对总辐射通量变化的敏感性系数与其反射率及吸收辐射通量关系密切。

关键词：冬克玛底冰川 辐射平衡 能量交换


The solar radiation budget and energy balance were analyzed based on a long time series observation in an automatic station set on the equilibrium line altitude (ELA) of Dongkemadi Glacier. At the observation point, the annual mean air temperature is -9.8°C, the annual mean air vapor pressure is 2.6 hpa, and the annual wind speed is 4.3 m/s. The annual amount of global radiation that reaches the surface of the glacier is about 7300 MJ/m², only 1/4 of which is absorbed by the glacier. The net radiation is positive from April to October but negative for the rest of the year. The latent heat flux has a seasonal variation in the opposite direction from net radiation. The conductive heat flux is insignificant in the energy budget on the glacier surface. Both the energy-exchanging level and the energy-exchanging coefficient are large in summer and winter. The sensitivity coefficient of air temperature above the glacier to variation of global radiation correlates well with albedo and absorbed radiation.

Keywords: Dongkemadi Glacier, radiation budget, energy exchange

The river runoff changes in the Yili River basin are estimated under various future climatic scenarios using the river runoff model based on water balance. The impact of future climatic warming on water resources will depend on changes in precipitation rather than on a rise in air temperature because of the low air temperature and rich precipitation in the mountains. The future climatic warming would change the distribution and lower the peak of runoff. The runoff peak would occur earlier. Spring runoff would increase with a corresponding decrease of runoff in other seasons, particularly in the summer. Considerable change in runoff would occur with climatic warming and variational differences of runoff would increase with the shrinking of glacier area, and this would be unfavorable for the utilization of water resources.

Keywords: climate change, cold mountain region, runoff


Sea ice in the Arctic ocean, which covers large areas, and its transport into the North Atlantic represents a freshwater flux comparable to that of continental runoff and affects salinity stratification through brine rejection during freezing, transport, and melting. Salinity stratification is critical to the vertical circulation of the high-latitude ocean. Variation in sea ice may cause a great salinity anomaly or halocline catastrophe that can alter or stop convection. Evidence suggests that climate variations from decadal to millennial time scales are linked to the sea ice interaction with the thermohaline. This strong coupling between the Arctic sea ice, ocean, and atmosphere implies that variations in sea ice are involved in high-latitude and global climate feedback processes.

Keywords: Arctic sea ice, North Atlantic Deep Water (NADW), thermohaline circulation, climate variability

In the recent decades, especially after 1980, global warming has become more and more obvious. The cryospherical system of glaciers, snow cover, and permafrost is clearly reacting to the warming climate. Glacier mass balance shows an accelerating negative tendency within the main glacier regions of the Northern Hemisphere. The average mass balance in the 1980s in the Northern Hemisphere was reduced by 1.3 times compared with that in the 1960s and 1970s corresponding to a rise of 0.38°C in air temperature. The retreating number of small glaciers (less than 2 km in length), which appears to be very sensitive to climate change, has increased 15% to 20% in the 1980s compared with the numbers in the 1960s and 1970s. Permafrost temperature also shows a significant increase. The permafrost table and the altitude of the permafrost lower limit in the northeast region of China are changing with climate warming. Average area of snow cover in the Northern Hemisphere was reduced by approximately 1 million km² for the 1980s compared with the 1970s which equals a decrease of 4% in area of snow cover. Various indications show that the cryospherical system has changed with global warming.

Keywords: glacier mass balance, glacier variation, permafrost temperature, snow cover, cryosphere, global warming

The runoff in the Urumqi River mainly depends on precipitation and snow and ice meltwater. Because of the summer warming and precipitation reduction during the last 30 years, the glaciers are thinning. This article discusses the influence of temperature and precipitation on glaciers. Precipitation has decreased 19 mm (July-August) or 24 mm (June-August), and the mean summer (June-August) temperature has increased 0.14°C in the glaciated region in the Urumqi River from the beginning of the 1960s to the beginning of the 1990s. The annual precipitation has decreased 17 mm. Glacier No. 1 has thinned 140 mm per year in the nearly 30 years. A thinning rate of 181 mm per year was measured from 1991 to 1993. It is expected that the thinning rate will increase.

Keywords: temperature, precipitation, runoff, melting


The uplift of the Tibetan Plateau has great influence on the Asian monsoon and global change. The loess section in the Tibetan Plateau is the result of the uplift of the plateau. Magnetic polarity dating of an 86-m loess section at Garze on the southeastern Tibetan Plateau demonstrates that the bottom of the section was formed 818.4 ka BP. Analysis of various quartz sands in the section indicates that the plateau uplifted above the snow line and began to develop glaciers at least 818.4 ka BP ago. Soon afterward (ca. 760 ka BP), glaciers reached their maximum, and may have

This article introduces the application of a comparative method that uses repeated aerial photogrammetric mapping to monitor the variation of glacier size and morphologic factors in the drainage area of the Urumqi River. The article also discusses the management control and accuracy of the method. The detection shows that the method with higher accuracy can be used to determine the variation of morphologic factors of glacier variation. The measurement data show that 155 glaciers in the drainage area of the Urumqi River all retreated from 1964 to 1992, with an average retreating rate of the glacier terminus of 12.4% and an average reducing rate of the glacier area of 13.8% as well as a loss of 15.5% of ice storage.

Keywords: aerial photogrammetry, comparative mapping, glacier variation
章新平，1996. 青藏高原东北地区现代降水中δD与δ¹⁸O的关系研究. 冰川冻土，18（4）：360-365.

本文通过对取自青藏高原东北地区部分降水样本的氢氧稳定同位素比率的分析得到以下结论：沱沱河站的大气水线（MWL）为：δD=8.258⁸O+9.22‰.

与全球平均MWL的差别较小；德令哈、西宁站的MWL分别为：δD=5.86⁸O=27.28‰和δD=6.96⁸O=30.19‰，均与全球平均MWL差别较大。这主要归因于水汽源地的非平衡蒸发和凝结物在非饱和大气中降落时的非平衡蒸发。上述地区的过量氘Ex d (=δD-8⁸O) 具有较大的波动范围，并且与δD存在显著的正相关关系。这说明过量的氘在很大程度上受非平衡蒸发过程中氘分流速度差的制约。

分析表明，青藏高原东北地区的春季，来自海洋的水汽具有较低的稳定同位素比率和过量氘；来自本地区蒸发的水汽具有较高的稳定同位素比率和过量氘。

关键词：青藏高原
稳定同位素比率
过量氘
大气水线


The application and understanding of stable isotopic ratio in ice core has become very important today. The meteoric water line (MWL) of Tuotuohe Station is obtained as δD = 8.258⁸O+9.22‰ according to the analysis of the samples from some regions of the northeast Tibetan Plateau. This result is similar to that of the globe. But the results of MWL of Delingha and Xining Stations, which are δD = 5.86⁸O=27.28‰ and δD = 6.96⁸O=30.19‰, respectively, are different from that of the globe. Excess deuterium (Ex d) in the regions mentioned above has great fluctuation, and there is a positive relationship between Ex d and δD. Analyses show that in the northeast Tibetan Plateau the vapor from oceans has a low stable isotopic ratio and Ex d and the vapor from the evaporation in the Plateau has a high ratio and Ex d.

Keywords: Tibetan Plateau, stable isotopic ratio, excess deuterium, meteoric water line


This paper discusses the climate and southwest monsoon change in the temperate and semi-arid monsoon areas in the middle Yarlung Zangbo River Basin in Tibet which is usually called “One River Two Tributaries.” The study indicates that
马继瑞, 田素珍, 郑文振. 1996. 太平洋水位站相对海平面升趋势分析, 海洋学报, 18(5):14-21


According to the analysis of period components in the monthly mean sea level variation from 236 tide gauge stations in the Pacific, a monthly mean sea level series is fit by using significant period components plus the linear trend. The results of the linear trend show that if the abnormal rise of sea level isn’t considered, the rate of relative sea level rise in the Pacific is 1.16 mm/year. Because of inconsistent earth subsidence, the regional difference of sea level variations in the Pacific is notable. Sea level variation of various oceans in the Pacific is assigned zones according value of linear trend and geographical position. The average rates of sea level variations in various oceans are obtained, and the results are consistent with historical records.

Keywords: Pacific Ocean, sea level, nonlinear, bispectrum, spectral analysis, period components, linear trend
East Asia Monsoon


The relation of the East Asian summer monsoon (EASM) to the rainfall and temperature over China is investigated using data from the past 40 years. The investigation shows that when a strong monsoon occurs, China experiences an extensive high temperature in summer. The EASM effect on summer rainfall in the mainland is displayed in the meridional position of the rainbelt. The position of the summer belt moves northward (southward) from its mean position when the summer monsoon is strong (weak). Flooding (drought) years over the middle and lower reaches of the Changjiang River are related to the weak (strong) monsoon. Finally, the northern 500-hPa summer circulation feature for the years of the strong and weak EASM are examined and the results indicate that the EASM intensity represents a main factor for the temperature and rainfall anomalies over China in summer.

Keywords: East Asian summer monsoon, intensity index, rain belt, middle and lower reaches of the Changjiang River


Loess stratigraphy has been shown to bear a variety of information on past global change. The loess-paleosol sequence is a well-preserved materialized record of the glacial-interglacial cycles, which is now confirmed by various proxy climatic indices obtained from many loess profiles on the Loess Plateau of China. In this paper, progress in the studies of loess and the evolution of the East Asian Monsoon on the Loess Plateau during the late Pleistocene are reviewed.

Keywords: loess, late Pleistocene, the East Asian Monsoon, loess plateau

Results from analysis of a high-resolution paleoclimatic record of the Zhaitang loess sequence in Beijing reveal: (1) An apparent phase difference of the summer and winter monsoon change and (2) that differences of the summer and winter monsoon change are distinguishable in some aspects, and summer and winter monsoon variations are not always matched to each other. These scenarios indicate that summer and winter monsoons over East Asia are not dominated by the same factors and mechanisms.

Keywords: loess, paleomonsoon, phase, tropical Pacific

Historical Climate Change


The possible use of tree-ring image analysis with *pinus balfouriana* sampled from West Sichuan Province in climate change research for historical time in the Kangding area is studied. There is almost no difference between the ring-width series derived from image analysis and from instrumental ring-width measurement, but the relationship between the series of gray value parameters is not as close as that of the series of ring-width parameters. Gray value chronologies from image analysis are superior to ring-width chronologies in indicating some climate factors, especially the minimum gray value, average gray value, and later wood gray value.

Keywords: climate change, tree ring, image analysis


利用甘肃葫芦河流域第一阶地剖面的地层观察资料，对秦安大地湾附近第一阶地沉积剖面的沉积相、粘土矿物、碳酸钙、孢粉等古环境指标进行了分析，恢复了该地区大约距今8000年至3000左右的环境演变过程，并对该地区古环境变化与人类活动规模及古文化特征变化之间的关系进行了讨论。

关键词：葫芦河流域 中全新世 古环境演变 人类活动

Keywords: Hulu River area, middle Holocene, paleoenvironment evolution, human activity

苗丰民, 李淑媛, 庄振业. 1996. 辽东湾东部砂岸的近期变化及演变趋势, 海洋学报, 18(2): 75-84


根据鱼鱼圈观测站近30年（1963-1991年）的波浪资料，结合水准测量以及若干简易标致桩跟踪监视，并借助地方志及不同时期地形图对比等资料，讨论了区域沿岸泥沙演变特点。

The present situation of the coastline and the causes of sand coastal recession and its serious consequences are analyzed using the wave data of a 27-year period (1963-1991) at the Bayyuquan Observation station in Liaodong Gulf, together with monitoring by beach leveling and some simple marking stakes and by the aid of local
Climatic change over the past 8000 years in Caohai, Guizhou is studied using the $\delta^{13}C$ and $\delta^{18}O$ values of peat cellulose. The peat archives in the area have information that indicates the hemispheric climatic events, such as three new ice ages and the Medieval Warm Period that occurred in the Northern Hemisphere. These data indicate that the climate of Caohai might be sensitive to global environmental changes. Also, the authors believe that there was a typical variation of the warm-moist/cool-dry climate in Caohai during the past 8000 years.

Keywords: peat cellulose, carbon and oxygen isotope, climatic change
Wang Chengyi and Hu Yangbin. 1996. Analysis of the characteristics of cold-warm climatic variation in the last 250 years of Yili, Xinjiang, China. Arid Land Geography 19(3): 37-44.

The annual mean series of temperature at Yili, Xinjiang, China for the last 250 years is reconstructed using tree-ring data. Characteristics of warm/cold change are analyzed from this series. The results indicate that there were three cold periods and four warm periods by 166, 83, 11, and 2.2 years respectively.

Keywords: cold-warm climatic variation, Yili region, tree-ring


The influence of the early diagensis process on lake sedimentary carbonate at Hongfeng Lake is analyzed through comparison of the carbonate geochemical profile in the core, calibrated to mass-depth from varve-counting dating, with recent annual temperature data. It found that carbonate concentration and the Ca/MgO.Al2O3 ratio can be used as a high-solution temperature index in recent lake sediments.

Keywords: annually laminated sediments, temperature records, carbonate, geochemistry, Hongfeng Lake
张志华，吴祥定，1996，祁连山地区1310年以来湿润指数及其年际变幅的变化与突变分析，第四纪研究，(4):368-378

为研究祁连山地区的气候变化与气候变化，用树木年轮数据重建了祁连山地区5-7月份1310年以来的湿润指数序列M(i)以及湿润指数年际变幅序列MV(i)。对两个序列分别进行了等级分类和干湿、强弱的时段分析，并用最大熵分析法对这两个序列的不同时段分别进行了周期分析，显示祁连山地区湿润指数及其年际变幅有明显的周期性。采用H-K突变检验方法对这两个序列分别进行了突变分析，发现祁连山地区的湿润指数及其年际变幅存在明显的突变年份。

关键词：湿润指数，湿润指数年际变幅，气候突变

张青松，李元芳，杨惟理，1996，北极巴罗Elson泻湖过去450年气候与环境变化记录，第四纪研究，(3):211-220

对北极巴罗地区Elson泻湖AB-67站孔岩芯进行了\(^{210}\)Pb测年、沉积物粒度、有机质、化学元素和微体古生物化石等分析。结果显示：巴罗地区过去450年的气候、环境变化过程存在如下3个阶段：1）1540-1740年为低海面寒冷时期；2）1740-1827年为气候转暖-海侵过渡时期；3）1827年至今为继续海侵-气候波动变暖时期。另外，


In order to study climate change and abrupt change of climate, the moisture index (May to July) time series M(i) since A.D. 1310, was obtained from tree-ring chronologies in the Qilianshan Mountains (38°51 ‘N, 100°08’E, 3500 m). A time series of the annual moisture index variability MV(i) was also made. The M(i) and MV(i) were classed into five grades and were analyzed using maximum entropy spectrum. Results indicate significant periodic climatic variation. Discontinuous changes of the M(i) and MV(i) are detected by the Lepage test, and results show that there was obvious abrupt change of moisture in the Qilianshan Mountains over the last 680 years.

Keywords: moisture index, annual moisture index variability, rapid climate shift


An unfrozen 60-cm-deep lake deposit core (AB-67) from Elson Lagoon at Barrow, Alaska, is analyzed for \(^{210}\)Pb, grain size, organic materials, environmental geochemical elements, micro-fossils, etc. The results show that there are three stages of climatic and environmental changes occurred in the Barrow area over the past 450 years: (1) From 1540 to A.D. 1740 was a relatively cold stage with a low sea level; (2) from 1740 to A.D. 1827 was a transitional stage of warming and transgression; and (3) after A.D. 1827 was a fluctuating warming stage followed by sea-level rising.

Keywords: Arctic, lagoon, climatic and environmental change
本研究还就若干海面变化事件和未来气候变化趋势进行了讨论。
关键词：北极 沿海
气候与环境变化

徐文鋕，
邹春静，卜军，1996，全球变暖
对中国东北植被的影响及对策，地理
科学，16(1): 26-36

中国东北植被对全球变暖的响应如下：未来建群种的变动类型分为三个类
群：气候变暖后，植物种群将向北迁移400-700km，向上迁移250-350m。
栽培作物的界线有所变化；大部分
植物物候发育将提前一个节律；主要
森林生态系统生产力将提高7.65%，
农业生态系统生产力将提高36.4%。
关键词：全球变暖 水热指标

Xu Wendo, Zou Chunjiang, and Bu Jun. 1996. The influence of global warming on vegetation in
northeast China and measures to be taken. Scientia Geographica Sinica 16(1):26-36.

According to the prediction of general circulation models (GCM) by the middle of the next century,
the concentration of CO2 in the atmosphere will be doubled and the global temperature will increase
about 2°C. The vegetation response to global
warming in northeast China will include the
following changes: (1) The future alternative types
of edicators (builders) can be divided into three
types (extending population; retreat population;
extinct population). (2) The edicators will move
northward about 400 to 700 km and the population
move upward 250 to 350 m. (3) The distribution
border of cultivated crops will move. (4) The
growth period of plants will extend 15 days and
the phenological development of trees will
roughly advance one season. (5) The productivity
of the main forest ecosystem will increase 7.65%
and that of main agroecosystems will increase
36.4%.

Keywords: global warming, moisture-temperature
indexes

王秀兰，1996，
全球农作物对大气CO2及其倍增的吸
收量估算，气象学报，
54(4): 466-473

根据农作物产量资料（FAO，1992年）
，计算出中国和全球各种农作物

Wang Xiulan. 1996. The estimation of crop
absorbing CO2 under current and doubling CO2
conditions in the World. Acta Meteorologica

The CO2 absorption from crops has been
estimated on the basis of crop production data
(FAO, 1992). It is about 550 million tC/year in
China and 2890 million tC/year in the world.
对CO₂的吸收量分别为5.5×10⁸ t/ha和28.9×10⁴ t/ha。同时以不同CO₂浓度下小麦、玉米、大豆等全生育期光合速率实验数据直接计算的CO₂吸收量为对照，与相应的中国产量资料计算结果比较，两者相差2.6%。从而进一步依据作物对CO₂倍增反应诊断实验结果，推算出大气CO₂浓度比目前倍增（700 ppm）条件下，中国和全球农作物CO₂总量将增长21%—26%，分别为6.6×10⁸—6.9×10⁸ t/ha和34.1×10⁸—36.2×10⁸ t/ha。研究还表明，单位面积作物年吸收CO₂量全球 [3.2 t/(hm²·a)] 比中国 [4.2 t/(hm²·a)] 低25.4%，而且C₄作物普遍高于同科C₃作物。

关键词：作物 CO₂倍增
CO₂吸收量 估算

Photosynthetic experimental data for wheat, corn, and soybean in all growing seasons can be used to calculate absorption of CO₂ directly, with a 2.6% error between estimation and calculation. Thereby, according to experimental results of crop response to a doubling CO₂, crops absorption of CO₂ will increase 21% to 26% under a doubling CO₂ concentration condition (700 ppm compared with 350 ppm). That is, the total CO₂ absorption from crops will be 660 to 690 million t/year in China and 3410 to 3620 in global world. Additionally, this study indicates that crops absorb C at a rate of 4.2 t/(hm²·a) in China, which is 25.4% more than the mean level of the world (3.2t/m²·a), and that C₄ crop species take up more C than do C₃ crops generally.

Keywords: crop, CO₂ doubling, absorbing CO₂ estimation


利用中国科学院阿克苏水监测试验站30余年的气象观测资料，分析了近年来荒漠化对气候的影响及气候与沙漠化的关系。主要结论如下：1）若人类不改变沙漠边缘的水文和植被状况，气候因子不会导致沙漠化；2）春季风沙和浮尘天气多，是土地沙漠化易发生的季节；3）塔克拉玛干沙漠北部绿洲以外的广大地区近来水文条件有所变劣，植被减少，气候条件对沙漠化有促进作用。

关键词：塔里木盆地西北部气候特征 荒漠化


The relationship and changing regularity between the climate and desertification in the northwestern part of Tarim Basin are discussed on the basis of climatic data collected at the Aksu Water Budget Experiment Station (AWBS) from 1962 to 1993. The conclusions are: (1) Desertification cannot be brought about by climatic factors if the hydrological and vegetation conditions are not changed by human activities. (2) Sand-drifting and dust-floating weather occurs frequently and desertification occurs easily in spring. (3) Hydrological and vegetational conditions become worse and the climate impuls desertification around the oases in the northern part of Tarim Basin.

Keywords: Tarim Basin, climatic characteristic, desertification

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The corresponding relationship between the southern migration of nomadic nationalities in North China and climatic changes is studied. It is believed that there are relationships between climatic changes and Chinese historical development. In the warm period, the nomadic nationalities that dwelt north of the Great Wall lived together in peace with the agricultural nationality that dwelt in the Central Plains. However, in the cold period, the nomadic nationalities launched an all-out offensive on the agricultural world because the forage grass withered and the water source had dried up in the prairie. At the same time in the Central Plains, the agricultural world was also hit by the cold climate. Thus either the nomadic nationalities controlled the agriculture nationalities or they confronted each other.

Keywords: nomadic nationality in North China, climatic change, migrating south


A diagnostic experiment on the impacts of different CO₂ concentration treatments on the growth and development of winter wheat is made using open top chambers OTC-1. Results show that the impacts of different CO₂ concentration treatments on the development stage, biomass, leaf area, grain yield, grain quality, and armyworm infestation are remarkably different.

Keywords: open top chamber (OTC-1), different CO₂ concentration treatment, winter wheat

The changes of easily available nitrogen (N) content in the soil are measured and the responses of soil fertilizer efficiency to temperature are studied using a soil fertilizer experiment under three urea levels with different release rates. Results show that the release amount of N increases in the soil when temperature goes up, and the release rate shortens. When temperature increases 1°C, the release amount of N enhances 4% on the average and the release period shortens 3.6 days. In addition, the greater the fertilizer amount, the more the release amount of N is, and the quicker the release rate will be. Therefore, in conditions of climate warming, the total of fertilizer amount and frequency should be increased relatively, but the amount each time should be decreased, thereby enhancing fertilizer efficiency, and reducing the disadvantageous impact of climate warming on fertilizer efficiency.

Keywords: climate warming, fertilizer, fertilizer efficiency


Based on the data of meteorology and crop yield in seven regions of China from 1961 to 1990, the method of entropy analysis in information theory is applied to discussion of the temporal and spatial distribution patterns of entropy change of four meteorological factors (mean temperature, maximum temperature, minimum temperature, and rainfall) in the last 30 years. Regression models of yield and entropy of meteorological factors in different regions are established.

Keywords: climate change, variability, entropy, agriculture
马守庆, 1996. 气候变化对东北地区粮食产量的影响及适应性对策, 气象学报, 54 (4): 484-492

采用作物生长发育阶段的热量条件影响产量的反映函数，建立了在气候变化条件下粮食产量变化的理论模型，分析了在主要农作物生长季气温升降与降水增减的各种组合条件下，东北各地粮食作物产量的变化，提出了适应气候变化的农业对策。

关键词：气候变化 粮食产量 影响模式 农业对策 东北三省

张苏平, 胡桂芳, 朱平盛. 1996. 降水长期变化对胶东地区水资源的影响, 气象, 22 (11): 3-9

利用1960-1994年胶东地区降水和水资源资料，用变点分析方法将35年分成A、B两个气候段。分析发现从A段到B段降水，水资源明显减少。水资源总量的变化趋势和降水变化趋势一致，但前者的变率要明显小于后者。对2000年水资源分析表明，水的利用率要提高30%以上方能满足经济社会发展的需要。

关键词：降水长期变化 水资源分析预测


Using the response function of the growth and yield of crops to temperature and precipitation, the calculating model of the variability of yield in various parts of northeast China is analyzed in association with variable combined conditions of temperature change and precipitation change. The agricultural countermeasures to the climate change are also put forward.

Keywords: climate change, grain yield, impact model, agricultural countermeasures, northeast China


Precipitation and water resources data for 35 years (1960-1994) in the Jiaodong region are divided into two periods by means of change-point analysis. Marked shifts between the two periods are revealed for both rainfall and water resources. The variation trends of precipitation and total amount of water resources are identical, but the former variation rate is smaller than the latter’s. Supply-and-demand analysis for the year 2000 indicates that the utilization efficiency of water resources must be raised at least 30% in order to meet the needs of basic economic development.

Keywords: long-range variation of precipitation, water resources, analysis and prediction

The impacts of “higher-temperature” on both winter wheat and spring wheat development stages, production structure, and economic yield are analysed using field experiments, artificial chamber simulation experiments, historic data, statistical analysis, and Crop Environmental Resource Synthesis (CERES) winter wheat models. The results show that the wheat development period shortens and the economic yield decreases as temperatures rise. The increase of temperature improves the overwinter condition for winter wheat which is favorable for ear grain numbers and grain yield. However, the “higher-temperature” after spring greening is unfavorable for winter wheat economic yield.

Keywords: wheat, development, production, “higher-temperature” impact


Climate change and its relationship with the yields of three main crops in Guangdong Province are studied with multiple regression analysis. The first eigenvector of each variable describes the same phase change pattern. The trends of yields of three main crops are all nonlinear and have no periodic signals. The climate factors in the prediction equations are very different from those of the simultaneous equations, and the multiple correlation coefficients in the prediction equations of multiple regression analysis are even better than those in the simultaneous equations.

Keywords: climate change, crop yield, prediction, Guangdong Province
大的不同，比较4种方程，预报方程的最佳效果比同期拟合方程的效果还好。
关键词：气候变化 农作物产量 预报 广东省。


The water deficits at various development stages and during the whole growing season of winter wheat in North China under different climate change scenarios are calculated based on the meteorological data, crop development period, and soil hydrological data from 43 stations. The results show that when temperature rises, the water deficit status deteriorates, the isolines of deficit might shift southward, and the climate-suitable areas of wheat would contract. The yield reduction would become serious, output values would lose, and production costs resulting from additional irrigation also might increase.

Keywords: climate change impacts, water deficit, winter wheat.


The effects of an increase of CO₂ in the atmosphere on agricultural production in China are predicted. (1) The primary productivity of crops would rise because of a strengthening of photosynthesis. (2) Crops would have a higher rate of water-use under increased atmospheric CO₂. (3) Roots, stems, leaves, flowers, fruits, and seeds might experience enhanced growth. (4) Global climate change, caused partly by the increasing CO₂, would lead to a series of
气候变化将导致一系列农业生产条件如光、温度、水、土壤的改变，作物产出将受到影响。由于中国各地自然环境差异大，不同地区农业条件的变化有很大的不同。

关键词：CO₂ 农业生产 对策


Studies of the effects of enhanced solar ultraviolet (UV) radiation on the growth and physiology of soybean and wheat show that under natural conditions, the increase of UV radiation can inhibit the net photosynthetic rate and the growth of leaves, stems, and roots of both tested crops. The decrease of biomass and yield is caused by the decline of transpiration and stomatal conductance of leaves. Estimation of the crop response to enhanced UV radiation shows that the mean error between the fitting value and an observed one is 0.30 to 8.56%.

