NDP-003/R1

CDIC NUMERIC DATA COLLECTION

Global Surface Air Temperature Variations: 1851-1984

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^{*}Sponsored by the Carbon Dioxide Research Division (CDRD), Office of Basic Energy Sciences (BES), Office of Energy Research, U.S. Department of Energy.

GLOBAL SURFACE AIR TEMPERATURE VARIATIONS:
1851 - 1984

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**CDIC NUMERIC DATA PACKAGE
ABSTRACT**

1. NUMERIC DATA PACKAGE NAME

NDP-003/R1: Global Surface Air Temperature Variations:
1851-1984.

2. CONTRIBUTORS

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3. CITATION OF THE PACKAGE

The Carbon Dioxide Information Center (CDIC) recommends the following citation for those citing or referencing this package:

Jones, P.D., S.C.B. Raper, T.M.L. Wigley, P.M. Kelly, R.S. Bradley, and H.F. Diaz. 1986. Global surface air temperature variations: 1851-1984. NDP-003/R1, Carbon Dioxide Information Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

4. BACKGROUND INFORMATION

Many attempts have been made to combine station surface air temperature data into an average for the Northern Hemisphere. Fewer attempts have been made for the Southern Hemisphere because of the unavailability of data from the Antarctic mainland before the 1950s and the uncertainty of making a hemispheric estimate based solely on land-based analyses for a hemisphere that is 80% ocean. Past estimates have been based largely on data from the World Weather Records (Smithsonian Institution, 1927, 1935, 1947, and U.S. Weather Bureau, 1959-82) and have been made without considerable effort to detect and correct station inhomogeneities. Better estimates for the Southern Hemisphere

are now possible because of the availability of 30 years of climatological data from Antarctica. The mean monthly surface air temperature anomalies presented in this package for the Northern and Southern Hemisphere serve as more reliable estimates than those previously published because of the incorporation of data previously hidden away in archives and the analysis of station homogeneity before estimation.

5. SOURCE AND SCOPE OF THE DATA

Monthly mean surface air temperature variations for the Northern and Southern Hemispheres are presented based on land-based meteorological station data and fixed-position weather ship data (World Weather Records, Smithsonian Institution, 1927, 1935, 1947, and U.S. Weather Bureau, 1959-82). The Northern Hemisphere record extends from 1851-1984 and the Southern Hemisphere record from 1858-1984. These anomalies are derived from grid point temperature estimates that have been made by interpolating onto a 5° latitude by 10° longitude grid for each month of the 134 year record. The averaging period used for calculating the hemispheric monthly anomalies is 1951-1970, the period with the best coverage. Station data have been analyzed to assess their homogeneity and only reliable or corrected station data have been used in calculating area averages.

For the Northern Hemisphere (north of 2.5°S), 1584 records (i.e., those for which the 1951-70 reference period means could be calculated), of which 509 commence before 1900, were used to determine the mean monthly anomalies. For the Southern Hemisphere, 293 stations were found to be usable after review of the station histories. Greater detail on the detection and correction of station inhomogeneities is provided in the pertinent literature at the back of this document (pg. 17).

The annual mean Northern Hemisphere temperature series shows a slight cooling between the late 1870s and the late 1880s. The decades of the 1880s and 1890s are the coldest of the entire record. Rapid warming occurred around 1920 culminating in the warmest trend in the late 1930s. Mean temperatures for the period 1921-1984 are approximately 0.4°C warmer than those prevailing over the period 1851-1920. Year-to-year estimates for the Northern Hemisphere are considered reliable back to about 1875 and earlier estimates can indicate trends back to 1851.

The annual mean Southern Hemisphere temperature series shows fairly steady warming since the last century, except for the interval between the late 1930s and the mid 1970s. Over the period 1881-1984 the linear trend amounts to 0.49°C . Year-to-year estimates for the Southern Hemisphere are considered reliable back to about 1890 and earlier estimates can indicate trends back to the 1860s.

6. APPLICATIONS OF THE DATA

Long-term chronologies of temperature anomalies such as these provide an important source for checking the predictions of

theories linking increased carbon dioxide concentrations to climate changes and global warming trends. These mean surface air temperature anomalies for the Northern and Southern Hemisphere serve as a basis for comparison to other attempts to estimate hemispheric mean anomalies, such as those based on marine data, and represent variations not influenced by station inhomogeneities. By correcting for station inhomogeneities, these anomalies reflect the degree of influence inhomogeneities can have on hemispheric anomaly estimates. By calculating anomaly estimates for both hemispheres, one can determine whether the general belief that northern latitude trends are indicative of global trends is a valid assumption.

7. LIMITATIONS AND RESTRICTIONS OF THE DATA

One major problem in trying to determine long-term anomalies is the lack of a spatially-distributed station network during the 1800s. Estimates before 1900 are based on fewer stations and for the Northern Hemisphere are based mainly on midlatitude (35° - 60° N) data. Fortunately, the station temperature network has expanded significantly since the nineteenth century. Presently, most of the land surface of the Northern Hemisphere is covered and in the period of best coverage, 58% of the area for the Northern Hemisphere is covered by the station network. The addition of data from Antarctica since 1957 has considerably expanded the coverage of the Southern Hemisphere. The land averages for the Southern Hemisphere represent, at best, 32% of the hemisphere with the remaining area being mainly ocean too far from land-based stations to warrant extrapolation. Despite considerable effort to correct station inhomogeneities, there may be small residual data inhomogeneities in the individual datasets. However, the significance of these to the monthly hemispheric estimates is minimized by the gridding method used.

8. CONTENTS OF THE PACKAGE

This package contains Northern and Southern Hemisphere mean monthly temperature variations for 1851-1984 and 1858-1984, respectively, along with pertinent literature (a) discussing the data. Magnetic tapes are available that include a descriptive file (page 7), a FORTRAN retrieval program to read and list the data (page 8), Northern Hemisphere variations, and Southern Hemisphere variations. Each data file contains three variables; year (IYEAR), monthly anomalies in degrees Celsius (ANOM), and the annual anomaly in degrees Celsius (ANN). The data files are formatted as follows:

```
      READ(UNIT,10)IYEAR(I),(ANOM(I),I=1,12),ANN
10    FORMAT(I4,1X,12(F5.2),F5.2)
```

a. Literature included in the package:

Jones, P.D., S.C.B. Raper, R.S. Bradley, H.F. Diaz, P.M. Kelly,
and T.M.L. Wigley. 1986. Northern Hemisphere surface air

temperature variations: 1851-1984. Journal of Climate and Applied Meteorology 25(2): 161-179.

Jones, P.D., S.C.B. Raper, and T.M.L. Wigley. 1986. Southern Hemisphere surface air temperature variations: 1851-1984. Journal of Climate and Applied Meteorology 25(9): 1213-1230.

b. Background information:

Bradley, R.S., and P.D. Jones. 1985. Data bases for detecting CO₂-induced climatic change. In Detecting the Climatic Effects of Increasing Carbon Dioxide. DOE/ER-0235, United States Department of Energy, Carbon Dioxide Research Division, Washington, DC.

Folland, C.K., D.E. Parker, and F.E. Kates. 1984. Worldwide marine temperature fluctuations, 1856-1981. Nature 310: 670-673.

Hansen, J.E., D. Johnson, A. Lacis, S. Lebedeff, P. Lee, D. Rind, and G. Russell. 1981. Climatic impact of increasing atmospheric carbon dioxide. Science 213:957-966.

