WHOI-82-44

HYDROGRAPHIC STATION DATA OBTAINED IN THE EAST CHINA SEA.
NOVEMBER, 1981

by

R. Limeburner and R. C. Beardsley

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543

October 1982

TECHNICAL REPORT

Prepared for the National Atmospheric and Oceanic Administration under Cooperative Agreement NA81AA-H-00008 and for the National Science Foundation under Grant OCE 80-14941.

Reproduction in whole or in part is permitted for any purpose of the United States Government. This report should be cited as: Woods Hole Oceanog. Inst. Tech. Rept. WHOI-82-44.

Approved for Distribution:

N.P. Fofonoff
N.P. Fofonoff, Chairman
Department of Physical Oceanography

Table of Contents

	<u>Page No.</u>
List of Figures	3
Abstract	4
1. Introduction	5
2. Instrumentation	
A. CTD	6
B. Transmissometer	6
C. Calibration Samples	6
D. Navigation	7
3. Data Acquisition and Analysis	7
4. Error Analysis	7
5. Hydrographic Data Presentation	8
6. Acknowledgements	8
7. Reference	9
8. Hydrographic Data	10

List of Figures

<u>Figure No.</u>		<u>Page No.</u>
1.	Hydrographic Station Locations	10
2.	Temperature at 2 and 10 meters	11
3.	Temperature at 20 and 30 meters	12
4.	Temperature at 2 and 40 meters	13
5.	Bottom Temperature	14
6.	Salinity at 2 and 10 meters	15
7.	Salinity at 20 and 30 meters	16
8.	Salinity at 2 and 40 meters	17
9.	Bottom Salinity	18
10.	Sigma-t at 2 and 10 meters	19
11.	Sigma-t at 20 and 30 meters	20
12.	Sigma-t at 2 and 40 meters	21
13.	Bottom Sigma-t	22
14.	Transmission at 2 and 10 meters	23
15.	Transmission at 20 and 30 meters	24
16.	Transmission at 2 and 40 meters	25
17.	Bottom Transmission	26
18.	Dissolved Oxygen at 2 and 10 meters	27
19.	Dissolved Oxygen at 20 and 30 meters	28
20.	Dissolved Oxygen at 2 and 40 meters	29
21.	Bottom Dissolved Oxygen	30
22.	T/S Diagram for all Stations	31
23.	T, S, Sigma-t for Section A1-A6	32
24.	Dissolved Oxygen Transmission for Section A1-A6	33
25.	T/S Diagram for Section A1-A6	34
26.	T, S, Sigma-t for Section B1-B6	35
27.	Dissolved Oxygen Transmission for Section B1-B6	36
28.	T/S Diagram for Section B1-B6	37
29.	T, S, Sigma-t for Section C1-C6	38
30.	Dissolved Oxygen Transmission, for Section C1-C6	39
31.	T/S Diagram for Section C1-C6	40
32.	T, S, Sigma-t for section D2-D6	41
33.	Dissolved Oxygen Transmission for Section D2-D6	42
34.	T/S Diagram for Section D2-D6	43
35.	T, S, Sigma-t for Section E1-E6	44
36.	Dissolved Oxygen Transmission for Section E1-E6	45
37.	T/S Diagram for Section E1-E6	46
38.	T, S, Sigma-t for Section F1-F6	47
39.	Dissolved Oxygen Transmission for Section F1-F6	48
40.	T/S Diagram for Section F1-F6	49

Abstract

A hydrographic survey was made on November 18-23, 1981 on the People's Republic of China R/V Shijian to measure the regional hydrographic structure in the East China Sea near the mouth of the Chang Jiang (Yangtze) River. The objectives of the hydrographic program were to document the spatial structure of the Chang Jiang discharge over the continental shelf and characterize the river's influence on the shelf water masses during a period of low river discharge. A summary of the hydrographic observations made during Cruise ECS81-2 on the R/V Shijian is presented in graphic form.

1. Introduction

The Chang Jiang (Yangtze River) is the third largest river in the world in terms of water discharge, and the maximum discharge on average occurs in July and August. In June, 1980, the first field experiment of a cooperative research program took place in the East China Sea involving U.S. and Chinese scientists from many institutions including specialists in marine geology, biological oceanography, marine geochemistry, and physical oceanography. The overall objective of this joint U.S. - P.R.C. program is to develop an understanding of the discharge of fresh water and sediment from the Yangtze River, and to determine its influence on the East China Sea sedimentary regimes. As part of this program, a hydrographic component was designed to measure the spatial and temporal structure of the Yangtze River plume from the mouth of the estuary out onto the shelf and characterize the influence of this plume on the shelf water masses. In November, 1981, the third field experiment involved two Chinese research ships, the R/V Shijian, which worked over the shelf adjacent to the Yangtze River mouth, and the R/V Shugang No. 6, a smaller coastal vessel which worked within the mouth of the Yangtze estuary. A small-scale array of stations on lines A-F (see Figure 1) was completed November 18-19 by the R/V Shijian, and the remaining hydrographic stations were completed November 19-23, 1982. We present here in graphical form a preliminary analysis of the hydrographic observations made in the East China Sea on the R/V Shijian during the November 18-23, 1981 survey.