Keywords: ultraviolet radiation, soybean, wheat growth, biological response


The possible change of crop evapotranspiration in different development stages of winter wheat and its impact on wheat yield under a warming climate are estimated on the basis of a simulation model. The results show that the transpiration and evapotranspiration after the jointing stage of winter wheat decrease significantly under a
化。结果表明温度升高时小麦生长中后期实际蒸腾量和总蒸散量明显减少，将导致干物质下降，产量减少，产值降低，并需额外增加灌溉，从而使农业生产费用增加。

关键词：气候变化 冬小麦 蒸散

李秀斌. 1996. 全球环境变化研究的核心领域土地利用土地覆被变化的国际研究对象，地理学报，51(6)：553-558

论述了全球环境变化中的土地利用土地覆被变化的内涵，在全球环境变化中的作用，其主要内容、关键问题及研究方法，并介绍了国外有关研究项目的情况。

关键词：土地利用 土地覆被 全球环境变化


A general review on the basic concepts, background, and progress on the methodologies of international land use and cover change (LUCC) research is presented. Relevant programs are introduced.

Keywords: land utilization, land cover, global environmental change

李培基. 1996. 青藏高原积雪对全球变暖的响应，地理学报，51(3)：260-265

根据60个地面气象站1957-1992年逐日雪深观测记录，用统计模式检验了青藏高原积雪变化趋势。证明近36年来高原积雪变化呈普遍增加趋势，并且与北半球冬季气温呈正相关。高原积雪的增加与北半球温带低地春季积雪自80年代后期的减少形成了鲜明地对比，与两个大陆冰盖雪积累率的增加相一致。

关键词：青藏高原积雪 变化趋势检验 全球变暖


A study of trend testing of Tibetan snow cover variation is presented using daily snow depth records at 60 primary climatic stations covering the period from 1957 to 1992. It is found that the increase of snow depth was almost omnipresent over the Tibetan Plateau, and the fluctuation of snow cover over the Tibetan Plateau revealed a positive relationship with surface air temperature in wintertime over the Northern Hemisphere. This association tends to contrast sharply with the reduced extent of snow cover in extratropical lands in the late 1980s, but coincides with the recent increases in Antarctic and Greenland snow accumulation.

Keywords: Tibetan snow cover, trend testing, global warming
王铮, 张不凡, 
周清波. 1996. 历史气候变化对中国社会发展的影响. 地理学报, 
51 (4): 329-339

讨论了历史时期气候变化与人口分布、社会经济、政治疆界的关系, 
试图说明全球气候变化对中国可能产生的影响。最后讨论了人地关系。
关键词: 全球变化 人文影响 中国

张定琪, 
乔宗乘. 1996. 冬季气温变化与小麦 
生产对策, 中国农业气象, 
17 (3): 10-13

气象资料显示, 近期自1980年以来 
冬季气温变暖, 主要表现在: 冬半年 
, 小麦越冬前及越冬期间的气温均比 
1980年前同期偏高, >0℃积温多 
75.1℃, 冬季积温少24.6℃。因此 
, 小麦生产应采取相应对策, 除了优化产品结构, 减少用种量, 科学施肥 
运筹之外, 适宜播期应较往年推迟3 
-4天, 冬性小麦最适宜播期推迟到 
10月11日~14 日, 
春性小麦在10月20日~22日, 
才能防止冬前、越冬期间旺长拔节, 
躲过冬季低温和春霜冻的危害。
关键词: 冬季气温变暖 
小麦生产对策


The relationship between demography and the social-economy of China with climate change during historical times is discussed, and the human impact of global change on society in China is investigated.

Keywords: global change, impact of human dimension, China

Zhang Dingqi and Qiao Zongyan. 1996. 
Discussion of temperature variation in winter and countermeasures for wheat production. 

Meteorological data show that climate is becoming warmer since 1980 in Jianhu, Fujian. Not only before but also during the period of wheat overwinter, the temperature is higher than that in the same period before 1980, accumulated temperature is 75.1℃ higher, and negative accumulated temperature is 24.6℃ lower. Therefore corresponding countermeasures should be taken for wheat production. To optimize structure of product, reduce the use of seed, and enhance fertilization and irrigation, the suitable sowing time should be delayed 3 to 4 days.

Keywords: warmer in winter, countermeasures for wheat production

为了解甘肃省玉米产量的年际变化及其成因，本文对全省玉米气候产量进行了功率谱分析，并研究了其气候产量周期与降水量、干燥度的关系。分析表明甘肃省玉米气候产量主要有6-7a，10a和3a的周期，其周期分布与5-6月，6-8月降水量的分布，特别是玉米生育期的干燥度分布有较一致的关系。

关键词：玉米产量 功率谱分析 分布规律


This paper analyzes the climatic corn yield (yw) of each district in the Gansu area by means of power spectrum analysis. The result shows three major periods in the yw series, which are 6-7 years, 10 years, and 3 years. The distribution of these periods coincides with the isohyet figures of May to June and June to August, especially with the pattern of dryness during corn growing period.

Keywords: corn yield, power spectrum analysis, regularity of distribution

封国林，曹鸿兴. 1996. 全球气候长期振动的方程及其求解，气象学报，54（6）: 753-758

假定行星反照率为温度的平方关系，导出了零维随机动力气候模式。对相应的Fokker-Planck方程用矩阵方法求解，得到了10万年、4万年、2万年气候周期的本征值和本征向量。数值计算表明，在随机噪声强度D=1.95时，10万年气候振动具有最大的振幅，即Milankovitch理论无法解释的10万年周期。

关键词：零维气候模式 Fokker-Planck方程 阶矩阵法


Assuming the planetary albedo is equal to a temperature square, a zero-dimensional stochastic-dynamic climate model has been suggested. The appropriate Fokker-Planck equation is solved by use of the matrix continued-fraction method, eigen values, and eigen vectors of 100,000-, 40,000- and 20,000-year climatic periods. When a value of 1.95 is used for the intensity of random noise, the calculations indicate a maximum climatic variability at 100,000 years, which is not explained with the Milankovitch theory.

Keywords: zero-dimensional climate model, Fokker-Planck equation, matrix continued-fraction method


Studies of the Louvain-la-Neuve two-dimensional (altitude-latitude) (LLN 2-D) model of the earth’s ice volume change in the late Quaternary are presented. The first periods are from 0.122 Ma BP to the present, then from 0.22 Ma BP, the last from 0.575 Ma BP. The major periods of the simulated ice-volume change correspond to the change in parameters of the earth’s orbit and rotation. Cross-spectral analysis reveals that the simulated ice volume highly correlates with the SPECAMP 180 record at frequency bands associated with the above-mentioned periods.

Keywords: LLN 2-D climate model, Milankovitch theory, atmospheric CO$_2$ concentration, earth’s ice volume, deep-sea oxygen isotope record

杨清华, 吴超武. 1996. 傅氏变换在短序列确定海平面变化趋势中的应用, 热带地理, 16(2): 107-113


The normal equation of linear regression is used to assess the effects of high-frequency components on determination of the secular trend of relative sea level (RSL). It shows that high-frequency components (with periods less than 4 years) have significant effects in determining the secular trend of the short time series, but that the linear regression can be still used to forecast the secular trend of RSL.

Keywords: sea level change, high-frequency components, short time series, Fourier transform

A 34-level coupled planetary wave-zonal flow, mechanistic global primitive equation model is constructed, and the effects of planetary wave transport on ozone are studied with the Lagrangian mean circulation forced by planetary waves while the flows are steady. The results show that there is an obvious seasonal variation of ozone as a result of planetary wave transport and the transport is largest during the winter over the Northern Hemisphere. It also shows that the quasi-biennial oscillation (QBO) of tropical winds may cause interannual variation of ozone not only in the tropical regions through the secondary meridional circulation in the westerly or easterly shear zones, but also in the middle and high latitudes areas through planetary wave transport. When tropical winds are easterly, the effects of planetary wave transport on ozone are stronger at the middle and high latitudes than that during the westerly phase.

Keywords: ozone, planetary wave transport, Lagrangian mean circulation, interannual variability


The effects of CO₂ concentration increase on corn were studied using open top chamber (OTC-1). The result shows that increases in CO₂ concentration have no effects on corn development stage and height but increase the biomass and grain yield. With CO₂ concentration increased, negative effects on corn seed, rough protein, rough fiber, and contents of total carbohydrate were observed, but the starch of corn was positively effected.

Keywords: CO₂ concentration, yield, quality

The simulated interannual variability of sea level pressure, surface air temperature, and precipitation is computed using the 20-year model output of the Institute of Atmospheric Physics (IAP) general circulation model (GCM). The model's ability in simulating variability is shown in that the model successfully reproduces the characteristic features of the geographical distributions of the observed variability. Therefore, the internal dynamical physical interaction processes in the atmosphere have substantial influence on interannual variability. However, the model underestimates the observed variability systematically because of the absence of some external factors, such as the interannual variations of the sea surface temperature and sea ice coverage. Additionally, the long period of change of average surface temperature in the Northern Hemisphere is discussed.

Keywords: interannual variability, simulation, observation


A one-dimensional climate model that includes an explicit hydrological cycle and sea ice physics is devised. The model is used to mainly study the feedback mechanisms in the climate system. Results show that (1) water vapor feedback and ice-albedo feedback are positive with the former stronger than the latter; (2) precipitation is proved to be a negative feedback both at the surface and in the atmosphere; (3) evaporation is a strong positive feedback in the atmosphere and at the surface, whereas evaporation is a strong negative feedback in middle-low latitude and a positive feedback in high latitudes; (4) the atmospheric sensible heat flux represents a negative feedback as it dampens the ice-albedo feedback; (5) the atmospheric latent heat flux proved to be a positive feedback by strengthening greenhouse
大气中还是在地表均表现为较弱的负反馈，其负反馈作用通过抑制冰雪反照率而表现出来。（5）大气中的潜热输送在大气中还是在地表均表现为正反馈，其正反馈效应过大水汽的温室效应体现出来。（6）不同反馈的合成是以一种非线性方式，而不是简单的线性相加。

Keywords: feedback mechanism, hydrological cycle, sea ice physics

石广玉，郭建东. 1996. 近百年全球平均气温变化的物理模式研究，科学通报，41(18): 1681-1684

用物理模式分析了近百年全球平均气温变化的因素。结果表明：大气GHGs浓度的增加支配了过去一个多世纪以来的全球增暖，并很可能将继续支配未来几十年的全球增暖；平流层火山气溶胶的变化是造成年际和10年间平均地表气温变化的主要原因；无论是对全球的气温变化趋势，还是对其10年和10年际的变化，太阳活动看来都不大可能具有重要的贡献。

Keywords: global-mean temperature, greenhouse gases, sources of natural climate variability
胡桂芳，张苏平. 1996. 近40年山东省各水资源分区降水变化特征及多步预测时序模型. 气象, 22(8): 16-19

利用近40年山东省41站降水资料，分析了各水资源分区降水演变特征，以均生函数为基础函数，用主成分分析进行筛选，建立了山东省各水资源分区降水时序多步预测模型。通过计算，试验，拟合，预报效果均较好。

关键词: 降水变化特征 水资源分区 多步降水预报


In this paper, we analyze the abnormal circulation of the preceding stage on drought and flood in summer over the Hetao Huabei region, present an attempt to explore the forming mechanism of this abnormal circulation, and perform a numerical experiment on the effect of Atlantic heating with the Oregon State University atmospheric general circulation model (OSU-AGCM). The results show that the abnormal circulation of the preceding stage in autumn and winter agree roughly with the drought and flood over the area in summer. The abnormal circulation is formed by the energy propagation upstream and downstream of the stationary waves that are forced by the action of Atlantic SST anomaly.

Keywords: Hetao Huabei region, drought and flood in summer, Atlantic SST anomaly
刘树华，黄子琛，孙立超. 1996. 半干旱区植被覆盖度对边界层气候热力影响的数值模拟，气象学报，54(3): 303-312

在陆-气相互作用的中小尺度系统研究中，水平非均匀下垫面的强迫作用是主要的物理过程。本文利用能量闭合二维陆面过程与大气边界层耦合模式，研究了我国西北半干旱地区（38°N，105°E）夏季下垫面物理特征的变化对区域边界层气候的影响。结果表明：土壤湿度、植被覆盖度对局地环流和区域边界层气候的形成起着决定性的作用。模拟结果揭示了在半干旱地区大面积植树造林、提高植被覆盖度，可涵养土壤水分，改善局地生态环境，是人工持续改造干旱、半干旱荒漠地区局地气候的重要途径。

关键词：植被覆盖度 边界层气候 数值模拟

朱乾根，兰红平，沈树立. 1996. 土壤湿度和地表反射率变化对中国北方气候影响的数值研究，气象学报，54(4): 493-500

本文利用OSU两层大气环流模式来考察土壤湿度和地表反射率变化对中国北方气候的影响。在（30-46°N, 90-120°E）的区域上进行了3个实验，结果表明干土壤对我国东部季风区和西部非季风区有不同的影响特征。高反射率造成降水减少。并指出地表过程的作用可能是经常发生在华北地区春夏季旱现象的重要原因之一。


Three numerical simulations by the Oregon State University atmospheric general circulation model (OSU AGCM) that integrated more than 50 days are carried out to show the effects of changes in soil moisture and surface albedo on the climate of the northern part of China (30-46°N, 90-120°E). Results of the simulations indicate that dry soil moisture has different effects on the nonmonsoonal area in the west of China and the monsoonal area in the east of China. High albedo produces a decrease in rainfall. The article points out that the effect of surface processes is one of the possible major reasons for spring-to-summer
连续干旱发生在华北北部，

Keywords: soil moisture, surface albedo, North China, spring-to-summer continuous drought

王晓春，吴国雄，1996。
利用空间均匀网格对中国夏季降水异常区域特性的初步分析，气象学报，54（3）：324-332

Wang Xiaochun and Wu Guoxiong, 1996.

The regional characteristics of precipitation anomalies of total summer precipitation (total precipitation of June, July, and August) and monthly precipitation are analyzed using the results of Varimax empirical orthogonal function (EOF) and correlation analysis. The data set used is the grid point precipitation over a (5° lat × 5° lon) network in China in the period of 1959 to 1994. The analysis of total precipitation shows that the most significant regional characteristic is the existence of negative correlation in precipitation anomalies between the low-reaches of the Yangtze River and Huaihe River Valley (LRYH) and the middle-reaches of the Yellow River Valley (MRY region), and between the LRYH region and South China. The precipitation anomaly over the Sichuan Basin is negatively correlated with that over the eastern part of the Qinghai Xizang Plateau and that over the LRYH region. The regional characteristic of summer precipitation anomalies in western China is that there exists a negative correlation between the summer precipitation anomalies over the southern part of the central and eastern Qinghai Xizang Plateau and that over the northern part. There also exists positive correlation between the southern part of eastern Qinghai Xizang Plateau and the eastern part of North China and southern part of Northeast China. The noted spatial correlation models have significant periods of about 3 years and 10 years. The analyses of monthly precipitation show that in June, there exists a positive correlation among the precipitation anomalies over the LRYH region, the eastern part of North China, and Northeast China. In July, the precipitation in the MRY region and the LRYH regions are negatively correlated. The regional characteristic of precipitation anomalies in August
Radiation and Trace-Gas Emission


The characteristics of the ultraviolet and global radiation (UV/Q) during the period from February 1993 to December 1994 are analyzed, and the relationship between the decrease of Antarctic ozone in spring with the ultraviolet and global radiation is discussed. The annual mean ratio of UV/Q in Zhongshan is 5.7%. In spring (September-November) it is larger than that in other seasons. The ozone and UVB have a close relationship basically met by logarithmic line. The relationship between UV and ozone was almost similar to that of UVB and ozone and has a confidence level of less than 0.01. It can be concluded that the decrease of ozone in spring in Zhongshan Station not only obviously enhances UBV but also has effects on UV and global radiation.

Keywords: Antarctic Zhongshan Station, ultraviolet radiation


This paper calculates the change of organic carbon in desertified lands of China using data of areas and conversion rates (positive and negative) of desertified lands and contents of organic carbon in
料，分地区分类型统计了我国沙漠
化土地中有机碳的变土地沙漠化而
释放到大气中的CO₂，总量达173.28
6Mt，而逆转过程中固定的CO₂量为
59.124Mt碳，所以，近40年来我国
沙漠化土地净释放到大气中的CO₂量
为24.475Mt碳占全球温带和寒带土
地每年释放CO₂量133Mt碳的93.5%

关键词：沙漠化  CO₂  大气环境
全球变化

郭世昌, 杨秀洪, 邱金桓. 1996, 昆明地面生物有效紫外辐照度的初步计算，大气科学，
20（4）: 414-421

近年来，大气平流层臭氧含量普遍
呈下降趋势。这将对人类的生存环
境构成极大威胁，应当引起人们的
高度重视。其中，太阳紫外辐射是
一大因素。太阳紫外光（UVB和UV
A，尤其是波长为280-320nm）对
动植物生长及人类健康具有重要的
生物学效应。但太阳光在大气中的
传输过程极其复杂，涉及到大气臭
氧吸收、空气分子散射、气溶胶颗
粒以及云滴的散射等作用。针对昆
明地处低纬高原，季风云系影响显
著等特点，本文在同时考虑上述几
种情况下，用二流（two-stream
model）模式方法对太阳紫外辐射传
输问题进行了研究，得出了一些有
意义的计算结果，并对其作了讨论。

关键词：UV辐照度
二流近似  臭氧垂直分布

Guo Shichang, Yang Xiuhong, and Qin Jinhuan. 1996. A preliminary calculation on the
surface biologically active ultraviolet (UV) irradiance for Kunming by two-stream

Recent reports of stratospheric ozone depletion
have caused concern about the levels of solar
ultraviolet radiation at the earth's surface. A
preliminary calculation using a two-stream model
of surface biologically active ultraviolet (UV)
irradiance (UVB and UVA) in the Kunming area
is described in this paper. In the model, the
influences of ozone absorption, Rayleigh
scattering, cloud droplet scattering, aerosol
scattering, and their seasonal variations are
considered. Finally, the calculated results
including spectral and integral surface irradiances
are discussed.

Keywords: UV irradiance, two-stream
approximation, O₃ vertical distribution

An estimation of the amount of carbon accumulated by forests are made using the data of changing trends of the forests in China. It shows that the accumulation is higher than the release at the present time, and that the net absorption is about 86.27 million tons per year, which will increase by 7.73 million tons per year in the future 20 years and reach to 146.97 million tons by the year A.D. 2000.

Keywords: forests, carbon accumulation, carbon sink


Using an electrochemical ozonesonde, we measured the vertical profile of ozone and temperature over the Antarctic Zhongshan Station in the spring of 1993. We observed a total ozone less than 220 Dobson units (Du) three times. The reduction of ozone concentration begins in September and reaches a maximum from mid September to mid October. The vertical distribution of the typical ozone indicates that the altitude from 13 to 23 km is the range of the largest ozone losses. This height has a good corresponding relationship with the existing height of the polar stratospheric clouds (PSCs) and volcanic aerosol. The paper presents observation results and fundamental analyses.

Keywords: total ozone, vertical profile of ozone partial pressure, atmospheric temperature, Antarctic ozone hole

As one part of global research, surface ultraviolet (UV) spectral radiance observation began in Changchun, China, in May 1992, and later in Beijing. UV spectral radiance was measured with an absolute-calibrated UV spectroradiometer developed by the Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Science. This paper describes the instrument and the observation, analyzes the statistics of UV-B and UV-A radiances, and the ratio spectra of diffused global radiances as well as ratio spectra for different solar zenith angles. Observations are compared with calculations by radiative transfer models.

Keywords: UV spectral radiance, UV-B radiance, UV spectroradiometer


A preliminary discussion on the concentration and distribution of greenhouse gases in deeper loess sediments is made. The carbon dioxide (CO₂) concentration in loess and modern soil is similar; that is, CO₂ concentration in loess and modern soil is higher and generally several times to several ten times as high as that in the atmosphere. Furthermore, CO₂ concentration in loess and modern soil increases with depth. However, carbon isotope compositions of CO₂ in loess and modern soil are greatly different. The isotope δ¹³C of CO₂ in loess is 16% higher than that in modern soil and much higher than that in the atmosphere.

Keywords: CO₂, CH₄, N₂O, loess sediments, Weinan
 Shan Zhenjun, Cai Daoji, and Ren Zhenhai.  

Greenhouse gas emissions from soils in China were assessed based on the mineralization rate of soil organic matter. It was estimated that 3.75 billion tonnes of CO$_2$ from soil and 20 million tonnes of methane and 345,000 tonnes of N$_2$O from paddy soils in China are emitted into the atmosphere every year. The paper provides a simple method for assessing greenhouse gas emissions from soils, and proposes further studies in the next step.

Keywords: soil organic matter, mineralization, greenhouse gas, emission

 Wang Hongqi, Zhao Gaoxiang, and Sun Jinhui. 

The effects of variations in volcanic aerosols on direct, diffuse, and total ultraviolet spectral irradiances and UV-B irradiances arriving at the surface have been simulated with the applied theory of transfer calculations. The simulation results and observed UV-B irradiance change in the northwest suburb of Beijing before and after eruptions of Mt. Pinatubo are compared, and some causes related to the difference between them are discussed.

Keywords: ultraviolet irradiances, UV-B, volcanic aerosol, ozone
关键词: 紫外辐射度 UV-B
火山气溶胶 臭氧

杨永辉, P. Ineson, 1996, 草原土壤N₂O释放及全球变暖影响下
土壤养分变化的反馈效应，应用生态学报，7(4): 386-390

用实验的方法研究了寒温带草原生态系统中不同土壤N₂O释放规律，
以及全球变暖时土壤有机质分解加速
情景下土壤养分(N、P)浓度升高对N₂O释放的影响。结果表明，
以沼泽泥炭土N₂O释放量最大，
生长季节为1.3~12.2kg·Nm⁻²·a⁻¹，
其次为灰壤土，1.5~2.4kg·Nm⁻²·a⁻¹，
酸性棕壤最小，为0~3.2kg·Nm⁻²·a⁻¹；
N₂O的释放层灰壤土在0~5cm，
其它2种土壤为0~10cm。施肥试验表明，N、P肥在生长季节对土壤N₂O释
放量影响不显著，但在生长季末期，
N肥对酸性棕壤及灰壤土N₂O影响显著，施肥后第3天酸性棕壤由1.3提高
到44.2kg·Nm⁻²·a⁻¹，
灰壤土则由1.9提高到31.1kg·Nm⁻²·a⁻¹。
这说明全球变暖对土壤有机质分解的
影响不会诱发N₂O释放量的大幅度增加。
关键词: N₂O 全球变暖 山地草原

Yang Yonghui and P. Ineson. 1996. N₂O emission from grassland soils and the feedback
7(4):386-390.

Nitrous oxide (N₂O) emissions from grassland soils and the influence of nutrient changes
resulting from global warming are studied. The study shows that in growing season peaty gleys soil
has a maximum N₂O emission that varies from 1.3 to 12.2 kg nitrogen·Nm⁻²·yr⁻¹. This N₂O
emission mainly comes from the top 5 cm in the micropodzol soil and from the top 10 cm in the
other two soils. Fertilizer application in growing season doesn't make any difference in different
soils. However, nitrogen application greatly stimulates the N₂O emission at the end of the
growing season in acid brown earth and
micropodzol soil, and it reached 44.2 from 1.3 kg nitrogen·Nm⁻²·yr⁻¹ and 31.1 from 1.9 kg nitrogen
hm⁻²·yr⁻¹ respectively. This implies that the
influence of global warming on the decomposition
of organic matters may not play a significant role
in an increase of N₂O emission.

Keywords: N₂O, global warming, mountainous grassland, fertilizer application
Yu Bende, Tang Xiaoyan, and Li Jinlong. 1996. A study of the impact of increasing concentrations of CH$_4$ and N$_2$O in the atmosphere on O$_3$ destruction by halocarbons and ODP. China Environmental Science 16(3):186-190.

The impact of increasing concentrations of methane (CH$_4$) and nitrogen dioxide (N$_2$O) in the atmosphere on ozone (O$_3$) destruction by halocarbons and ozone depletion potential (ODP) has been studied with counter species method. In the atmosphere from 0 to 20 km, O$_3$ increases quickly with NO$_x$ rapid growth and HO$_x$ decrease, and the latter distinctly reduces the decomposition of HCFC-22. The CFC-11 decomposition is only slightly affected by the increasing of CH$_4$ and N$_2$O. The increasing of CH$_4$, HO$_x$, and N$_2$O in the upper middle stratosphere considerably increases the reservoir molecules of Cl, and thus the ability of O$_3$ destruction of halocarbons decreases. The impact of these trace components on ODP is not distinct according to the paper.

Keywords: ozone, ozone depletion potential, halocarbons, stratosphere chemistry, model calculation

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The impact of precipitation and soil moisture on N$_2$O production and emission is studied on the basis of in situ measurement of soil humidity and N$_2$O emission from a rice-wheat rotation ecosystem and on a simulated experiment in the laboratory. The results show that the N$_2$O emission from the wheat field is positively correlated with precipitation in spring and autumn but not in winter, and that N$_2$O emission from a rice field is not influenced by precipitation. Within the rice-wheat rotation, N$_2$O emission is intensively affected by soil moisture. A 97 to 100% of soil water-holding capacity (i.e., 84 to 86...
湿度为田间持水量的97-100% 或84-86% WFPS（土壤体积含水量与总孔隙度的百分比）时，N₂O排放最强，低于此湿度范围时，N₂O排放通量与土壤湿度呈正相关，反之，则呈负相关。田间N₂O排放随土壤湿度的变化形式与模拟条件下培养土壤样品的N₂O产生率变化非常相似，但前者的最佳湿度范围比后者窄，而且偏小。

关键词：N₂O排放通量 土壤湿度 降雨量 N₂O产生率

张厚娍，李玉娥. 1996. 减缓农业生产中温室气体排放的对策及其经济可行性初探，中国农业气象，17（5）：7-11

分别探讨了减缓农业生产中CO₂和CH₄排放的各种可能途径。减少CO₂排放的途径：改进土地利用格局，减少农业系统碳分离，增加生物燃料生产等。减少CH₄排放的主要途径：提高饲料质量，开发沼气生产，加强稻田水肥管理等。最后还初步讨论了实施这些减排措施的经济可行性问题。

关键词：农业生产 温室气体排放 经济可行性


Strategies for retarding carbon dioxide (CO₂) and methane (CH₄) emissions in agricultural production are discussed. The ways to reduce CO₂ emissions are to improve land use, reduce carbon decomposition in the agrosystem, and increase production of biological fuel. The ways to reduce CH₄ emissions are to improve the quality of forage, utilize methane, and enhance the management of fertilizing in rice fields. Finally, the economic feasibility of these strategies is discussed.

Keywords: agricultural production, greenhouse gas emission, economic feasibility
Adaptation


The relationship between alluvial terraces and the climatic changes in the Holocene is discussed. It is found that the downcutting period was coincident with a stable warmer and wetter climate, and that aggradation took place when the climate was changing either from drier to wetter or from wetter to drier. The lower terraces were formed between 5.57 ka BP and 3.15 ka BP, when climate was changing from wetter to drier. The higher terraces were formed between 11 ka BP and 8 ka BP when the climate was changing from drier to wetter. There was a downcutting period of the rivers from 8 ka BP to 6 ka BP.

Keywords: alluvial terraces, climatic change, Hexi Corridor Basin


This paper presents the experimental research used to analyze the degree of the adaptability of climate for growing olive trees in the Bailong River Valley of Wu Du, Gansu Province, and also examined the use and exploitation of changes in climate.

