

preliminary data report

May 10, 1995

A. Cruise Narrative

A.1 Highlights

A.1.a WOCE designation PR03N

A.1.b EXPOCODE 49KF9110_1

A.1.c Chief Scientist Tsutomu Tohmine
Hakodate Marine Observatory (HMO)

A.1.d Ship R/V Kofu Maru

A.1.e Port of call None

A.1.f Cruise Date October 12 to October 22, 1991

A.2 Cruise Summary

A.2.a Geographic boundaries

A.2.b Total number of stations occupied

A.2.c Floats and drifters deployed

A.2.d Moorings deployed or recovered

A.3 List of Principal Investigators

Table 1. Principal Investigators for All Measurements

Name	Responsibility	Affiliation
T. Tohmine	CTD, S	HMO
N. Kubo	Oxygen, Nutrients	HMO

A.4 Scientific Programme and Methods

Observations of PR03N (North of 34N of the section PR03) were carried on the R/V Kofu Maru Cruise in the K09110. The ship sailed from Kushiro at 0130 UTC on 12 October 1991. At 0321 UTC on 15 October, we arrived at the northernmost station along the section PR03N and started observation. The performances of the CTD, the multisampler and other instruments were good throughout the cruise. The observation of PR03N was completed 0941 UTC on 18 October.

A.5 Major Problems and Goals Not Achieved

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 2. Cruise Participants

Name	Responsibility	Affiliation
T. Tohmine	Chief Scientist S, CTD Hardware	HMO
K. Kubo	Oxygen, Nutrients	HMO
M. Fujimura	CTD Software CTD hardware	HMO
Y. Shinohara	Watch Stander	HMO
H. Naitoh	Watch Stander	HMO
Y. Kan-no	Watch Stander	HMO
K. Hayashi	Oxygen, Nutrients	HMO
S. Murakami	Oxygen, Nutrients	HMO

- B. Underway Measurements
 - B.1 Navigation and bathymetry
 - B.2 Acoustic Doppler Current Profiler
 - B.3 Thermosalinograph and underway dissolved oxygen, fluorometer, etc
 - B.4 XBT and XCTD
 - B.5 Meteorological observations
 - B.6 Atmospheric chemistry

C. Hydrographic Measurements

CTD

The Neil Brown Mark III B CTD (6000dbar sensor without oxygen sensor) mounted in the frame with the 12 x 1.7 liter General Oceanics rosette multisampler was used all of the vertical CTD work.

In general at the CTD stations the package was lowered to the depth of 90 percents of the bottom depth and max 4000 or 2000 dbar, because of avoiding the obstructions near the bottom such as fishing nets and of the time limit of the cruise.

A Hewlett Packard HP9000-330 with a 4 MByte of memory was used as a primary data collection device. Though the original sampling rate is 31.25 samples per second, our data collection system can get around 25 samples per second and compress the collected data to one sixth by software due to the limitation of the memory. The periods of a collected datum and the next one are not fixed.

All of the processed data on CTD data in our observatory were based on the compressed data described above. The collected compressed data were stored onto the 9-track magnetic tape.

The results of the laboratory calibration for the temperature and pressure are shown in Table 3. We adopted the pre-cruise calibration factors for the temperature. The pressure calibration factors, however, were not used because the calibration methods for pressure were not decided.

Table 3. CTD Calibration Constants at Laboratory

Temperature; linear fit

Time	Bias	Slope
Pre -Cruise (8 June 1991)	-0.0040492	0.9999990
Post-Cruise (16 Jan. 1992)	-0.0018410	0.9998945

Pressure increasing; linear fit

Time	Bias	Slope
Pre -Cruise (8 June 1991)	0.3254	1.000976
Post-Cruise (16 Jan. 1992)	-3.6908	1.000782

The conductivity scaling factor given in Table 4 is derived from a linear fit through zero point between CTD data and water sample data. Using this factor all the data were processed for the final data set. The salinity determination of the water samples was with the Guildline AUTOSAL 8400A. Standard seawater from the batch of P114 was used to standardize the AUTOSAL.

Table 4. The Conductivity scaling factor

station No.	Bias	Slope
KO6008 - KO6026	--	1.00025

Oxygen

The amount of dissolved oxygen was determined by the manual Winkler method shown in "Kaiyou Kansoku Shishin (Manual of Oceanographical Observation)" published by the Japan Meteorological Agency (1970). The reagent blank was not subtracted. Precision and accuracy have not been estimated.

Nutrients

The concentration of the nutrients -- phosphate, nitrate and nitrite was determined by the Technicon Auto Analyzer II showed in "Kaiyou Kansoku Shishin (Manual of Oceanographical Observation)". Precision and accuracy have not been estimated.

Sampling for dissolved oxygen and following one for nutrients were done 5-10 minutes after the casts were on deck. Samples were drawn into 100 cm³ glass bottles with narrow mouth glass cap. Then they were immediately introduced into the Auto Analyzer II sampler by pouring into 4 cm³ polystyrene cups arranged on the AA-II sampler tray. Analyses were begun within 30 to 40 minutes after sampling water and completed within additional two hours.

