Research Plan
Franklin
FR 9/94

Air-Sea Interaction studies in the equatorial Indian Ocean

Itinerary

Sail Colombo	1300	Friday 16 September 1994
Arrive Fremantle	1500	Sunday 9 October 1994

Aims of the cruise

The major objectives are as follows:

(1) Heat budget closure and mixed-layer measurement:
The primary aim of this cruise is to achieve as accurate a closure of the ocean heat budget as possible, following a drifting buoy. The four components of surface heat flux, plus rainfall, will all be measured directly and continuously; the integral of the total heat flux will be compared with the change in heat content of the top few tens of meters near the buoy, every four hours. This was also the aim of two previous previous cruises during TOGA-COARE (FR9/92 and Fr1/93), but some improvements in technique will be incorporated, on the basis of experience during TOGA-COARE.

(2) Mooring recovery and deployment:
A TAO (Tropical Atmosphere-Ocean) mooring, of the type used in the equatorial Pacific array, is located at (0°, 84°E). This will be recovered. It will have collected a year's data on surface meteorological variables, and temperatures in the top 250 meters. An upward-looking ADCP mooring will be deployed near (0°, 90°E). It was originally planned to place a TAO mooring at this location also, in collaboration with PMEL in Seattle, but they have withdrawn to redesign their mooring, because their TAO mooring at (0°,80°E) broke loose and was lost..

The ADCP mooring — due to be recovered in August, 1995 — will provide the first detailed coverage of the semiannual Wyrtki jets as they approach Sumatra (in May and November). They should also give an indication of the whether the 28 day waves in meridional velocity (a prominent feature further west) are also present near Sumatra.

Scientific Program

Mooring recovery:

After leaving Colombo, we will first recover the mooring at (0°,84°E), and then proceed to about (2°S, 87°E), (where winds are light at this time of year, on climatological average), launch the buoy, and start the experiment.

Drifter following experiment:

(a) As in COARE, we will deploy SEASOAR, and run triangular tracks within a 25 km radius around the buoy, with legs past the buoy every 4 hours. We hope the SeaSoar will have been refurbished to permit accurate measurement of pressure and salinity near the surface; and that a new system will be deployed for getting the SeaSoar up to the surface outside the ship's wake.

(b) During COARE, the "Silverfish" (a T-S profiler suspended from the boom, sampling the top 2m under undisturbed conditions) was an experimental instrument. We propose to deploy "Silverfish" and "SeaSoar" simultaneously, to see whether they give closely similar depth distributions. If they do (or if a well-defined correction scheme can be devised), the "SeaSoar" data will provide long (several-day) time series of detailed mixed-layer evolution, which can be used to verify details of the diurnal mixed-layer formation process under a variety of conditions.

c) The heat fluxes will be estimated by bulk formulae only, using the 15-minute mean data from the foremast: no eddy-correlation measurements will be made. This foremast platform has been extensively calibrated using the COARE results (which, as anticipated, have been the primary standard for accuracy during COARE).

d) During COARE, the buoy had two current meters suspended below it. It also had a raingauge, radiometer and standard weather station (wind, air temperature and humidity, SST) on it. We found that the presence of only two current meters below the buoy was limiting. This time we plan to deploy a downward-looking ADCP, which should resolve to better than 4m (possibly as small as 1m) below a depth of about 5m. This will permit accurate evaluation of Richardson numbers.

The budget will be evaluated in real time (using ship's estimates of fluxes), permitting detailed checks on instrument performance. The data will also provide a detailed data set for evaluating the performance of mixed layer models. We anticipate having 10 days available for buoy following.

Mooring deployment:
We will then proceed to (0°,90°E), and deploy the ADCP mooring, before returning to Fremantle.

Principal Investigators

Objective (1):
Dr. J.S. Godfrey (DO)
Dr. E.F. Bradley (CEM)

Objective (2):
Dr. J.S. Godfrey (DO)
Dr. M. Tomczak (Flinders Uni).

Cruise Track

The largescale cruise track is shown on the attached figure. After recovery of the buoy at (0°,84°E), the ship will proceed to near (2°S, 87°E), where the SeaSoar work following the drifting buoy will commence. The inset shows a typical "inverse butterfly" track following the buoy. During the 10 days or so of buoy following, any refurbishment of the TAO mooring can be undertaken.
After completion of the buoy drift, we will proceed to (0°, 90°E) and deploy the two moorings; "Franklin" will then head directly for Fremantle. .

ORV Equipment required

All standard equipment, including: SEASOAR and winch; standard meteorological instruments, including Eppley pyranometer and pyrgeometer; R.M. Young raingauge; thermosalinograph; ADCP; CTD, with 12-bottle rosette.

Equipment to be provided by users

Meteorological boom, with associated sensors and loggers
Optical raingauge
Drifting buoy, with met. sensors and 2 current meters

Current meter reader

Time estimates

Travel Colombo-(0°,84°E): 480 miles @ 12 kts = 1.67 days
Recover TAO mooring =0.5 days.
Travel (0°84°E)-(2°S,87°E):216 miles @ 12 kts = 0.75 days
Buoy following 10 days
Travel (2°S,87°E) - (0°90°E):216 miles @ 12 kts = 0.75 days
Deployment of TAO mooring, ADCP mooring 1 day
Travel, (0°,90°E) to Fremantle: 2340 miles @11 kts =8.9 days
Total 23.6 days
Time allowed 23.95 days

Personnel

Stuart Godfrey (DO) Chief Scientist
One person (CEM)
Jeff Butt (DO)
Lindsay Pender (ORV)
Ian Helmond (ORV)
V.Latham or R. Plaschke (ORV)
D. Edwards (ORV)
One from Mooring Group (DO)
One student (Flinders University)*
One student (Oxford University)*
One student (Tas. University)*

*: These are possible participants