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Small-Scale Coastal Eddies and Hazards off California: Comparison of SAR and CODAR in the Santa Barbara Channel

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As part of an ongoing interdisciplinary study, we seek to provide a better understanding of circulation, biological processes, and pollution in the coastal waters off California. Toward this goal, we utilize a variety of multi-sensor satellite data including high resolution SAR (from RADARSAT, ERS, and upcoming ASAR), ocean color (SeaWiFS, MODIS, and upcoming MERIS), and sea surface temperature measurements (AVHRR and upcoming AATSR) that are complemented by coincident field data (from moorings, drifters, ships, and shore-based HF radar). These synergistic data enable the detection and quantification of under-sampled and poorly described small-scale coastal ocean processes and hazards including eddies, storm water runoff plumes, and hydrocarbon seepage, and an assessment of their bio-geophysical impacts.

This contribution focuses on a comparison of high resolution (~ 100 m) SAR imagery with coastal HF radar (CODAR) data for the detection of small coastal eddies and other circulation features. An array of CODAR instruments are positioned along the coast west of Santa Barbara CA, providing estimates of surface current velocity. This region is characterized by complex circulation patterns, including recurring westward-propagating cyclonic eddies. The Santa Barbara Channel also has extensive natural oil seepage and episodic freshwater discharge that is impacted by these variable flow regimes, as are resident and transitory marine organisms. We compare flow fields derived from CODAR data with those from near-coincident SAR imagery (RADARSAT, ERS-2) to help us ascertain exactly what each sensor is detecting, as well as assess the impact that variable environmental conditions (e.g., wind) have on each type of data. Contrary to initial expectations, our preliminary comparisons have revealed that the flow fields derived from these different sensors are often quite different. While both SAR and CODAR provide an instanteous observation of the ocean surface, the SAR imagery might, to varying extents, reflect a sampling integration over time, providing a short-term system "memory" or "history". This 'memory' is likely related to the extensive presence of oils, both biogenic and mineral, which are swept up by the underlying current and eddy fields as well as dispersed by winds.

From these observations and analyses, we expect to contribute to the understanding of the seasonal, interannual, and regional variability in the bio-geophysical characteristics of small-scale coastal phenomena in southern California coastal waters as well as provide maps of oil seepage and storm water plumes that are important coastal management tools.