Keywords: olive tree, climatic ecology, exploitation and utilization
吴景云, 杜志贵,
华云峰, 1997, 浙中地区菜豌豆翻秋栽培的气候适宜性,
中国农业气象, 18(1): 30-33

通过菜豌豆翻秋栽培试验, 分析出秋播期气候对豌豆生长的相宜性与相悖性, 并发现如采取相应的农艺措施, 趋利弊害, 豌豆翻秋是可行的。并且证实菜豌豆翻秋栽培具有生产周期短, 工本投资少, 经济效益高的优势。关键词: 菜豌豆 翻秋栽培
气候适宜性


Based on field experiments on the cultivation of peas for off-season consumption, the adaptation and the conventions were found. Results showed that it is feasible to grow peas in autumn if appropriate cultural practices are used, leading to a shorter production cycle, less labor input, and higher economic return.

Keywords: Pisum salivum var. hortense Poir, autumn cultivation, climatic suitability

姜逢涛, 马红, 胡汝骥,

采用经验正交函数展开了分析新疆北部地表水资源的时空分布特征, 并将实测资料与历史资料相结合, 对南疆地表水资源进行分析。结果表明: 新疆地表水资源的未来变化趋势受亚洲中部未来气候变化的影响, 亚洲中部气候变冷的效应对新疆来说总体上是有利的。关键词: 新疆 地表水资源
亚洲中部 气候变化


The spatial and temporal distribution of surface water resources in north Xinjiang are analyzed using an empirical orthogonal function expansion. Based on research done previously, the sequence of surface water resources in north Xinjiang is extended from 250 to 412 years, by combining two different sequences of tree-ring chronologies into one sequence. The water resources in the south Xinjiang are analyzed using historical data with the regional characteristics of water resource circulation taken into account. The results show that the cooling trend of the climate in Central Asia will produce some good effects on water resources in Xinjiang.

Keywords: Xinjiang, surface water resources, Central Asia, climate change

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根据对长江三峡及汉江平原地区新石器文化遗址的分布、文化层、自然地层和埋藏古树的研究，并结合历史资料分析，探讨了本区全新世异常洪水频发的变化，共划分出4个洪水频发期：第I个洪水期（8000 a BP-5500 a BP），共发生特大洪水9次；第II洪水期（4700 a BP-3500 a BP），至少发生特大洪水9次；第II I洪水期（2200 a BP-700 a BP），共发生特大洪水11次；第IV洪水期（500 a BP-100 a BP），共发生特大洪水52次，其中在小冰期最冷期（300 a BP-100 a BP）就有40次。前3个洪水期均与高湿、高海面期强盛的夏季风活动有关，其中第II I洪水期还与江汉平原地区围、筑堤等不合理的土地利用有关，第IV洪水期与强盛的冬季风活动和环太平洋表层海温异常事件有关。

关键词：长江三峡 汉江平原 全新世 环境考古 异常洪涝灾害
Xue Bin, Wang Sumin, Xia Weilan et al.  
1997. The uplifting and environmental change of Qinghai-Xizang (Tibetan) Plateau in the past 0.9 Ma inferred from core RM of Zoige Basin. Science in China (Series D) 27(6):543-547.

According to a multidisciplinary study on the lake sediments from core RM of the Zoige Basin (i.e., the deepest wholly collected core in Tibetan Plateau), the paleoclimatic and paleoenvironment for the basin in the past 0.9 Ma are reconstructed. The analytical results suggest that there were 3 distinct accelerated uplifting periods for the east Plateau in the past 0.9 Ma (i.e., 800, 300, and 160 ka BP). Sedimentary characteristics, the texture of sedimentary cycles, and variations of depositional rates, in conjunction with the environmental features of cold/warm to dry/wet combinations, are presented. The paper also probes into the environmental effects under the three accelerated tectonic upliftings on the background of global change.

Keywords: Zoige Basin, 0.9 Ma BP, uplifting process, environmental change

Liu Yu, Wu Xiangding, Shao Xue Mei et al.  

Relative function analysis indicates that there is significant correlation between the minimum tree-ring density of early woods and the temperature of June and precipitation from April to June. The correlation coefficients were 0.616 and -0.662, respectively. Based on these, the index of minimum density of early woods coincided with the index of stable C isotope using the first principle factor analysis, the temperature of June was reconstructed precisely, with an interpretive variance of 45%. At the same time, the precipitation from April to June was also reconstructed based on the minimum density of early woods and its interpretive variance was...
上指示了东亚夏季风前锋到达此地时间上的早晚。
关键词：陕西黄陵 树轮密度
稳定C同位素 气温 降水
东亚夏季风

49%. The temperature of June actually indicated the early and late coming of the front of East Asian monsoon.

Keywords: Huangling Shaanxi Province, tree-ring density, stable C isotope, temperature, precipitation, East Asian monsoon


The Mn$^{2+}$ electron paramagnetic resonance (EPR) intensity recorded in the Chinese loess-paleosol sequence shows a close correlation with magnetic susceptibility and strontium content as well as the oscillation of the paleoclimate. Thus the Mn$^{2+}$ EPR signal can serve as an indicator of the East Asia summer monsoon intensity fluctuations.

Keywords: paleomonsoon, loess, paleosol, EPR signal of Mn$^{2+}$


An oxygen isotope temperature record from 381 to 166 ka BP has been obtained by combining data on the isotopic composition of calcites with that of fluid inclusions trapped in a stalagmite from a limestone cave in which a fossil cranium was deposited. Several laminae in the microsequence of the stalagmite represent climatic events or shifts.

Keywords: stable isotope, climatic change, stalagmite, Nanjing

The dryness variation in the glaciated region is inferred from the $SO_4^{2-}$ within the Guliya ice core, based on the facts that $SO_4^{2-}$ in the core mainly originates from terrestrial surface minerals, soluble sulfate is widespread in the dry inland regions, and the changes in concentrations of surface minerals are governed by climate conditions, particularly dryness. The dryness variation since the Little Ice Age can be inferred in accordance with the $SO_4^{2-}$ within the Guliya ice core.

Keywords: Guliya Ice Cap, $SO_4^{2-}$, dryness variation


The Holocene megathermal event took place about 9.0-3.5 ka BP in the Tibetan Plateau, earlier than in other places in China. The starting and ending dates of the megathermal had regional differences inland of the plateau, in general, early in northeastern, western, and southern parts and late in the other parts. During the megathermal, vegetation on the plateau was very different from vegetation at the present time. The altitude zonation of vegetation moved forward and that of forests extended. In the maximum megathermal stage, the mean annual air temperature was 3 to 5°C higher than that of the present, annual precipitation increased by 100-400 mm with strengthened summer monsoon, and lakes extended and their level rose with freshened water in them. In addition, highland peat formed, glaciers retreated, and permafrost degraded during the Holocene Megathermal in the plateau.

Keywords: Tibetan Plateau, Holocene Megathermal, environment features
Yao Tandong, L. G. Thompson, and Shi Yafeng et al. 1997. Climate variation since the last interglaciation recorded in the Guliya Ice Core. Science in China (Series D) 27(5):447-452.

The climatic and environmental variations since the Last Interglacial are reconstructed based on a study of the upper 268 m of the 309-m-long Guliya ice core. Five stages can be distinguished since the Last Interglacial from the δ¹⁸O record in the Guliya ice core: Stage 1 (Deglaciation), Stage 2 (the Last Glacial Maximum), Stage 3 (interstadial), Stage 4 (interstadial in the early glacial maximum), and Stage 5 (the Last Interglacial). Stage 5 can be divided further into 5 substages. The δ¹⁸O record in the Guliya ice core indicates clearly the close correlation between temperature variation on the Tibetan Plateau and solar activities. The study indicates that solar activity is a main forcing factor on the climate on the Tibetan Plateau. Through a comparison of the ice record in Guliya with that in Greenland and the Antarctic, it can be found that the variation amplitude of temperature is different.

Keywords: climate variation, Last Interglaciation, Guliya ice core, comparison of three poles


Using a high-resolution ¹⁴C chronology, δ¹³C values, and organic content from loess/paleosol and peat profiles in China, we can demonstrate century-scale warm-cold East Asia monsoon palaeoclimatic fluctuation events and significant precipitation variability within the Last Deglaciation. The major climatic events recognized are the Bolling (13-12.5 ka BP), Older Dryas (12.5-11.750 ka BP), Allerod (11.75-11.2 ka BP), and Younger Dryas (11.2-10 ka BP). The stratigraphic structure of the last deglaciation sediments is characterized by frequent changes in sedimentation phases.
reflecting climatic instability. These high-frequency, rapid climatic events can be correlated with fluctuations recorded by sea surface temperature in the Norwegian Sea. This indicates a palaeoclimate teleconnection between polar, high-latitude areas and East Asian monsoon areas through westerlies and the related atmospheric pressure system.

Keywords: Last Deglaciation, East Asian monsoon climatic instability, palaeoclimatic teleconnection, loess-paleosol


通过若尔盖盆地RM孔湖泊化学沉积碳酸盐氧、碳同位素代用指标, 重建了该区近140 ka以来的古气候演化历史, 其中末次冰期至少存在有7次暖波动及5次冷事件, 其波动特征可与冰芯及深海记录相比较; 而末次间冰期内部的次级波动与格陵兰冰芯GRIP氧同位素记录相一致, 早期的Eemian暖期也存在两次冷波动。演化结果表明了末次间冰期和冰期气候的不稳定性。色素和碳酸盐含量指标也具有与氧同位素记录相似的结果。

关键词: 若尔盖盆地 氧同位素 气候波动


The sequences of climatic evolution are reconstructed by the analyses of δ¹³C and δ¹⁸O of carbonate from core RM in the Zoige Basin since 140 ka BP. During the Last Glaciation at least seven warm climatic fluctuations and five cold events correlated with the ice core and deep sea records and during the preceding last interglacial period there were two cold climatic variations coinciding with the record of ice core of the Greenland Ice Core Project (GRIP). These results depict climatic instability in east Qinghai-Xizang Plateau over the last interglacial period. In addition, the environmental proxies of the carbonate content and pigments indicate similar results for the stable isotope record from core RM.

Keywords: Zoige Basin, oxygen isotope, climatic fluctuation
陆龙辉, 辰林根.
贾丽群, 1997, 南极和邻近地区温度的时空变化特征, 中国科学, 27(3): 284-288

对南极和邻近地区1957-1993年气温的空间分布特征、时间变化趋势及多年振荡特征的研究表明，南极地区的短期气候变化在时间、空间上都是多样的，南极不是对全球温室效应响应最强烈的地区，其温度变化趋势与全球平均变化有较大差异。这种变化和差异很难简单地用全球温室效应来解释。
关键词: 南极 温度 温室效应 变化趋势 振荡特征


The 3310-m-high Chia-min Lake records the climatic history since 4 ka BP in Taiwan. The warm/wet period before 2.2 ka BP seemed to correspond to the later part of the Holocene Megathermal, and the cold/dry period during 0-2.2 ka BP correspond to the Katathermal. Before the termination of the Megathermal, an especially warm and humid segment (2.2-4 ka BP) emerged. The palaeoclimatic records from Yuen-yang and Chi-tsaï Lakes support the notion that the Megathermal in Taiwan terminated during 2-2.3 ka BP. A warm segment (820-1320 AD) in the Katathermal could be considered the Medieval Warm Period. The climate turned cold and dry after 1320 AD and this indicated the onset of the Little Ice Age. These palaeoclimatic variations are also in good agreement with those recorded in Great Ghost Lake.

Keywords: palaeoclimate, Little Ice Age, Medieval Warm Period, Holocene, Megathermal, Taiwan, Chia-min Lake, Yuen-yang Lake, Chi-tsaï Lake

Desert-loess boundary belt, which is located in the fringe of the contemporary monsoon climate region, has undergone a multi-phase northward-shift, southward-retreat, and the change of warm and cold, wet and dry since the Last Interglacial Period. During the Last Interglacial stage, its southern border reached about 30°N, and during the Last Glacial Period, the northern border was close to the 400 mm isohyet of today, its middle part being at the zone of the ancient Great Wall ruins. The shift of the desert-loess boundary belt is an inevitable outcome of global glacial-interglacial climatic variation and is related to the variations of the East-Asia monsoon.

Keywords: Last Interglacial period, desert-loess boundary belt, climatic change


There are three eolian paleosand layers in the loess profile of Dadunling, Xining Basin. The age and environmental records of loess stratigraphy proved that these three eolian paleosand layers, which represent three extensive desert expansion periods in the Xining Basin since 1.2 Ma BP, were formed in the early part and the latter part of the Middle Pleistocene and the latter part of the Last Pleistocene, respectively. Furthermore, the Quaternary climatic changes and the uplift of Qinghai-Xizang Plateau controlled the advance and the retreat processes of desertification in the studied area. In detail, the periglacial action of the plateau glacier in the Quaternary produced a lot of detritus for desert and loess deposition in adjacent areas.

Keywords: Xining Basin, Eolian paleosand, climatic changes

The data for age determination from lake facies sedimentation in the northeastern Sahara Desert showed that there were a lot of large lakes in 9900-2400 a BP. Moreover, the time 9800-6450 years BP is a period of significant growth in the processes of lake forming. From 6000 years BP to 3600 years BP, the evolution of lakes arrived at its fluctuating period which corresponded to the changing climatic environment. This changing period lasted about 600 years. The humid period, represented by lake facies sedimentation in the Holocene in the northeastern area of the Sahara Desert, was also a period of development, progress, evolution, and differentiation of ancient human beings in this area, as well as the key period in natural evolutionary history. The heavy erosion and detrital accumulation in this period had laid a foundation of material source for forming the Sahara Desert.

Keywords: Sahara Desert, Holocene, paleoclimate


Based on glacial investigation well preserved in the headwater of the Urumqi River and relationship between glacier mass balance and climate in the contemporary climatic scenarios, this paper presents the estimated climatic scenarios in the Last Glacial Maximum (LGM) using glacier dynamics method. By combining the equilibrium line altitude (ELA) and glacier volume in the LGM, it is determined that summer air temperature in the headwater of the Urumqi River in the LGM was 4.8°C lower than the contemporary temperature and the precipitation in that time accounted for approximately 30% of the contemporary one.
However, other paleoclimatic studies demonstrate that the temperature in the LGM was 5.6°C lower than at present. The difference of 0.8°C is attributed to the fact that ground surface uplift was not figured by the glacier dynamics method.

Keywords: Last Glacier Maximum, glacier, climate


During the Last Glacial Maximum (LGM) at about 16-32 ka BP, it was 7°C colder than at the present and precipitation was 30% to 70% that of the present on the Tibetan Plateau. Polar-type glaciers developed extensively. The equilibrium line in the LGM was 300 to 500 m lower than at present and subpolar type glaciers might exist in the eastern, southern, and western edges of the plateau, with an equilibrium line altitude (ELA) decrease of 800 m or even up to 1,000-1,200 m. According to preliminary statistics, the glaciated area on the plateau in the LGM is about 350,000 km², 7.5 times larger than at present, and the ice volume on the plateau at that time was estimated to be about 87,500 km³ and equivalent to a decrease of 24.2 cm of the global sea level. Permafrost developed extensively to its maximum, about 2,200,000 km². Lakes in the eastern part of the plateau, which depended significantly on monsoon precipitation, shrunk or even disappeared during the LGM. Those located in the northwestern part of the plateau had lower levels than in former interglacial stadial and higher than that during the post glacial period because of the effect of the westerlies. Almost all lakes on the plateau became saltier.

Keywords: Last Glacial Maximum (LGM), glacier, equilibrium line altitude (ELA), lakes, permafrost
Climate Variation


Analysis of ice cores drilled through Greenland and Antarctie ice sheets and high glaciers has made great progress in our study of the evolution of Earth’s climate. One of the principal advances made by the Greenland Ice Core Project (GRIP) and Greenland Ice Sheet Project (GISP2) ice cores has demonstrated that the last glacial period was punctuated by a series of abrupt warm interstadials during which temperature increased by about 5°C to 8°C for a few hundred years. Another significant new finding documents that the Eemian interglacial was interrupted by a series of severe cold periods. In a third advance, two ice cores from the Andes open a view of the ice age tropics. And the last advance, analysis of the borehole temperature at GISP2 proves that polar amplification of climate change is a central characteristic of Earth’s climate. With these new discoveries, the widely accepted concepts of a noisy glacial climate and a quiet interglacial climate as well as thermostatic tropic came under challenge. These discoveries also bring out questions about the consequences of future global warming. The greenhouse effect will end the recent climate stability and bring rapid climate change to our doorstep. We can not ignore all of these!

Keywords: ice core, climate instability, stadial and interstadial, tropic climate sensitivity
许国昌, 魏辉, 李珊. 1997. 中国干旱-半干旱区当代气候变化, 第四纪研究, (2):105-114

作者在最近几年有关研究的基础上，结合最新资料和成果，对我国干旱-半干旱区当代气候变化的基本趋势做了比较系统的分析，并与全国及北半球气候变化相结合。研究结果表明：中国干旱-半干旱区气候变化与全国以及北半球气候变化相比有一定的特点。冬夏气温变化不同，干旱-半干旱地区降水变化趋势不同。关键词：干旱-半干旱地区气候变化


On the basis of a recent investigation together with up-to-date information, the authors made a comparative study on the present climate changes in arid and semiarid regions of China. It revealed that the general trend of climate change in arid and semiarid regions of China was characteristic compared to that of all China and the entire Northern Hemisphere. Temperature variation is different between summer and winter in arid and semiarid regions. The trend of precipitation variation is also different in arid and semiarid regions.

Keywords: arid and semiarid regions, climate change

林志强. 1997. 全球平均海温演变的奇异谱分析, 气象, 23(9):31-34

应用奇异谱分析法（SSA）对1856－1991年全球平均海温季距平演变特征进行了研究，并对各分量做了最大熵谱分析。研究结果表明，海温演变除了具有81年的周期外，另两个明显周期是经10年和2.6－6年。从各主分量的方差贡献来看，前15个主分量的方差贡献之和是总方差的78%。从特征向量的分布函数来看，第1、2特征向量的方差之和占总方差的48%。

其合成曲线基本描述了海温年距平在数年或数十年时间内的总体平均特性；前四个分量的合成曲线能够很好地模拟海温年变化特征。

关键词：海温 奇异谱分析 主分量


The global sea surface temperature anomaly (SSTA) for the past 136 years (1856-1991) was studied with singular spectrum analysis, then a maximum entropy spectrum analysis for several principal components was conducted. The result shows that SSTA has several very evident periods of quasidecade and 2.6 to 6 years in addition to 81 years. The first fifteen principal components have a variance contribution of 78%. Eigenvector 1, 2 stand for linear characteristic of SSTA, their variance contribution is 48%, and their resultant curve basically describes average trends during several years and several decades. Eigenvector 3 and later eigenvectors stand for wave characteristics of SSTA. The first four principal components can better fit SSTA yearly change characteristics.

Keywords: SSTA, singular spectrum, principal component

The long-term changing trend of the Antarctic sea ice and the annual variation of global sea level were analyzed. It was found that the area of the Antarctic sea ice was much smaller and that the global sea level was much higher in 1980s than in the 1970s. This indicates that the global temperature has been increasing. Because of the higher air and water temperatures, the long-term accumulation of sea ice has been decreasing greatly and more and more of the glacier has been flowing to the ocean from the Antarctic ice sheet. All these influences caused the distinct increases in the global sea level, especially in the Pacific. Corresponding to the high water temperature in the South Ocean, the temperature of the Cold Wave has been increasing. So, an El Niño event is likely to occur.

Keywords: the Antarctic sea ice, global sea level, ocean circulation, long-term variation, El Niño event


Field investigation shows no permafrost in the interior of the Zoige Plateau. The mean annual air temperature is 0.6 to 3.3°C, and the annual range of air temperature is from 19.1 to 21.2°C. This is not cold enough to form permafrost. According to the temperature measurement from pits and boreholes (in July 1992), the groundwater temperature is 5.0 to 8.4°C at a depth of 1.0 to 2.2 m, and the shallow ground temperature is 6.0 to 7.8°C. The seasonal frozen depth is 1.0 to 2.0 m. The swamp evolution reveals that a part of swamp has been drained and another part will be drained. The degeneration and desertification of grasslands
becomes an important problem to the ecological environment and impacts livestock.

Keywords: Zoige Plateau, frozen ground, environment evolution


Two red clay profiles near Xi'an and Xifeng were investigated in an attempt to determine magnetostratigraphic and palaeoclimatic records. The results show that aeolian dust accumulation and the East Asia palaeomonsoon system had begun by 6.5 Ma. The late Tertiary palaeoclimatic history of the red clay as reflected by magnetic susceptibility is reconstructed during the period of 6.5 to 2.5 Ma. A stepwise increase in susceptibility of aeolian dust accumulation appears to have a close correlation to the uplift processes of the Tibetan Plateau. The remarkable increase of aeolian dust accumulation at 3.2 Ma appears to be a result of the influence of global ice volume on the East Asia monsoon. Palaeomonsoon variation during the late Tertiary as recorded in the red clay sequences from the Chinese Loess Plateau can be regarded as the product of a number of interacting factors, such as uplift of the Tibetan Plateau, solar radiation, global ice volume, etc.

Keywords: magnetostratigraphy of red clay, aeolian dust accumulation, monsoon variation, uplift of Tibetan Plateau

Comparison of the ground temperature and other investigation data in the 1990s with that in the 1970s, showed significant permafrost degradation and eco-environmental change in the patchy permafrost zone in the south section of the Qinghai-Tibet Highway. The southern limit of permafrost moved northward about 12 km. The area of patchy permafrost decreased 7%. The area of swamp land decreased about one-third. The swamp meadow gradually changed into grassy meadow, and the aquatic plants in lakes and low wetlands were replaced by moderate hydrophilous plants. Along with serious degradation of grassland, some lands underwent desertification and a movable sand dune formed. The eco-environment became worse gradually.

Keywords: southern section of the Qinghai-Tibet Highway, permafrost degradation, environmental change


In this paper, the spatial-temporal variations of Antarctic ozone are studied using the surface-observed data of Antarctic ozone from 1957 to 1992. The results show that during the last 35 years the mean total ozone in Antarctic has an obvious decreasing trend, but in different regions, periods, and seasons, there are great differences for the ozone variable trend. In recent years, the formation and the development of the Antarctic ozone hole caused the discrepancy in ozone data in the Antarctic.

There exist obvious annual oscillation periods of approximately 20 and 30 months for Antarctic ozone. The ozone variations are closely related to astronomical sunshine, stratospherical temperature field, polar...
1997


Data on typhoons over the West Pacific and the South China Sea for the last 40 years show that the short-term climatic oscillation of typhoon activities is anomalous. Results show that the variation in typhoon activity had a climatic shift in the early 1970s. Before the climatic shift, the number of typhoons and intensity increased, but after that the tendency of variation is contrary. In addition, the increased number of typhoons during the recent years also suggests a climatic shift in the late 1980s, but the intensity of typhoons has not increased at present. Analysis indicates that the short-term climatic oscillation and the sudden climatic change is related to the climatic oscillation of general circulation and sea surface temperature especially to the West Pacific subtropical high.

Keywords: typhoon, short-term climatic oscillation, climatic shift
利用旋转主分量(RPC)方法, 分析近40年来我国夏季温度变化的规律, 得到了表示东北冷夏变化的指标(NE T1). 利用该指标对东北气温和500h Pa高度场, 以及全球SST进行时滞相关分析发现, 东北低温一般在当年5月开始, 持续至第二年4月结束, 构成一个“冷夏年”. 而在前一年6月和后一年的6月有显著的暖夏, 呈现着准两年韵律的特征. 东北冷夏的这种变化规律与大气环流异常关系密切.
关键词: 东北 冷夏 旋转主分量 时滞相关


The method of rotational principal component (RPC) was used to diagnose the evolution of the air temperature in summer over China in the last 40 years. An index presenting the cold summer in Northeast China was obtained. Time-lagged correlation analysis between this index and the 500 hPa geopotential height of the Northern Hemisphere and the global sea surface temperature (SST) shows that the lower temperature in Northeast China usually starts in May and persists for about one year, which composes a “cold-summer year.” In addition, the monthly mean temperature in June in the preceding year and that in the following year are significantly warmer than normal, showing characteristics with a “quasi-biannual” duration. It was shown that these characteristics are significantly linked to an anomaly of the atmospheric circulation.

Keywords: Northeast China, cold summer, rotational principal component, time-lagged correlation

张一平, 彭贵芬, 1997. 低纬高原城市昆明的气候特征, 高原气象, 16(3): 319-325
利用昆明城内的实测资料及城郊气象站的资料, 研究了低纬高原城市昆明市内外的气候特征、变化规律及其差异. 在此基础上, 探讨了低纬高原城市气候形成的机制, 为城市环境污染防治及城市建筑设计提供科学依据.
关键词: 低纬高原、城市气候、热岛效应


Observation of the microclimates was carried out at the surface in the city and suburbs of Kunming, China. The main results are as follows: the wind speed in the suburbs is larger than in the city, and differences in the daytime temperature of the city is higher than that of the suburbs, with differences larger at nighttime. Another result of the complicated thermodynamics in the city is the humidity in city is less than that in the suburbs, but its differences vary at different time, sky, and surface conditions.

Keywords: low latitude and plateau, urban climate, urban heat island effects

The trend of summer precipitation is predicted with the method of grey topology using summer precipitation data from stations at Yulin, Xi’an, and Hanzhong. Analysis shows that there are obvious droughts at the beginning and middle of the summer in the Guanzhong area. The mean summer precipitation in Xi’an (a semi-moist area) is less than in Yulin (a semi-drought area). Trends of summer precipitation have decreased in Guanzhong and the southern part of Shanxi Province since 1951, but the decreasing trend didn’t change significantly in the northern part. In addition, more rain happened successively in Guanzhong and in the southern part, whereas high oscillation happened frequently in the northern part.

Keywords: summer, precipitation, variation trend

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With sea level pressure data from 1873-1990, the paper calculates the East-Asia monsoon intensity index to analyze the periodic oscillation of East-Asian monsoon long-term variation in recent century using the method of singular spectral analysis (SSA). It indicates that: (1) Long-term variation in the East-Asian monsoon shows the interannual oscillation of the quasi-biennial (QBO) low-frequency oscillation (LFO) of 3-6 years and the interdecadal oscillation (IDO) of 16-18 years. (2) These oscillation components all exhibit the interdecadal variation and the QBO is particularly remarkable. (3) The amplitude of the QBO in winter monsoon is smaller before 1920s and shows a wavelike changing with greater amplitude of about 12 years and smaller
QBO在1920年以前振幅较小，大约
呈现12a大振幅和6a
小振幅的波状变化特征；而夏季风
则呈现6a大振幅和3a小振幅的波状
变化。夏季风中的年代际变化影响
较小。
关键词：东亚季风、年际、年代际
、奇异谱分析。

许建军, 朱乾根,
施能. 1997, 近百年东亚冬季风与E
NSO循环的相互关系及其年代际异
常, 大气科学, 21(6): 641-648

文章以东亚季风强度指数作为衡量
冬季风强弱的标准，采用相关及滑
动相关的计算技术，研究了近百年
东亚冬季风与ENSO循环的相互关系
及其年代际变化。此研究表明：1) 东
亚冬季风的强弱变化与赤道东太
平洋海温变化之间具有显著的年
代际变化特征；2) 季风与ENSO循环
之间的关系受到季风的准两年振荡
(QBO) 以及季风
- 海洋系统的年代际背景配置关系的
共同作用，3) 当季风与海洋背景场
处于相同的位相时，强冬季风有利
于第二年冬季赤道东太平洋海温的
升高，产生EI
Nino事件；当双方背景场处于反位
相状态时，强冬季风则对应于第
二年冬季的La Nina事件。
关键词：东亚冬季风 ENSO循环
年代际异常

of about 6 years. (4) The summer monsoon
changing is opposite that of the winter monsoon
with about 6 years greater and about 3 years
smaller. (5) The interdecadal variation in
summer monsoon is dominant.

