February 14, 1995

Dr. Thomas Kinder, ONR Code 321CD
Office of Naval Research
Ballston Tower One
800 N Quincy St
Arlington VA 22217-5660

ONR Grant # N00014-92-J-1177
OSU Acct # 30-262-3154

Dear Dr. Kinder:

In order to complete my ONR grant entitled "Equatorward Jets, Poleward Undercurrents, and Coastal Upwelling", I am sending three copies of the Final Technical Report to you with copies distributed as indicated below.

Sincerely,

Robert L. Smith

cc: Defense Technical Information Center (2 copies)
    Bldg 5, Cameron Station
    Alexandria, VA  22304-6145

    Administrative Contracting Officer (1 copies)
    Office of Naval Research
    Seattle Regional Office
    1107 NE 45th St
    Suite 350
    Seattle WA  98105-4631

    Director, Naval Research Laboratory  (1 copy)
    Attn: Code 2627
    Washington DC  20375

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The focus of the research was on the ocean along its eastern boundaries. A review of recent developments in our understanding of coastal upwelling was prepared based primarily on the several major oceanographic experiments that were conducted over the continental margins in coastal upwelling regions during the past decade. These studies extended farther seaward than the continental shelf and often extended over the seasons. Our understanding of the processes associated with coastal upwelling, especially the Ekman transport in the surface layer and the processes affecting the ocean farther seaward, has increased. The wind-driven cross-shelf transport in the surface mixed layer agrees well in magnitude and variability with the Ekman transport estimated from the wind stress. The 'cool filaments' conspicuous in satellite images of SST during the coastal upwelling seasons off northern California, Portugal and Africa, have been studied and shown to usually be jets along the boundary (front) between recently upwelled water and the warmer adjacent ocean water. Sverdrup wrote more than 50 years ago: "One may ... raise the question whether a boundary region of the nature described can exist on a long horizontal distance ... it appears indeed likely that on a long distance it must be broken up owing to the intensive mixing processes, and that horizontal eddies of considerable dimensions may break away from the boundary region." Although the question remains, observations with new techniques suggest that the boundary is maintained over long horizontal distances as the jets meander equatorward, but that eddies may break away. The upwelled water (and the front associated with coastal upwelling) can extend farther offshore than previously realized. Cross-isobath flow, although generally small compared to the along-isobath flow over the continental margins, is of crucial importance to the physics and ecology of both the coastal ocean and the ocean boundary currents seaward of the shelf; this topic, especially over the inner shelf and in the bottom boundary layer, will be the focus of much future research, as will the problems of cross-frontal exchange.

In addition to preparing the review of studies in the eastern boundary regions associated with coastal upwelling, we continued the analyses of data from two of the experiments undertaken with ONR support:

Data from moored and shipborne Acoustic Doppler Current Profilers in the 1988 CTZ (Coastal Transition Zone) experiment were analyzed to obtain a more accurate estimate of transport in the CTZ jet by removing the tides from the ADCP data. Using the detided ADCP together with CTD data, the application of mass and salt conservation improves our view of the flow field around the box surrounding the 1988 CTZ surveys. One useful result is a fairly accurate estimate of the geostrophic transport carried by the CTZ jet (5.6-5.9 Sv in late June-early July). Noteworthy is a strong poleward undercurrent >20 cm/s centered about 100-200 m in depth, carrying at least 2.1 Sv of 'spicy' (warmer, more saline) water into the region in late July. This feature is only detectable if properly referenced geostrophic velocities are available; if the 500 dbar pressure field is assumed to be a level-of-no-motion, the undercurrent is hardly detectable.

Using data from moored ADCPs in the Gulf of Tehuantepec experiment, we investigated the extent to which it is possible to use the surface bin from the ADCP data to infer the wind speed and direction. The backscatter from the surface bin was found to be a significant predictor of wind speeds from nearby met buoys and the ship. Direction was more problematic, with the direction inferred from the ADCP surface bin falling between the direction of current in deeper bins and the wind observed from the ship.
LIST OF PUBLICATIONS (ONR GRANT # N00014-92-J-1177):


SUBJECT: Distribution Statements on Technical Documents

OFFICE OF NAVAL RESEARCH
CORPORATE PROGRAMS DIVISION
ONR 353
800 NORTH QUINCY STREET
ARLINGTON, VA  22217-5660


2. The Defense Technical Information Center received the enclosed report (referenced below) which is not marked in accordance with the above reference.

   FINAL REPORT
   N00014-92-J-1177
   TITLE: EQUATORWARD JETS,
   POLEWARD UNDERCURRENTS, AND
   COASTAL UPWELLING

3. We request the appropriate distribution statement be assigned and the report returned to DTIC within 5 working days.

4. Approved distribution statements are listed on the reverse of this letter. If you have any questions regarding these statements, call DTIC's Cataloging Branch, (703) 274-6837.

FOR THE ADMINISTRATOR:

1 Encl

GOPALAKRISHNAN NAIR
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The cited documents has been reviewed by competent authority and the following distribution statement is hereby authorized.

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(Reason)

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