Jones, P.D., T.M.L. Wigley, and P.M. Kelly. 1982. Variations in surface air temperatures: Part 1. Northern Hemisphere, 1881-1980. Monthly Weather Review 110(2):59-70.

Jones, P.D., S.C.B. Raper, B. Santer, B.S.G. Cherry, C. Goodess, P.M. Kelly, T.M.L. Wigley, R.S. Bradley, and H.F. Diaz. 1985. A grid point surface air temperature data set for the Northern Hemisphere. TR022, United States Department of Energy, Carbon Dioxide Research Division, Washington, DC.

Jones, P.D., S.C.B. Raper, C. Goodess, B.S.G. Cherry, and T.M.L. Wigley. 1986. A grid point surface air temperature data set for the Southern Hemisphere. TR027, United States Department of Energy, Carbon Dioxide Research Division, Washington, DC.

Smithsonian Institution, 1927, 1935, 1947. World Weather Records, Smithsonian Inst. Miscellaneous Collections, Vols. 79, 90, and 104. Smithsonian Institute, Washington, DC.

U.S. Weather Bureau. 1959-1982. World Weather Records, 1941-50, 1951-60 (Vols.1-6), 1961-1970 (Vols. 1-6). U.S. Department of Commerce, Washington, DC.

Wigley, T.M.L., and P.D. Jones. 1981. Detecting CO₂-induced Climate Change. Nature 292:205-208.

Wigley, T.M.L., J.K. Angell, and P.D. Jones. 1985. Analysis of the temperature record. 55-90. In Detecting the Climatic Effects of Increasing Carbon Dioxide. DOE/ER-0235, United States Department of Energy, Carbon Dioxide Research Division, Washington, DC.

9. KEYWORDS

TEMPERATURE ANOMALIES, NORTHERN HEMISPHERE, SOUTHERN HEMISPHERE, CLIMATIC CHANGE.

10. HOW TO OBTAIN THE PACKAGE

This document contains listings of the mean monthly and annual surface air temperature anomalies for the Northern (1851-1984) and Southern (1858-1984) hemispheres for those who may not need computerized data. Computerized data are available on 9-track, magnetic tapes from CDIC. Requests for magnetic tapes should include any specific instructions for transmitting the data required by the user to access the data. Requests should be addressed to the:

Carbon Dioxide Information Center
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37831-6050
Telephone (615) 574-0390
FTS 624-0390

11. DATE OF ABSTRACT

November 1986

Each numeric data package (NDP) assembled by CDIC goes through a process of assuring the quality of the data. This process includes review(s) by the contributors of the data to ensure that, in compiling the data, CDIC does not misrepresent or inaccurately describe the data. NDPs are not distributed without the written consent of the contributors.

MAGNETIC TAPE CONTENTS

Description	Mode	Logical Records	Record Format	Block Size	Record Length
1. General Descriptive Information File	EBCDIC	65	FB	8000	80
2. FORTRAN IV Data Retrieval Code	EBCDIC	15	FB	8000	80
3. Northern Hemisphere Mean Monthly and Annual Surface Air Temperature Variations: 1851-1984	EBCDIC	134	FB	8000	80
4. Southern Hemisphere (2.5° - 62.5° S) Mean Monthly and Annual Surface Air Temperature Variations: 1858-1984	EBCDIC	127	FB	8000	80
5. Southern Hemisphere Mean Monthly and Annual Surface Air Temperature Variations: 1957-1984 (2.5° - 90°S)	EBCDIC	27	FB	8000	80

Total Records 368

MAGNETIC TAPE DESCRIPTIVE FILE

DATASET TITLE: NDP-003/R1: Global Surface Air Temperature
Variations: 1851-1984

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SCOPE OF THE DATA: Monthly mean surface air temperature variations for the Northern (1851-1984) and Southern (1858-1984) Hemispheres are presented. These variations are based on grid point temperature estimates that have been made by interpolating onto a 5 degree latitude by 10 degree longitude grid for each month of the 134 year record. The grid point temperature estimates are derived from land-based meteorological station data and fixed-position weather ship data. A unique feature of this data is the fact that station inhomogeneities have been analyzed and only reliable or corrected station data have been used in estimating the monthly anomalies.

DATA FORMAT: Three data files are provided on the tape (Files 3, 4, and 5) which contain the Northern Hemisphere variations (1851-1984), the Southern Hemisphere variations (2.5°-62.5°S, 1858-1984), and the Southern Hemisphere variations using the Antarctica data (2.5°-90°S, 1957-1984). All anomalies are expressed in degrees Celsius and are calculated with respect to a 1951-1970 reference period mean. The data files contain three variables: year (IYEAR), monthly anomalies (ANOM), and annual anomalies (ANN). The files are formatted as:

```
10      READ (UNIT,10) IYEAR(I), (ANOM(I), I=1,12), ANN  
      FORMAT(I4,1X,12F5.2), F5.2)
```

REFERENCES

- Jones, P.D., S.C.B. Raper, R.S. Bradley, H.F. Diaz, P.M. Kelly, and T.M.L. Wigley. 1986. Northern Hemisphere surface air temperature variations: 1851-1984. Journal of Climate and Applied Meteorology 25(2): 161-179.
- Jones, P.D., S.C.B. Raper, and T.M.L. Wigley. 1986. Southern Hemisphere surface air temperature variations: 1851-1984. Journal of Climate and Applied Meteorology 25(9): 1213-1230.

FORTRAN IV Data Retrieval Program Listing

```
C  FORTRAN DATA RETRIEVAL PROGRAM TO READ AND PRINT
C  THE SOUTHERN OR NORTHERN SURFACE AIR TEMPERATURE
C  DATA FILES (FILES 3, 4, AND 5 ON THE MAGNETIC
C  TAPE
      DIMENSION IYEAR(134),ANOM(134,12)
      WRITE(6,5)
5     FORMAT(1H0,'YEAR',4X,'JAN',4X,'FEB',4X,'MAR',4X,'APR',4X,'MAY',
1     4X,'JUN',4X,'JUL',4X,'AUG',3X,'SEPT',3X,'OCT',4X,'NOV',4X,'DEC',
2     3X,'ANNUAL',/1H0)
      DO 999 J=1,134
      READ(5,10) IYEAR(J),(ANOM(J,I),I=1,12),ANN
10     FORMAT(I4,1X,12(F5.2),F5.2)
      WRITE(6,15) IYEAR(J),(ANOM(J,I),I=1,12),ANN
15     FORMAT(1X,I4,2X,12(F5.2,2X),F5.2)
999   CONTINUE
      STOP
      END
```

