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FINAL TECHNICAL REPORT

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Assimilation Modeling of Coastal Transition Zone Data
and Continental Slope Flow Fields

Linear analysis of Coastal Transition Zone (CTZ) jet profiles (Pierce, Allen, and Walstad, 1991) indicates that 150 km and less wavelength instabilities are predominantly barotropic, while for wavelengths 200 km and greater the fastest growing modes have nearly equal contributions from barotropic and baroclinic energy conversions. Non-linear finite amplitude studies (Allen, Walstad, and Newberger, 1991) indicate that some linear analysis signals are also apparent at finite amplitude. Despite the importance of baroclinic instability processes at 200 km, there will be significant conversion of kinetic to potential energy at meander crests. Analysis of field estimates from the model assimilation of hydrographic and ADCP data, combined with the results of the linear analysis and finite amplitude studies, leads to the following conclusions (Walstad, Allen, Kosro, and Huyer, 1991). The coastal transition zone jet meanders at length scales of 130 km due to primarily barotropic instability. Accompanying this meandering is a significant vertical velocity (10 m/day) which is well correlated with crests and troughs. At length scales of 200 km a mixed instability meander is apparent and leads to offshore movement of the jet. Assimilation of hydrographic and ADCP data is capable of reproducing transition zone flow fields as indicated by comparison with independent data (ADCP and floats). Unlike deep ocean applications, direct ADCP measurements are needed to provide good field estimates.

Physical mechanisms for retention and accumulation of biomass at fronts have been identified and explored. Effects of frontal circulation patterns on biomass have been shown to result in short length scale variability independent of specific physiological response to the circulation (Franks, 1992a). The horizontal length scales of phytoplankton patches at a variety of fronts (wind, buoyancy, tidally and topographically generated) were examined in relation to the internal Rossby radius of deformation of the front (Franks, 1992b). No correlation was found between the patch scale and the frontal scale, implying either decorrelating mechanisms or forcing of the biology by mechanisms uncorrelated with the front. These two possibilities were examined in detail, with the conclusion that most of the phytoplankton production at fronts occur through mechanisms uncorrelated with the front itself.

Results of intermediate model (IM) studies applied to the shallow-water equations (Allen, Barth, and Newberger, 1990) show that the IM equations may be solved numerically with appropriate boundary conditions to correctly represent ageostrophic coastally-trapped wave dynamics. In addition, the results show that the balance equations, and closely related approximations, consistently give accurate solutions and clearly appear to be the best IMs. A new IM for continuously stratified flows that is closely related to the balance equations, but that is based on momentum equations and conserves both energy and potential enstrophy has been formulated (Allen, 1991). This model has been found to give extremely accurate approximate solutions to the primitive equations for unstable CTZ jet flows.

Final Technical Report (cont'd)
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## LIST OF PUBLICATIONS

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