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Sequal/Focal: First Year Results on the Circulation in the Equatorial Atlantic

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SEQUAL/FOCAL: FIRST YEAR RESULTS ON THE CIRCULATION IN THE EQUATORIAL ATLANTIC

Guest Editor

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Since the tropics are a principal region of heat exchange between the oceans and the atmosphere, the distribution of heat in the tropical oceans is crucial to global climate. Relative to mid-latitudes, the dynamics of the equatorial zone of the tropics allow for rapid baroclinic responses to external forcing. Thus the equatorial ocean's circulation responds seasonally to the surface wind stress resulting in a largely advective distribution of heat.

The equatorial ocean's response is not simply local so its study requires basin-wide observations. Our understanding of equatorial ocean circulation has evolved to the point where the lack of a quasi-synoptic data set now impedes further progress. Required is an intensive yet extensive set of measurements over at least one full year. Of the three oceans the Atlantic is the most attractive for this because earlier programs have demonstrated its having the largest ratio of annual to interannual variability and its size makes the logistics for basin-wide coverage manageable. To acquire the necessary data and coordinate the modelling efforts, a program called SEQUAL, "The Seasonal Response of the Equatorial Atlantic", was developed. The SEQUAL program is an observational and theoretical study of the response of the temperature and current fields of the equatorial Atlantic Ocean to the seasonally varying surface winds. The objective is to model correctly the dominant physical processes producing the seasonal redistribution of heat, mass, and salt in the upper ocean (e.g. The Oceanography Report, EOS, 63, 218, 1982). The efforts of SEQUAL are greatly enhanced by the Francais Ocean et Climat dans l'Atlantique Equatorial (FOCAL) program whose objectives overlap with that stated above.

The SEQUAL/FOCAL field program commenced during the latter part of 1982. Most of the field program elements were in place by February 1983 and they are scheduled to run through 1984 yielding measurements over approximately two complete seasonal cycles. Figure 1 gives a schematic overview of the joint SEQUAL/FOCAL field program. Fixed arrays and shipborne profiles span the North Equatorial Countercurrent, the South Equatorial Current and the Equatorial Undercurrent. The fixed instruments consist of inverted echo sounders, tide gauges, surface moored current meters, and surface wind recorders. These are complemented by a regular series of cruises making

