preliminary report
may 18, 1995

A. Cruise Narrative

A.1 Highlights

A.1.a WOCE designation PR21
A.1.b EXPOCODE 21OR266/2

A.1.c Chief Scientist: Cho-Teng Liu
Institute of Oceanography
National Taiwan University
Taipei POB 23-13
Taiwan, ROC 10764
e-mail: Ctliu@ccms.ntu.edu.tu

A.1.d Ship Name: R/V Ocean Researcher I
A.1.e Ports of call: Leg 1: Kaohsiung to Manila
Leg 2: Manila to Kaohsiung
A.1.f Cruise Dates: Leg 1: 1990/12/16-21, southbound
Leg 2: 1990/12/26-30, northbound

A.2 Cruise Summary

A.2.a Geographic boundaries

A.2.b Total number of stations occupied

There was no water sample collected
11 CTD stations

A.2.c Floats and drifters deployed

None

A.2.d Moorings deployed or recovered

None

A.3 List of Principal Investigators

Table 1: List of Prinicipal Investigators

Name	Responsibility	Institution*
LIU, Cho-Teng	Calibration, processing and interpretation of CTD data	NTU
PAI, Su-Cheng	collection, analysis and interpretation of water sample data	NTU
CHEN, Chen-Tung Arthur	developing skills for collecting C-14 samples for one-time survey	NSYSU
JACINTO, Gil	Interpretation of chemistry data, jointly with S-C PAI	UP

*See Table 2 for list of Institutions

Table 2: List of Institutions

Abbreviation	Institutions
NTU	National Taiwan University Taipei, Taiwan, ROC 10764
NSYSU	National Sun Yat-sen University Kaohsiung, Taiwan, ROC
UP	University of the Philippines Quezon City, RP

A.4 Scientific Programme and Methods

This cruise was carried out jointly by oceanographers from the Republic of China in Taiwan and from the Republic of the Philippines. After a simple ceremony for the start of Sino-Filipino Cooperative WOCE Program, R/V Ocean Researcher 1 left Kaohsiung Harbor at the noon of December 16, 1990. The southbound cruise along PR21 was under heavy seas. The sections of T & S show lots of interleaving water masses and the T & S structures of Kuroshio were smeared. During the return trip two weeks later, the weather improved slightly but it was not good enough for collecting water samples. So, there is no water sample data from Leg-2 and the Leg-2 CTD data were corrected by the water sample data collected during Leg-1.

A.5 Major Problems

None

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 3: List of Cruise Participants

Name	Responsiblity	Institution*
LIU, Cho-Teng	chief scientist	NTU
PAI, Su-Cheng	chief chemist	NTU
GONG, Gwo-Ching	nitrate analysis, chemical hydrography	NTU
	data processing	NTU
LIN, Sheng-Fon	CTD data processing	NTU
YANG, Chung-Cheng	silicate analysis	NTU
JENG, Kwung-Lung	phosphate analysis	NTU
KUO, Ting-Yu	dissolved oxygen analysis	NTU
JACINTO, Gil	Quality check on chemical data	UP
WANG, Shu-lun	pH analysis	N

*See Table 2 for list of Institutions

C. Hydrographic Measurements

The pressure, temperature (T) and salinity (S) were derived from the CTD data according to the methods described in the SBE-9 CTD manual. The CTD Digiquartz pressure transducer was calibrated in 1987. The CTD temperature and conductivity sensor were calibrated on 1991/01/24 through Sea Bird Electronics Inc.. Assuming that the drift of temperature sensor is linear with time, we

found that temperature data have bias 0.0006 oC. The conductivity and salinity data were corrected by the following procedure:

(1) use the Guildline Salinometer to measure the salinity of water samples collected during Leg-1;

(2) use the corrected CTD temperature data and the measured salinity from step (1) to derive the in situ conductivity of each sample;

(3) use polynomial fit to derive the bias of CTD's conductivity; the bias of CTD conductivity was found to be negligible;

(4) calculate the salinity with no correction on conductivity data.
All the data presented in this report are derived from the T and S data which have been corrected by the above procedure.

Comparing the T-S data of St. 118 to those of St. 36 & 37 of INDOPAC Expedition, we found that the temperature is 0.04C higher at St. 118 than those at St. 36 & 37. Same for the salinity data which is 0.002 psu higher at St. 118. In the T-S diagram the salinity minimum of NPIW (North Pacific Intermediate Water) is less apparent for water closer to shore.
Since St. 118 is on the shelf side of Kuroshio as compared to St. 36 & 37, the result of above comparison is reasonable.

D. Acknowledgements
E. References

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

G. Data Quality Evaulation

Several data files are associated with this report. They are the or266.sum, (no hydro data at the present time), or266.csl and *.wct files. The or266.sum file contains a summary of the location, time, type of parameters sampled, and other pertient information regarding each hydrographic station. The *.wct files are the ctd data for each station. The *.wct files are zipped into one file called or266wct.zip. The or266.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 or266.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-

$$t(j) = 0.25ti(j-1) + 0.5ti(j) + 0.25ti(j+1) \quad j=2....N-1$$

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=fN2/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.