TABLE 1. Mean monthly and annual surface air temperature variations for the Northern Hemisphere. The variations are from the 1951-1970 reference period mean and are expressed in degrees Celsius.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1851	0.58	0.44	-0.62	-0.55	-0.30	-0.14	-0.11	0.04	0.10	0.28	-0.36	-0.36	-0.08
1852	-0.24	-0.20	-0.66	-1.78	0.08	-0.05	0.16	-0.14	-0.26	-0.54	-0.85	1.34	-0.26
1853	0.58	-0.37	-0.70	-0.91	-0.18	0.10	0.38	0.34	-0.19	-0.15	-0.53	-0.95	-0.22
1854	-0.72	-0.15	0.25	-0.63	0.30	-0.37	0.73	0.28	-0.03	0.43	-0.61	0.58	0.01
1855	-0.31	-1.36	-0.29	0.20	0.25	0.01	0.22	-0.04	-0.61	-0.13	-0.66	-1.99	-0.39
1856	0.27	-0.55	-1.26	-0.40	-0.40	0.47	0.04	-0.32	-0.54	-0.83	-1.61	0.05	-0.42
1857	-0.91	-0.12	0.01	-1.05	-0.92	-0.34	-0.13	0.19	-0.53	-0.38	-0.82	0.77	-0.35
1858	-0.25	-1.29	-0.62	0.0	-0.07	0.61	0.26	-0.28	-0.13	0.23	-1.40	-0.35	-0.27
1859	0.21	0.89	0.64	0.18	0.14	0.13	0.18	0.06	-0.45	-0.12	-0.05	-0.91	0.08
1860	0.09	-0.83	-1.39	-0.30	-0.02	0.04	-0.32	-0.04	-0.10	-0.33	-1.30	-2.11	-0.55
1861	-2.50	0.45	0.66	-0.93	-0.83	0.09	0.38	0.44	-0.19	-0.33	-0.30	-0.48	-0.30
1862	-1.77	-1.56	-0.19	-0.02	-0.08	-0.44	-0.18	-0.58	-0.34	-0.44	-1.37	-1.86	-0.74
1863	1.91	0.88	0.62	-0.05	0.35	-0.30	-0.14	0.09	0.15	-0.29	0.02	-0.31	0.24
1864	-1.62	0.11	0.50	-0.59	-0.54	0.51	0.0	-0.28	0.52	-1.32	-1.37	-1.70	-0.57
1865	0.57	-1.40	-1.13	-0.23	0.33	-0.06	0.50	-0.19	0.33	-0.48	0.21	-0.66	-0.19
1866	0.78	-0.15	-0.43	0.05	-0.74	0.14	0.23	-0.33	0.21	-1.09	-0.59	-0.01	-0.16
1867	-0.66	0.73	-1.15	-0.08	-1.24	-0.31	-0.46	-0.35	-0.23	-0.23	-0.58	-1.13	-0.47
1868	-1.15	-0.83	0.10	-0.28	0.52	0.32	0.72	0.41	-0.20	-0.10	-1.13	0.29	-0.11
1869	-0.21	1.71	-0.56	-0.12	0.06	0.11	0.44	0.37	0.36	-0.70	-0.49	-0.47	0.04
1870	0.09	-1.44	-0.56	-0.28	0.62	0.48	0.64	-0.22	-0.37	-0.83	-0.06	-2.18	-0.34
1871	-1.20	-1.39	0.66	0.06	-0.63	-0.35	0.27	0.31	-0.71	-0.53	-1.10	-1.34	-0.50
1872	-0.33	-0.51	-0.08	0.36	0.48	0.08	0.33	0.30	0.01	-0.20	-0.45	-0.65	-0.05
1873	0.20	-0.20	-0.04	-0.94	-0.62	0.13	0.28	0.17	-0.53	-0.50	-0.58	0.17	-0.21
1874	0.66	0.06	-0.49	-0.20	-0.29	0.18	0.25	-0.10	0.21	-0.17	-0.58	-0.15	-0.05
1875	-1.23	-1.66	-1.30	-1.00	0.06	0.40	-0.09	-0.09	-0.68	-0.88	-1.25	-1.08	-0.73
1876	-0.16	0.21	-0.10	-0.12	-0.76	0.38	0.36	0.17	-0.13	-0.50	-1.18	-1.70	-0.30
1877	0.10	0.06	-0.30	-0.66	-0.64	0.21	0.35	0.36	-0.12	-0.62	0.41	0.38	-0.04
1878	-0.33	0.84	1.22	0.69	-0.20	0.33	0.27	0.29	0.33	0.21	0.21	-0.63	0.27
1879	-0.23	0.10	0.09	-0.26	-0.28	-0.27	-0.06	-0.07	-0.31	0.0	-1.00	-1.41	-0.31
1880	0.0	-0.35	-0.07	-0.19	-0.05	-0.21	-0.07	-0.03	-0.18	-0.83	-1.14	-0.91	-0.34
1881	-0.98	-0.42	-0.38	-0.21	0.10	-0.46	-0.07	0.0	-0.34	-0.79	-0.63	-0.14	-0.36
1882	0.85	0.41	0.71	-0.49	-0.62	-0.51	-0.39	-0.02	-0.18	-0.79	-0.79	-0.97	-0.23
1883	-1.20	-1.07	-0.62	-0.52	-0.45	-0.06	-0.14	-0.23	-0.40	-0.45	-0.46	-0.21	-0.48
1884	-0.31	-0.23	-0.67	-1.08	-0.63	-0.64	-0.51	-0.75	-0.66	-0.46	-1.02	-0.46	-0.62
1885	-1.36	-0.50	-0.09	-0.59	-0.79	-0.47	-0.15	-0.66	-0.48	-0.74	-0.44	0.21	-0.51
1886	-0.96	-0.18	-0.76	-0.30	-0.28	-0.54	-0.14	-0.21	-0.12	-0.47	-0.61	0.01	-0.46
1887	-1.09	-0.59	-0.11	-0.43	-0.10	-0.26	-0.06	-0.56	-0.17	-0.71	-0.11	-0.40	-0.38
1888	-1.01	-1.04	-0.76	-0.04	-0.34	-0.32	-0.23	-0.37	-0.31	-0.33	-0.35	-0.43	-0.46
1889	-0.86	-0.25	0.03	0.25	0.05	-0.07	-0.11	-0.23	-0.51	-0.59	-0.91	-0.18	-0.28
1890	-0.05	-0.16	-0.16	0.05	-0.50	-0.19	-0.21	-0.30	-0.16	-0.32	-0.65	-0.56	-0.27
1891	-0.94	-0.98	-0.31	-0.60	-0.40	-0.30	-0.25	-0.34	0.04	-0.49	-0.87	0.50	-0.41
1892	-0.74	0.0	-0.73	-0.57	-0.44	0.01	-0.25	-0.31	0.02	-0.24	-0.85	-1.29	-0.45
1893	-2.53	-1.64	-0.12	-0.23	-0.72	-0.10	-0.03	-0.22	-0.21	-0.14	-0.26	-0.28	-0.54
1894	-0.74	-0.12	0.32	-0.23	-0.22	-0.30	-0.07	-0.15	-0.32	-0.22	-0.39	-0.41	-0.24
1895	-1.34	-1.61	-0.41	-0.08	-0.19	-0.28	-0.35	-0.30	0.09	-0.39	-0.13	-0.32	-0.44
1896	-0.29	-0.24	-0.57	-0.63	0.03	0.14	-0.06	-0.22	-0.21	-0.13	-0.74	-0.26	-0.26
1897	-0.61	-0.33	-0.39	-0.07	0.11	-0.10	0.14	-0.02	0.18	-0.11	-0.42	-0.73	-0.20
1898	0.56	-0.46	-1.25	-0.47	-0.35	-0.11	-0.15	-0.01	-0.02	-0.38	-0.08	0.06	-0.22
1899	0.24	-0.57	-0.37	-0.04	-0.10	-0.27	-0.03	0.02	0.08	0.14	0.82	-0.65	-0.06
1900	-0.51	-0.42	0.06	-0.19	0.0	0.05	-0.12	0.08	0.04	0.50	-0.01	0.49	0.0

