Survey of Historical Water Column Profiles for the COPE 95 Experiment

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**Survey of Historical Water Column Profiles
for the COPE 95 Experiment**

Harry F. Robey

February 15, 1995

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To : Distribution

From : H. F. Robey

Subject : Survey of historical water column profiles for COPE experiment

A preliminary survey of water column measurements in the vicinity of the COPE experiment has been conducted. Figure 1 shows a map of the region under consideration, near the mouth of the Columbia River along the coast of Oregon. The historical data comes from a set of two CD-ROMs from the National Oceanographic Data Center (NODC) which contain global ocean temperature and salinity profiles taken between 1900 and 1990. Disk 1 contains 1.62 million profiles from the Atlantic, Indian, and Polar oceans. Disk 2 contains 1.57 million profiles from the Pacific ocean.

The data is organized in files containing all profiles within an area measuring 10° of latitude by 10° of longitude. Figure 2 shows the grid system for disk 2. Within each of these files, the individual profiles are separated by headers containing the latitude and longitude in degrees and minutes, the date and time of the profile measurement to the nearest 10th of an hour, the vessel country of origin and ID number, the number of data points in the file and the type of measurement (CTD, XBT, etc.). An example of the header information is as shown here:

quadrant = 7
latitude = 46 degrees, 12 minutes
longitude = 124 degrees, 16 minutes
date = 9/ 20/ 73
time = 1.70000
ship country code = 31
ship id no. = 1329799200
number of points = 20
data type = 2
cruise no. = 9557
station no. = 141

For this report , a survey was conducted for cell number 7412. The time of year was restricted to the month of September only. Latitude and longitude were restricted for this search to the range from $45^\circ 50'$ to $46^\circ 10'$ N latitude and $124^\circ 0'$ to $124^\circ 30'$ W longitude. This area has a significant overlap with the 30 Km radius covered by the proposed hillside radar. 48 profiles were found meeting these criteria, most of them being rather shallow profiles very close to the mouth of the Columbia River. Of these, 6 profiles from 3 different years have been analyzed for this report. The location of each profile is shown on Figure 1 and listed in the table below as well. For each case, plots are shown of the temperature, salinity, density, and Brunt-Vaisala (BV) frequency. From the BV profiles, dispersion relations are calculated. For each case, plots of the dispersion relation, phase and group velocities and the eigenfunction of the internal wave vertical velocity are shown for the first two internal wave modes. The following table summarizes the important information for each profile. The dates and locations of the measurements are shown followed by the depth of the profile, the peak BV frequency, the depth of the peak, and the long wave phase speed for mode 1 waves, $c_p(0)$.

Profile Summary Table

Profile	Date	Lat.	Long.	Depth (m)	BV _{max} (rad/s)	D _{max} (m)	c _p (0) (cm/s)
1	9/26/72	45° 49'	124° 22'	140	0.053	14.0	49
2	9/26/72	45° 50'	124° 9'	90	0.046	11.0	43
3	9/20/73	46° 11'	124° 29'	120	0.047	27.0	63
4	9/20/73	46° 12'	124° 16'	80	0.070	11.0	44
5	9/18/78	46° 0'	124° 20'	120	0.085	7.5	75
6	9/18/78	46° 0'	124° 12'	90	0.112	5.0	65

The profiles are all basically similar, with a relatively near-surface peak in the BV profile between 5 and 27 meters depth. The maximum BV frequency ranges from 0.046 to 0.112 radians/s. The corresponding dispersion relations give long-wave phase speeds in the range of 43 cm/s to 75 cm/s. Phase and group velocities for higher wave number internal waves have a smaller variation from profile to profile.

These profiles should be characteristic of the type of profiles to be expected during the COPE experiment.

Figure 1. Map of the region with location of profiles

Appendix B. WMO Ten-Degree Squares for the Pacific Ocean

Figure 2. Grid system for NODC data set

Profile Parameters :

Date : 9/26/72
Latitude : 45° 49'
Longitude : 124° 22'

Profile Parameters :

Date : 9/26/72
 Latitude : 45° 49'
 Longitude : 124° 22'

Profile Parameters :

Date : 9/26/72
Latitude : 45° 50'
Longitude : 124° 9'

Profile Parameters :

Date : 9/26/72
 Latitude : 45° 50'
 Longitude : 124° 9'

Profile Parameters :

Date : 9/20/73
 Latitude : 46° 11'
 Longitude : 124° 29'

Profile Parameters :

Date : 9/20/73
 Latitude : 46° 11'
 Longitude : 124° 29'

Profile Parameters :

Date : 9/20/73
 Latitude : 46° 12'
 Longitude : 124° 16'

Profile Parameters :

Date : 9/20/73
 Latitude : 46° 12'
 Longitude : 124° 16'

Profile Parameters :

Date : 9/18/78
Latitude : 46° 0'
Longitude : 124° 0'

Profile Parameters :

Date : 9/18/78
 Latitude : 46° 0'
 Longitude : 124° 0'

Profile Parameters :

Date : 9/18/78
 Latitude : 46° 0'
 Longitude : 124° 12'

Profile Parameters :

Date : 9/18/78
 Latitude : 46° 0'
 Longitude : 124° 12'