WHP Ref. No.: ISS1/ISS2/IR3
Last updated: 23 June 1995

NOAA/AOML/PhOD Cruise Report
Indian Ocean Repeat Hydrography

A. Cruise narrative

A.1. Highlights

a. WOCE designation: ISS1
ISS2
IR03

b. Expedition designation: 3175MB95/02
MB-95-02

c. Chief scientist: Amy Ffield
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d. Ship: MALCOLM BALDRIGE

e. Ports of call: Durban, South Africa to Colombo, Sri Lanka

f. Cruise dates: March 21, 1995 to April 22, 1995

A.2. Cruise Summary Information

a. Geographic boundaries: The cruise took place in the Arabian Sea and the southwest Indian Ocean within an area bounded by 40¿S to 10¿N and 29¿E to 64¿E.

b. Stations occupied:
Total number of stations occupied on the cruise:
CTD/O2: 114
LADCP: 113
XBT: 51

c. Floats and drifters deployed: Twelve drifters were deployed on the cruise (need deployment locations and details)

A.3. List of Principal Investigators

The principal investigators for all measurements are listed in Table 1.

TABLE 1: List of principal investigators and their responsibilities

Principle Investigator	Measurements	Affiliation
Amy Ffield	CTD, O2, salinity	CIMAS
Doug Wilson	ADCP, LADCP	AOML
Rik Wanninkhof	pCO2, TCO2	AOML
Andrew Dickson	pH	SIO
Francisco Chavez	nitrate, chlorophyll, irradiance, nutrients	MBARI
Paul Quay	C-13	Univ. of Washington
Allan Devol	O2, Ar	Univ. of Washington
Tom Carsey	O3, NO2, NOx, NOy, PAN	AOML
Russ Dickerson	sonde, CO, photolysis rate of NO2, aerosols aerosol optical depth, surface	University of Maryland
Lisa Ballance	ocean fauna	Southeast Fisheries

A.4. Scientific Programme and Methods

Physical Oceanography

Amy Ffield and Doug Wilson, CIMAS/AOML

The NOAA Climate and Global Change Program (C&GC) objective of measuring the ocean property distributions and their evolution in time coincides with the major objectives of the World Ocean Circulation Experiment (WOCE) to understand the general circulation of the global ocean well enough to be able to model its present state and predict its evolution. During the Indian Ocean field period in 1995 high resolution hydrographic surveys will be obtained by the NOAA Ship MALCOLM BALDRIGE along WOCE Hydrographic Program (WHP) area ISS1 (I5W), IR03 (I7N), IR01W (I1W) and ISS2, and IR04 (I8N). In the Indian Ocean the major oceanographic questions are intrinsically coupled to its large monsoonal variability. The surveys are designed to capture the variability in the Indian Ocean by repeating measurements along the same WHP lines as sampled by the R/V Knorr in 1995. In order to sample during the opposite monsoon season then the Knorr, some of the BALDRIGE's repeat surveys actually precede, or "prepeat", the Knorr's one-time surveys.

WHP repeat section IR03 and Special Study Areas ISS1 and ISS2 were chosen to most efficiently capture a broad sampling of the current regimes influenced by the monsoons, thermohaline overturning regions, and historically poorly sampled thermocline and deep flows in the Indian Ocean. Together, the repeat and one-time WHP surveys will be used to estimate monsoonal variations of the thermohaline overturning, meridional and zonal flows, and heat and freshwater fluxes. These processes have been carefully selected as fundamental to increasing the understanding of the Indian Ocean's role in climate. In addition, the hydrographic measurements will also support NOAA CO2 measurements for the OACES program. All together, the international effort will provide a data set with unprecedented coverage of the Indian Ocean and will serve as a reference point for future monitoring of its physical and chemical properties.

Within ISS1, WHP line I5W extends from the South African coast along ~33¿S to 55¿E with relatively sparse CTD/O2/LADCP sampling. XBTs were used along I5W in order to improve the sampling density. The stations near the South African coast span the mooring array deployed one month earlier (Bryden). The I5W line in the ISS1 area was previously sampled in 1987 by Toole and Warren, and will be resampled by the Knorr in 1995. WHP line IR03 continues north from I5W generally along 55o E to 8.5o N, and the typical sampling is 30 nm. Automated continuous measurements of position, bathymetry, sea surface parameters, and standard meteorological parameters complement the data set.

Several sections are presented using the preliminary current measurement data (Wilson). Two hundred meters was the deepest common depth along this section, where range was reduced due to higher sea states. The south(west)ward flowing Agulhas current is visible along the western boundary, with energetic alternating bands extending off shore. A contoured LADCP section from I5W is not shown due to the relatively large and uneven station spacing on this leg.

Notable features include near bottom eastward flow near 27¿S, relatively weak South Equatorial Current and Countercurrents between 20¿ and the Seychelles at 5¿S, and a strong, deep equatorial current system. Figure 9 shows the upper ocean equatorial currents at an expanded scale and highlights the favorable comparison between velocities measured by the lowered and shipboard ADCP systems. Much of the difference seen is due to interpolation between LADCP stations, mostly spaced at 30 to 50 kilometers.

A.5. Major Problems and Goals Not Achieved

Five days of the Scientific Computing System underway data may have been lost due to an undetected error on the backup disk; 2 of the 5 days were during transit and anchorage for the medivac described in the section below. Previous

problems with the starboard side winch and narrow beam bathymetry were corrected before the beginning of this cruise, and they performed well throughout the entire cruise. All the scientific goals of the cruise were achieved.

A.6. Other Incidents of Note

Twenty-four hours were used for an emergency medivac to Mauritius. After medical consultation at Mauritius, arrangements were made to fly the patient to the US for treatment.