Notes for the --.SUM, --.SEA and --.CTD files

The first 2 characters of the file name of --.SUM, --.SEA and --.CTD files are KO for R/V Kofu maru. These characters are followed by the last two digits of the year and the month for the --.SUM and --.SEA files. For the --.CTD files the character KO are followed by the unique station number given by the Japan Meteorological Agency.

--.SUM

Header records identifying the columns are added at the first three records of --.SUM file.

Since the time of the bottom (BO), the position and the water depth at the bottom (BO) were not recorded, we leave the column of them blank.

Since the acoustic pinger was not available, we leave blank on the column of HEIGHT ABOVE BOTTOM.

Since the surface water samplings were carried out by a polyethylene bucket, we write "BOT" on the column of CAST TYPE.

--.SEA

Since the surface water samples were collected by a polyethylene bucket, we write "0" on the column of the bottle number (BTLNBR) at the surface.

We would use the unit "umol/l" for describe the concentration of dissolved oxygen, nitride and phosphade in our routine analysis. Now we must seek the density of samples and convert the unit into "umol/kg". It is need the sample temperature to calculate the its density. Since we did not measure the temperature of the samples, the appropriate temperature were assumed and then density were calculated.

For dissolved oxygen, we divided the value in umol/l by the in-situ potential density calculated from CTD temperature, CTD pressure and CTD salinity. We calculate the sample density at the time of analysis from CTD salinity and assumed temperature of laboratory (20°C) and that of analyzer-heatbath(40°C) to convert the unit for nitride and phosphate respectively.

The unevenness of the density between each samples were so small. The converted values are in good agreement with the value introduced from a unique density ,e.g. 1.025kg/l, within the extent of the measurement errors.

--.CTD

Though original transmission rate is 31.25 data per second, the collecting rate is only 4 or 5 data per second on our system. But the period of a collected datum and the next one is not fixed. Then we leave the column for SAMPLING RATE blank.

D. Acknowledgements

E. References

Japan Meteorological Agency, 1970. Kaiyo kansoku shishin (Manual of Oceanographic Observation). (in Japanese)

Unesco, 1983. International Oceanographic tables. Unesco Technical Papers in Marine Science, No. 44.

Unesco, 1991. Processing of Oceanographic Station Data, 1991. By JPOTS editorial panel.

F. WHPO Summary

Several data files are associated with this report. They are the kf9110.sum, kf9110.hyd, kf9110.csl and *.wct files. The kf9110.sum file contains a summary of the location, time, type of parameters sampled, and other pertinent information regarding each hydrographic station. The kf9110.hyd file contains the bottle data. The *.wct files are the ctd data for each station. The *.wct files are zipped into one file called kf9110.wct.zip. The kf9110.csl file is a listing of ctd and calculated values at standard levels.

The following is a description of how the standard levels and calculated values were derived for the kf9110.csl file:

Salinity, Temperature and Pressure: These three values were smoothed from the individual CTD files over the N uniformly increasing pressure levels. using the following binomial filter-

$$t(j) = 0.25t_i(j-1) + 0.5t_i(j) + 0.25t_i(j+1) \quad j=2\dots N-1$$

When a pressure level is represented in the *.csl file that is not contained within the ctd values, the value was linearly interpolated to the desired level after applying the binomial filtering.

Sigma-theta(SIG-TH:KG/M3), Sigma-2 (SIG-2: KG/M3), and Sigma-4(SIG-4: KG/M3): These values are calculated using the practical salinity scale (PSS-78) and the international equation of state for seawater (EOS-80) as described in the Unesco publication 44 at reference pressures of the surface for SIG-TH; 2000 dbars for Sigma-2; and 4000 dbars for Sigma-4.

Gradient Potential Temperature (GRD-PT: C/DB 10-3) is calculated as the

least squares slope between two levels, where the standard level is the center of the interval. The interval being the smallest of the two differences between the standard level and the two closest values. The slope is first determined using CTD temperature and then the adiabatic lapse rate is subtracted to obtain the gradient potential temperature. Equations and Fortran routines are described in Unesco publication 44.

Gradient Salinity (GRD-S: 1/DB 10-3) is calculated as the least squares slope between two levels, where the standard level is the center of the standard level and the two closes values. Equations and Fortran routines are described in Unesco publication 44.

Potential Vorticity (POT-V: 1/ms 10-11) is calculated as the vertical component ignoring contributions due to relative vorticity, i.e. $pv=fN^2/g$, where f is the coriolius parameter, N is the bouyancy frequency (data expressed as radius/sec), and g is the local acceleration of gravity.

Bouyancy Frequency (B-V: cph) is calculated using the adiabatic leveling method, Fofonoff (1985) and Millard, Owens and Fofonoff (1990). Equations and Fortran routines are described in Unesco publication 44.

Potential Energy (PE: J/M2: 10-5) and Dynamic Height (DYN-HT: M) are calculated by integrating from 0 to the level of interest. Equations and Fortran routines are described in Unesco publication, Processing of Oceanographic station data.

Neutral Density (GAMMA-N: KG/M3) is calculated with the program GAMMA-N (Jackett and McDougall) version 1.3 Nov. 94.