TABLE 1. (continued)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1901	-0.13	-0.34	0.55	0.33	-0.02	0.08	0.23	0.14	-0.21	-0.19	-0.21	-0.58	-0.03
1902	0.33	0.18	0.19	-0.44	-0.53	-0.44	-0.45	-0.21	-0.28	-0.52	-0.56	-0.79	-0.29
1903	0.24	0.58	0.19	-0.34	-0.46	-0.60	-0.49	-0.39	-0.33	-0.42	-0.40	-0.71	-0.26
1904	-0.62	-0.39	-0.39	-0.53	-0.34	-0.40	-0.48	-0.31	-0.54	-0.30	0.05	-0.13	-0.36
1905	-0.37	-1.25	-0.16	-0.73	-0.18	-0.22	-0.09	-0.16	-0.02	-0.34	0.38	0.19	-0.24
1906	-0.04	-0.67	-0.16	0.21	0.04	-0.04	-0.09	-0.03	-0.09	-0.10	-0.33	0.27	-0.09
1907	-0.51	-0.87	-0.14	-0.79	-0.92	-0.75	-0.41	-0.44	-0.24	-0.01	-0.71	-0.41	-0.52
1908	-0.18	-0.17	-0.62	-0.37	-0.30	-0.21	-0.34	-0.41	-0.12	-0.45	-0.66	-0.32	-0.35
1909	-0.73	-0.41	-0.49	-0.61	-0.50	-0.41	-0.34	-0.08	-0.05	-0.08	0.40	-0.41	-0.31
1910	0.14	-0.15	0.21	-0.16	-0.29	-0.36	-0.17	-0.30	-0.34	-0.25	-0.64	-0.58	-0.24
1911	-0.57	-0.73	-0.44	-0.46	-0.26	-0.16	-0.16	-0.10	-0.08	-0.28	-0.10	0.06	-0.27
1912	-0.42	0.10	-0.24	-0.22	-0.11	-0.33	-0.61	-0.83	-0.83	-1.04	-0.55	-0.31	-0.42
1913	-0.13	-0.69	-0.18	-0.23	-0.63	-0.54	-0.55	-0.25	-0.33	-0.48	0.34	0.42	-0.27
1914	0.69	0.28	0.22	-0.30	-0.02	-0.19	-0.20	-0.21	-0.24	-0.09	-0.27	-0.19	-0.04
1915	0.04	0.30	-0.35	0.16	-0.06	-0.05	-0.05	-0.09	-0.11	-0.24	0.23	0.13	-0.01
1916	0.32	-0.06	-0.37	-0.18	-0.30	-0.33	-0.07	-0.22	-0.44	-0.25	-0.16	-0.88	-0.25
1917	-0.46	-1.15	-0.89	-0.57	-0.99	-0.28	0.0	-0.10	-0.06	-0.61	-0.06	-1.46	-0.55
1918	-0.61	-0.33	-0.09	-0.66	-0.70	-0.45	-0.25	-0.29	-0.15	0.25	-0.23	-0.51	-0.33
1919	-0.13	-0.15	-0.31	-0.07	-0.51	-0.23	-0.22	-0.02	0.06	-0.18	-0.85	-0.66	-0.27
1920	0.11	-0.30	0.50	-0.15	-0.05	-0.20	0.02	-0.05	-0.06	-0.40	-0.52	-0.58	-0.14
1921	0.71	-0.01	0.53	0.23	0.05	0.09	0.19	-0.19	-0.20	-0.08	-0.50	0.06	0.07
1922	-0.51	-0.39	0.18	-0.04	0.18	0.12	-0.07	-0.06	-0.18	-0.16	-0.04	0.0	-0.08
1923	0.27	-0.72	-0.08	-0.67	-0.17	-0.17	-0.10	-0.14	0.08	0.28	0.53	0.44	-0.04
1924	-0.34	-0.22	-0.07	-0.20	0.03	0.03	-0.03	-0.01	0.0	-0.06	0.09	-0.44	-0.10
1925	-0.05	0.12	0.14	0.03	-0.12	-0.13	-0.07	0.13	0.19	-0.27	0.16	0.39	0.04
1926	0.78	0.66	0.53	-0.23	-0.19	-0.08	-0.09	0.02	0.16	0.08	0.28	-0.23	0.14
1927	-0.10	0.08	-0.01	-0.18	-0.12	0.05	0.28	0.13	0.23	0.45	0.19	-0.66	0.03
1928	0.55	0.23	-0.19	-0.29	0.02	-0.28	0.24	-0.05	0.02	0.10	0.30	0.22	0.07
1929	-0.62	-1.54	0.02	-0.37	-0.08	-0.20	-0.10	0.02	-0.08	0.14	0.22	-0.51	-0.26
1930	-0.16	0.04	0.48	0.12	-0.09	-0.05	0.21	0.39	0.03	-0.03	0.40	0.20	0.13
1931	0.27	-0.39	0.10	-0.07	-0.05	0.25	0.31	0.30	0.28	0.46	0.40	0.42	0.19
1932	1.07	-0.40	-0.30	0.20	0.07	0.07	0.06	0.24	0.29	0.23	-0.19	0.03	0.11
1933	-0.39	-0.52	-0.26	-0.11	-0.16	-0.18	0.24	0.09	0.09	-0.01	-0.20	-0.80	-0.18
1934	-0.03	0.43	-0.24	-0.10	0.29	0.07	0.13	-0.05	-0.01	0.31	0.60	0.48	0.16
1935	-0.37	1.14	0.43	-0.22	-0.34	-0.02	0.10	0.05	0.12	0.35	-0.49	-0.19	0.05
1936	-0.07	-0.80	0.08	-0.14	-0.04	0.20	0.36	0.18	0.14	-0.03	0.24	0.52	0.06
1937	0.02	0.42	-0.09	0.11	0.23	0.29	0.30	0.42	0.50	0.52	0.34	-0.17	0.24
1938	0.44	0.35	0.83	0.44	0.18	0.10	0.25	0.43	0.48	0.63	0.45	-0.14	0.37
1939	0.50	0.03	-0.22	0.06	0.12	0.06	0.27	0.24	0.11	-0.19	0.39	1.16	0.21
1940	-0.56	0.18	0.22	0.31	0.06	0.08	0.21	0.14	0.36	0.18	0.24	0.51	0.16
1941	0.20	0.63	0.27	0.25	0.14	0.18	0.27	0.10	-0.08	0.23	-0.07	0.07	0.18
1942	-0.13	-0.35	0.38	0.22	0.06	0.23	0.06	-0.08	0.12	0.41	0.19	0.08	0.10
1943	-0.41	0.32	-0.25	0.11	0.08	-0.18	0.13	0.14	0.15	0.46	0.30	0.59	0.12
1944	1.06	0.46	0.28	0.10	0.23	0.07	0.12	0.15	0.41	0.37	0.06	-0.30	0.25
1945	-0.17	-0.33	0.37	0.13	-0.20	-0.09	-0.04	0.29	0.15	0.11	-0.05	-0.64	-0.04
1946	0.52	0.32	0.44	0.53	-0.05	-0.02	0.06	0.09	0.27	-0.07	0.27	-0.31	0.17
1947	-0.11	-0.20	0.57	0.28	0.02	0.03	0.21	0.19	0.26	0.60	0.43	0.28	0.21
1948	0.74	-0.09	-0.26	0.06	0.36	0.18	0.04	0.13	0.24	0.21	0.25	-0.07	0.15
1949	0.53	-0.36	0.11	0.10	0.19	-0.06	-0.06	0.10	0.06	0.19	0.37	-0.13	0.09
1950	-0.77	-0.49	-0.17	-0.05	0.11	-0.06	-0.22	-0.22	0.01	-0.08	-0.46	-0.06	-0.18
1951	-0.41	-0.69	-0.18	0.21	0.14	-0.07	0.08	0.29	0.34	0.16	0.06	0.41	0.03
1952	0.23	0.16	-0.17	0.30	0.21	0.22	0.24	0.09	0.15	-0.08	-0.25	0.09	0.10