2. Instrumentation

A. CTD

A Neil Brown Instrument System Model MK3 CTD fish (No. 038-D) was used as the primary profiling instrument aboard the R/V Shijian. The instrument provided continuous sampling of temperature, conductivity, pressure, dissolved oxygen, and light transmission. Salinity and density were subsequently derived from the measured variables. Conductivity is measured with a miniature four electrode ceramic cell. Temperature is sensed from the combined outputs of a high speed (30 millisecond) thermistor and a platinum resistance thermometer. Pressure is sensed by a strain gauge pressure transducer. Dissolved oxygen is measured by a Beckman polarographic partial pressure oxygen-sensor.

B. Transmissometer

A Sea Tech beam transmissometer (25 cm pathlength) was attached to the CTD underwater unit and light transmission was recorded continuously during each CTD cast. The light source is a Light Emitting Diode (LED) with a wavelength of 660 nm. The instrument design has been field-tested in Oregon and Peru (Bartz, Zaneveld and Pak, 1978) with satisfactory results and used here without additional calibration.

C. Calibration Samples

Water samples were not collected for salinity calibration since a salinometer was not available on the R/V Shijian. Suspended sediment samples were obtained by Chinese scientists, and these samples were used for comparison with the light transmission data.

D. Navigation

The R/V Shijian relied primarily on the local Chinese Loran-A navigation system to position the ship at each station. The estimated accuracy of the station locations was ± 4 km.

3. Data Acquisition and Analysis

An HP85 desktop computer was integrated with the Neil Brown CTD deck unit as the primary data acquisition system. The acquisition program was initially written by Frank Sommer of the University of Alaska, Fairbanks, and slightly modified for this application. Temperature, conductivity, pressure, dissolved oxygen, and the original light transmission data, were also recorded continuously in FM format using an analog cassette recorder as a backup for the HP85 system at each station. The Neil Brown digital data stream was subsampled by the HP85 every 0.4 seconds giving a typical pressure interval of 15 cm between data records. Vertical profiles produced immediately after each cast in engineering units enable the user to qualitatively assess the data quality of each station. The raw data in engineering units were then averaged over 2 meter depth intervals, recorded on the HP85 tape cassette, and subsequently used with analysis software to compute other derived variables and make edited data plots.

4. Error Analysis

The USGS Neil Brown CTD fish (No. 038-D) was calibrated prior to the cruise by Karl Schleicher at the WHOI calibration facility.

The following calibration offsets and standard deviations were measured:

	<u>Offset</u>	<u>Standard Deviation</u>
Temperature :	- .010°C	.001°C
Conductivity :	+ .010 mmho	.003 mmho

Since these calibration offsets were small compared to the local variability in the hydrographic structure in the East China Sea, no correction was made to the data.

5. Hydrographic Data Presentation

The hydrographic data taken on the survey are presented here in three different formats - vertical and horizontal sections, and T/S diagrams. The horizontal sections are shown in two scales: a fine scale region which was located near the Yangtze estuary, and a large scale region consisting of all CTD stations. The horizontal and vertical cross-sections are drawn with contour intervals of 1°C, 1‰, 1 σ_t , 1 ml/l O₂, and every 10 percent light transmission. T/S diagrams are also presented for each vertical section as well as a composite of all stations. The T/S diagrams are plotted from the raw CTD data whereas the vertical and horizontal cross-sections are drawn from the 2 m averaged data. The horizontal plan view sections are presented for the survey at standard depths of 2 m, 10 m, 20 m, 30 m, and 40 m.

6. Acknowledgements

Cruise ECS 81-2 of the R/V Shijian was supported jointly by the People's Republic of China, National Bureau of Oceanography and the National Atmos-

pheric and Oceanic Administration under Cooperative Agreement No. NA81AA-H-00008. The authors were also supported under NSF Grant No. OCE 80-14941. Dr. Robert Beardsley was the U.S. Chief Scientist on the multi-disciplinary cruise which involved current meter mooring deployment and recovery, sea-floor sampling and coring, and the hydrographic program. The work was a cooperative effort between scientists from the People's Republic of China and the United States. The helpfulness of the officers and crew of the R/V Shijian contributed significantly to the success of the cruise. We are especially indebted to Dr. Brad Butman of the USGS who loaned the CTD profiling system.

7. Reference

Bartz, R. J., R. V. Zaneveld and H. Pak, A transmissometer for profiling and moored observations in water. SPIE, Volume 160, Ocean Optics V, 1978, p. 102-108.