Keywords: East-Asian monsoon, interannual,
interdecadal, singular spectral analysis

Xu Jianjun, Zhu Qiangen, and Shi Ning.
1997. The interaction of East Asian winter
monsoon with ENSO cycle and their
interdecadal variations in recent century.

The interaction of the East Asian monsoon
with the El Niño/Southern Oscillation (ENSO) cycle
and their interdecadal variation in recent
century are discussed using the method of
coherence and moving coherence analysis. The
results point out: (1) the relationship of the East
Asian monsoon and the east equatorial Pacific
sea surface temperature (SST) on the
interannual time scale shows a distinct
interdecadal variation; (2) the interaction of
monsoons with the ENSO cycle is influenced by
the quasi-biennial oscillation (QBO) in the
monsoon and the phase relation of monsoons to
SST on the interdecadal time scale; (3) when the
interdecadal variation of the East Asian
monsoon is in phase with that of the east
equatorial Pacific SST, the strong winter East
Asian monsoon is favorable to the temperature
increasing in the east equatorial Pacific in the
next winter and leads to El Niño event; and
when the two air-sea systems are out of phase,
the strong winter monsoon corresponds to La
Niña in the next winter.

Keywords: East Asian winter monsoon, ENSO
cycle, interdecadal variations
利用十多年的岛屿站、沿岸站、船舶观测记录及卫星观测的高反射云（HRC）资料，研究南海西南季风爆发的过程及有关气候学特征，包括环流场、云量场、降水场、海气热交换场的迅速变化。南海西南季风爆发的平均时间为5月中旬，其年际变化达一个月左右。西南季风的爆发使南海云量和降水量增多，对流加强，但各海区具有不均匀性。强对流区稳定在南海中部，季风雨带之间没有明显的跳跃现象。西南季风爆发一个月之前南海表层析迅速升温，为季风爆发提供了热量和水气条件。南海海面热交换分量在4月至5月间有明显改变，尤其是潜热交换和蒸发量显著增大，这可能是触发西南季风爆发的原因之一。

关键词：南海 西南季风爆发 气候学特征


According to the records of meteorological stations, marine ship observation data, and high reflective clouds (HRC) data by satellite remote sensing of more than ten years, the circulation patterns and variability in elements during the onset and the established periods of the South China Sea (SCS) southwest monsoon are discussed. The averaged date of the onset of the Southwest (SW) monsoon over the SCS occurs in the middle of May climatically, and the interannual range of the dates of onset is about one month. Following the onset of the SW monsoon, the cloud amount and the precipitation increase while the convection activities increase over the SCS. But there is a strong spatial variation within the domain. After the onset of the SW monsoon, the strong convective area moves northwards, while the SCS rain band moves to the center and north. The sea surface temperature (SST) increases rapidly before the onset and the leading time is one month. The increment of SST supplies heat and vapor for the onset. In April, the surface heat fluxes display obvious changes (e.g., latent heat exchange and evaporation enhancement). Increased SST is one of the reasons why the SW monsoon bursts first over the SCS.

Keywords: South China Sea, southwest monsoon onset, climatological characteristics

Some aspects of the climatology of the monsoon over the South China Sea (SCS) have been discussed using pentad mean European Center for Medium-Range Weather Forecasts (ECMWF) and Outgoing Longwave Radiation (OLR) data from April to September from 1980-1986. The studies revealed: that the onset of the northern SCS summer monsoon on the average is marked by the onset of the northerly at 200 hPa, the abrupt enhancement of the westerly at 850 hPa, and the formation of the meridional monsoon circulation of East Asia. Another abrupt enhancement of the westerly corresponds to the onset of Meiyu in the Yangtze River and Huaihe valley. The zonal wind and specific humidity appear with a two-peak pattern, and the abrupt increases of the zonal wind correspond well to the increase of the specific humidity. Before the onset of the summer monsoon, the temperature increases undulately, but drops down undulately after the onset. There are three abrupt changes in the distribution of specific humidity in East Asia. During the middle April, the humid band appears over the northern SCS; it suddenly jumps from the southern SCS to the northern SCS during middle May. From mid June to August, the high humid band appears over the Yangtze River and Huaihe valley and disappears over the southern SCS.

Keywords: SCS summer monsoon, Bay of Bengal summer monsoon, climatology, abrupt change

This paper discusses the evolution of the East Asian winter monsoon and draws a comparison with those in South Asia. It found that there exists an abrupt change of meridional circulation in East Asia during the middle of October, which represents the onset of the East Asia winter monsoon circulation. Three abrupt changes of temperature occur in lower troposphere in early September, middle November, and late January. However, the change of the circulation in South Asia is not as strong as that in East Asia. The change of meridional wind in the upper troposphere is earlier than that in the lower troposphere. Two abrupt changes of the temperature in lower troposphere are weaker than in East Asia longitudinally. During the whole winter in East Asia, the frequency of cold surges has its maximum in the South China Sea in December, but in the western Pacific in January. On the other hand, in South Asia, the cold surges occur most frequently in December, but much less than in East Asia, and they decrease quickly with time. Another different aspect is that the cold surge frequencies decrease upward in East Asia, but increase in South Asia.

Keywords: East Asia winter monsoon, South Asia winter monsoon, abrupt change, cold surge


The paper discusses the spatial and temporal distributions of trends for maximum and minimum temperatures of China from 1951 to 1990 (minimizing the possible biases caused by station location and urban heat islands). It concludes that the increasing trends of maximum temperature are in the areas west to 95°E and north to the Yellow River, but
影响）。结论如下:
从地域分布上看，最高温度在黄河以北、95°E以西以增温为主，其他地方则以降温为主；最低温度在全国表现出一致的增温，但在不同地区和不同季节其变化趋势有较大差异。这种变化使得日较差表现出显著的变小趋势。最高、最低温度变化线性趋势表现出明显的不对称性。中国近四十年的增暖反映了温室效应作用的持续加强。由相关分析得知，最高最低温度变化与日照条件及大气水分条件有关。
关键词：最高温度 最低温度 变化

洪光

刘春光，1997，青岛市气候变暖的特征，气象，23(8): 55-57

利用青岛市近百年来的气温资料研究了气候变暖的特征。青岛的年平均气温以0.05℃/10年的速度上升，而年平均最低气温则以0.13℃/10年上升。在近百年的时间序列中，后期气温明显高于前期，尤其是近四十年来，由于城市发展速度快，城市化影响强烈，所以在气候上反映出最低气温明显升高的趋势。
关键词：气候变暖 特征分析 青岛市


The annual mean temperature for the last 90 years is warming at the rate of 0.05ºC/10 years in Qingdao City, whereas the annual mean minimum temperature is warming at 0.13ºC/10 years. In the time series, the annual mean temperature of later period is higher than that of the early days. The annual mean temperature for the last 40 years is warming faster than that of the past period, especially the annual mean temperature. The influence of Qingdao City development for the last 40 years on the climatic warming appears obvious in the minimum temperature increase.

Keywords: climate warming, characteristic analysis, Qingdao

Using monthly rainfall data from 89 stations in Northwest China from 1961 to 1990, the paper discusses the interannual and decadal change of precipitation in June. It points out that in the last 30 years the ratio of precipitation in June in Northwest China has an increasing tendency compared with the precipitation of the whole year, and this variation range ranked first every month.

Keywords: Northwest China, rainfall in June, distinct increase


The characteristics of precipitation and atmospheric circulation for snow disaster over the eastern part of the Tibetan Plateau in the winter of 1995 and 1996 are analyzed. The relationship between the climatic oscillation of the precipitation over Tibet and atmospheric circulation background is discussed. The results show that there is a tendency of increased snow disaster and precipitation in the winters from 1960 to 1990.

Keywords: Tibetan Plateau, snow disaster, climatic analysis
孙继敏，丁仲礼，1997，
近13万年黄土高原干湿气候的时空变迁，第四纪研究，(2)：168-175

黄土高原这一特定地区，其风成沉积序列在地域上的差异主要与东亚地区的季风环流在时间上和空间上的变化有关。本文依据从毛乌素沙漠南缘到黄土高原南部的不同地区的土壤地层配置特点，借助磁化率曲线，探讨了近13万年来黄土高原季风环流在时空上的演变规律。此研究揭示出，近13万年里，最为显著的成壤期有6期，与这6个成壤期对应的时段也应当是夏季环流加强、气候温暖的时期；在空间上，地层配置有较大变化，全新世适宜期及末次间冰期与深海氧同位素阶段5a、5c、5e对应的时期，夏季风足可以深入到毛乌素沙漠腹地，并具有占优势的环境效应。在阶段3的早、晚期及5b时期夏季风虽然也能深入沙漠－黄土边界带，但其环境效应在黄土高原北部及毛乌素沙漠南缘已不再显著。在阶段2、阶段4及阶段3的中期夏季风已不能深入沙漠－黄土边界带。

关键词：13万年 黄土高原 干湿气候 时空变迁

Sun Jimin and Ding Zhongli. 1997. Spatial and temporal changes of dry and wet climate during the last 130,000 years in the Loess Plateau. Quaternary Sciences (2):168-175.

The aeolian sequences in the Loess Plateau mostly respond in a coherent fashion to the cyclic variation of the East Asian winter and summer monsoon circulation. Based on the characteristics of stratigraphic correlation from the Mu Us Desert to the Loess Plateau (along the N-S transect) and the magnetic susceptibility profiles, the paper probed into the spatial and temporal changes of monsoon circulation over the last 130,000 years. The results indicated that there were six dominant soil-forming episodes during the last 130,000 years. These episodes should coincide with the intensified summer monsoon circulation. There were also spatial variations in stratigraphic correlation. During the Holocene Optimum and the sub-stages of 5a, 5c, and 5e, the enhanced summer monsoon could easily reach the far interior of the Mu Us Desert and dominated. During the earlier and later periods of stage 3 and sub-stage 5b, the summer monsoon could still reach the marginal zone of Mu Us Desert, but the geological records show that the summer monsoon was not the dominant monsoon circulation. During the stage 2 and stage 4, as well as the middle of stage 3, the summer monsoon could not reach the desert-loess transitional zone.

Keywords: last 130,000 years, Loess Plateau, dry and wet climate, spatial and temporal changes

Historical information is an important factor in the assessment of global change. The paleoclimate records have shown that there were a lot of abrupt climatic changes at the global and regional level, in time scales, annual, and decadal and during the the periods of glaciation and transfer from one glacial period to another. Recently, some studies in China show that many abrupt climatic changes also existed in the Holocene interglacial, particularly in the past 2000 years. More and more evidence of abrupt climatic changes in the past is considered to be an important factor to prediction of climatic change in the future.

Keywords: paleoclimate, abrupt change, last interglacial, last glacial


The data sequences of precipitation amount measured in Nanjing from 1905 to 1994 has been analyzed in detail. The results show that the annual precipitation amount in Nanjing has experienced such long-term variations that there are four periods with abundant precipitation and three periods with small amounts of precipitation. But the temperature variation of same period provided some kind of reverse phase. The outstanding period of interannual precipitation variation is 3.2 years. Since the 1990s, the phenomena of abnormal precipitation amounts are obvious and the number of years tends to increase.
常现象明显，年数增多。关键词：统计特征 反位相


利用西藏18个站1961-1990年的历年各月平均温度资料，分析了西藏30年温度变化的特征。结果表明：各地年平均气温及冬季平均气温变化有较好的一致性，从60年代到80年代逐年增高。气温异常暖在全年过程都可能发生，而异常冷则非常少见。22年、11年、4.4年、2-3年周期显著。西藏气温在前冬和夏季具有较好的持续性，但在10-11月易发生转折。关键词：温度变化 气候特征 西藏


Based on field observational information from 1900 to 1987, the characteristics of the temperature variations of air temperature and seawater temperature in the East Sea and its adjacent areas as well as the relationship between variation in these two temperatures in the nearby continent and islands are discussed. The results show that the trend of air temperature variations and the trend of water temperature variations in the East Sea are coincident. In winter the correlation coefficient of air temperature between the East Sea and its western lands is high, whereas in summer the correlation coefficient
of seawater temperature in East Sea to air temperature in its eastern island is high. There exists cold 2-year cycle oscillation in air and water temperatures in the East Sea and 5 to 7 year cycle oscillation in water temperature.

Keywords: East Sea, studied region, hundred year, temperature variations


According to the radical principle and concept of the dendroclimatologu, the relationship between the tree-ring index and temperature, and precipitation are studied using the newest analytical program. A sequence of humidity index variations of the past in the Qilian Mountain Region is reconstructed, and the characteristics of past climatic variations in this area are also discussed.

Keywords: Qiliangshan, tree-ring, humidity index, climatic variation

You Weihong, Fu Baopu, and Lin Zhenshan. 1997. Climatic characteristics analyses of surface air temperature variations for Yunnan Province during the last one hundred years and chilling damage weather in August. Plateau Meteorology 16(1):63-72.

Using the multiresolving theory of wavelet analysis, the climatic characteristics of surface air temperature variations for Yunnan province during the last hundred years and chilling damage weather in August are analyzed. The results show that the surface air temperature variation for Yunnan Province can be divided into 4 hierarchies. They are the cold period before 1919, the warm period from 1920 to 1954,
1987年以后的偏暖期。对应于这4个
层次演变，气温变化表现出了十分
明显的突变特性，其冷暖交替的突
变点分别发生在1920, 1955和
1987年。云南8月低温冷害天气发生
在1955-1986年这一较大时间尺度
的偏冷期中。
关键词：低温冷害天气 气温变化
保留信息

anomaly and catastrophe in this century in
Kunming City. Plateau Meteorology
16(1):73-80.

Based on mean air temperature data for annual,
summer (6-8), and winter (12-2) from 1921 to
1993 in Kunming City, the air temperature
changing tendency, cold and warm ranges, and
frequency of air temperature and air temperature
catastrophe are analyzed. The results show that
air temperature rose from the 1920s, air
temperature reached the maximum about the
1940s, and then fell down. It reached the
minimum in the 1970s and rose slightly from
the 1980s in Kunming City. The warm range is
from 1921 to 1954 and the cold range from
1955 to 1993. The high-temperature anomaly
appeared before 1950, low-temperature anomaly
after 1960, and the frequency is low. Air
temperature catastrophe appeared in 1957 for
the annual mean, in 1955 for the winter mean,
and no catastrophe for the summer mean.

Keywords: Kunming City, air temperature
change, air temperature anomaly, air
temperature catastrophe

Using a data set from 10 representative stations in Jilin Province for 40 years and the power spectral method, the seasonal variation of temperature and precipitation were analyzed. The results show that a period of short-term climatic change in Jilin that is almost consistent with that of the interannual oscillation of quasi-3.5-year (QTO) and quasi-biennial (QBO) of the East Asia monsoon. Furthermore, it found that the seasonal temperature got warm clearly about 2°C higher than that of the 1950s in winter, but weak in the summer. As compared with the low-temperature period in summer from the 1950s to the 1970s, the temperature was relatively warm during the period of 1980s. Also, progression or retrogression of the subtropical summer monsoon has a great effect on the temperature and precipitation of the summer in Jilin Province.

Keywords: temperature, precipitation, oscillation period


The cause for the changes in China’s temperature fields during the last 100 years (1881-1992) is diagnosed using the canonical correction analysis (CAA) method. The results show that: (1) The enhanced greenhouse effect due to the increase of CO₂ is closely correlated with the linear trend of warming in China’s temperature fields and the relationship appears more obvious since the 1980s. (2) The sensitive regions of the greenhouse effect are located in northern North China, Northeast China, western Northwest China, and the mid-lower reaches of the Changjiang River. (3) The effect caused by volcanism is of relative importance in the fluctuations in long temperature trends, and the
邓自旺, 林振山, 周晓兰. 1997. 西安市近50年来气候变化多时间尺度分析, 高原气象, 16(1): 81-93

利用Morlet小波变换法分析了西安市近50年平均气温距平和月降水量距平变化的多层次时间尺度结构，发现西安市气候变化除1年的自然周期变化和20-40年尺度范围的周期变化信号在全时间区域中都强烈，其它时间尺度的周期变化在时间域中分布很不均匀，具有很强的局部化特征。西安市月平均气温距平变化主要表现为随机振荡，无特征尺度，而月降水量距平变化则有显著的4-5个月的时间尺度。对于大时间尺度来讲，西安市气候呈暖干和冷湿结构排列，而对于小时间尺度而言呈现为复杂的暖湿和干湿结构。

关键词：气候变化 时间尺度 周期 Morlet小波变换

Keywords: climate change, time scale, period, Morlet wavelet transformation

用Maorlet波变换，分析了西安市近50年平均气温距平和月降水量距平变化的多层次时间尺度结构，发现西安市气候变化除1年的自然周期变化和20-40年尺度范围的周期变化信号在全时间区域中都强烈，其它时间尺度的周期变化在时间域中分布很不均匀，具有很强的局部化特征。西安市月平均气温距平变化主要表现为随机振荡，无特征尺度，而月降水量距平变化则有显著的4-5个月的时间尺度。对于大时间尺度来讲，西安市气候呈暖干和冷湿结构排列，而对于小时间尺度而言呈现为复杂的暖湿和干湿结构。

关键词：气候变化 时间尺度 周期 Morlet小波变换

Keywords: climate change, time scale, period, Morlet wavelet transformation

1997

敏感区位于35°N以南，中心位于西南地区；(4) 20年代至40年代增温可能是温室效应、火山活动和太阳活动多种因素综合作用的结果，而70年代以来的增温主要与温室效应的加剧有关。

关键词：典型相关分析 气候变化 温室效应

Keywords: canonical correlation analysis (CAA), climatic variation, greenhouse effect
马晓波, 
高山梅, 1997, 中国西北地区和蒙古国40年气温时空特征及其变化趋势, 高原气象, 16(3): 282-291

利用我国西北地区及蒙古国共59个台站的EOF分析时取的25个站)1951－1990年逐月平均气温资料, 采用EOF法分析了该地区40年来气温场不同季节的空间分布特征及其随时间变化的规律。结果表明气温场的空间分布主要有三种类型: (1) 全区一致型, (2) 南北差异型, (3) 东西差异型。各月、季、年的变化周期主要集中在三个时段: 2-4年, 5-8年和10-13年, 夏季以短期为主, 冬季和年主要是长周期。气温变化趋势的空间分布不均匀, 全区年、冬季升温, 夏季降温, 春、秋季则有增有减, 幅度不大。

关键词: 西北地区 气温 时空特征变化趋势


In this paper, monthly mean air temperature data from 59 stations in Northwest China and Mongolia from 1951 to 1990 are analyzed using the empirical orthogonal function (EOF) method (for 25 stations) to find out its spatial and temporal characteristics. There are three kinds of spatial distributions: (1) seasonal variation in all areas is identical, (2) north-south distribution, and (3) west-east distribution. The main variation periods are 2-4, 5-8, and 10-13 years; shorter periods dominate in summer, and longer periods in the winter and the whole year. Spatial distributions of air temperature trends are nonuniform. The mean air temperature rises in winter and annually, falls in summer, and rises or falls in spring and autumn, but the variation amplitude is small.

Keywords: Northwest China, air temperature, spatial and temporal characteristics, variation trend

陈兴芳, 
宋文玲, 1997, 近10年我国降水的QBO分析, 应用气象学报, 8(4): 469-476

近10年来我国东部地区降水分布趋势的年际变化具有QBO特征, 双年降水为中部地区少南北多, 单年的降水为中部多南北少, 其中江淮流域的降水变化最明显。分析表明, 降水量QBO的特征与西太平洋副高和冷空气活动有关, 一般双年副高偏北, 亚洲经向环流发展, 雨带偏北; 单年相反, 副高偏南, 亚


During the last 10 years, the interannual changes of the precipitation distribution tendency in eastern China are characteristic of quasi-biennial oscillation (QBO). The precipitation in even-numbered years is less in central China and more in northern and southern areas, whereas the precipitation in odd-numbered years is contrary with more precipitation in the central area and less in northern and southern parts. The feature of precipitation change in the Changjiang-Huaihe River basin is the most obvious. The results show that the QBO feature of precipitation is related to the West Pacific subtropical high and

In this paper, an attempt is made to reveal climate change by analyzing glacier fluctuation quantitatively. The equilibrium line can be determined from the change of Glacier No. 1 at the source of Urumqi River in the Tianshan Mountains. Based on the correlation between the fluctuation of the equilibrium line and climatic factors, summer temperature has risen about 0.23-0.25°C in this source area since the beginning of this century. Meanwhile, the climate sensitivity of the glacier under its different lengths is discussed.

Keywords: Glacier No.1 at the source of Urumqi River, glacier fluctuation, equilibrium line, climate sensitivity, climate warming

Based on traces of permafrost, ice-wedge casts and fossil sand wedges are environmental indicators. There were at least four periods in which permafrost intensity expanded during the last 150 ka BP in the northeastern Qinghai-Tibetan Plateau. The first period, in which ice wedges developed extensively, was the penultimate glaciating period 140 ka BP. The second period was the early Last Glacial (80-53 ka BP), when involution appeared in the Zoige Basin. Ice wedges developed in the Gonghe Basin and the Qinghai Lake region in the third Period (27-23 ka BP). In the fourth period from 21 to 10 ka BP, the regional differences of the natural environment became very clear. Ice wedges developed in the Zoige Basin and Bayanhar Mountain because of the humid and cold climate. However, sand wedges appeared in the source of the Yellow River, Gonghe Basin, and Qinghai Lake region because of the dry and cold climate. The altitudes of lower limits of the permafrost zone in the cold periods were 1700-1800 m lower than at the present, leaving out the tectonic uplift.

Keywords: permafrost evolution, ice-wedges casts, fossil sand wedges, the northeastern Qinghai-Tibetan Plateau


Using monthly mean temperature data from 1952 to 1995, the paper analyzes the 44 years variational characteristics of Lhasa temperature. It shows that in the last 44 years, there are warm-cold-warm-cold evolution processes for Lhasa temperature, with a long cold period in the 1960s and a warm period in the 1980s to the 1990s. Temperature of Lhasa has good persistence in spring and summer, but this persistence is subject to change in August to September and December to January. The 3-
1997

year, 11-year and 22-year periods are significant. Middle-latitude circulation and sunspot activity mainly affect Lhasa temperature.

Keywords: temperature, climatological characteristics

Impact


The paludification meadow in the Qinghai Lake drainage area is an ecosystem affected by eco-environmental factors. Its formation, development, and spatial and temporal distribution are governed by a few main meteorological factors in the eco-environment to a certain extent. The main meteorological factors are \( \geq 10^\circ C \) accumulated temperature, precipitation from May to September, and annual humidity coefficient. A mathematical model of the wetland rate and the main meteorological factors are given by multivariate linear regression in the paper.

Keywords: Qinghai Lake drainage area, paludification wetland, formation and development, main meteorological factors

The paper analyzes the characteristics of climatic changes and their effect in the last 36 years. The results show annual average temperature rises of 0.15°C/10 years. This rise in annual average temperature is associated with the temperature raising in the cold season; the rise in the warm season contributed a little to annual average temperature. Precipitation usually oscillates with average value for many years and has no obvious trend to change, but the precipitation rate increased slightly. In this case, biomass production of alpine meadow plants decreased, and the number and construction of community show new changes.

Keywords: alpine meadow, biomass production, climatic change, Qilian Mountain


The paper analyzes the relationship between meteorological factors and the type and yield of production using rice yield and meteorological data in the Jining district from 1964 to 1994. The main period of yield variability, the principal meteorological factors, and the varying rule are given, and countermeasures that respond to unfavorable factors are suggested.

Keywords: rice yield, meteorological factors, countermeasure

Based on field observation, the characteristics of climate variations in Lianyungang are discussed. The report points out that since the 1980s the air temperature increases in winter but has a slight decrease in midsummer; there is precipitation in winter and spring and less precipitation in midsummer; the drought occurred frequently; and cold waves and microtherms cause serious injury. The background of these climatic characteristics and impacts on the national economics are also analyzed.

Keywords: climatic characteristics, impact on economics


Through detailed analysis on climate change in the period of 1981-1994 in Hubei Province, it was found that the gradual lowering of the yearly mean temperature and the climate getting warmer in winter and colder in summer were the main features of climate change in Hubei Province. These factors had obvious effects on the yields of wheat and rape-seed oil.

Keywords: climate change, geographic distribution, summer harvest crop
林孝宾, 梁悦宁.
麦建辉, 1997, 农业气象灾害对广东水稻生产的影响及防御措施,
中国农业气象, 18(4): 42-45

从气候角度分析了影响广东水稻生产的主要气象灾害及其减产原因,
并提出了防御对策, 以促进广东水稻稳产高产。
关键词: 水稻 农业气象灾害 对策

王春红, 蒋全荣,
余志斐, 1997, 北极III区海冰面积低频变化对北半球冬季大气环流异常的作用,
大气科学, 21(1): 123-126

讨论了北极III区（70°~160°E,年平均海冰面积约200万平方纬度）海冰面积变化与冬半年（11-4月）大气
冰面积变化的联系问题。揭示出: 1) 北极III区海冰面积变化具有40个月
左右（3~4年的低频振荡周期。2) 北极III区海冰面积的低频变
化所引起的热力强迫作用，可以激发出EA型及类似于WP的大
气环流模式。冰水系统之间存在着3
~4年的不规则振荡，在振荡过程中，它们是相互作用的。3) 北极III区
海冰面积异常对北半球冬季大气环流异常的影响。对比表
明，在重冰年和轻冰年，北半球冬季中纬度地区大气环流以及我国的天气气候特征
有十分明显的差异。
关键词: 北极III区 海冰面积
大气环流异常 EA型

Lin Jubin, Tu Yuexian, and Mai Jianhui.

This paper analyzes the climatic disasters that affect the yields of rice in Guangdong and the reasons for decreases in yields. Countermeasures to accelerate rice generation and maintain steady and high growth are pointed out.

Keywords: rice, agrometeorological disaster, countermeasure


The paper discusses the issues of teleconnection between the Region III Arctic sea ice cover variation and winter atmosphere. It shows: (1) Region III Arctic sea ice cover has a low-frequency variation of 3 to 4 year cycle. (2) The Eastern Atlantic (EA) pattern teleconnection and teleconnection like that of the western
Pacific (WP) can be aroused by the low-
frequency variability of the Region III Arctic
sea ice cover. The irregular fluctuation of 3 to 4
years exists in the ice-air system. In the process
of this fluctuation, the ice and the air affect each
other. (3) The characteristics of the atmospheric
circulation in winter in the mid-latitude region
of the Northern Hemisphere and the
characteristics of the weather-climate in China
show the distinct difference in the heavy ice
years and in the light ice years of the Region III
Arctic sea ice cover.