TABLE 1. (concluded)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1953	0.29	0.52	0.51	0.51	0.28	0.29	0.27	0.24	0.18	0.30	0.08	0.29	0.31
1954	-0.57	-0.09	-0.08	-0.21	-0.10	0.05	-0.12	-0.01	0.08	0.07	0.44	-0.13	-0.05
1955	0.65	0.01	-0.54	-0.13	0.0	0.04	0.01	0.13	0.04	0.14	-0.27	-0.28	-0.02
1956	-0.16	-0.68	-0.42	-0.30	-0.33	-0.22	-0.27	-0.36	-0.39	-0.35	-0.46	-0.44	-0.37
1957	-0.35	-0.16	-0.11	-0.15	-0.18	0.02	0.04	0.10	0.13	-0.07	0.21	0.43	-0.01
1958	0.79	0.35	0.32	0.14	0.19	-0.08	-0.04	0.04	0.03	0.0	0.14	0.25	0.18
1959	0.30	0.10	0.46	0.25	0.0	0.12	0.03	0.04	0.10	-0.18	-0.29	0.13	0.09
1960	0.19	0.79	-0.52	-0.18	0.02	0.25	0.05	0.10	0.10	0.01	-0.06	0.47	0.10
1961	0.20	0.38	0.42	0.23	0.11	0.28	0.0	0.03	-0.11	-0.20	0.07	-0.16	0.10
1962	0.23	0.39	0.19	0.17	0.10	-0.19	0.03	-0.01	-0.08	0.24	0.12	0.13	0.13
1963	-0.04	0.55	-0.15	-0.04	-0.06	-0.10	0.11	0.08	0.20	0.56	0.52	-0.05	0.13
1964	0.13	-0.26	-0.33	-0.25	-0.03	-0.13	-0.13	-0.28	-0.31	-0.31	-0.10	-0.42	-0.20
1965	0.05	-0.56	-0.04	-0.37	-0.13	-0.19	-0.22	-0.38	-0.29	-0.12	-0.17	-0.01	-0.20
1966	-0.20	0.21	0.13	-0.20	-0.12	0.08	0.16	0.15	0.12	-0.05	-0.19	-0.41	-0.03
1967	-0.23	-0.43	0.15	-0.03	0.13	-0.16	-0.03	-0.01	-0.11	0.29	0.01	-0.04	-0.04
1968	-0.54	-0.28	0.57	-0.04	-0.11	-0.20	-0.24	-0.22	-0.07	-0.06	-0.12	-0.30	-0.13
1969	-0.66	-0.74	-0.11	0.10	0.01	-0.11	0.0	0.0	-0.05	-0.02	0.21	0.46	-0.08
1970	-0.02	0.42	-0.06	0.12	0.05	0.05	-0.01	-0.06	-0.08	-0.23	0.06	-0.38	-0.01
1971	0.02	-0.25	-0.33	-0.20	-0.13	-0.22	-0.17	-0.20	-0.07	-0.02	0.18	-0.04	-0.12
1972	-0.82	-0.80	-0.04	-0.08	-0.25	-0.16	-0.11	-0.07	-0.45	-0.19	-0.27	-0.25	-0.29
1973	0.25	0.65	0.59	0.36	0.33	0.26	0.12	0.08	-0.02	0.05	-0.09	0.19	0.23
1974	-0.43	-0.44	0.06	0.0	-0.17	-0.12	-0.02	-0.12	-0.22	-0.33	-0.02	-0.21	-0.17
1975	0.28	0.28	0.39	0.33	0.17	0.09	0.04	-0.04	0.05	-0.06	-0.20	-0.33	0.08
1976	0.19	-0.18	-0.58	0.03	-0.19	-0.25	-0.27	-0.28	-0.18	-0.89	-0.42	-0.48	-0.29
1977	-0.45	0.36	0.81	0.48	0.31	0.27	0.04	-0.11	0.11	-0.03	0.65	-0.12	0.19
1978	0.15	0.13	0.35	0.15	-0.02	-0.20	-0.20	-0.29	-0.09	-0.10	0.28	-0.02	0.01
1979	-0.04	-0.54	0.48	-0.16	0.11	0.18	0.04	-0.03	0.13	0.25	0.27	0.91	0.13
1980	0.18	0.19	0.01	0.39	0.35	0.25	0.10	0.05	-0.01	0.10	0.62	0.01	0.19
1981	0.98	0.90	1.18	0.52	0.12	0.29	0.17	0.24	0.11	0.11	0.39	0.77	0.48
1982	-0.25	0.24	-0.04	0.14	0.09	-0.10	0.12	-0.08	0.12	-0.01	0.01	0.60	0.07
1983	1.03	0.61	0.68	0.46	0.06	0.02	0.27	0.42	0.37	0.21	0.88	0.19	0.43
1984	0.23	0.06	0.26	0.09	0.30	0.08	-0.01	0.10	-0.23	0.06	-0.15	-0.63	0.01

