Reports

The Indian Ocean Experiment: Introduction

The following six reports summarize the results of the Indian Ocean Experiment (INDEX), an oceanographic survey of the Somali Current and western equatorial Indian Ocean during the onset of the southwest monsoon in 1979. In this region, surface currents change dramatically with the annual cycle of monsoon winds in a qualitatively well known manner (*1*). Off the east coast of Africa the Somali Current follows each seasonal wind reversal within 1 month, reaching speeds of 7 knots (3.5 m/sec) during the southwest monsoon. Previous studies of the width and shape of the current and its water properties were all made in mid-monsoon, with the current fully developed in one direction or the other (*2–4*). The transition seasons have generally been avoided because of the practical problem of mapping rapid changes over a large area. Such observations as have been made then (*5, 6*), although significant, were limited in extent.

A more detailed description of the way the Somali Current changes in response to the onset of the southwest monsoon would be useful for comparison with dynamic models of the process (*7–9*). Such a study was considered timely in view of the Global Weather Experiment, which offered the prospect of frequent satellite-derived maps of sea surface temperatures and greatly improved surface wind observations. An earlier experiment (*10*) had suggested that the velocity field along the equator has a complex vertical structure of mainly zonal jets. At the surface, the eastward equatorial jet appeared to be closely related to the occurrence of eastward winds there during the change of monsoon (*11*). The Global Weather Experiment offered an ideal opportunity for extending the observations of the distribution of these phenomena in space and time and relating them to the variable wind field and possibly the Somali Current.

Proposals for oceanographic work in these two areas were coordinated by the INDEX group and linked to international plans for other observations in the Indian Ocean through the Scientific Committee on Oceanic Research working group 47 (oceanography in the Global Weather Experiment). A composite program of shipboard work and satellite-derived observations ran from February to August 1979. None of the ships were continuously involved through that period. Specific contributions are detailed in the reports on separate topics that follow.

The Somali Current did not grow continuously but appeared to extend itself northward in a series of steps. For much of the early part of the southwest monsoon, it separated from the coast near 4°N. A clockwise eddy evolved in situ to the north of that latitude in late May or early June, and was swept away by the main current migrating through to the northeast in August. There was evidence of a deep countercurrent under the southern part of the Somali Current, connected to a westward equatorial jet centered at 700 m. Along the equator to the east of 50°E, satellite-tracked drifter buoys moved intermittently eastward in qualitative agreement with mathematical models of behavior of the equatorial surface jet. None of these observations has yet been related in detail to the wind field.

A driving force behind INDEX and these reports was Dr. Walter Düing, who died on 24 March 1980. To acknowledge Dr. Düing's inspiration and many contributions, we dedicate these reports to his memory.

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References and Notes

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12. Financial support for INDEX is acknowledged in the reports that follow.

6 February 1980; revised 19 May 1980

Somali Current: Evolution of Surface Flow

Abstract. *The transition of the Somali Current from northeast monsoon conditions to southwest monsoon conditions was observed from April through August 1979. The northeastward flow associated with the Somali Current of the southwest monsoon progressed from the equator in April to 4°N in August. The separation of the current from the coast, as observed at the northern boundary of the northeastward flow, did not intrude north continuously, but rather in distinct steps. South of 4°N, the circulation was characterized by the incorporation of increasing amounts of somewhat more saline water from the south and east into the boundary current. A clockwise gyre with northeastward flow along the coast developed between 6° and 10°N during June.*

The equatorial Indian Ocean along the east coast of Africa provides an excellent setting for studies of the response of the sea to atmospheric forcing. The atmospheric forcing signal is large because of the monsoonal wind, and the ocean response is dramatic. In the northern winter, the Somali Current flows from north of the equator to about 2°S. In the northern summer, the current reverses direction and flows north.

Our experiment encompassed the transition period between the northeast monsoon and the southwest monsoon. During this time, the flow of the Somali Current changes from southwestward to northeastward. Our findings include important spatial and temporal data about this transition, and provide a conceptual framework for many of the results of previous studies.

Data were collected from three ships: the *Discovery* of the British Institute of Oceanographic Sciences, the *Columbus Iselin* of the University of Miami, and the *Researcher* of the U.S. National Oceanic and Atmospheric Administration. The courses of the ships were coordinated to obtain maximum spatial and temporal coverage of the area while permitting individual programs to be conducted. Meteorological data were also collected on all the cruises.

Surface current charts were constructed for four time periods from three different types of data (Fig. 1, A to D).

0036-8075/80/0801-0588$00.50/0