

Surface Transport and Mixing in Monterey Bay I: Objective Surface Current Maps

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Abstract: HF radars measure synoptic surface currents near the coast at time intervals like one hour with spatial resolution of a few kilometers. Although increasing numbers of HF radars make synoptic surface current maps routinely available, these maps are not useful for environmental or ecological studies, which require quantitative descriptions of near surface transport to study the impacts of upwelling, the ecology of nearshore habitats, or the effects of harmful algal blooms or oil spills. Particle studies provide a natural way to reveal synoptic surface transport properties embedded in a synoptic Eulerian velocity archive.

Particle trajectories cannot easily be computed directly from an HF radar surface current archive, since the measurements contain space and time gaps and do not extend to the shoreline. Here we apply a technique called

normal mode analysis (NMA) to objectively map HF radar surface current archives in Monterey Bay so that particle trajectories can be reliably computed. The NMA technique uses two sets of basis functions (vorticity modes and divergence modes) and exactly enforces no normal flow at the coastline and a specified normal flow (obtained from the radar measurements themselves) along the open boundaries. Spatial filtering is applied to reduce white noise, and an eight hour low-pass filter (with a sharp cutoff) is used to limit large accelerations while preserving semi-diurnal fluctuations. The resulting objective maps typically recover about 70% of the mean kinetic energy in the radar measurements. This is the first of three talks describing the computation of synoptic maps of particle properties from HF radar measurements in Monterey Bay.