TABLE 2. Mean monthly and annual surface air temperature variations for the Southern Hemisphere (2.5°-62.5°S). The variations are from the 1951-1970 reference period mean and are expressed in degrees Celsius.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1858	0.60	0.58	0.36	0.41	-0.09	-0.46	-1.01	-0.45	-0.87	-0.73	-0.72	-0.61	-0.25
1859	-0.90	-1.05	-0.36	0.18	-0.03	-0.59	-0.76	-0.33	-0.73	0.45	-0.40	0.14	-0.37
1860	0.35	-0.17	-0.43	-0.35	-0.84	-0.54	-0.26	0.68	-0.12	-0.04	-0.61	-0.05	-0.20
1861	-0.57	0.09	0.18	0.41	-0.96	-0.22	-0.88	-0.11	-0.21	-0.60	-1.01	-0.53	-0.37
1862	-0.25	-0.33	0.04	-0.15	-0.22	0.03	-0.93	-1.23	-0.87	-0.93	-0.44	-0.33	-0.47
1863	-0.56	-0.36	-1.20	-0.50	-1.14	-0.83	-0.80	-1.05	-1.47	-0.87	-0.94	-0.42	-0.84
1864	-0.79	-0.51	-0.39	-0.14	0.12	-0.15	-0.18	-0.72	-0.11	-0.50	-0.30	-0.11	-0.31
1865	-0.68	0.05	0.0	0.42	-0.47	0.41	-0.06	-0.31	0.07	0.26	0.05	-0.14	-0.04
1866	0.03	-0.32	-0.21	-0.10	0.28	-0.34	0.0	-0.01	0.15	-0.29	-0.52	-0.22	-0.13
1867	0.11	0.02	-0.51	-0.10	0.11	-0.27	-0.03	-0.37	-0.26	-0.20	-0.32	-0.08	-0.16
1868	-0.58	-0.60	-0.42	-0.42	0.18	0.19	-0.28	-0.11	-0.32	0.24	-0.32	-0.30	-0.23
1869	-0.04	-0.36	-0.35	0.11	-0.04	-0.20	-0.93	0.01	-0.25	-0.62	-0.40	-0.09	-0.26
1870	-0.26	0.47	-0.37	-0.38	-0.51	-0.01	-0.40	-1.11	-0.77	0.04	-0.47	-0.32	-0.34
1871	-0.44	-0.35	-0.86	-0.62	-0.34	-0.52	-0.50	-0.25	-0.88	-0.89	-0.90	-0.18	-0.56
1872	0.11	-0.10	-0.73	-0.48	-0.80	-0.50	-0.48	-0.83	-0.33	0.03	-0.27	0.16	-0.35
1873	-0.17	-0.65	-0.90	-0.79	0.08	0.09	-0.92	-0.13	0.08	0.02	-0.37	0.32	-0.28
1874	-0.33	-0.31	-1.00	-0.35	-1.39	-0.97	-1.31	-0.36	-0.77	-1.00	-0.97	-0.25	-0.75
1875	-0.23	0.01	-0.83	-0.11	-0.36	-1.23	-0.45	-0.54	-0.42	-0.43	-0.70	-0.37	-0.47
1876	-0.47	-0.22	0.08	0.10	-0.12	-0.68	0.16	-0.52	0.0	-0.22	-0.94	-0.59	-0.29
1877	0.14	-0.07	0.66	0.19	-0.86	-0.25	0.31	0.09	-0.09	0.50	0.14	-0.10	0.06
1878	-0.16	-0.25	0.06	0.19	-0.62	-0.55	-0.20	-0.38	0.28	-0.03	0.31	-0.45	-0.15
1879	-0.41	-0.74	-0.75	-0.76	-0.63	-0.74	-0.29	-0.41	-0.37	-0.52	-0.20	-0.31	-0.51
1880	-0.33	-0.09	-0.39	-0.38	-0.18	-0.10	-0.17	0.48	-0.50	-0.69	0.04	0.19	-0.17
1881	-0.78	-0.02	-0.10	-0.22	-0.11	-0.76	-0.81	-0.37	-0.16	0.02	-0.25	0.41	-0.26
1882	-0.03	-0.23	-0.29	-0.49	-0.59	-0.94	-0.61	-0.11	0.05	0.03	-0.30	-0.31	-0.32
1883	-0.36	-0.24	-0.33	-0.46	-0.26	0.50	-0.11	-0.22	-0.58	-0.61	-0.50	-0.37	-0.29
1884	-0.71	-0.55	-0.57	-0.69	-1.21	-0.66	-0.93	0.82	-0.37	-0.63	-0.66	-0.46	-0.55
1885	-0.60	-0.54	-1.02	-1.02	-0.47	-0.62	-0.58	-0.08	0.03	0.04	-0.03	-0.13	-0.42
1886	0.05	-0.06	-0.26	-0.14	-0.45	-0.71	-0.61	-0.42	-0.14	-0.76	-0.21	-0.46	-0.35
1887	0.18	-0.51	-0.39	-0.60	-1.04	-0.37	-0.48	0.12	-0.63	-0.45	-0.66	-0.47	-0.44
1888	-0.30	-0.46	-0.65	-0.31	-0.70	-0.35	-0.21	-0.01	-0.15	-0.13	-0.23	0.03	-0.29
1889	-0.04	0.04	-0.11	-0.15	0.07	-0.30	-0.47	-0.61	-0.26	-0.04	-0.34	0.12	-0.17
1890	-0.37	-0.42	-0.62	-0.27	-0.78	-0.30	-0.88	-0.63	-0.24	-0.30	-0.33	-0.20	-0.45
1891	-0.77	-0.74	-0.48	-0.49	-0.34	-0.70	-0.70	-0.62	-0.43	-0.24	-0.07	-0.07	-0.47
1892	-0.21	-0.19	-0.12	-0.49	-0.76	-0.80	-0.43	-0.13	-0.59	-0.27	0.01	-0.22	-0.35
1893	-0.42	-0.58	-0.53	-0.59	-0.57	-0.95	0.06	-0.23	-0.41	-0.27	-0.02	-0.05	-0.38
1894	-0.24	-0.46	-0.49	-0.62	-0.71	-0.69	-0.54	-0.36	-0.70	-0.14	0.18	-0.15	-0.41
1895	-0.63	-0.42	-0.45	-0.56	-0.54	-0.24	-0.66	-0.07	-0.31	-0.24	-0.43	0.25	-0.36
1896	-0.29	-0.24	-0.22	-0.18	-0.29	-0.44	-0.05	0.19	0.22	0.10	-0.29	0.30	-0.10
1897	-0.35	-0.23	-0.14	0.35	-0.08	-0.07	-0.28	-0.43	-0.38	-0.11	-0.10	0.0	-0.15
1898	-0.21	-0.38	-0.62	-0.53	-0.92	-0.22	-0.60	-0.60	-0.28	-0.59	-0.39	-0.13	-0.46
1899	-0.46	-0.30	-0.10	-0.01	-0.34	-0.75	-0.14	0.0	-0.43	-0.43	0.08	0.08	-0.24
1900	-0.28	0.0	-0.22	0.22	-0.04	0.06	0.07	-0.09	-0.14	0.02	-0.06	-0.21	-0.06
1901	-0.21	-0.18	-0.62	-0.35	-0.09	0.19	-0.25	-0.22	0.22	-0.02	-0.14	-0.05	-0.14
1902	-0.31	0.22	-0.14	0.07	0.24	0.15	-0.13	-0.88	-0.33	-0.38	-0.24	-0.07	-0.15
1903	-0.41	-0.16	-0.12	-0.44	-0.37	-0.40	-0.26	-0.40	-0.20	-0.59	-0.48	-0.41	-0.35
1904	-0.71	-0.86	-0.76	-0.21	-0.50	-0.34	-0.32	-0.59	-0.40	-0.74	-0.55	-0.79	-0.56
1905	-0.62	-0.73	-0.41	-0.23	-0.34	-0.12	-0.49	-0.43	-0.20	-0.28	-0.43	-0.27	-0.38
1906	0.12	-0.06	-0.31	0.02	0.05	-0.40	-0.19	-0.31	-0.50	-0.28	-0.61	-0.67	-0.26
1907	-0.28	-0.11	-0.23	-0.28	-0.65	-0.64	-0.42	-0.58	-0.60	-0.50	-0.55	-0.42	-0.44