Keywords: Region III sea ice cover, atmosphere
general circulation anomaly, Eastern Atlantic
(EA) pattern

This paper presents studies of the climatic effects of waters in different natural conditions based on theoretical analysis and the observational results of twenty-six waters located in various regions in China. It also offers approximate numerical value ranges of positive and negative influences on temperature, humidity, wind speed, and precipitation.

Keywords: waters, climatic effects, natural condition


In recent years, annual mean temperature has been dropping at rate of about 0.11℃ per ten years in Yichang. The lowest and highest temperatures in a year tend to be subsiding. The trend of temperature dropping in summer is most obvious. Because the accumulated temperature has decreased and cool injury has gradually become more significant, agricultural production has been seriously imperiled. The paper also proposes some suggestions and countermeasures.

Keywords: temperature, interannual variation, statistical characteristic, influence on agriculture, countermeasure

根据试验结果, 研究了紫外线辐射增加对小麦产生的影响，包括导致小麦植株变矮、长势变差、生理活动受阻、产量下降等。在此基础上，综合评价了气候变化对小麦的影响，并对CO₂倍增后南京地区冬小麦气候生产潜力进行了估算。
关键词：CO₂倍增 小麦 紫外辐射 气候生产力


通过对季风环流的季节变化及地形对台湾降水的影响的分析，得出以下结论：东北季风和地形的共同影响造成了冬半年台湾北部多雨和西南部干旱；夏半年由于受西南季风的影响，出现了岛西部降水略多于岛东部的现象，且缓解了西南部干旱。台湾地形对降水的影响居全国之冠，海拔每上升100m，年降水量递增值都大于100mm。
关键词：季风 地形 降水 递增值 台湾


The experiment conducted showed that enhanced solar ultraviolet (UV) radiation could produce negative effects on wheat, leading to shortened plants, poor growth, inhibition of normal physiological activities, and decrease in yield. Based on the overall evaluation of climatic changes on wheat production, estimates of climatic production potential were obtained for winter wheat grown in Nanjing under a doubling CO₂ concentration.

Keywords: CO₂ doubling, wheat, UV radiation, climatic production potential


The paper analyzes the impacts of seasonal variations of monsoon circulation and landform on precipitation in Taiwan. It reports that in the winter half of the year, the plentiful rains in the northeast part and the drought in the southwestern parts are caused by the joint effect of the northeast monsoon and landform. In the summer half, the rainfall in the western part of the island is slightly more than that in the eastern part at the same latitude. The southwest monsoon rainfall in summer has the major contribution to alleviating the drought in the southwest. The altitude increase rate of annual rainfall is rather high, more than 100 mm per 100 meters of altitude.

Keywords: monsoon, landform, rainfall, increase rate, Taiwan

Using the data of turbulence observation from the Huayin Station in the Gobi area during the intensive observation period (IOP) of the Heihe River Field Experiment (HEIFE), the effects of rainfall forcing on the transport of water and heat in the local climate system of Gobi are analyzed. The results show the following: the local climate system becomes unbalanced due to the rainfall forcing; the unbalanced state can return to the balanced state after the rainfall through a new adjustment of substance and energy; the process of the new adjustment can be divided into four periods with the sensible heat flux, latent heat flux, and water vapor flux very different within the periods; the relaxation time of the unbalanced state is about four days; and about two-thirds of the rainfall is transported into the atmosphere by the evaporation of ground surface while the rest may permeate the ground.

Keywords: rainfall forcing, local climate system of Gobi, unbalanced state, transport of water and heat, relaxation time.


Based on the data observed from 1961 to 1990 (some data to 1994) and statistical analysis of the effect of ENSO, the following conclusions are reached. In an ENSO year the atmospheric pressure in Nansha waters is all positive anomaly, the annual precipitation is obviously little, and the annual number of tropical cyclones is fewer. The total cloud cover


利用1961-1990年
(部分资料到1994年)南沙海域的观测资料, 对南沙海域气候状况进行了统计分析。
结果表明: 在ENSO发生的当年, 南沙海域的海平面气压呈正距平,
1997

Anomalies in Nansha waters are basically identical with the variation trend of Southern Oscillation Index (SOI) in each ENSO.

Keywords: ENSO, Nansha waters, climate


The paper analyzes the relationship between Arctic and Antarctic sea ice and the Southern Oscillation Index on the temporal scales of month, season, and year. There is a negative correlation between Arctic sea ice and the Southern Oscillation Index, and a positive correlation was found between Antarctic sea ice and the Southern Oscillation Index. The variation of Antarctic sea ice seems to have a more important influence on the atmosphere. Their relationship seems more nonlinear than linear. The relationship between Arctic and Antarctic sea ice in the early stage and the Southern Oscillation Index exhibits periodicity. The periodic variation and the common factors in monthly series are also discussed in this paper.

Keywords: analysis for time scale, nonlinear relationship, simulation on statistic-dynamic modeling, periodic model


The paper discusses two episodes of severe cold weather on 11/18/1993 and 11/18/1979 and reveals the formation process of cold high
气降温形成的强冷高压。按Brunt公式计算出晴天有效辐射，与实际情况相吻和，并按照对流层中下层相似的气温直减率，得到当地新雪面空气制冷的净降温客观估值值。内蒙古东部高雪面强冷高压的偏北气流顺坡南下在京津冀地区形成超低空急流，促使当地气温剧烈下降，出现异常低温天气。还给出强冷高压控制下，华北东部特殊地形上的中尺度下坡风的物理图象。

关键词：雪面降温 冷高压 下坡气流 超低空急流

王谦谦, 钱永浦, 1997,
太阳辐射日变化对夏季风模拟特征的影响, 气象学报, 55(3): 334-345

利用60° S-60° N范围内地气和海气相互耦合的耦合模式系统，进行了有无太阳辐射日变化的对比试验。研究表明：
太阳辐射日变化对于模拟的夏季风准平衡态平均环流形势影响不大。
对平均风速等值线的影响主要来自于海陆和地形分布。但模式中包含太阳辐射日变化后，
对大气高低层季风系统的模拟强度有所改善。日变化对降水场影响较大，如无日变化，
大陆降水将大大减少，
而沿岸地区降水则增加。增雨区和减雨区呈波状分布。太阳辐射日变化可以促使季风气候的准平衡态较早达到。

关键词：太阳辐射日变化 夏季风 数值模拟


Using an atmosphere-ocean coupled model system in a zonal domain between 60°S and 60°N, the comparative experiments are made with and without diurnal variation of solar radiation. The results show that the diurnal variation of the solar radiation does not have a very large influence on the mean monsoon system in the quasi-equilibrium state; the main influences may come from the land-sea and the topography distributions. But, its inclusion into the model does improve the simulations of the monsoon systems at the upper and the lower levels. The diurnal variation of the solar radiation influences the simulated precipitation pattern greatly. In the experiment without the diurnal variation of the solar radiation, the precipitation amount over the land areas is greatly reduced while it is increased over the areas along the coasts. The areas with increased precipitation and the areas with decreased precipitation are distributed in a wavellite form. The diurnal variation of the solar radiation can make the monsoon development reach the quasi-equilibrium state earlier.

根据福州气象站1951-1993年的气象资料,
分别建立了福州最热月平均气温、
最高气温、极端最高气温和全年出现的最高气温≥35℃
日数的变化趋势方程,
计算了各自的倾向率,
揭示了福州气候的变化规律。通过
城区和郊区的气候资料对比分析,
发现城区存在热岛、雨岛、干岛、
浑浊岛等城市气候效应现象以及雾、
雷暴负效应现象。并讨论了这些
现象产生的原因。
关键词：城市气候 热岛效应
负效应

Keywords: diurnal variation of solar radiation,
summer monsoon, numerical simulations


Based on climatic information from 1951 to 1993, the paper discusses the air temperature
tendency at Fuzhou City. The results show that there are some urban effects, such as heat
island, rain island, dry island, and turbid island in Fuzhou City, and that there are also some
negative effects of fog and thunderstorm. The causes of these effects are also discussed.

Keywords: urban climate, heat island effects,
negative effects

李红梅, 刘文杰. 1997. 景洪市城市发展对气候的影响,气象, 23(3): 38-41

选取景洪市与热带气候区自
60年代以来的气候资料进行对比分
析,探讨了景洪城市发展对
气候的影响。结果表明,
景洪市城市热岛效应日趋明显,
年均温、平均最高温及平均最低温
差均有增大趋势,而降水量、空气
湿度、雾日数、日照时数、太阳辐射
量等逐年减少。城市热岛效应有明
显的季节性,其规律是:

Meteorological Monthly 23(3):38-41.

Based on the compared observations between Jinghong City and the rural area, the effects of
the development of Jinghong City on climate are studied by analyzing long-term data (since
1960's). The results indicate that: (1) With the rapid development of Jinghong City, the urban
heat island effect is gradually obvious. (2) The difference of the temperature and wind speed
between city and rural area is gradually increasing. (3) The rainfall, air humidity,
number of fog days, sunshine duration, and
solar radiation over the city attenuate
remarkably. The urban heat island effect is more
obvious in the dry season than in the rainy
season, far more obvious at night than day in
干季强于湿季，干季夜间强于白天，雨季白天强于夜间。
关键词：城市
局地气候变化
城市热岛效应

the dry season, far more obvious at day than
night in the rainy season.

Keywords: development of city, local climate,
urban heat island effect

许金钦, 唐文伟, 林仲平, 1997.
副高持续偏强对福建气候的影响,
气象, 23(1): 36-37

针对近几年副高持续偏强这一异常现象，并以1951-1995年副高特征量
和气候、降水等气象要素为基础，
分析了副高
持续偏强这一基本事实以及对福建的
气候、降水、热带气
旋等天气气候的影响。
关键词：副高强度指数 面积指数
天气气候

Xu Jinjing, Tang Wenwei, and Lin
Zhongping. 1997. Effect of persistently strong
subtropical high on Fujian climate.

In the study of the persistently strong
subtropical high that existed for a few years, the
subtropical high features, air temperature, and
precipitation data from 1951 to 1995 are
analyzed. Also the effects of the phenomenon
on the weather and climate in Fujian Province
are studied.

Keywords: subtropical high intensity index,
area index, weather and climate

谢安, 刘霞, 叶谦, 1997.
赤道涡与南海夏季风爆发,
气象学报, 55(5): 611-619

利用1979-1995年的850hPa
风场和卫星资料OLR，讨论了
南海夏季风爆发和推进的特征，
着重分析了赤道涡与夏季风
爆发的可能联系。结果表明，
南海夏季风的爆发滞后于
其两侧的陆地和岛屿，但在东西方向
上几乎是同时的，具有某种驻波
的特性。大多数年份的4、5月间，
在105°E附近有赤道涡形成，引
导西南季风和赤道西风进入南海南部，
为南海夏季风

Equatorial vortex and the onset of the summer
monsoon over the South China Sea. Acta

Using National Meteorological Center (NMC)
wind data and outgoing longwave radiation (OLR)
data from the National Oceanic and Atmospheric
Administration (NOAA) from 1979-1995, the
characteristics of summer monsoon onset in the
South China Sea (SCS) are discussed. The results
show that the onset of the summer monsoon
occurs later in SCS region than in peripheral
island areas. But the onset of the summer
monsoon in the eastern part of SCS is almost at
the same time as that in the western part of SCS,
which has a somewhat standing wave feature. In
most years, an equatorial vortex forms near 105°E
in April or May and the vortex leads the equatorial
westerly in its upper reaches and the westerly in
the Southern Hemisphere to the southern part of
SCS. This creates a favorable condition for onset of the SCS summer monsoon. In the years when the equatorial vortex is inactive, the onset of the summer monsoon in the SCS is late. There is some relationship between the equatorial vortex and the onset date of SCS summer monsoon. In middle April, the forming of the vortex and the preliminary building of cross-equatorial flows at 105°E is simultaneous. In May, these cross-equatorial flows enhance gradually and the activity of the SCS summer monsoon may be closely associated with these flows.

Keywords: summer monsoon onset in the South China Sea, equatorial vortex, East Asian vortex, cross-equatorial flows at 105°E


Using gridded field data of sea level pressure over the Southern Hemisphere, through the difference value fields and correlation analysis, the influence of the general circulation of the atmosphere over the Southern Hemisphere on precipitation over South China during the pre-flood season is analyzed. The result shows that: The general circulations of the atmospheric system over the Southern Hemisphere are basically out-of-phase for drought and waterlogging years, in the same term or earlier stage. The influence of the Australia anticyclone, the Mascarene anticyclone, and the convective active region of South America is preliminarily analyzed.

Keywords: Southern Hemisphere, general circulation of the atmosphere, precipitation over South China during pre-flood season, Australia anticyclone, Mascarene anticyclone

Calculation shows a good correlation between summer rainfall in Shandong Province and sea surface temperature (SST) in the equatorial eastern Pacific (EEP) and in the North Pacific Current (NPC) areas. On the basis of the correlative analysis, the contemporary and antecedent SST anomaly features of rainy and dry summers and the relationship with atmospheric circulation is discussed. The contemporary SST departure is noted, and the negative SST anomaly in the EEP area prior to those summers is closely related to a negative West Pacific pattern, and the SST anomaly in NPC area is likely to be modulated by the anomaly of atmospheric circulation. The experiments using SST of February-April in highly correlative areas and SST of March in the EEP area and of July in the NPC area show that SST is of great reference value for long-term forecast of summer rainfall in Shandong Province.

Keywords: summer rainfall, North Pacific sea surface temperature, atmospheric circulation

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This paper comments on the new understandings, new advances, and new points of view in recent research on the relationship between global change and the terrestrial ecosystem in China. It points out the need for future interplant study and presents some important suggestions.

Keywords: global change, ecophysiological experiment, modeling, desertification

全球环境变化可能成为下一个世纪最为紧迫的国际问题。这是因为人类活动的能力已经大到足够影响到全球的环境, 而全球环境变化又给人类带来重大影响。文章探讨了人文因素在全球环境变化中所扮演的角色。由于人类在对待环境要素变化时, 有选择其行为的自由, 所以人文因素没有像大气、海洋那样, 称为全球环境变化的子系统。这一点在建模中应给予充分考虑。文章讨论了各类系统对气候变化适应的脆弱性定义, 并以海平面、农业、林业、渔业和人类健康为例, 观测它们如何受到全球气候变暖的影响。

关键词: 全球环境变化 人文因素 影响


Global change may be one of the urgent international issues in the coming century. Because of humankind's unprecedented importance as an agent of global change and the potential for future environmental changes to alter societal arrangements, no one would argue that there are no connections between human activities and changes in global climate. What connections should exist between natural science research on change to the earth system and social investigations of the human dimensions of global change is explained in brief. Generally speaking, the human dimension is one of the subsystems in the global change, however, it has not been given the name of subsystem, but dimension. This is based on its special characteristics. Mankind can select activities that either cope with the environmental change or not. We have to select a more flexible model to deal with such characteristics. The vulnerability of a system's response to climate change is discussed as are examples of the impacts of climate change on vulnerable systems, such as sea level, agriculture, forestry, fishery, and human health are explained.

Keywords: global environmental change, human dimension, impacts


分析了干旱、半干旱地区沙质荒漠化的过程、发展趋势。指出干旱是荒漠化形成的原因, 而不合理的人类活动则加剧了它的发展。在中国北方荒漠化土地的成因类型中, 过度放牧占30.1%, 过度开垦占26.9%, 过度樵采占32.7%, 资源利用不当占9.6%, 而由于在工交建设中不重视环境保护而造成的占0.7%。由此可知,


The origin and trend of sandy desertification in the arid and semi-arid regions was analyzed. It is pointed out that although sandy desertification is caused by drought, the irrational human activities in recent times are responsible for the increased development of desertification. In North China, 30.1% of sandy desertification was caused by overgrazing, 26.9% by over-reclamation, 32.7% by excess woodcutting, 9.6% by misuse of water resources, and 0.7% by industrial mining and communication activities. Using land rationally and taking protective measures is the most

在1960-1990年(雅砻江)和1960-1987年的实测资料, 采用人工神经网络模型建立了雅砻江和嘉陵江流域年平均气温、年降水量与年径流之间的BP网络模型。定量研究并模拟了气温和降水的变化对雅砻江和嘉陵江流域水资源环境的影响。结果表明气温增高和降水量减少将造成水资源量的大量减少，对生态环境造成威胁。

关键词：气候影响 BP神经网络 水资源环境

张宏，樊自立. 1997. 气候变暖对渭干河三角洲农业的影响. 干旱区研究, 14(3): 65-68

研究了在未来气候变暖条件下渭干河三角洲≥0℃和≥10℃活动积温及其持续日数的变化规律。结果表明，随着气温的升高，活动积温及持续日数也相应增加。在此基础上，讨论了农业种植制度随积温的变化而进行调整的可能性。


The two kinds of active-accumulated-temperature (AAT), titled ≥0℃ and ≥10℃ and sustainable time were calculated under two different climate-warming scenarios in the Weiganhe Delta. The two AATs will enhance to some extent the annual temperature increase. Meanwhile, the possibility of change of agricultural planting system (APS) in the Weiganhe Delta to matching the changed AATs is discussed.

The synchronous, automatic, and continuous observations on N$_2$O emission from rice-wheat rotation systems and temperature in the Taihu Lake Region of Southeast China were conducted using box-gas chromatographic method. A series of simulated tests were carried out in order to study the greenhouse effects caused by N$_2$O generation and emission. The results showed that under the condition of suitable soil humidity, the dependence of N$_2$O emission on temperature can be prescribed by
N\(\text{2O}\) emission is positively correlated with temperature. Using the exponential function \(F = Ae^{at}\), it is evident that the frequency of \(N\text{2O}\) emission occurred in a normal distribution corresponding to the temperature variations, and that 67\% of emission flux is concentrated in the range from 15°C to 25°C. In the dry land, temperature is the major factor that influenced the seasonal variations of \(N\text{2O}\) emission; it was different in paddy fields. The \(N\text{2O}\) emission in the diurnal variation both in dry land and paddy field.

Keywords: \(N\text{2O}\) emission, temperature, emission flux, rice-wheat rotation system, farmland, Taihu Lake area

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The paper discusses the relationship between El Niño/Southern Oscillation (ENSO) events and interannual variations of winter sea-ice in the Greenland, Kara, and Barents Seas. The results show that the extent anomaly of winter sea-ice in those sea regions would result in a Northern Hemispheric atmospheric circulation anomaly, especially when atmospheric circulation lags the sea-ice 3 years, and that the sea-ice extent variations would lead to a Pacific-North American (PNA) pattern anomaly. ENSO events happened when the variation velocities of the sea-ice extent reached an extreme value.

Keywords: interannual variation, sea-ice, ENSO, variation velocity

In this paper, the influences of seven Tibetan Plateau raising processes on climate and environment are discussed. The cause of climate formation is analyzed using meteorological theory. The main conclusions are as follow: (1) the cause of the hot-dry climate before the elevation of the plateau is that the efficiency of the atmospheric heat engine is lower than after the elevation because of the flatter global landform. (2) At the beginning of Oligocene Epoch, the horizontal scale of the plateau reached the critical scale of geostrophic adjustment of the baroclinic atmosphere, following which atmospheric general circulation changed from "two vortexes" to "three vortexes." (3) A series of variability in atmospheric general circulation corresponding to the plateau’s reaching 2000 m, at 2.5 Ma BP is analyzed. (4) The energy balance of the earth-atmospheres system at the Great Ice Age is estimated, and the difference between the energy balance at the Great Ice Age and at present is contrasted.

Keywords: uplift of the Plateau, planation, abrupt change of geological climate, maximum glacial age, energy balance


In this paper, using daily historical synoptic map data and precipitation map of July and August during the period from 1970 to 1985, the basic activity characteristics of the South Asia High (SAH) and the relationship between the SAH and precipitation over Northwest China are analyzed. The results show: (1) The 100 hPa SAH in summer stays mainly over the
亚高压过程，还区分了西北区东、西部的多雨、少雨日。结果表明：南亚高压脊线和中心位置（特别是持续的东、西部型南亚高压过程）与东、西部多雨和少雨过程有密切关系。

关键词：100hPa南亚高压
西北地区降水
东、西部型SAH过程

Qinghai-Xizang Plateau and its neighborhood, which suggests impacts of the Plateau on the SAH. (2) When the monthly mean SAH ridgeline is located somewhat south, the precipitation over Northwest China will increase. (3) During the continuous processes of eastern pattern of the SAH, it will be rainy in the eastern part of Northwest China but dry in the western part of Northwest China. (4) We also sum up the distribution of rainy area of eastern pattern of the SAH.

Keywords: 100 hPa SAH, precipitation of Northwest China, eastern- and western-pattern SAH processes

刘子臣, 梁生俊, 张建宏, 1997. 登陆台风对黄土高原东部暴雨的影响, 高原气象, 16(4): 402-409

对80年代以来3次登陆台风低压外围影响黄土高原的大暴雨作了气候分析，对9608号台风进行了天气动力诊断分析。结果表明：登陆台风低压外围产生大暴雨的主要机制是台风外围低空偏东急流与西风带低值系统的共同作用以及地面冷锋的动力抬升作用。这一结果可为此类暴雨预报提供理论依据。

关键词：登陆台风低压外围暴雨低空东风急流 西风带低值系统


This paper reports a climatic analysis of 3 cases of heavy rain on land typhoon depression in the Loess Plateau since the 1980s and a diagnostic analysis of torrential rain around 9608 typhoon depressions. The results show that the main mechanism of heavy rain formation is the influence of the easterly jet around a typhoon depression, a low-pressure system in the westerly belt, and the lifting of the surface cold front. The result provides the theoretical basis for forecasting this kind of torrential rain.

Keywords: heavy rain around typhoon depression, low-level easterly jet, low-pressure system in westerly belt

白虎志, 张焕儒, 张存杰, 1997. 兰州城市化发展对局地气候的影响, 高原气象, 16(4): 410-416

研究了兰州气候变化特征及其城市化发展对局地气候的影响，发现80


Features of the climatic variation of Lanzhou and the influences of urbanization development on the local climate of city and suburbs are
studied. The results show that the rise of mean temperature in Lanzhou since the 1980s is about four times that of the Gansu province in the 1960s and 1970s. The interannual and seasonal variation characteristics of other factors are clear. The differences of the annual and seasonal mean temperature and the mean maximum and minimum temperature between Lanzhou City and its suburbs are gradually increasing. The annual and seasonal differences of rain day and sunshine duration are decreasing.

Keywords: urbanization development, climatic effect, air temperature


In order to achieve the goal of using the atmospheric radiative transfer model over the Qinghai-Xizang Plateau region, surface temperature in the model and effects of that on the calculation results of atmospheric longwave radiative cooling are analyzed with the Liou-Ou one-dimension radiative transfer model based on the data set of surface, radiosonde, and satellite observation over the Qinghai-Xizang Plateau during the period from August 1982 to July 1983. The effects of both underlying surface temperature ($T_s$) and near-surface air temperature ($T_a$) are distinguished in the radiative transfer model, and the effectiveness is verified using satellite observation data. The diurnal cycle and seasonal cycle of $T_s$ and $T_a$ are analyzed, and a simple method to calculate the $T_f$ from the $T_a$ is presented.

Keywords: The Qinghai-Xizang Plateau, surface temperature, radiative transfer

The potential CO₂-induced impacts on the geographical shift of wheat growth zones in China are analyzed based on General Circulation Model (GCM) outputs. The results show that the wheat growth regions may move northward and westward under conditions of a doubled CO₂ climate. The wheat cultivation features and variety types may also experience significant changes. Climatic warming would have a positive influence in Northeast China, but high-temperature stress may be produced in some regions of central and southern China. Higher mean air temperatures during wheat growth, particularly during the reproductive stages, may increase the need for earlier maturing and more heat-tolerant cultivates.

Keywords: climate variation, carbon dioxide, climate impact, crop geographical distribution


The impact factors of climate over the North Indian Ocean on the choice of shipping routes in winter and summer are summarized on the basis of the operation in the last 10 years of the Center of Ocean-Meteorological Route in the Central Meteorological Observatory. Analysis shows that different Meteorological routes should be chosen by combining winter and summer climate variation over the North Indian Ocean and characteristics of ocean orography. This work supplies a valuable basis for choosing different routes to avoid regions with high-frequency strong wind and huge wave according to the conditions of different seasons and ships.

Keywords: North Indian Ocean, climate change, route choice

Based on the analysis Northern Hemispheric snow cover data from 1973 to 1995, climatological characteristics and changes of snow cover extent over the Northern Hemisphere, Eurasia, and North America are studied. It is found that the 1970s are a period of snow cover expansion with the maximum in 1978. After the 1980s, snow cover decreased significantly. Correlation analysis shows that East Asia winter snow cover is negatively correlated to summer precipitation in the areas from the mid-lower reaches of the Yangtze River to south of it. Spring snow cover is significantly correlated with rainfalls in northeastern Xinjiang and northern Northeast China. Significant reverse correlations were found between East Asia winter snow cover and the Meiyou duration when El Niño/Southern Oscillation (ENSO) years are excluded.

Keywords: change of snow cover, summer precipitation, correlation


The atmospheric circulation anomaly and the North Pacific sea surface temperature anomaly (SSTA) in the spring prior to droughts/floods of summer in North China are analyzed, and the relationships between SSTA and atmospheric circulation anomaly are discussed. Then numerical simulation by heat source anomaly in the Kuroshio current area is made using the Oregon State University (OSU) atmospheric general circulation model (AGCM). The results show that rainy summers in North China would occur if Arctic low vortices weaken significantly and zonal circulation strengthens.
middle-high latitudes in Eurasia, the West Pacific subtropical high lies northerly and westerly, and a remarkable negative Pacific North American (PNA) pattern exists in spring. Otherwise, there would be dry summers in North China. At the same period, positive and negative SST departures exist in the Western North Pacific and in the equatorial east Pacific respectively, which are closely related to atmospheric circulation anomalies in spring. Positive SSTA in the Kuroshio current area is an important factor for the anomalous atmospheric circulation pattern prior to flood of summer in North China.

Keywords: drought/flood of summer, anomalous atmospheric circulation, subtropical high, sea-surface temperature anomaly (SSTA)


In this paper, based on published data, the relationship between the action of a subtropical high and the movement of the sun and moon is systematically studied. It shows that all types of action of subtropical highs are related to various periodical actions of the sun and the moon and that the forms of relation reveal both a Poisson periodicity and a synchronous tendency to astronomical singularities. The paper also points out that if the types of subtropical high are distinct, the related periodical action of the movement of the sun and the moon and forms of relation are distinct.

Keywords: action of subtropical high, movement of the sun and the moon, periodicity Poisson relation, synchronous tendency to astronomical singularities

首先对ENSO过程中亚洲夏季风环流的变化进行了诊断分析, 结果表明在El Niño事件和La Nina事件中夏季风系统各成员均发生不同程度的变化, 甚至出现相反的变异特征。其次, 对我国东部地区夏季降水进行了EOF分析, 并在此基础上分析了赤道太平洋SSTA对我国东部地区夏季降水影响的程度和区域, 该影响与ENSO循环的发展阶段密切相关, 且在长江中下游地区和华南地区最为显著。

关键词: ENSO 亚洲夏季风合成分析


In this paper, the variability of the Asia summer monsoon circulation during the El Niño/Southern Oscillation (ENSO) period is diagnostically analyzed. Evidence suggests that every member of the Asia summer monsoon system change in varying degrees, even, oppositely, during El Niño and La Niña events. Then, on the basis of the summer rainfall in east China analyzed by using empirical orthogonal function (EOF), both the region and the extent of the impact of the equatorial Pacific sea surface temperature anomaly (SSTA) on the summer rainfall in East China are analyzed. The impact is related closely with the development phase of ENSO cycle, being most notable in the middle-lower reaches of Yangtze River and South China.

