California Coastal Current

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Off the west coast of North America there is a wide (300 km), slow (< 0.1 m/s) persistent southward current. It is the surface expression of the California Current System (CCS): southward at the surface; narrow and northward (30 km, 0.3 m/s) in the Undercurrent centered in the strong density stratification around 200 m depth; and with strong narrow upwelling near the coast that brings cold water rich in nutrients into the sunlit layer where it feeds an abundant food web.

The CCS undergoes large fluctuations at all-time scales, from daily surface temperature fronts and weekly mesoscale eddies (see figure) to El Nino and other multi-year climate cycles with accompanying large swings in the biological populations (e.g., anchovies and sardines).

Summertime has the strongest flows in the CCS because the southward winds are most persistent. In the figure the upwelled cold water is most abundant near the coast, especially north of Monterey Bay. It is being carried by eddy currents out into the ocean in narrow "squirts" with sharp (frontal) edges. As it goes farther and the eddy currents chaotically reverse, it is diluted and mixed with the surrounding warmer waters. Similar patterns occur for the chlorophyll that indicates plankton growth through photosynthesis.

Both surface temperature and chlorophyll are monitored from radiometers on satellites. Quite similar patterns are produced by computational simulations, from which this figure is taken.