Table 2. (continued)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1908	-0.27	-0.29	-0.24	-0.55	-0.21	-0.28	-0.36	-0.41	-0.13	-0.65	-0.55	-0.23	-0.35
1909	-0.35	-0.52	-0.39	-0.12	-0.49	-0.15	-0.08	0.21	-0.16	-0.19	-0.44	-0.44	-0.26
1910	-0.18	-0.25	-0.54	-0.24	-0.08	-0.11	-0.19	0.06	-0.08	-0.34	-0.41	-0.22	-0.21
1911	-0.42	-0.58	-0.54	-0.50	-0.42	-0.72	-0.41	-0.55	-0.60	-0.27	-0.07	0.11	-0.41
1912	0.01	-0.07	-0.15	-0.05	-0.29	-0.02	-0.48	-0.40	-0.06	0.04	-0.23	0.06	-0.14
1913	-0.19	-0.16	-0.38	-0.05	-0.46	-0.49	0.32	0.05	-0.08	-0.02	0.07	-0.11	-0.12
1914	0.09	-0.08	-0.01	0.13	0.04	0.23	0.12	-0.19	-0.19	-0.06	-0.39	-0.14	-0.04
1915	-0.05	0.40	-0.12	0.16	-0.08	-0.62	0.16	0.0	0.28	0.18	0.01	-0.06	0.02
1916	-0.17	0.0	-0.27	0.12	-0.11	-0.75	-0.52	-0.15	0.17	-0.04	-0.31	-0.32	-0.20
1917	-0.11	-0.50	-0.58	-0.30	-0.80	-0.30	-0.02	-0.65	-0.18	-0.36	-0.38	-0.33	-0.38
1918	-0.49	-0.60	-0.61	-0.21	-0.72	-0.14	-0.63	-0.39	-0.32	-0.04	-0.12	-0.01	-0.36
1919	0.01	0.05	0.13	0.30	0.28	0.01	-0.04	-0.43	-0.44	-0.26	-0.46	-0.03	-0.07
1920	-0.13	-0.31	-0.31	-0.05	-0.21	-0.32	-0.35	-0.21	-0.14	-0.34	-0.09	-0.22	-0.21
1921	-0.44	-0.11	-0.22	-0.32	0.12	-0.26	-0.50	-0.42	-0.16	-0.20	-0.37	-0.14	-0.25
1922	-0.22	-0.22	-0.19	0.07	-0.36	-0.61	0.0	-0.27	0.0	-0.29	-0.05	0.05	-0.18
1923	-0.22	-0.09	-0.02	-0.19	-0.40	-0.19	-0.90	-0.65	-0.31	-0.47	-0.05	0.02	-0.29
1924	-0.09	-0.29	-0.10	-0.31	-0.32	0.02	-0.32	-0.52	-0.17	-0.19	-0.36	-0.22	-0.24
1925	-0.48	-0.08	-0.22	-0.09	-0.41	-0.56	-0.58	0.08	-0.41	-0.47	-0.08	0.29	-0.25
1926	0.22	0.36	0.30	0.08	-0.33	0.09	-0.29	0.13	0.06	0.09	0.07	-0.10	0.06
1927	-0.07	0.02	0.03	0.01	-0.31	-0.32	-0.23	-0.19	-0.09	0.09	0.08	-0.11	-0.09
1928	-0.11	0.01	0.08	0.45	-0.26	-0.46	-0.15	-0.14	-0.04	0.10	0.09	-0.08	-0.04
1929	-0.01	-0.02	-0.30	-0.14	-0.53	-0.28	-0.38	-0.44	-0.23	0.02	0.13	-0.20	-0.20
1930	-0.24	-0.22	-0.19	-0.07	-0.13	0.13	-0.33	-0.60	-0.30	-0.46	-0.05	0.11	-0.20
1931	0.10	0.20	0.13	-0.20	-0.13	-0.16	-0.03	-0.05	-0.45	-0.12	-0.34	0.14	-0.08
1932	0.09	0.0	-0.06	0.30	-0.21	-0.32	-0.10	-0.39	-0.08	0.16	0.23	0.0	-0.03
1933	-0.02	-0.02	0.04	0.12	0.19	-0.13	-0.44	-0.20	-0.13	0.10	-0.32	-0.32	-0.09
1934	-0.09	-0.53	-0.22	-0.12	0.10	0.15	0.01	0.06	-0.17	-0.33	-0.24	-0.11	-0.12
1935	0.04	0.03	0.13	-0.34	-0.08	-0.07	-0.21	-0.41	-0.44	-0.04	-0.22	0.04	-0.13
1936	-0.20	-0.22	-0.10	0.03	-0.20	-0.15	0.13	-0.12	-0.18	0.07	0.0	-0.02	-0.08
1937	-0.18	0.07	-0.11	-0.18	-0.11	0.02	-0.26	-0.04	-0.10	-0.17	0.24	0.01	-0.07
1938	-0.16	-0.13	0.01	0.08	0.18	0.02	0.07	-0.34	-0.09	0.13	-0.18	-0.01	-0.04
1939	-0.12	-0.22	-0.36	-0.31	0.21	0.19	-0.21	-0.20	-0.38	-0.21	-0.37	-0.16	-0.18
1940	0.04	0.04	-0.03	-0.19	0.09	0.30	0.27	0.11	0.09	-0.19	-0.15	0.46	0.07
1941	0.03	0.05	0.03	0.22	0.19	0.18	0.28	0.10	-0.37	0.07	-0.06	0.21	0.08
1942	0.27	0.29	0.09	0.06	-0.01	-0.05	-0.19	0.17	0.07	-0.28	-0.01	-0.04	0.03
1943	-0.02	-0.10	-0.17	-0.12	-0.20	-0.27	0.03	-0.57	-0.16	0.25	-0.16	0.04	-0.12
1944	0.07	-0.04	-0.09	-0.01	-0.14	0.10	0.23	0.28	0.32	0.27	0.07	0.30	0.11
1945	0.19	0.13	-0.05	0.25	-0.27	-0.33	-0.06	0.51	0.17	0.18	0.03	-0.18	0.05
1946	-0.20	0.0	-0.23	0.05	0.17	-0.16	-0.01	-0.04	0.11	-0.09	-0.07	-0.07	-0.04
1947	0.08	0.18	-0.02	0.10	0.16	0.42	-0.06	0.03	-0.10	-0.09	0.15	-0.13	0.06
1948	-0.07	-0.09	-0.31	-0.10	0.19	0.27	0.04	-0.23	-0.08	-0.02	-0.27	0.10	-0.05
1949	0.10	-0.24	-0.12	-0.21	-0.09	0.05	0.06	-0.11	-0.07	-0.01	-0.09	-0.08	-0.07
1950	-0.22	-0.11	-0.16	-0.08	-0.27	0.06	0.04	-0.26	-0.27	-0.37	-0.36	-0.16	-0.18
1951	-0.39	-0.39	0.0	-0.20	0.0	0.03	0.04	-0.08	0.01	-0.02	0.07	0.07	-0.07
1952	0.29	0.19	0.22	0.04	0.11	-0.20	0.08	0.15	0.10	0.04	-0.18	0.05	0.08
1953	-0.06	-0.09	0.22	0.13	0.07	0.05	-0.24	0.06	0.08	-0.03	0.17	0.20	0.05
1954	-0.06	-0.03	0.0	-0.09	-0.11	-0.26	-0.16	-0.01	-0.13	-0.09	-0.07	-0.04	-0.09
1955	0.06	0.0	-0.32	-0.20	-0.11	-0.20	-0.36	0.0	0.0	-0.19	-0.16	-0.23	-0.14
1956	-0.39	-0.23	-0.18	-0.25	-0.33	-0.17	-0.05	-0.23	-0.30	-0.13	-0.24	-0.20	-0.23
1957	-0.09	-0.12	0.07	0.17	0.37	0.15	-0.14	0.09	-0.04	0.07	0.33	0.28	0.10
1958	0.21	0.30	0.28	0.36	0.25	0.20	0.41	-0.01	-0.03	0.12	0.14	-0.01	0.19
1959	0.05	0.09	0.19	0.03	-0.11	0.10	0.33	-0.02	0.14	-0.02	0.21	0.11	0.09