Keywords: ENSO, Asian summer monsoon, composite analysis


应用滑动T检验方法对北太平洋海温10年际的气候跃变进行了研究, 指出在70年代末至80年代初确实存在着一次明显的气候跃变, 而跃变前后北太平洋海温结构、厄尔尼诺事件的发展过程都明显不同, 进而讨论了北太平洋海温跃变前后对我国6—8月汛期降水量的影响, 指出海温跃变前我国汛期降水量在东北地区偏少、华北偏多; 长江流域偏少、华南偏多。而跃变后相反。

关键词: 气候跃变 海温 汛期降水


This paper presents a study of the annual climatological jump of sea surface temperature (SST) in the northern Pacific by means of a moving T test. An obvious climatic jump is indicated in the late 1970s through the early 1980s, and there are significant differences before and after the jump in terms of its SST structure and the evolutionary processes of an El Niño event. The study of the effect of the jump on rainfall in June-August floods season in China concludes that the seasonal precipitation is less (more) than usual in the northeast of China and Yangtze River Basin (North China and South China) before the jump and vice versa.

Keywords: climatic jump, SST, rainfall in floods season
胡增臻，黄荣辉，1997．冬季热带西太平洋对流活动异常的年际变化及其对北太平洋风暴轴的影响．大气科学，21(5): 513-522

通过诊断分析表明，80年代菲律宾周围对流活动2-4年周期振荡比较明显：北太平洋风暴轴中心有线性增强、偏北、偏东的趋势；在2-4年时间尺度上，菲律宾周围对流活动的变化与北太平洋风暴轴的变化有密切联系：当菲律宾周围活动强(弱)时，北太平洋风暴中心偏强(弱)，偏东(西)、偏北(南)．产生这种联系的物理机制是，当菲律宾对流活动强(弱)时，在东亚-北太平洋-北美地区产生一个距平波列(ANA)，位于美国西海岸的正(负)距平及其北侧的负(正)距平，使气压梯度增大(减小)，北太平洋急流和风暴轴中心强度增强(减弱)、北抬(南退)、东伸(西退)。

关键词：菲律宾 对流活动
北太平洋风暴轴
东亚-北太平洋-北美遥相关型
2-4年周期振荡


Diagnostic analysis shows that convective activities around the Philippines have a 2 to 4 year period of oscillation in the 1980s. The storm track in the North Pacific has a linear strengthening, a northward and eastward trend, and the obvious 2 to 4 year period of oscillation. There are close connections between the anomaly of convective activities and storm track variation in the North Pacific on the 2 to 4 year time scale. The center of the storm track in the North Pacific is strong (weak), eastward (westward), northward (southward) when the convective activities around the Philippines are strong (weak). The physical mechanism producing this connection is considered to be a forced anomaly wave train from east Asia to North America (ANA) via North Pacific when the convective activities around the Philippines are strong (weak). At the same time, both the positive (negative) anomaly in the west coast of the U.S.A. and the negative (positive) anomaly to its north increase (decrease) the pressure gradient, so that the jet stream and the storm track centered in the North Pacific are strong (weak), northward (southward) and eastward (westward).

Keywords: Philippines, convective activities, storm track in the North Pacific, East Asia-North Pacific-North America teleconnection pattern, 2 to 4 year period of oscillation

蒋全荣，郑定英，余志豪，1997．副热带高气压季节性移动与海温场的联系，大气科学，21(2): 199-204

本文通过EOF分解，分析讨论了西北太平洋副热带高压季节性移动与海温场之间的联系。结果表明：副高的两次北跳与东西进退都与海温


Based on empirical orthogonal function (EOF), the relationship of the seasonal movement of the subtropical high over the northwestern Pacific with sea surface temperature (SST) is discussed. The results show that the two north jumps and
east-west movement of the subtropical high are closely related with the perturbation of SST. The role of the oceanic thermal forcing is one of the most important reasons causing the seasonal variation of the atmospheric circulation.

Keywords: subtropical high, sea surface temperature, seasonal movement

**Bian Lingen, Lu Longhua, and Jia Pengqun.**

Temporal-spatial characteristics of Antarctic surface air temperature and sea ice variations are statistically analyzed. Results show that, during the last 30 years there is an obvious warming trend in Antarctica, but there exist substantial differences in different regions and different time periods. The most significant warming trend occurred in the Antarctic Peninsula, about 2 to 3 times greater than in the whole east Antarctica. In the last 20 years the correlation between Antarctic mean temperature and mean sea ice area is low and insignificant, but their linear trends are found to be opposite in all regions, that is, sea ice extent is reduced when temperature is high. The different climate regions defined by cluster analysis clearly show a close relationship between the two parameters on an inter-seasonal time scale.

Keywords: Antarctica, temperature, sea ice, temporal-spatial characteristic

The precipitation data at 5° by 5° grid (June, July, and August) from 1959 to 1994 are used to analyze the monthly change of the spatial mode of summer precipitation anomalies over China. The relationship between the spatial mode of summer anomalies and the atmospheric general circulation is analyzed using indices of the Northwestern Pacific high and the geo-potential height index \( B \) of the Tibetan Plateau. The Monte-Carlo method is used to evaluate the significance level of the collective significance of the correlation field between the circulation index and precipitation. The results show that the negative correlation between the precipitation anomaly over the lower-reaches of the Yangtze River and Huaihe River valley (LRHY region) and that over the middle-reaches of the Yellow River (MRY region) and over South China is the most significant in August. The negative correlation between the precipitation over the southern part of the eastern Tibetan Plateau is more significant in June and August than in July. The analysis for the correlation between indices of the Northwestern Pacific high and monthly precipitation show that the anomaly of the north boundary of the Northwestern Pacific high in August has the greatest influence on LRHY region.

Keywords: spatial mode of summer precipitation anomalies, indices of the Northwestern Pacific high, geo-potential height index \( B \) of the Tibetan Plateau, collective significance


Global climatic change that would seriously limit agricultural production and cause widespread famine and starvation has been studied closely and is a source of controversy. The agricultural impacts of potential climate change have now

Daily snow depth data, together with monthly average temperature and monthly total precipitation, at 60 primary weather stations from 1957 to 1990 were analyzed using autoregressive moving average (ARMA) (p,q) and multiple linear regressive analysis. The results show an increasing trend of snow volume almost omnipresent over the entire Tibetan Plateau, with some local decreasing trends. The secular trend of cold season temperature and precipitation in the Tibetan Plateau is also increasing. A significant positive correlation exists between snow cover and precipitation, but the correlation of snow cover and temperature is negative over the Tibetan Plateau. The increase of snow cover results from the increase of precipitation during the cold seasons with global warming.

Keywords: Tibetan Plateau, snow cover, variation trends, global warming, multiple linear regressive analysis

In this paper, the climatic variations in West China are discussed and analyzed using climate scene and statistics modeling. In the last forty years, climate warming and decreasing precipitation are notable in West China because of the rapid development of industries and agriculture, increasing the greenhouse gases in the atmosphere. According to statistics from the late 1950s to the 1980s, the total runoff was reduced 6.4% in the Xinjiang Region, and from the 1960s to the 1980s it was reduced 13.2% on average in the three large rivers in the southern Tibet Region. The decreasing range in the Xinjiang Region is less than that in the southeastern Tibet Region. The reason is that decreasing precipitation is compensated by increasing glacier and snow meltwater in the Xinjiang Region.

Keywords: greenhouse effect, runoff, impact


A survey of the water conservancy and power projects at the upper reaches of the Yellow River is briefly introduced. The influence of the Liujiaxia Reservoir and the Longyangxia Reservoir on the local climate is studied by comparing the analyzed results of the meteorological data from the meteorological stations near the two reservoirs. The results are as follows: After the reservoirs were built, the mean annual air temperature and water temperature went up, and the daily differences of air temperature and water temperature were lower at the areas near two reservoirs and the lower reaches of the Yellow River as a result of the heat storage of the reservoirs. The reservoirs are relatively cold sources in spring and summer and warm sources in autumn and winter. The atmospheric layer is stabilized, which makes
convection, low-level clouds, and thunderstorms decrease and sunshine duration increase at the reservoir areas.

Keywords: water conservancy and power project, climatic effect, upper reaches of the Yellow River.


The paper analyzes the relationship between global climatic fluctuation and dynamic landscape changes of the main sandy lands and deserts in China since the Holocene. The monitoring showed that global climatic variation affected desertification in China in both space and time, especially spatial influences. The responsiveness and sensitivity to climatic changes are different in the eastern part and western part of China.

Keywords: global climatic variation, land desertification, desertification monitoring

Modeling


Using the National Center for Atmospheric Research (NCAR) community climate model 2 (CCM2), the simulated East Asian climate was analyzed and checked against observation data and information. The large-scale features of the East Asian climate were simulated pretty well by the model, though there are still some discrepancies between the model output and
observation. The simulated geopotential height, wind, and temperature fields are very close to the observation. The large-scale systems, such as the subtropical high, Mongolia high, and Indian low, which have an important influence on the East Asia Monsoon are also simulated pretty well. The moisture field is not simulated as well as the fields just mentioned. The simulated precipitation of the model has a rather big difference from the observation. These differences suggest that some physical processes in the CCM2 need to be improved.

Keywords: East Asia climate, simulation, validation


The research developed a hybrid coupled model (HCM) of the tropical atmosphere-ocean to study the tropical air-sea interactions and El Niño/Southern Oscillation (ENSO) cycles. The atmospheric component is a simple tropical model consisting of a well-mixed planetary boundary layer (Lindzen-Nigam model) and a free troposphere represented by the first-order baroclinic model (Gilltype model) in the tropical Pacific. The oceanic component is the Institute of Atmospheric Physics (IAP) free-surface tropical Pacific oceanic general circulation model (OGCM). The coupled model can produce both annual mean and seasonal cycle climatology as well as short-term climate variations. The coupling procedure consists of exchanging the surface fluxes (i.e., the surface wind stress) estimated from the simple atmosphere together with the heat flux calculated by the Haney relation formula and the prescribed water flux are used to force the OGCM; the OGCM calculates sea surface temperature (SST) within the domain and uses the observed surface temperature outside the domain, which gives the surface boundary condition for the atmospheric model. The
simulations of the tropical Pacific climatology are conducted using synchronous daily coupling and numerical results without flux correction. It is shown that the coupled model is free from climate drift and is able to accurately reproduce the observed tropical Pacific climatology of the atmosphere and ocean and their seasonal variations.

Keywords: simple tropical atmosphere model, oceanic general circulation model (OGCM), coupling simulated climatology of the tropical atmosphere and ocean


Using a dynamic glacier model, the processes and responses of Glacier No. 1 in the headwaters of the Urumqi River to various future climatic scenarios are discussed. The conclusion is as follows: Glacier No. 1 in headwaters of the Urumqi River will continue to retreat if current climatic conditions prevail until it reaches a steady state of 1600 m in length. If the air temperature were to rise 1°C (rise of 2°C actually, because the cooling function of the glacier would decrease), the glacier would degenerate and become a hanging glacier with a length of 300 m after 700 to 800 years. The current glacial runoff is higher in comparison with that of the equilibrium state under the current climatic condition. If the air temperature continues to rise, however, the runoff of the glacier would increase and reach a new peak but then decrease rapidly.

Keywords: glacier, runoff, climatic change, Urumqi River

On the basis of the principles of disaster risk analysis and the method of improved agricultural ecological areas, a practical model of agro-meteorological disaster risk analysis is established. It was developed from the gradual three-level enlargement of a basic concept model (basic concept model, transitional model, practical model). The risk degrees of main agro-meteorological disasters and risks of litchi cultivation in Southern China are analyzed and calculated.

Keywords: agro-meteorological disaster, risk analysis model, litchi


Using the daily date of precipitation during October to January from 1961 to 1994 and the criteria of regional severe precipitation in the dry season in the Sanxia area, the days of regional severe precipitation in the area are ascertained. The reasons, the impacting systems, and the features of general circulation for regional severe precipitation in the area are analyzed using the historic synoptic charts for the same period. The features of general circulation of two ridges and two troughs models during regional severe precipitation in Sanxia area are summarized. A synoptic model for forecasting regional severe precipitation in the dry season in the Sanxia area on the Changjiang is given. The predictive indexes of the circulation pattern are drawn. The operational experiment shows that the two ridges and two troughs model and its predictive indexes are of preferential value to forecast the regional severe precipitation in dry season in Sanxia on the Changjiang.
Keywords: severe precipitation, general circulation, forecast index


The paper developed a new mathematical model for searching the analogue weather process, in which the discriminant matrix is made by means of the Saaty method. The analogue order and analogue degree are calculated using the matrix, and the model has proved to be very useful in operational weather forecasting.

Keywords: analogue technique, mathematical model, forecast test


A general circulation model, which has been coupled with a simple biosphere model, was used to assess the influence of anomalous Plateau snow cover in winter on the east and south Asian summer monsoon circulation and rainfall. The results point out that the summer monsoon in east and south Asia is weakened when the winter snow cover over the Plateau is increased. The main features are that the precipitation is reduced in the east and south Asian summer monsoon region and the Somali jet, the Indian monsoon trough, and the Indian southwest air flow are weakened. In addition, the sensitivity of the effects of the snow cover over Eurasia and the east Plateau on the Asian monsoon are also examined. It is found that the Plateau snow cover was more sensitive than that over Eurasia.
Keywords: snow cover over the Plateau, east and south Asian summer monsoon, numerical experiments


An atmospheric general circulation model (AGCM) resolution (with 9 sigma levels in the vertical and rhomboidal truncation at wave number 15 in the horizontal) was run for 10 years with and without Qinghai-Xizang Plateau respectively (called TP and NTP experiments hereafter). Comparing the results of TP and NTP experiments, the influence of Qinghai-Xizang Plateau on the mean circulation of Asian monsoon is investigated. It found clear differences between the mean circulation of Asian monsoon with and without Qinghai-Xizang Plateau either in summer or in winter.

Keywords: atmospheric general circulation model (AGCM), Qinghai-Xizang Plateau, mean circulation of Asian monsoon, seasonal variation

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**Radiation and Trace-Gas Emission**


The study reveals the mutual connection between methane (CH4) and nitrous oxide (N2O) emissions on the basis of a synchronous automatic observation series on the CH4 and N2O emissions from the Tai Lake rice paddy fields. The seasonal variations of CH4 and N2O emissions from rice fields are completely different. The N2O emission intensively increases whereas CH4 emission decreases.
because of drainage. However, their patterns of diurnal variation are similar. On clear days, the order of CH$_4$ and N$_2$O emission is distinct, the maximum emissions of both gases usually occur in the afternoon. Sometimes, another smaller peak of CH$_4$ emission is observed during the night. Significant effects of fertilizer application on emissions were also detected.

Keywords: CH$_4$ emission, N$_2$O emission, rice paddy fields


Statistical figures on ammonia (NH$_3$) emission amounts for 27 provinces and 3 cities of China are presented and emission factors are determined. Since 1960, the amount of ammonia emission in China has increased year after year. The total ammonia emission amount was 12 Mt in 1993 with a major contribution (52%) from livestock wastes. The NH$_3$ concentrations in the atmosphere were measured in Beijing, Guangdong, Guangxi, Hunan, Hubei, Jiangxi, and Shandong. The NH$_3$ concentrations varied with season in Beijing. From the diurnal pattern, it can be seen that NH$_3$ concentrations at night were often higher than those observed during the day. The ammonia concentrations were also measured at different elevations.

Keywords: ammonia, emission amounts, diurnal pattern
王木林，程红兵，李兴生，温玉璞，1997，
中国部分清洁地区大气中N2O的浓度。
气候学报，55(3): 363-370

根据1993年4月-1995年8月对中国部分清洁地区大气的N2O浓度进行的现场观测，（中国农科院试验田、中国科学院农业生态实验站二个农田及临安、龙风山、瓦里关山三个大气本底站）并采用气相色谱分析法，对大气中N2O的背景特征及日、季变化进行了初步研究。研究表明：农田大气中N2O平均浓度高达322.1－343.4ppbv，这是土壤排放N2O的结果
临安、龙风山和瓦里关山大气本底观测站（WMO/GAW）平均浓度分别为318.8±8.4ppbv，317.4±4.7ppbv和314.0±4.2ppbv。在此基础上，对大气中N2O的分布及变化特征进行了分析，并且还初步分析和评价了现场取样和浓度测量技术。
关键词：氧化亚氮，本底浓度，气相色谱法


Based on the observation of NO2 emission from rice-wheat rotation in East China, its seasonal and diurnal variation and the effects of temperature, soil moisture, fertilization, and availability are discussed. Meanwhile, the methane (CH4) and NO2 emissions from the rice season are analyzed comparatively. The study shows that the amount of NO2 emitted during the rice season only accounts for about 30% of the whole rotation cycle. The CH4 emission increases 26% with flooding in the rice season, and NO2 emissions from rice-wheat rotation.
规律。在稻麦轮作周期内，其生长季的NO2排放量仅占30%。
稻田持续淹水比常规灌溉增加CH4
排放量26%，减少NO2排放量11-26%
关键词：NO2排放 时间变化
控制因子 CH4排放 稻麦轮作系统

卢维等. 1997. 广州地区晚稻田
CH4和NO2的排放通量及其影响因
素, 应用生态学报, 8(3): 275-278

采用密闭箱法同时观测了广州地区
晚稻田CH4和NO2的排放通量，研
究了水分管理及水旱轮作的影响。
研究表明：连续淹水、常规轮作和
水旱轮作等三种处理方式的CH4平
均排放通量分别为17.63、2.84和0.3
6mg·m⁻²·h⁻¹，而NO2的平均排放通量分别6.47
11.69和55.07µg·m⁻²·h⁻¹
，这说明稻田NO2和CH4排放之间
存在着消长关系。稻田连续淹水显
著增加CH4的排放而降低NO2的排
放，水旱轮作降低CH4排放却增加N
O2的排放，并且讨论了这两种气体
排放的影响因素及各自对温室效应
的相对贡献。
关键词：稻田 CH4和NO2排放通量
水分管理 水旱轮作

李晶等. 1997. 水稻田甲烷的减排
方法研究，中国农业气象,
18(6): 9-18

通过1987年以来对我国五大水稻产
区稻田甲烷排放量的野外观测，对

cycle are reduced 11 to 26%, compared with
normal irrigation.

Keywords: NO2 emission, temporal variation,
regulating factor, CH4 emission, rice-wheat
rotation system

Lu Weisheng et al. 1997. Methane (CH4) and
nitrogen dioxide (NO2) fluxes from late-rice
fields in the Guangzhou region and the factors
affecting emission. Chinese Journal of Applied
Ecology 8(3):275-278.

Using a closed chamber method, methane (CH4)
and nitrogen dioxide (NO2) emissions from late-
rice fields in the Guangzhou region were
measured simultaneously. It is revealed that
when treated by continuous flooding, rotation
succession cropping, and rice-vegetable
rotation, the mean CH4 emissions are 17.63,
2.84, and 0.36 mg · m⁻² · h⁻¹ respectively,
wheras the mean NO2 emissions are 6.47,
11.69, and 55.07 µg · m⁻² · h⁻¹
correspondingly. This indicates a trade-off
between CH4 and NO2 emission. The continuous
flooding can greatly increase CH4 emission,
while significantly reducing NO2 emission. But
with a rice-vegetable rotation the reverse is true.
The factors affecting CH4 and NO2 emissions
are also discussed, and the contribution of CH4
and NO2 to global warming is preliminarily
analyzed.

Keywords: rice field, CH4 and NO2 fluxes,
water management, rice-vegetable rotation

Li Jing et al. 1997. Studies on the mitigation of
methane emission from rice fields. Agricultural

Based on field observation of the generation and
emission factors of methane since 1987, the paper
discusses three promising methods for mitigation
of methane from rice fields. The effectiveness and

The anthropogenic emissions of ammonia in China are calculated based on the number of livestock, poultry, fertilizer applications, and human beings. The results show that the emission of ammonia reached 891.8 kt in 1991, among which NH3 emissions from animals, nitrogen fertilizer application, human beings, and fertilizer production accounted for 64%, 18%, 17%, and 1%, respectively. The geographical distribution of emission intensity and emission trends were also estimated.

Keywords: animals, fertilizer, geographical distribution, NH3 emission intensity
许晓斌等，1997，中国东北区域背景大气中酸性气体的研究，中国环境科学，17(4): 345-348

介绍了首次在我国黑龙江龙凤山大气背景污染监测站取得的NOx和SO2一年的连续观测资料及分析结果。龙凤山大气中NOx和SO2浓度低于我国空气质量标准，有明显的季节变化，夏季值最低，冬季值最高。NOx和SO2浓度与风速、湿度、相对湿度等气象要素有密切关系。

关键词：NOx, SO2, 浓度变化, 来源


The paper introduces the in situ measurements of nitrogen oxides (NOx) and sulfur dioxide (SO2) in the surface air at Longfengshan for the first time. The data show that the levels were much lower than those of the Class I in the China National Air Quality Criteria. The obvious seasonal variations, with the lowest points in summer and the highest points in winter, were also observed. The concentrations of both gases were found to be closely related to the meteorological parameters, such as wind speed, temperature, and relative humidity.

Keywords: NOx, SO2, variation of concentration, source

傅立新，郝吉明，周学龙，何东全，赵磊，1997，中国东部地区能耗和SO2排放趋势预测研究，中国环境科学，17(4):349-352


关键词：能源消耗, SO2排放, 趋势预测


The Long-range Energy Alternatives Planning (LEAP) model and emission factor analysis are used to predict the future trends for 2000, 2010, and 2020 on the basis of systematic research on the current situation of energy consumption and sulfur dioxide (SO2) emission in 18 provinces in East China. The factors, including the Three Gorges project, nuclear power plants, and so on, are taken into account. Given power plants as point source, emission data are divided into 100×100 km² geographical grids.

Keywords: energy consumption, SO2 emission, trend prediction

Atmospheric SO₂ and NO₂ were sampled during the period from August 1994 to July 1995 using the filter packs (FP) method, and the concentrations of these gases were analyzed with ion chromatography (IC) at the Waliguan background baseline station of Qinghai Province. The results indicate that the average concentrations of SO₂ and NO₂ are 0.417 × 10⁻⁹ and 0.055 × 10⁻⁹, respectively. There is a good correlation between SO₂ and NO₂ concentrations with a coefficient of 0.87, the ratio of SO₂ to NO₂ given a linear regression of about 2.6. The concentrations of SO₂ and NO₂ vary with season and wind direction. Higher concentrations are easterly, and lower are westerly. The concentrations of SO₂ and NO₂ are lower in winter and higher in summer.

Keywords: SO₂, NO₂, clean air, observation


Based on the 1753 samples from Beijing and Lhasa, the expression \( Q_0 = (I_0 \sin h) / (1 + f_m) \) is used to investigate parameterization of clear-sky total radiation with a new scheme for calculating \( f \). The new scheme has high universality in addition to maintaining a high fitting accuracy compared with the original scheme. It is superior to seven parameterization schemes and two radiation models as revealed by a comparison of computations. The form of the profile from the scheme agrees with observed profiles from home and abroad. The climatic calculation of the total radiation for six stations over the Tibetan Plateau agrees with these measurements.

Keywords: clear-sky solar total radiation, parameterization, climatic calculation

Microclimatic observation was conducted at different underlying surfaces in the urban area of Kunming City. The net long-wave radiation was calculated with observed data. The results showed that in the urban area, the variation of the net long-wave radiation is moderate in the morning, but marked in the afternoon; the variations of the net long-wave radiation are considerably affected by the nature and position of the surface. In the daytime, on the rooftop, the net long-wave radiation is larger than at ground level. On the road, the net long-wave radiation is lower than at ground surface. The difference of the net long-wave radiation on the grass and the ground surface varies with time; the values and variations of the net long-wave radiation vary with time.

Keywords: urban area, net long-wave radiation, different underlying surfaces


The climatic characteristics of cloud radiative forcing of earth-atmosphere system over Qinghai-Xizang Plateau are analyzed based on the data set of the Earth Radiation Budget Experiment (ERBE)-S4 and the International Satellite Cloud Climatology Project (ISCCP)-C2 from 1985 to 1988. It reveals that there are distinct differences in cloud radiative forcing of the earth-atmosphere system between winter and summer. Also the greenhouse effect of clouds is stronger than the reflective effect of clouds in winter and weaker in other seasons.

The components of the radiation budget in a winter wheat field on the Tibetan Plateau were measured, and then their diurnal variations were analyzed. The results were as follows: There are obvious diurnal variations in reflectivity and net radiation; the average reflectivity was 13.3%, and the average net radiation was 75% of the global radiation in daytime or 67.4% of the global radiation including day and night during the measuring period. A linear relationship between net radiation and global radiation that can be used to calculate net radiation from global radiation was established.

Keywords: Tibetan Plateau, winter wheat, radiation budget


A field experiment of "Arid Environment Comprehensive Monitoring 95" was done in August 1995. The experimental sites were near the Oasis boundary area in Hei River basin of Northwest China. Analytical results of the observational data show that the characteristics of the radiation budget, surface albedo, and contribution of radiation flux density components to net radiation flux density are different inside and outside of the Oasis site. The discrepancy of downward radiation flux density
贡献并不存在差异；入射辐射通量密度值比较接近；绿洲上的反射率小于戈壁上的。
戈壁上反射率随太阳天顶角的变化主要是由近红外波段反射率随太阳天顶角的变化引起的；向上长波辐射通量密度白天戈壁大，夜间绿洲大，并且戈壁上有明显的日变化过程；白天绿洲有效辐射通量密度小于戈壁上的；夜间两者比较接近；白天戈壁面净辐射通量密度绿洲大于戈壁上的。
绿洲和戈壁上近地面净辐射通量密度的不同主要是由地表吸收太阳辐射通量密度特性不同而引起的。
关键词: 绿洲边缘 辐射 反射率


Continuous measurements of atmospheric CO₂ were carried out using the non-dispersive infrared (NDIR) method at Mt. Waliguan where the environment is unaffected directly by local anthropogenic pollution. The characteristics of the atmospheric background CO₂ concentration variation for the inland Plateau of China are presented in this paper. The results show that the area has clear diurnal and seasonal variations related to the growing cycle of the land’s vegetation and that the pattern of seasonal variation corresponds with the global geographical distribution of atmospheric CO₂. Furthermore, the emission rates of CO₂ from the Plateau grassland soil were also measured. The results show that the CO₂ emission rate from the soil surface increases relatively in winter with the largest value above 170 mg/m²•h when the photosynthesis of vegetation is essentially stagnant.

The secular variation characteristics and the relationship between global radiation and temperature are analyzed using the data of air temperature and global radiation from 1956 to 1994 at Golmud. The results show that the decreasing tendency of global radiation was not obvious in these 39 years. The annual mean air temperature is low in the 1960s, and rapidly increases in the 1970s about 10 years earlier than in the eastern plain. There is a tendency toward warming in winter and cooling in summer. The relationship between annual air temperature and global radiation shows a positive correlation with a delay of one year from the 1970s to the 1990s. The relationship between air temperature and global radiation for the same period shows a positive and negative correlation in summer and in winter.