Figure 1: Cruise Track

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

Figure 19

Figure 20

Figure 21

Figure 22

T/S Diagram of All Stations

Figure 23

Figure 24

Figure 25

Figure 26

Figure 27

Figure 28

Figure 29

Figure 30

Figure 31

Figure 32

Figure 33

Figure 34

Figure 35

Figure 36

Figure 37

Figure 38

Figure 39

Figure 40

<p>Woods Hole Oceanographic Institution WHOI-82-44</p> <p>HYDROGRAPHIC STATION DATA OBTAINED IN THE EAST CHINA SEA, NOVEMBER 1981 by R. Limeburner and R. C. Beardsley, 49 pages. October 1982. Prepared for the National Atmospheric and Oceanic Administration under Cooperative Agreement NA81AA-H-00008 and for the National Science Foundation under Grant OCE 80-14941.</p> <p>A hydrographic survey was made on November 18-23, 1981 on the People's Republic of China R/V Shijian to measure the regional hydrographic structure in the East China Sea near the mouth of the Chang Jiang (Yangtze) River. The objectives of the hydrographic program were to document the spatial structure of the Chang Jiang discharge over the continental shelf and characterize the river's influence on the shelf water masses during a period of low river discharge. A summary of the hydrographic observations made during Cruise ECS81-2 on the R/V Shijian is presented in graphic form.</p>	<p>1. East China Sea</p> <p>2. Hydrography, CTD</p> <p>3. Light transmission, dissolved oxygen</p> <p>I. Limeburner, R.</p> <p>II. Beardsley, R. C.</p> <p>III. NA81AA-H-00008</p> <p>IV. OCE 80-14941</p> <p>This card is UNCLASSIFIED</p>	<p>Woods Hole Oceanographic Institution WHOI-82-44</p> <p>HYDROGRAPHIC STATION DATA OBTAINED IN THE EAST CHINA SEA, NOVEMBER 1981 by R. Limeburner and R. C. Beardsley, 49 pages. October 1982. Prepared for the National Atmospheric and Oceanic Administration under Cooperative Agreement NA81AA-H-00008 and for the National Science Foundation under Grant OCE 80-14941.</p> <p>A hydrographic survey was made on November 18-23, 1981 on the People's Republic of China R/V Shijian to measure the regional hydrographic structure in the East China Sea near the mouth of the Chang Jiang (Yangtze) River. The objectives of the hydrographic program were to document the spatial structure of the Chang Jiang discharge over the continental shelf and characterize the river's influence on the shelf water masses during a period of low river discharge. A summary of the hydrographic observations made during Cruise ECS81-2 on the R/V Shijian is presented in graphic form.</p>	<p>1. East China Sea</p> <p>2. Hydrography, CTD</p> <p>3. Light transmission, dissolved oxygen</p> <p>I. Limeburner, R.</p> <p>II. Beardsley, R. C.</p> <p>III. NA81AA-H-00008</p> <p>IV. OCE 80-14941</p> <p>This card is UNCLASSIFIED</p>	<p>Woods Hole Oceanographic Institution WHOI-82-44</p> <p>HYDROGRAPHIC STATION DATA OBTAINED IN THE EAST CHINA SEA, NOVEMBER 1981 by R. Limeburner and R. C. Beardsley, 49 pages. October 1982. Prepared for the National Atmospheric and Oceanic Administration under Cooperative Agreement NA81AA-H-00008 and for the National Science Foundation under Grant OCE 80-14941.</p> <p>A hydrographic survey was made on November 18-23, 1981 on the People's Republic of China R/V Shijian to measure the regional hydrographic structure in the East China Sea near the mouth of the Chang Jiang (Yangtze) River. The objectives of the hydrographic program were to document the spatial structure of the Chang Jiang discharge over the continental shelf and characterize the river's influence on the shelf water masses during a period of low river discharge. A summary of the hydrographic observations made during Cruise ECS81-2 on the R/V Shijian is presented in graphic form.</p>	<p>1. East China Sea</p> <p>2. Hydrography, CTD</p> <p>3. Light transmission, dissolved oxygen</p> <p>I. Limeburner, R.</p> <p>II. Beardsley, R. C.</p> <p>III. NA81AA-H-00008</p> <p>IV. OCE 80-14941</p> <p>This card is UNCLASSIFIED</p>	<p>Woods Hole Oceanographic Institution WHOI-82-44</p> <p>HYDROGRAPHIC STATION DATA OBTAINED IN THE EAST CHINA SEA, NOVEMBER 1981 by R. Limeburner and R. C. Beardsley, 49 pages. October 1982. Prepared for the National Atmospheric and Oceanic Administration under Cooperative Agreement NA81AA-H-00008 and for the National Science Foundation under Grant OCE 80-14941.</p> <p>A hydrographic survey was made on November 18-23, 1981 on the People's Republic of China R/V Shijian to measure the regional hydrographic structure in the East China Sea near the mouth of the Chang Jiang (Yangtze) River. The objectives of the hydrographic program were to document the spatial structure of the Chang Jiang discharge over the continental shelf and characterize the river's influence on the shelf water masses during a period of low river discharge. A summary of the hydrographic observations made during Cruise ECS81-2 on the R/V Shijian is presented in graphic form.</p>	<p>1. East China Sea</p> <p>2. Hydrography, CTD</p> <p>3. Light transmission, dissolved oxygen</p> <p>I. Limeburner, R.</p> <p>II. Beardsley, R. C.</p> <p>III. NA81AA-H-00008</p> <p>IV. OCE 80-14941</p> <p>This card is UNCLASSIFIED</p>
---	---	---	---	---	---	---	---