TABLE 2. (concluded)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1960	0.18	0.0	-0.13	-0.16	-0.33	-0.03	-0.11	0.0	0.10	0.20	-0.09	0.13	-0.02
1961	0.11	0.07	-0.01	0.20	0.23	0.01	0.10	0.02	0.18	0.38	0.09	0.20	0.13
1962	0.07	-0.01	0.05	-0.07	-0.07	0.30	-0.05	0.03	0.22	0.10	0.23	0.13	0.08
1963	-0.19	0.06	-0.09	-0.09	-0.01	-0.03	0.11	-0.05	0.0	-0.03	-0.27	-0.01	-0.05
1964	0.09	0.06	-0.05	-0.02	-0.10	-0.39	-0.19	-0.17	-0.06	-0.34	-0.36	-0.47	-0.17
1965	-0.23	0.02	-0.25	-0.30	-0.09	0.21	-0.28	0.05	-0.01	-0.11	-0.11	-0.11	-0.10
1966	0.02	-0.19	0.05	0.06	-0.03	0.23	0.01	-0.17	-0.16	-0.32	-0.08	-0.22	-0.07
1967	-0.12	-0.16	-0.28	0.15	0.29	-0.25	-0.14	-0.04	-0.10	0.27	-0.01	0.0	-0.03
1968	-0.02	-0.14	-0.19	-0.33	-0.44	-0.25	0.03	0.0	-0.24	-0.06	0.03	-0.08	-0.14
1969	0.23	0.18	0.20	0.25	0.35	0.07	0.34	0.20	-0.07	-0.02	0.25	0.24	0.19
1970	0.20	0.31	0.14	0.28	0.05	0.33	0.21	0.13	0.19	0.11	-0.09	-0.07	0.15
1971	-0.21	-0.23	-0.06	-0.22	-0.29	-0.37	0.02	0.07	0.13	-0.07	-0.28	-0.22	-0.14
1972	-0.18	-0.08	-0.24	0.02	0.27	0.06	0.13	-0.13	0.22	-0.04	0.16	0.69	0.07
1973	0.59	0.33	0.50	0.28	0.39	0.32	0.21	0.12	0.08	0.14	-0.09	-0.12	0.23
1974	-0.25	-0.38	-0.21	-0.23	-0.09	-0.22	0.22	-0.17	-0.33	-0.29	-0.20	-0.20	-0.20
1975	-0.28	-0.16	-0.25	-0.02	0.12	0.01	0.07	-0.21	0.06	-0.35	-0.20	-0.18	-0.12
1976	-0.45	-0.42	-0.45	-0.25	-0.20	-0.22	-0.06	-0.23	-0.32	-0.21	0.04	0.05	-0.23
1977	0.13	0.20	0.0	0.09	-0.07	0.16	0.22	0.14	-0.10	0.27	0.12	0.19	0.11
1978	0.08	0.13	0.17	0.04	0.16	-0.04	0.32	-0.05	-0.09	-0.16	-0.03	-0.04	0.04
1979	0.19	0.17	0.15	0.10	0.02	0.21	0.24	0.34	-0.02	0.12	0.10	0.31	0.16
1980	0.33	0.28	0.46	0.41	0.62	0.09	0.04	0.26	0.13	0.13	-0.03	0.30	0.25
1981	0.20	0.22	-0.03	0.53	0.46	0.0	0.10	0.16	0.13	-0.04	0.10	0.35	0.18
1982	0.36	0.11	-0.02	0.02	0.29	-0.22	-0.09	0.35	0.02	-0.20	0.19	0.45	0.10
1983	0.50	0.59	0.46	0.49	0.58	0.30	0.25	0.10	0.23	0.23	0.22	0.38	0.36
1984	0.0	0.14	-0.02	-0.09	0.16	-0.16	0.03	-0.09	0.10	0.28	0.05	0.0	0.03

TABLE 3. Mean monthly surface air temperature variations for the Southern Hemisphere (2.5°-90°S). The variations are from the 1951-1970 reference period mean and are expressed in degrees Celsius.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1957	-0.06	-0.06	0.07	0.25	0.33	0.20	-0.32	0.28	0.12	0.15	0.35	0.35	0.14
1958	0.24	0.41	0.28	0.34	0.36	-0.35	0.33	-0.33	-0.34	0.09	0.14	-0.23	0.08
1959	-0.14	0.04	0.19	0.19	-0.08	0.04	0.31	-0.08	-0.29	-0.09	-0.03	0.11	0.02
1960	0.02	-0.18	-0.50	-0.29	-0.46	-0.28	-0.30	-0.04	0.08	0.20	-0.17	0.04	-0.16
1961	0.0	0.10	-0.09	0.32	0.36	0.10	0.18	0.10	0.46	0.30	0.06	-0.02	0.15
1962	-0.15	-0.06	0.03	-0.20	-0.23	0.28	-0.24	-0.05	0.18	0.04	0.21	-0.01	-0.02
1963	-0.20	-0.04	-0.30	-0.30	-0.25	0.18	0.12	0.26	0.36	-0.21	-0.39	-0.09	-0.07
1964	-0.01	-0.08	-0.09	-0.33	-0.48	-0.14	0.10	-0.14	-0.39	-0.38	-0.18	-0.37	-0.21
1965	-0.21	0.14	-0.22	-0.27	-0.11	0.10	-0.25	0.18	-0.25	-0.14	-0.22	-0.07	-0.11
1966	-0.12	-0.08	0.35	0.12	-0.03	0.08	0.16	-0.40	-0.08	-0.52	0.01	-0.13	-0.05
1967	0.09	-0.08	-0.21	-0.03	0.28	-0.22	0.10	0.05	0.03	0.04	0.04	0.05	0.01
1968	-0.08	-0.07	0.09	-0.15	-0.33	-0.21	-0.09	-0.06	-0.58	0.14	0.06	-0.04	-0.11
1969	0.24	0.12	0.12	0.28	0.21	0.15	0.0	-0.13	0.0	0.02	0.11	0.22	0.11
1970	0.21	0.18	0.32	0.26	-0.03	0.26	0.28	-0.15	0.43	0.27	-0.07	0.04	0.17
1971	0.02	-0.09	-0.12	-0.04	-0.08	-0.38	-0.02	0.27	0.21	0.11	-0.31	-0.05	-0.04
1972	-0.03	0.03	-0.18	0.17	0.15	0.29	0.24	0.43	0.36	-0.13	-0.03	0.55	0.15
1973	0.47	0.17	0.22	0.43	0.55	0.33	0.24	-0.13	0.27	0.32	0.02	-0.24	0.22
1974	-0.08	-0.37	-0.25	-0.30	0.0	0.08	0.22	0.28	-0.21	0.06	0.02	0.07	-0.04
1975	-0.12	-0.09	0.0	-0.09	0.54	0.05	0.16	-0.47	-0.15	-0.27	-0.05	-0.16	-0.05
1976	-0.32	-0.31	-0.50	-0.50	-0.45	-0.20	-0.01	-0.23	-0.28	-0.26	0.10	0.29	-0.22
1977	0.39	0.20	-0.02	0.11	0.29	0.32	0.50	0.45	-0.47	0.02	-0.06	0.11	0.15
1978	-0.05	0.18	0.12	0.18	0.29	0.02	0.46	-0.43	0.02	-0.14	-0.02	0.01	0.05
1979	0.11	0.02	0.07	0.39	-0.20	0.09	-0.21	0.22	0.0	0.06	0.11	0.40	0.09
1980	0.29	0.23	0.56	0.55	0.51	0.02	0.33	0.41	0.38	-0.06	0.23	0.35	0.32
1981	0.18	0.26	0.17	0.39	0.29	0.15	0.67	0.85	0.15	-0.11	-0.04	0.28	0.27
1982	0.25	0.07	-0.39	-0.12	0.39	-0.14	0.17	-0.08	-0.30	-0.22	0.39	0.51	0.04
1983	0.52	0.46	0.28	0.57	0.90	0.37	-0.03	0.34	0.61	0.04	-0.03	0.22	0.35
1984	0.08	0.03	0.19	0.0	0.58	-0.44	0.27	0.29	0.40	0.03	0.07	0.20	0.14

*reprints
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