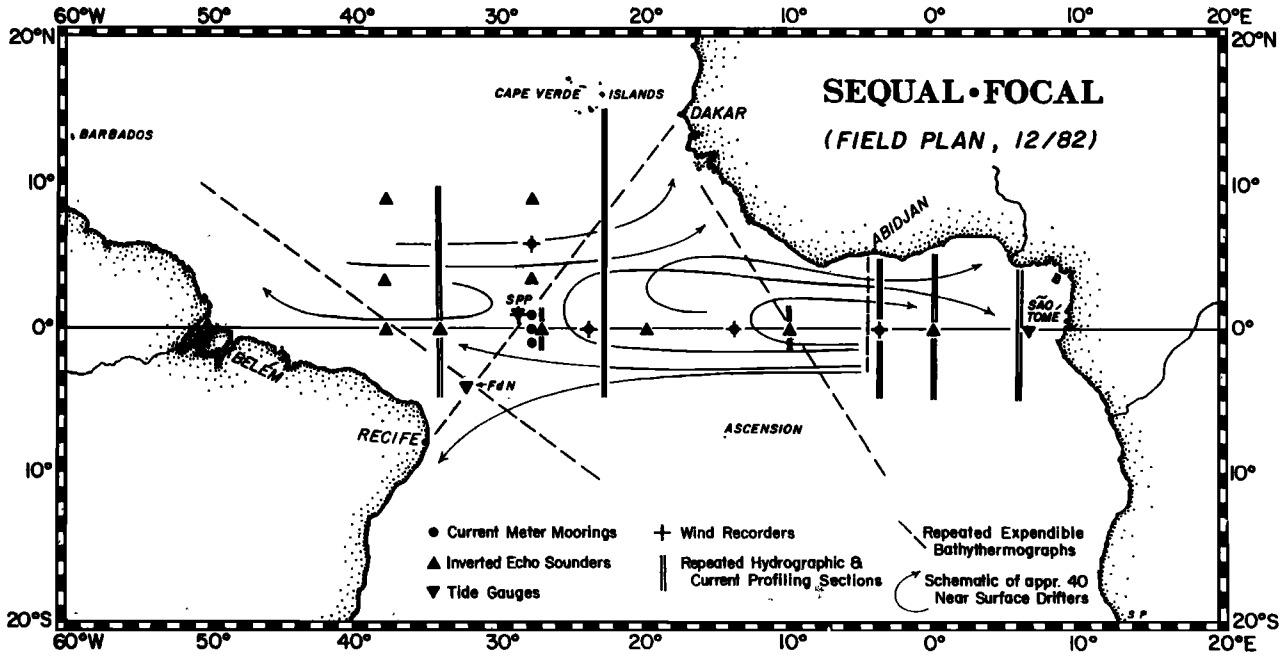

Fig. 1. Schematic of the SEQUAL/FOCAL field program showing positions of the various measurement systems.

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repeated hydrographic and velocity profile sections roughly every three months, merchant ship expendable bathythermograph (XBT) sections, seasonal aircraft XBT sections, and surface drifter deployments. Upon completion, the SEQUAL/FOCAL field program will for the first time provide quasi-synoptic data covering nearly an entire equatorial ocean basin for more than one year. This comprehensive and unique data set will serve as a benchmark for future model testing and theoretical advancement.

Given the diverse types of measurements and the timing of ongoing and planned (e.g. TOGA) equatorial programs in all three oceans, a rapid dissemination of SEQUAL/FOCAL first year results was desirable, both to promote dialogue amongst its participants and for the interest of the scientific community at large. What follows is a collection of 24 papers covering preliminary analyses of the first year measurements. The order of presentation begins with the wind as a forcing function. Four papers are given showing observed winds from moored buoys and a mid-ocean island station, inferred wind speeds from inverted echo sounders, and calculated winds from a numerical forecast model. As the winds near the equator intensified in the spring of 1983 the upper ocean underwent a basin-wide adjustment which is discussed based upon inverted echo sounder and surface moored current meter data in the next four papers. Moored current meter and surface drifter measurements showing the seasonal increase in the North Equatorial Countercurrent are then covered by two papers. Associated with the seasonal increase in surface currents is the generation by instability of large scale waves. These are discussed using moored current meter data and shipborne observations in two papers. Hydrographic and velocity profiler data along both meridional and zonal transects are presented in four papers followed by six papers on XBT, AXBT, and sea surface temperature studies. A single paper treating high frequency variability and two papers on numerical model studies complete the special issue. Many of these papers were presented at "The Third FOCAL-SEQUAL Reunion" held in Paris, France, 27-29 February 1984 and as guest editor I congratulate all contributors for their timely submittals, some of which literally arrived right off the boat. Our collective desire is that this special issue will serve as an initial representation of the varied range of physical processes being studied by SEQUAL/FOCAL. Recognizing that roughly half of the data set is yet to be collected, our final results and conclusions must remain some years away.

I want to express my appreciation on behalf of SEQUAL/FOCAL to the editorial office of Geophysical Research Letters for accomodating our special issue and to all of the reviewers for their timely and constructive manuscript critiques. Particular recognition must go to my two editorial assistants, Ms. Dora Cornwell and Ms. Toni Clay, without whose help this special issue, in its present scope, would not have been possible. SEQUAL funding has come primarily from the Oceanography Section, National Science Foundation, and the efforts of C. Collins and P. Hacker are largely responsible for the continuity that the program has enjoyed.

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