Keywords: energy budget, solar radiation, air temperature variation

In this paper the basic relationship between the measurements from the visible/infrared channel in a satellite and the surface radiation budgets has been derived. Based on this relationship, some useful models of estimating the surface radiation budgets are obtained with observational data from the visible/infrared channel in geostationary meteorological satellite (GMS) and the observational data from surface radiation budget stations. With the best of these models, the distribution of radiation budgets across China is obtained by the interpolation method. When compared with actual observational data, this distribution has a better consistency with the actual results, which shows that this model is very effective in estimating the radiation budgets in China.

Keywords: geostationary meteorological satellites (GMS), visible radiation, longwave infrared radiation, estimate model, radiative budgets of surface

Based on the surface effective radiation data collected from 1988 to 1990 in the Taklimakan Desert and the calculated data of surface effective radiation in the surrounding areas of the desert, the features of daily variation of surface effective radiation and some influencing factors on surface effective radiation in the desert are analyzed. The temporal and spatial distribution of surface effective radiation is also studied for the desert and its vicinities.

Keywords: Taklimakan Desert, surface effective radiation
Ancient Climate


Based on data of some spore-pollen assemblages from three culture ruins, the climate features of the Late Stone Age in the Changjiang Delta were revealed by correspondence analysis. In Majiabang and Songze culture stages, the climate was warmer and the mean annual temperature was 1 to 3°C higher than that at present. In the Liangzhu culture stage, the climate was cooler and the mean annual temperature was about 1.5°C lower than that at present. Precipitation was very different in different stages and areas. In the late Majiabang stage and the early Songze stage, it was humid and the mean annual precipitation was 150 to 300 mm higher than that at present.

Keywords: culture ruin, spore-pollen, climate change, correspondence analysis


A model of climate changes was built based on data of carbonate samples taken from lacustrine deposits in the Linxia Basin. The spectrum analysis results show that the paleoclimate had a clear 41,000 year dominant periodicity, suggesting that the monsoon climate was not stable in the Early Pleistocene.

Keywords: Early Pleistocene, climate change, East Asia monsoon, Linxia Basin


Keywords: historical period, Guanzhong area, climatic changes


Magnetostratigraphy and the grain-size record of a thick red clay-loess sequence at Lintai in the Chinese Loess Plateau are studied in this paper. The results suggest that the eolian red clay at Lintai began to accumulate at about 7.05 Ma BP. The grain-size record shows that in the entire red clay sequence, the particle size of all the samples does not show significant variation. This contrasts strikingly with the overlying loess-paleosol sequence in which the grain size of loess beds is proportionally coarser than that of soils. These results suggest that the climate during this period could have been relatively stable.

Keywords: Tertiary red clay, eolian deposit, paleomonsoon

丁仲礼等，1998，灵台黄土-红粘土序列的磁性地层及粒度记录，第四纪研究，(1): 86-93

本文研究了甘肃灵台县任家坡黄土—红粘土序列的磁性地层及粒度记录。结果表明，中国北方连续的风成堆积可下推到7.05 Ma BP。第三纪红粘土的粒度组成从上到下变化很小，与黄土-古土壤序列的粒度大幅度变化形成强烈的反差，意味着晚第三纪时期的气候总体上要比第四纪时期稳定。

关键词： 第三纪红粘土 风成堆积 古季风

From a study of the terrace deposits, erosion surface, and the neighboring loess-paleosol sequence from different erosion profiles located in flat land and hill land as well as in valley regions of the Loess Plateau, and links to the analysis of proxy indices of paleo-climate, three results are concluded. (1) The development of T3 terraces of the gullies in flat land, hill land and valley regions of the eastern Loess Plateau, and their identical deposit features, which include sand-gravel, subclay, and fluvial loess layers, indicate that they are sediments from a period of strong erosion. (2) The analysis of climatic proxy indices, such as magnetic-susceptibility, carbon-13 and variability of magnetic-susceptibility, reveal a greater climatic gradient or greater precipitation variability at about 130 ka BP, which shows, on one hand, that precipitation increased sharply, and on the other hand, that the precipitation contribution with time was rather uneven. (3) The deposits on the T3 terrace were sand mixed with gravel. The poor sorting implies that this erosion event was probably driven by high-intensity rainstorms.

Keywords: Loess Plateau, monsoon, climatic change period, erosion event

Jin Heling et al. 1998. The sandy land evolution and climatic change in the middle course area of the Yarlung Zangbo River in Tibet, China since 0.80 Ma BP. Journal of Desert Research 18(2):97-104.

This paper uses sedimentary facies, magnetic susceptibility and some chemical elements, and debris minerals as indices to analyze the sandy land evolution and climatic changes in middle course area of the Yarlung Zangbo River. The period and model of sandy land evolution and climatic changes were set up as: (1) 0.80-0.518 Ma BP sandy land was developing slowly with narrowing, fixed intervals and a climate
characterized as warm-humid dominantly, but warm-humid alternating with cold-arid appearance. (2) 0.518-0.08 Ma BP, the eolian sand deposit increased which showed that the sandy land area was developing quickly and that the climate was cold and showed semi-arid or arid conditions. (3) 80-10 ka BP, eolian sand almost covered everywhere, which indicated sandy land persistent drought, and the contemporary sandfield pattern was formed in this period. (4) After 10 ka BP, the sandy land had been fixed, which reflected the warm-humid climate in the optimum period followed by a period of frequent climate fluctuations.

Keywords: Tibet, Yarlung Zangbo River, sandy land evolution, climatic changes

许英勤. 1998. 新疆博斯腾湖地区全新世以来的孢粉组合与环境，干旱区地理，21（2）：43-49


Bosten Lake located in the Yanji basin on the southern slope of the Tianshan Mountains. The paper presents results of pollen analyses on sediment of the Holocene in which six pollen zones are defined. According to assemblage characteristics of the spore-pollen, vegetation change was defined in four stages since the Holocene. Analysis shows that the climate of the Bosten Lake area has been arid since the Holocene. During the period from the middle of the middle-Holocene to the early late-Holocene, the climate has been relatively warm and humid. Since the Holocene, under the influence of climate change, the Bosten Lake area has expanded or shrank many times.

Keyword: Bosten Lake, spore-pollen assemblage, environment
贾铁飞等. 1998. 乌兰布和沙漠北部沉积物特征及环境意义，干旱区地理，21（1）: 36-42

根据乌兰布和沙漠北部地区典型剖面记录，对各层沉积物进行了结构分析，在对沉积物性质、特点进行分析判断的基础上，初步揭示了各层沉积物的环境意义，并依次对乌兰布和沙漠的形成、发展与环境变迁间的关系做了初步探讨。认为乌兰布和沙漠的形成演化主要受自然环境变化的影响，人为因素应是叠加其上的辅助因素。

关键词：乌兰布和沙漠 沉积物特征 沉积环境 环境变迁


On the basis of field investigations at the northern part of the Ulan Buh Sandy Land, two profiles were selected for analysis. This paper covers the analysis of sedimentary grain size, triangular diagram, and cumulative curve. The main conclusions are as follows: (1) Ulan Buh Sandy Land is not a man-made desert after the Han Dynasty, but is the result of natural environmental evolution. (2) The forming time of the Ulan Buh Sandy Land is early Holocene or even the late stage of the late Pleistocene, which is an eolian sand epoch in Northern China. (3) The evolution pattern of Ulan Buh Sandy Land is the same as that of environmental change in Northern China, and the human factor is only a subordinate factor. (4) The forming and evolution of Ulan Buh could be connected with the alluviation of the Yellow River which may be a focus of a study of Ulan Buh’s environmental evolution in the future.

Keywords: Ulan Buh Sandy Land, feature of sediment, sedimentary environment, environmental evolution

曾永年. 1998. 柴达木盆地沙漠沉积中的新仙女木事件记录，干旱区地理，21（1）: 25-28

对柴达木盆地晚更新世沙漠演化过程的研究，发现青藏高原沙漠沉积中清楚地记录了新仙女木事件，并呈干冷降温的气候效应。进一步分析得出：新仙女木事件在我国不同自然气候带呈单一的干冷降温效应，并作为多模式效应。

关键词：新仙女木事件 沙漠沉积 柴达木盆地


According to the environmental record and the areas of stratigraphy in the Xiaxitai section in the southeastern part of Qaidam Basin, this paper concludes that the desert development, formation of the cold-dry climate, evolution of the natural environment, and reverse changes have occurred frequently since the late glacial. In eolian sand deposits, the Younger Dryas event clearly appears, which manifests that it was a dry-cold climate period. Now there are two different opinions about the climatic effect of the Younger Dryas. According to our predecessors’ research and the field work of the authors, it is considered that the Younger Dryas event not only exists in different climatic zones in China, but also manifests a unitary dry-cold climatic effect.

Keyword: Younger Dryas event, eolian sand deposit, Qaidam Basin

Based on field observation and measurement of periglacial phenomena, radiocarbon dating, and spore-pollen analysis of the samples from the Diaojiaohaizi section, this paper examines the low-temperature fluctuations in the Holocene in the Daqingshan Mountains. The research concludes: (1) There are six periods of low-temperature fluctuations in the Holocene including those in 9100 years BP-8800 years BP, 8000 years BP-7800 years BP, 7000 years BP-6900 years BP, 6000 years BP-5800 years BP, 5300 years BP-4700 years BP, and 3100 years BP-2400 years BP. These fluctuations have extensive regional significance except the 2nd and the 4th fluctuations which are relatively weak and confined to the Daqingshan Mountains. (2) The characteristics of the sand wedge in the Diaojiaohaizi section indicates that the extreme low-temperature interval in the cold stage of the Holocene was short, which was only 50-60 years.

Keywords: Daqingshan Mountains, Holocene, low-temperature fluctuation

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Characteristics of climatic change in the Svalbard area in the last 80 years are analyzed in the article. It found a general warming trend. But a decreasing temperature since the mid-1970s in the Svalbard area is an exception in the background of global temperature rising. The study concludes that there is a good correlation in climatic change between the Svalbard area and the Qinghai-Xizang Plateau, and there are differences because of local climatic change.

Keywords: Svalbard area, Qinghai-Xizang Plateau, climate change
Hao Yongping et al. 1998. The characteristics of climatic fluctuation recorded by soil formation since the Late Pleistocene in the eastern region of the Qaidam Basin. Scientia Geographica Sinica 18(4):249-254.

Based on characteristics of soil macro-structure and physical-chemical analysis of samples from the Amgutan section in the eastern region of the Qaidam Basin, the authors studied climate fluctuations, which were affected by global ice and characteristics of the East Asia monsoon. The authors believe that temperature and precipitation in the climate system do not coincide with each other and precipitation and low temperature are important factors in the humid episode from 50 to 30 Ka BP.

Keywords: pedogenic properties, information of climatic fluctuation, East Asia summer monsoon enhancement, Qaidam Basin, Late Pleistocene


Permafrost temperature, measured in borehole no. 5 in the ice pass at the source of the Urumqi River [the highest (3,900 m a.s.l.) borehole in the Tianshan Mountains] since September 1991, was analyzed. The results of the temperature measurements indicate significant diurnal, seasonal, and annual variations. Strong influences from flowing water and percolation have been detected in a coarse gravel layer at a depth of about 2 m during autumn each year. The depth of annual temperature change is estimated down to 25 to 30 m. The ground temperature indicates a rising trend at the active layer and a cooling one at 10 and 18 m in the permafrost during the 5 year observation.

Keywords: permafrost temperature, climatic fluctuation, Tianshan Mountains, permafrost cooling

本文对青藏高原1963－1992年逐日积雪深度记录进行了EOF分析。结果表明，青藏高原积雪空间分布极不均匀，高原东部分是高原积雪年际变化最显著的地区。从60年代到80年代积雪年际波动幅度有明显增加的趋势。
关键词：青藏高原 积雪深度 EOF分析 空间分布与变化


Daily snow depth data from 1963 to 1992 over the Tibetan Plateau was analyzed by using the empirical orthogonal function (EOF) method. The results showed that the spatial distribution of snow cover over the Plateau is very inhomogeneous. The heavy snow cover region in the east of the Plateau is the region where the most significant inter-annual variation of snow cover occurs. There is an increasing trend of inter-annual fluctuation amplitude of snow cover over the plateau from the 1960s to 1980s.

Keywords: Tibetan Plateau, snow depth, EOF analysis, spatial distribution and variation


希夏邦马峰—珠穆朗玛峰地区是新生代以来，在欧亚板块与印度板块碰撞的地质背景下，迅速隆起的极高山地区。本文研究了该地区的地貌与环境演化问题，认为进入第四纪以来，强烈的构造隆升，使这些山地上的冰川退进、河流发育和湖泊变迁都发生了重大变化，带来整个地貌格局的变化。
关键词：冰期 环境演化 河流劫夺


The Xixibangma–Qomolangma area has uplifted rapidly since the Cenozoic era, under the geological background of the collision of the Eurasia Plate with the Indian Plate. The geomorphological and environmental development is studied in the paper. With the dramatic tectonic uplift in the Quaternary, advance/retreat of glaciers, development of rivers, and change of lakes all underwent dramatic shifts and induced a change of the entire geomorphological pattern.

Keywords: glaciation, environmental evolution, capture of river

The dam of the Peikucuo Lake at the northern foot of Mt. Xixiabangma is discussed in the paper. During the Quaternary, the glacio-fluvial deposition at the northern foot of Mt. Xixiabangma choked the Menqu River valley and formed Peikucuo Barrier Lake. Evolution of the lake corresponds to the change of glacier types from valley glacier and piedmont glacier to valley glacier.

Keywords: Peikucuo Lake, cause of damming, environmental evolution


The Quaternary palynological record and the evolution of the environment at the Northeast margin of the Tibetan Plateau are discussed in this paper. According to the spore-pollen assemblage analysis, 22 main and secondary cycles are recognized and the best humidity and temperate conditions appeared in the early Pleistocene during the Quaternary. The climate has become dry-cold since 2.2 Ma BP with the highest level of moisture between 1.8-1.77 Ma BP; a historic turning point occurred about 1.7-1.6 Ma BP together with the appearance of loess sediment.

Keywords: spore-pollen assemblage, Quaternary, environmental evolution

本文对我国江西九江地区4个土壤剖面的土壤有机质及其δ13C值进行分析，结果认为末次冰期旋回内生态转型是由于季风效应和CO₂共同作用的表现：北大西洋末次冰期内的Heinrich事件对中国东部的气候也产生剧烈的影响，其分布直接控制着C₃和C₄植物的转型及其沉积物的类型。CO₂及其温室气体可能是Heinrich事件的重要驱动力。

关键词：碳同位素 土壤有机质 生态变迁 晚更新世 东南季风


The authors discuss soil organic matter content and δ13C from four soil profiles in Juijiang Prefecture, Jiangxi Province. The results indicate that the ecological shift in last glacial cycle was driven by the monsoonal effect and the change of CO₂ concentration. The North Atlantic Heinrich events also had dramatic impacts on the climate in eastern China, and their distribution directly controls the shift of C₃ and C₄ plants and type of sediments. The CO₂ concentration and other greenhouse gases may be one of the important factors forcing Heinrich events.

Keywords: carbon isotope, soil organic matter, ecological shift, Late Pleistocene, southeast monsoon

施淑燕, 曹秋萍，1998。黑龙江省无霜期的气候变化，气象，24（1）: 25-30

对黑龙江省的初、终霜日和无霜期按地区、年代进行了较详细的统计分析。结果表明：60/70年代终霜期较晚，初霜期较早，无霜期较短：80年代以来，多数地区终霜期有所提前，初霜期明显提前，无霜期延长，反映了60、70年代寒冷，80年代变暖，90年代前期持续变暖的气候特征。

关键词：无霜期 变化 分析


The spatial and temporal variations of the frost seasons in Heilongjiang Province were investigated. The main results are as follows: during the 1960s, the onsets of the frost seasons are earlier than normal, the ends of the frost seasons are later, and the frostless seasons are shorter. Since the 1980s the ends of the frost seasons have been earlier and their onsets are later in most parts of Heilongjiang Province, thus the frostless season is longer. These changes show that the climate was colder than normal before the 1970s, after which it changed to warmer.

Keywords: frostless seasons, variation, analysis

The climatic characteristics of severe tropical cyclone activities over the Northwest Pacific and general circulation features of the atmosphere and their relationship from 1951 to 1995 were statistically analyzed. The results show that the 1960s and 1970s were two periods of anomalous typhoon activities. Results also show that typhoons were well correlated with the subtropical high, the westerly circulation, and the Qinghai-Xizang Plateau index.

Keywords: severe tropical cyclone, climatic characteristic, atmospheric circulation, typhoon


Climate change and its characteristics in China in the last 45 years have been analyzed comprehensively on the basis of data of monthly mean air temperature and precipitation from 1951-1995 from about 400 stations, and from data on maximum and minimum air temperature, relative humidity, total cloud and low-cloud cover, sunshine duration, evaporation, wind speed, snow-covered days and depth, and soil temperatures in 8 layers from 0 to 3.2 m, from 200 stations from 1961-1995.

Keywords: climate change in China, air temperature and precipitation, maximum and minimum air temperature, relative humidity and sunshine

In this paper, three complete Qinghai-Xizang Plateau snow cover data sets consisting of Scanning Multichannel Microwave Radiometer (SMMR) microwave pentad snow-depth maps, operational National Oceanic and Atmospheric Administration (NOAA) weekly snow cover extent charts, and daily snow-depth data at 60 primary weather stations covering 36 years were used to investigate the spatial and temporal characteristics of snow cover on the Qinghai-Xizang Plateau. The empirical orthogonal function (EOF) method and spectral analysis, as well as trend estimate analysis, were used in the study. The results show that the spatial distribution of snow cover over the Qinghai-Xizang Plateau evidently compares with the light snow cover in the vast interior of the Qinghai-Xizang Plateau. The heavy snow cover region in the east of the Qinghai-Xizang Plateau is the most significant region of the interannual variation of snow cover on the Qinghai-Xizang Plateau and dominates the interannual variation of snow cover in the whole Plateau. There is an opposite phase relationship between the western parts and the eastern parts of the Qinghai-Xizang Plateau in the interannual fluctuation of snow cover from the 1960s to the 1980s.

Keywords: snow cover on the Qinghai-Xizang Plateau, EOF analysis, spectral analysis, characteristics of spatial distribution and variation


Using the precipitation data for the last 40 years from 48 meteorological stations in the Taklimakan Desert, surrounding mountains and neighboring areas, the stages and periods of the wet-dry changes in annual precipitation and four seasons in the Taklimakan area are analyzed. The correlation of precipitation change in the Taklimakan Desert and in surrounding mountains
析，探讨其与极涡位置的关系。
关键词：塔克拉玛干地区 干湿变化


A review of the past climate and environment in Xinjiang classifies the studied period into three different time scales (i.e., geological, historical, and instrumental) and analyzes the characteristics of past climate and the environment in Xinjiang and then predicts trends. It concludes that the arid condition in Xinjiang has remained since the early age of the Tertiary. However, climate and environmental variations that were characterized by dry-damp and cold-warm alternation have taken place during this long time. Periods of climate and environmental variation, such as 100 and 1000 years, are clearly found. By prediction, the arid condition in Xinjiang will continue into the middle of the next century. The air temperature will rise slightly in winter and decrease in summer. The precipitation will increase a little.

Keywords: Xinjiang, climate and environment, climate trend


Using the temperature data for the last 40 years from 48 meteorological stations, the paper analyzes the stages, periods, and trends of temperature change. The author also compares the temperature change in the Taklimakan area with that of the surrounding mountains and adjacent areas, and discusses the relationship between the Euroasian circulation index and temperature change in the studied area. The results are as

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姜逢清, 1998, 新疆气候与环境

关键词：新疆 气候与环境

袁玉江等, 1998, 塔克拉玛干地区

关键词：塔克拉玛干地区 近40年来的冷暖变化
follows: (1) The annual and seasonal mean temperature sequences of this area reflect the warm-cold changes in the area. (2) The annual and seasonal temperature changes have different warm-cold stages and change periods. The temperature changes annually and in winter shows a significant warming trend, and the changing range in winter is about three times as much as that of the annual range. (3) The correlation of the temperature change in the Taklimakan area with that from the surrounding mountains and adjacent area is better at the Toyun station. (4) The correlation of the temperature change in the Taklimakan area with that of the adjacent area is best at Gansu Province. (5) There is a significant negative correlation between annual temperature change in the Taklimakan area and the Euroasian annual mean longitudinal circulation index, and significant positive correlation between autumn temperature change and latitudinal circulation index from October to November.

Keywords: Taklimakan area, modern warm-cold change, adjacent areas, comparison


The desert evolution in the southeast margin of the Tengger Desert was reconstructed. The reconstruction shows the southeastern margin of shifting sand, the spread or fixation, semi-fixation and reduction of the desert to grassland as well as weak pedogenic processes since the middle Pleistocene. Simultaneously, the bioclimatic zones in the area underwent alternations from dry, cold and windy desert, and desert steppe to semi-arid steppe, semi-arid or semi-humid sparsely wooded steppe. The processes of evolution are controlled by the coupling between the glacial and interglacial climate fluctuation and the prosperity and decline of the eastern Asian monsoon.

Keywords: Tengger Desert, sedimentary facies, desert evolution model
陆日宇，黄崇辉．1998．东亚—太平洋遥相关型波列对夏季东北亚阻塞高压年际变化的影响，大气科学，22（5）：727-734

利用1980－1988年9年的观测资料，分析了夏季东北亚阻塞高压的年际变化及其与江淮地区夏季降水之间的关系，指出夏季东北亚阻塞高压具有十分明显的年际变化，同时它与江淮地区夏季降水之间存在着较密切的关系：当夏季东北亚阻塞高压频发时，江淮地区降水偏多；而当夏季东北亚阻塞高压维持日数少时，江淮地区降水偏少。为考察产生上述结果的原因，我们分析了全球海温异常，并利用合成的热带西太平洋海温异常每年研究了热带西太平洋海温异常对东北亚阻塞高压形成和维持的影响。最后指出热带西太平洋海温异常引起的东亚—太平洋型遥相关波列是产生夏季东北亚阻塞高压的年际变化加强及其与江淮地区夏季降水之间关系的一个重要原因。

关键词：东亚—太平洋遥相关型 东北亚 阻塞高压 海温异常

Lu Riyu and Huang Ronghui．1998．Influence of East Asia/Pacific teleconnection pattern on the interannual variations of the blocking highs over northeastern Asia in the summer．Scientia Atmospherica Sinica 22(5):727-734．

The interannual variations of the blocking highs over northeastern Asia in summer and their relationship to precipitation over the Yangtze River and Huaire River basin in summer are analyzed with the 1980-1988 European Centre for Medium-Range Forecast (ECMRF) data. The results show that the blocking highs over northeastern Asia in summer have obvious interannual variations. The results also show that there is a close relationship between blocking highs over the northeastern Asia and the precipitation over the Yangtze River and Huaire River basin. When blocking highs occur frequently over northeastern Asia in summer, the precipitation over the Yangtze River and Huaire River basin is higher than normal. And when blocking highs seldom occur, the precipitation is less than normal. To investigate the causes of these results, we analyzed the sea surface temperature (SST) anomalies and simulated the influence of the SST anomalies in the tropical western Pacific on the blocking highs over the northeastern Asia, using the composite SST anomalies. Results show that the East Asia/Pacific teleconnection pattern, which is caused by the SST anomalies in the tropical western Pacific, is one of the important causes of the interannual variations of the blocking highs over northeastern Asia in summer and is related to summer precipitation over the Yangtze River and Huaire River basin.

Keywords: East Asia/Pacific teleconnection pattern, blocking highs over northeastern Asia, sea surface temperature anomalies

钱云等，1998．末次冰期东亚区域气候变化的情境和机制研究，大气科学，22（3）：283-293

用一数值在全球大气环流模式中的区域气候模式，通过熟知试验和对内外因作用的机制分析，探讨了一

Qian Yun et al．Study on scenarios and mechanism of the regional climate change of East Asia in the Last Ice Age．Scientia Atmospherica Sinica 22(3):283-293．

The scenarios and mechanism of regional climate change over East Asia in the Last Ice Age, which are affected by large-scale circulation background and local mesoscale forcings, are discussed by
dynamic analysis and numerical simulations using a regional climate model and a general circulation model (GCM). The comparison between the simulated and the observed shows that results simulated by the regional model indicate more details and are closer to the evidences of geological data than results simulated by a GCM. The effects of large-scale forcing on regional climate change are mainly through the propagation of stationary wave trains and teleconnection, whereas the mesoscale forcing in the domain is mainly through local thermal and dynamic processes of the atmosphere. In the climate system, changes of one of the independent factors may touch off a positive or negative feedback process and influence other climate variables to various degrees.

Keywords: Last Ice Age, regional climate, general circulation background, local mesoscale forcing


A new three-component time-dependent climate model is established. The model consists of three equations that respectively govern the change of annual mean global surface temperature, atmospheric temperature, and cloud amount. The steady states and stability of the climate model with change in the solar constant are investigated using the bifurcation theory. The model results show that the cloud and snow-ice albedo feedbacks and the water vapor emissivity feedback may lead to multiple stable climate states, and thus show the complexity of climatic variation. Only under the condition of a strong water vapor emissivity feedback, can the cloud emissivity feedback change the structure of the climate system noticeably. The strong snow-ice feedback and water vapor emissivity feedback can lead to sudden global climate change, although the solar constant has slight changes within the 1% range.

Keywords: steady state, stability, climate feedback, climate jump change, solar constant

This paper mainly studies the spatial and temporal distribution of variability and trends for extreme temperatures based on China’s extreme temperature data during 1951-1990. Efforts are made to minimize the possible biases caused by changed locations of stations and the urban heat island effect, and to perform quality control procedures. The results show that the variability of extreme minimum temperature in most parts of China in spring and autumn is greater than those in other seasons, especially in northern China.

Keywords: China, extreme temperatures, change


The variation periods of the sea-ice area index in the Kara/Barents Seas, the intensity index of the Siberian High and the winter monsoon over East Asia during the winters of 1953-1990 were analyzed using maximum entropy and band-pass filter methods. The sea-ice area variation in winter in the Kara/Barents Seas was compared with the area and intensity indices of the subtropical high in the following spring and summer. These analyses show that there is an obvious decadal variation in the sea-ice-air system in the Northern Hemisphere. And the variations of intensity index of the winter Siberian High and winter monsoon over East Asia are out of phase with that of sea-ice area in winter in the Kara/Barents Seas. The more (less) sea ice there is, the weaker (stronger) the winter Siberian High and winter monsoon are; the variation trend of sea-ice area is similar to that of the area and the intensity of the subtropical high in the coming spring and summer with a lag period of 0-1 year for the latter. The decadal oscillation sources in the atmosphere are closely linked to some sea regions. The center of the strongest
并且海冰变化要超前0～1年；经验正交分析表明大气10年尺度周期性变化的振荡源分布均与某海区（洋区）有关，大气10年尺度变化是对海洋（海冰）变化的响应。
关键词：海冰 10年振荡 振源 副热带高压

李金龙等，1998。半球夏季环流持续性异常及其发展特征，大气科学，22（1）：57-65

利用美国国家气象中心（NMC）的1957－1979年夏季500hPa位势高度场，分析了热带外地区环流持续性异常。夏季持续性环流相当活跃，但异常（≥40m）的持续时间小于一个月。不同地区的持续异常极少能同时存在，主要表现为单独发生。持续异常具有遥相关结果，它们在相当尺度上同冬季遥相关型相似。持续异常建立过程中主要中心强度增长相当快，振幅加倍时间约为2天。持续异常的建立，对最优扰动的发展具有重要作用。
关键词：夏季环流 持续异常 发展过程

吴尚森，梁建芸，1998。南海西沙地区季风季节变化的气候特征。大气科学，22（5）：771-778

利用位于南海中北部的西沙观测站1959－1988年30年常规地面观测资

oscillation source excited by winter sea ice in the Kara/Barents Seas is near 70°E, 60°N.

