

SESSION: Eastern Boundary Currents

Seasonal variability in coastal upwelling:  
a comparison of four coastal upwelling sites from space

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Coastal upwelling of subsurface nutrient-rich water occurs along the eastern boundary of the ocean basins and leads to high primary production and fish catches. In this study satellite observations are used to compare the seasonal cycle in wind forcing and in the oceanic and biological response of the major coastal upwelling regions associated with the Canary, Benguela, California, and Humboldt Currents. The monthly averages of winds from ERS-1 (1992-1995), SST from a combination of AVHRR and ship observations (1988-1991), and chlorophyll concentrations from CZCS (1978-1986) provide independent measures of upwelling along the coastline at each site. The objective of this study is to provide a context for future work made possible by the launch of the ADEOS platform in August 1996 from which concurrent measurement of winds (NSCAT), SST (OCTS), and pigment (OCTS) will be made. Seasonal variability in upwelling is determined to the first order by the large scale atmospheric circulation patterns while the biological response -increase in phytoplankton standing stock- depends not only on the upwelling of deep water but also on the nutrient content of the source water and the presence of cells able to utilize the new nutrients. Monthly averages of the wind vector, offshore temperature difference, and chlorophyll concentration are used to indicate the presence of upwelling in terms of atmospheric forcing, oceanic and biological response respectively. Although they measured non-overlapping time periods, the three indicators of upwelling are consistent with each other in all four regions. The periods and locations of upwelling-favorable winds and with the largest zonal SST difference correspond to those with the highest chlorophyll concentrations while poleward winds and negative SST differences (indicating no upwelling) coincide with the lowest pigment values. The seasonal and meridional variability in coastal upwelling expressed by the three indicators is consistent with previous shipboard and satellite studies.