Keywords: sea ice, decadal oscillation, oscillation source, subtropical high


An analysis of persistent anomalies in the extratropical areas is presented based on the data of 500 hPa potential height of 23 years from 1957 to 1979 from the American National Meteorological Center. Persistent anomalies are considerably active in summer, but the duration of the anomalies larger than 40 m is less than one month. Persistent anomalies in different geographical regions are unlikely to coexist, and their structures are characterized by teleconnection patterns, which resemble those in winter. In the formation process of persistent anomalies, the intensity of main centers of perturbation increases with large growth rates in which the time of doubling intensity is about 2 days. This suggests that optimal perturbations play a crucial role in the development of persistent anomalies.

Keywords: summer current, persistent anomaly, developing process


In this study, the 30-year (1959-1989) conventional surface observations and the 9-year (1980-1988) radiosonde data at Xisha station
Located in the mid-northern part of the South China Sea were used to analyze the annual evolution of the summer monsoon at Xisha. The analyzed results show that the southwest wind (or south wind) at Xisha prevails in the middle of May, the convection and cloud amount increase suddenly at the same moment, and rainfall increases greatly in early June. Using the monsoon indices 1 and 2 proposed by us, the annual evolution of the summer monsoon can be divided into three phases: The southeast monsoon phase (from early April to early May), the southwest monsoon prevailing phase (from mid-May to early September), and the ending phase (from mid-September to early October). These phases are associated with both the seasonal precipitation variations in Guangdong and the annual evolution of atmospheric circulation over the South China Sea.

Keywords: Xisha area, monsoon, seasonal evolution, climatic characteristics

Historical Climate


One series of temperature indexes and two series of flood/drought data in the north and south of Jiangsu Province are available for the period 600 to 1,800 a. The authors studied the variation of temperature and precipitation during the last 2000 years and the most recent hundred years, respectively. The general tendency is presented.

Keywords: Jiangsu Province, last 2000 years, climatic change
2018

张德二，陈永林。1998。由我国历史
飞蝗北界记录得到的古气候推断，第
四纪研究，1998(1): 12-19

本文利用我国古代有关飞蝗的文献记
录，研究了我国古气候特征。推断出
飞蝗发生在我国北纬41°以北
地区的年份的气温条件，指出1162～
1177年、1265～1280年和1763～1773年是我
国东北地区气候温暖的时段。
关键词：飞蝗 历史气候记录
古气候推断

Man Zhimin。1998。Climate in the Tang Dynasty
of China: Discussion of its evidence. Quaternary

Based on data from the historical record, the
author discusses evidence of warm and cold
periods during the Tang Dynasty. According to
records, there is no firm evidence of a warm
period. The cold period can be divided into two
parts: the climate before the middle of the 8th
century is not markedly different from now, and in
the period of the Tang Dynasty after the middle of
the 8th century, the climate was cold.

Keywords: historical climate, climate change,
climate in Sui-Tang period

1999

马志敏，1998。关于唐代气候冷暖问
题的讨论，第四纪研究，
(1): 20-30

本文根据历史资料讨论了唐代气候冷
暖两方面的证据。从资料看，唐代
气候温暖的证据难以确定相应的气候
因子。但其冷期可分为两大阶段，8
世纪50年代以前大体与现代相差不
大，8世纪60年代以后气候变冷，某些
时段寒冷的特征可与明清小冰期相似。
关键词：历史气候 气候变化
隋唐气候

吴宏枝，吴安荣，1998。隋唐时期气
候冷暖特征与气候波动，第四纪研究
(1): 31-38

本文根据物候、动物分布、孢粉、雪
线和海平面等相关资料，对隋唐

Wu Hongqi and Dang Anrong。1998。
Fluctuation and characteristics of climate change
in temperature of the Sui-Tang times in China.
Quaternary Sciences (1):31-38.

Based on relevant materials, such as phonological
phenomena, distribution of animals, spore and
pollen, snow line, and sea level, the authors
1998


Through the discussion of the changes of litchi distribution in the upper reaches of the Yangtze River, the author concludes that the northern boundary of litchi distribution has been moving slowly to the south of China. This indicates that the cold weather of the 12th century was the coldest period during the recent 2,000 years. The 1170s were the coldest period of these times in the upper reaches of Yangtze River.

Keywords: upper reaches of the Yangtze River, litchi, northern boundary of litchi growing


According to analysis of the records of drought, flood, and the extreme low temperature in the Liao Historical Book, the author studied the climatic characteristics in the North Yanshan Mountain Region in the Liao Dynasty. The results show that in the earlier periods of that time the climate was drier and in the middle and late periods of that time, the climate was mainly wet.

Keywords: Liao Dynasty, North Yanshan Mountain Region, climatic series
王绍武等，1998. 中国小冰期的气候，第四纪研究，(1): 54-63

本文在建立了近百年中国10个区的年平均气温序列的基础上，利用史料、冰芯记录及年轮年轮，重建了各区近400-1000年的10年平均气温序列。分析表明，近千年来看中国可能有5次冷期分别出现于1100s-1150s，1300s-1390s，1450s-1510s，1560s-1690s及1790s-1890s。

关键词：小冰期 气候变化


Based on the construction of an annual temperature series of the past 100 years for each of 10 regions of China, a mean temperature series of 400-1000 years for each region is reconstructed using data of historical records, ice-core records, and tree-ring records. Results of analysis show that there are five cold periods for the recent 1000 years. They are 1100s-1150s, 1300s-1390s, 1450s-1510s, 1560s-1690s and 1790s-1890s.

Keywords: Little Ice Age, climate change

李平日，曾昭璇，1998. 珠江三角洲五百年来的气候与环境变化，第四纪研究，(1): 65-70

本文根据史籍资料和香港近五百年间的气温记录，探讨了珠江三角洲1488-1893年的小冰期及其后进入现代暖期的气候变化。作者认为珠江三角洲的小冰期开始于1488年，结束于1893年。另外，作者还预测了下世纪全球变暖、海平面上升对珠江三角洲的影响。

关键词：珠江三角洲 气候与环境变化

Li Pingri and Zeng Zhaoxuan. 1998. On the climatic and environmental changes in the Pearl River Delta during the last 500 years. Quaternary Sciences (1):65-70.

The characteristics of climatic changes of the Little Ice Age in 1488-1893 and recent warm period are discussed in the paper based on the historical data of occurrences of frosty weather in the Pearl River Delta during the last 500 years. The authors recognize that the Little Ice Age began in 1488 and ended in 1893 in the Pearl River Delta. The authors also forecast the possible effects on Pearl River Delta caused by global warming and a rise in sea level.

Keywords: the Pearl River Delta, climatic and environmental change

王守春，1998. 塔里木盆地三大遗址群的兴衰与环境变化，第四纪研究，(1): 71-79

本文研究了塔里木盆地中的三大遗址群的兴起、兴盛和发展，以及废弃。作者认为，气候变化是导致它


The occurrence, development, flourishing, and abandonment of three ruins groups in the Tarim Basin are studied in the paper. The author believes that climatic changes caused the abandonment of
the ruins groups. Therefore, global change of climate induced the variation of water sources, with little connection to the human factors.

Keywords: Loulan Ruins, Niya Ruins, Keria Ruins, environmental change


The evolution and existence of human beings are closely related to global environmental change. Human beings evolved from nature and continue to exist by adapting to it. But excessive consumption of the environment can cause serious environmental problems and lead to disasters for mankind, such as migration, war, and social upheaval. Modern humans should enter a new stage: humans in harmony with the nature.

Keywords: mankind, environment


The energy mechanisms for glacier fluctuation in the Qilian Mountains are discussed. It is found that the mass equilibrium line altitude (ELA) has linear correlation with climate change. A model is developed to study and forecast the ELA. From this model, the ELA response to climatic factors under different future climatic scenarios can be obtained. The future effects of climate change on mass balance are also forecasted.

Keywords: glacier variation, climate change, response

Impact
刘时银等，1998，天山乌鲁木齐河
源1号冰川物质平衡对气候变化的敏
感性研究，冰川冻土，20(1):9-13

本文应用度日物质平衡模式对天山
乌鲁木齐河源1号冰川物质平衡对气
候变化的敏感性进行了研究。结果
表明，乌鲁木齐河源1号冰川物质平
衡对气候变化的敏感性要小于海洋
冰川。此外，气温与降水在物质平
衡形成过程中的作用是不同的，气
温引起物质平衡剖面以旋转方式变
化，而降水可导致其平移方式的响
应。
关键词：1号冰川 物质平衡
平衡线高度 敏感性

Liu Shiyin et al. 1998. Mass balance sensitivity to
climate change of Glacier No. 1 at the Urumqi
River Head, Tianshan Mountains. Journal of

A degree-day mass balance model is applied to the
sensitivity test of mass balance/equilibrium line
altitude (ELA) to detect climate change of Glacier
No. 1 at the Urumqi River Head, Tianshan
Mountains. Results demonstrate that the mass
balance of Glacier No. 1 is less sensitive than that
of a maritime type glacier. In addition, air
temperature and precipitation play different roles
in mass balance (i.e., elevation-dependent mass
balance follows the temperature variation by
means of rotation against the elevation axis and it
shifts parallel to precipitation change).

Keywords: Glacier No. 1 at the Urumqi River
Head, mass balance, equilibrium line altitude
(ELA), sensitivity

王宁练等，1998，近1500年来古里
雅冰芯中NO$_3^-$浓度变化及其环
境意义，冰川冻土，20(1):14-20

本文研究了近1500年来古里雅冰芯中
浓度变化及其环境意义。作者认
为太阳活动、平流层NO氧化和陆源
gas是NO$_3^-$的主要来源。其中太
阳活动是古里雅冰芯中NO$_3^-$浓度
变化的主要控制因子，两者的长期
变化趋势呈现明显的正相关关系。
关键词：古里雅冰芯 NO$_3^-$浓度
太阳活动

Wang Ninglian et al. 1998. Variation and
environmental implication of nitrate concentration
in the Guliya ice core in the recent 1,500 years.
Journal of Glaciology and Geocryology

The variation and environmental implications of
nitrate concentration in the Guliya ice core in the
recent 1,500 years are studied in the paper. Solar-
induced oxidation of nitrous oxide in the
stratosphere and continental air mass is found to
be the major source of NO$_3^-$ in the Guliya ice
core. And solar activity is a major factor in
controlling the variation of NO$_3^-$ concentration
in the ice core. The secular variation of solar activity
and NO$_3^-$ concentration show a remarkable
positive correlation.

Keywords: Guliya ice core, NO$_3^-$ concentration,
solar activity

Palynological evidence of ecological environmental change since 240 ka BP for Tianshuihai Lake in the West Kunlun Mountains is discussed. Analysis indicates that alpine desert vegetation has been dominant since 240 ka BP in this region, but there have been several fluctuations of *Artemisia*, the main component of the steppe environment, reflecting that there have been several warmer and wetter intervals under the cold and dry climate background. According to the changes of pollen type and the ratio of *Artemisia* and Chenopodiaceae (A/C), the pollen record can be divided into 10 zones, showing 10 climatic fluctuations and an ecological environmental fragility in this area.

Keywords: ecological environment, pollen record, Tianshuihai Lake, West Kunlun Mountains


The Rongbuk Glacier was investigated and its terminus location was measured by means of global positioning system (GPS) techniques. Comparison of the 1997 and 1996 measurements shows that in the past 30 years the glacier has retreated 170-270 m, equivalent to a retreat speed of 5.5 to 8.7 m/a. This suggests that the climate in the region has mainly been warming since the early part of this century and that the glacier will continue retreating.

Keywords: glacier retreat, climatic warming, Mt. Qomolangma

Based on a background of systematic analyses and discussions on global climatic changes, the major achievements in research on the climatic changes in China in recent decades, especially in recent years, are described comprehensively. The future probable changes of climate pattern in China are outlined according to general, scattered, and sometimes even contradictory, research information. The effects of climatic changes on forest ecosystems and on aspects of Net Primary Productivity (NPP), geographical distribution, systematic structure, biodiversity, ecotope, and special habitats of forest ecosystems are analyzed. At the same time, the present situation, main results, and future developmental tendency of the research field on the effects of climatic changes are discussed, and the key problems that should be emphasized are pointed out. Finally, research strategy and approaches to resolve the problems are proposed for future improvement of research on climatic changes and their effects on China.

Keywords: climatic change, forest ecosystem, research strategy


The possible impacts of climate warming on rice production in China are studied using numerical experiments with the rice simulation model (ORYZA1) based on climate change scenarios projected from global climate models (GCMs) [Geophysical Fluid Dynamics Laboratory (GFDL), United Kingdom Meteorological Office (UKMO), and Max Planck Institute (MPI)]. A stochastic weather generator is used to make the projected climatic change scenarios suitable for input of ORYZA1. The results show that when CO₂ concentration in the atmosphere is doubled, the duration of the rice growing season would be lengthened for 6 to 11 days and the accumulated temperature would increase by about 2.20 to
The possibility of cool injury in the rice yield forming period would decrease whereas that of heat stress would increase. Rice yield would decrease if cultivars and farming practices remain unchanged. However, if the date of rice development stages could be maintained unchanged through variety adjustment, the rice yield in most areas would decrease, and the decrements would be considerably less than if cultivars and farming practices were unchanged.

Keywords: crop model, stochastic weather generator, GCMs, climate warming, rice production


The temperature variations during the crop growth period of the last 90 years at Changchun Station were analyzed by means of power spectrum, wavelets, and abrupt change methods. Results show that there are very low frequency of (VLF) oscillations about 3 years and, long periods of about 15 years and 60 years. In the Song-Liao Plain, from the early 1950s to the end of 1970s, was a cold period, then since the end of 1970s, is a warm period again. The warm period at present will persist to about 2010. The periodic variation of the temperature was discovered with the abrupt change method. The cold or warm periods are the same as those from the results of the wavelet analysis. In the crop growth period the abrupt changes took place. At present the temperature has a rising tendency.

Keywords: Song-Liao Plain, crop growth period, temperature variations, wavelet analysis

The objective of this study is the simulated global moisture condition at 6000 years BP. The purpose of the simulation is to verify that changes in insolation influence large-scale climatic systems. The observations used are lake-status records reconstructed from the various geologic evidence. In fact, the lake-level change reflects the variations of moisture conditions, particularly the effective precipitation (precipitation minus evaporation) within the lake basin. The results show that all the experiments can reproduce the wetter conditions in African and Asian monsoon areas, thereby confirming the hypothesis that the enhancement of the Afro-Asian monsoon is induced by seasonal changes of solar radiation. But all experiments fail to produce a broader and more intense monsoon enhancement compared with geologic records.

Keywords: 6000 years BP, global moisture conditions, model experiments, lake status records, comparison study


In this paper, the major tree-ring chronology (1750-1992) in Yishan, Shandong Province, was analyzed by running the program ARSTAN. The resulting analyses of tree-ring and climate data indicate that tree-ring growth in the Yishan Mountains is nonlinear correlated with precipitation and temperature. It is unreasonable to reconstruct climatic variables separately using traditional methods. The reconstructed moisture index (P/T) during May to August, in which both temperature and precipitation influence the tree-
为重建对象，该湿润指数值代表了温度和降水对树轮生长的共同影响，且相关性高，远超过信度检验。利用线性回归方法，获得重建湿润指数的预报方程，用树木年轮表重建了自1750年以来的沂山地区逐年5月-8月湿润指数变化。

关键词：沂山 树轮 湿润指数 气候重建


The variations of sea ice in the Arctic Ocean from 1966 to 1991 are simulated using an Arctic Ocean circulation and thermodynamic sea ice model developed by Yu Rucong et al. in 1995. The model is run with boundary conditions from observed monthly sea surface temperature, air temperature, and pressure. Analyses focus on the simulation of sea ice in the Barents and Greenland seas where the fluctuations of sea ice are more significant than in other regions. The results indicate that (1) the simulation of sea ice in the Barents Sea is successful, reflecting not only the interannual variability during 1969 to 1987 but also two extreme events (i.e., sea ice is extremely heavy in 1979 and extremely light in 1984) which are in good agreement with observation; (2) the simulation of annual variability of sea ice in the Greenland Sea is not consistent with observation; (3) both the observed and simulated sea-ice seasonal cycle in the Barents and Greenland seas lag behind the seasonal cycle of surface air temperature, but the lag time of the latter is more significant.

Keywords: Arctic Ocean, thermodynamic sea-ice model, Barents Sea, Greenland Sea

Using data of magnetic measurements of sediments from Lake Changhu, the authors studied the relationship between magnetic parameter changes and climatic changes in the Changhu area according to chemical analysis and spore-pollen analysis. The study shows that the tendency of the climatic changes is from cold to warm in the Jianghan Plain in recent 400 years.

Keywords: lake sediment, magnetic measurements, climatic change


The characteristics of contemporary climatic change over the Qinghai-Xizang Plateau are analyzed on the basis of monthly temperature and precipitation data for 30 years. The response of the plateau climate to the global warming is discussed in combination with global climate model (GCM)-simulated output. Results show that the plateau climate has been warming and precipitation change has been increasing in the recent 30 years and that these climatic trends seem to be related to the enhanced greenhouse effect induced by increasing CO₂ concentration in the atmosphere.

Keywords: Qinghai-Xizang Plateau, climatic change, greenhouse effect

This paper analyzes the relationship between global warming and the carbon cycle in the Arctic terrestrial ecosystems. It points out that atmospheric carbon dioxide and methane concentrations increased markedly during the past few centuries and caused the global warming. Analyses show that the Arctic is a huge organic carbon pool and a sink of atmospheric carbon dioxide. The global rise of air-temperature resulting from an increase in atmospheric carbon dioxide would influence markedly Arctic soil carbon and the carbon dioxide source/sink relationship of the ecosystems.

Keywords: Arctic terrestrial ecosystem, carbon cycle, global warming, CO₂, soil carbon pool


The study of methane (CH₄) fluxes of Huashixia in the Tibetan Plateau indicates that intra-site and inter-ecosystem variations of the CH₄ fluxes were very strong. Ecosystems in the studied region can be roughly divided into four groups. The CH₄ fluxes from alpine wetlands on the Tibetan Plateau are 1 Tg/year.

Keywords: Tibetan Plateau, alpine wetlands, methane emission, transect study

Nitrous oxide (N$_2$O) fluxes from a maize field were measured systematically in situ for a whole year using a closed chamber technique. The results show that N$_2$O emission has significant seasonal variation and mainly occurs during the growing stage of the crop. In addition, the maize plant can stimulate N$_2$O production through the function of its root in soil. Compared with urea and ammonium bicarbonate, slow-releasing ammonium bicarbonate (ammonium bicarbonate + dicyandiamide) and slow-releasing urea (urea + hydroquinone + dicyandiamide) can not only reduce N$_2$O emission in a maize field but also cause an increase of maize yield of 14%.

Keywords: maize field, N$_2$O emission, mitigation measures


The principle, structure and procedure of an automated system for the measurement of NO emission from croplands is described in detail. Some experimental results taken from wheat fields of Southeast China with this automated system are also discussed. In this study, the diurnal variation of NO emission from wheat fields that occurs in late autumn was found to be similar to the diurnal variation of temperature. Meanwhile, a seasonal

The pollen vitality and germination and also seed yield and germination of wheat (Triticum aestivum CV, 80101) and oat (Avena sativa VC Bayaer –3) under supplementary UV-B radiation from an approximately 15% ozone layer depletion were researched. There are sensitivity differences of reproductive characteristics to UV-B radiation between wheat and oat. The seed yield of oat and its germination rate (25°C, in dark) were inhibited significantly by UV-B radiation enhancement, whereas there was no effect of UV-B radiation on the seed yield and germination rate of wheat. The decrease of wheat pollen vitality and germination rate by UV-B radiation enhancement could be compensated for by increasing the numbers of ears per plant under supplementary UV-B radiation. The effects of UV-B radiation are related to metabolic changes of physiologically active compounds in pollen and seed that are connected with their germination.

Keywords: ultraviolet radiation, wheat, oat, pollen, seed germination

Dynamic and static combustion systems, composed of combustion bed; ignition device; electronic balance; temperature- and flow-rate sensors; sampling device; nondispersive infrared (NDIR), flame ionization detection (FID)/DC, electron capture detection/gas chromatography (ECD/GC), and relative percent difference/gas chromatography (RPD/GC) analyzers; datalogger; and computer, were used for the study of biomass combustion emissions. Samples of the above-ground components of typical Chinese tree, shrub, grass, and crop species were collected and burned under flaming and smouldering stages as well as in flowing and closed systems. The emission factors of CO, CO₂, CH₄, COS and emission ratios of CO/CO₂ and CH₄/CO₂ were determined. Meanwhile, a comprehensive investigation on the carbon pool of vegetation in China was performed. The Chinese forest and crop biomass inventory has been established, including the components and layer biomass of 16 main forest types and 4 eco-climatic regions as well as the major crops in China. To reduce statistical uncertainty in biomass estimation, all forests were classified into young, middle-aged, premature, mature, and overmature categories. Based on the vegetation carbon pool inventory and our emission factors, we made a preliminary estimation of the spatial distribution of trace gas emissions from fuelwood, crop residues, and forest fire.

Keywords: biomass burning, forest fire, trace gases, emission factor


Methane (CH₄) emission rates from Chinese rice fields have been measured in all the five major rice culture regions in China. Four types of diurnal variations of CH₄ emission rates have been found. Seasonal variation patterns of CH₄ emission differ slightly in different field locations, where climate system, cropping system, and other factors are
传输效率是日变化形成的主要因素。稻田甲烷土壤中排放率的季节变化形式在不同的地区是不同的，这取决于气温变化、水稻品种、施肥及水管理等不同因素。甲烷产生主要发生在稻田土壤耕层原层（2〜20cm），氧化主要发生在水土交界面的氧化层和根部氧化膜，并受多种因子的影响。土壤中的甲烷通过三个路径向大气排放，不同时期三个路径在甲烷传输中的相对重要性不同。施用化肥和沼泽肥可以降低土壤中甲烷的产生和排放，而有机肥会增加土壤中甲烷的产生和排放。中国的稻田每年向大气中排放9.67〜12.66百万吨甲烷，全球稻田甲烷的总排放量约为35〜56Tg/a。

关键词：甲烷排放 日变化 季节变化 氧化和传输 影响因子

different. CH₄ production mainly occurs in the reduced soil layer (2 to 20 cm). CH₄ is oxidized mainly in the thin surface layer of paddy soil and in the rhizosphere of rice plants. Production and oxidation rates are affected by many factors. CH₄ transport is through rice plant, gas bubble, and diffusion in flooded water. The relative importance of each route is different at different stages during rice growing. The effects of various mineral fertilizers on CH₄ emission were rather contradictory, but the amount and the type of organic manure are shown to enhance CH₄ emission from rice fields, which has been also indicated by CH₄ production rates. Application of fermented sludges from biogas generators and farmyard-stored manure instead of fresh organic manure seems to be promising. China's rice fields contribute about 9.67 to 12.66 Tg/year to the atmosphere. The total methane emission from global rice fields can be estimated as 35 to 56 Tg/year.

Keywords: methane emission, diurnal variation, seasonal variation, oxidation and transport, influence factors


对实际天气条件下北京地区1990年1月至1992年8月太阳辐射观测资料进行了详细的分析，得到了实际天气条件下到达地面的太阳紫外总辐射的计算公式。结果表明，计算值与观测值吻合的比较好。最后，利用此公式计算了北京地区1979年1月至1996年6月的太阳紫外总辐射，并讨论了1979〜1996年北京地区太阳紫外总辐射的变化趋势。

关键词：太阳紫外总辐射 大气臭氧总量 气溶胶


The formula for calculating solar UV radiation at the ground under actual sky conditions is given by using the observation data of solar radiation during the period from January 1990 to August 1992 in the Beijing area. The results show that the calculated values agree well with those observed. This formula is used to calculate the solar UV radiation and discuss its variation trends during 1979-1996 in Beijing.

Keywords: solar UV radiation, total ozone amount, aerosol
扬理权等，1998，火山气溶胶对北京大气臭氧总量变化趋势的影响，大气科学，22（5）：686-692


关键词 臭氧 气溶胶 北京


Ozone change trends for the period 1979-1995, column aerosol optical depth for the period 1980-1994, and the stratospheric aerosol optical depth for the periods of 1981-1985 and 1990-1994 over Beijing are analyzed using ozone data measured with Dobson and aerosol optical depth data with a photometer. The results show that the ozone yearly change rate over Beijing is -0.269% from 1979-1995 and reaches up to -0.954% and -1.439% for the periods of 1982-1985 and 1991-1994 respectively, which means that the eruptions of El Chichon and Pinatubo volcanoes have important effects on decreases in total ozone amount.

Keywords: ozone, aerosol, Beijing

白建辉等，1998，森林排放非甲烷碳氢化合物的初步研究，大气科学，22（3）：247-251

1995年6月至1996年4月，在广东肇庆鼎湖自然保护区每两周采样一次，利用0.8L不锈钢采样和气相色谱法分析，研究森林排放的非甲烷碳氢化合物的浓度。结果表明，森林排放的异戊二烯有明显的季节变化，其浓度与温度有明显的正相关关系。

关键词： 森林 非甲烷碳氢化合物 异戊二烯 气温


We used 0.8 L stainless steel flasks for air sampling twice weekly from June 1995 to April 1996 and gas chromatograph-flame ionization detector (GC-FID) to analyze the concentrations of nonmethane hydrocarbons (NMHC) in the Dinghushan Mountain biosphere protection zone, Zhaoqing City, Guangdong Province. The results show that the concentration of isoprene emission from the forest has an evident seasonal variation and a positive correlation with air temperature.

Keywords: forest, nonmethane hydrocarbon, isoprene, air temperature

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This study examines the linear trend and the periodic variation of the zonal mean total ozone over 60°S-60°N, based on global TOMS (Total Ozone Mapping Spectrometer) data for the period Nov. 1978-April 1993 after correcting for the annual variation. The results show that since the end of the 1970s, total ozone decreased at all latitudes with larger trends at higher latitudes, whereas the trend of ozone change in the Northern Hemisphere is greater than that in the Southern Hemisphere of the same latitude. Meanwhile, it is discovered that quasi-biennial oscillation is the most significant factor in the changes of ozone correcting for the annual variation. Also teleconnection analysis for the quasi-biennial oscillation has been done, and the result shows that zonal distribution and equatorial symmetry in intensity and phase are the main characteristics of quasi-biennial oscillation in the changes of ozone.

Keywords: global ozone, trend of change, quasi-biennial oscillation
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