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River plume patterns and dynamics within the Southern California Bight

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ABSTRACT

Stormwater river plumes are important vectors of marine contaminants and pathogens in the Southern California Bight. Here we report the results of a multi-institution investigation of the river plumes across eight major river systems of southern California. We use in situ water samples from multi-day cruises in combination with MODIS satellite remote sensing, buoy meteorological observations, drifters, and HF radar current measurements to evaluate the dispersal patterns and dynamics of the freshwater plumes. River discharge was exceptionally episodic, and the majority of storm discharge occurred in a few hours. The combined plume observing techniques revealed that plumes commonly detach from the coast and turn to the left, which is the opposite direction of Coriolis influence. Although initial offshore velocity of the buoyant plumes was ~50 cm/s and was influenced by river discharge inertia (i.e., the direct momentum of the river flux) and buoyancy, subsequent advection of the plumes was largely observed in an alongshore direction and dominated by local winds. Due to the multiple day upwelling wind conditions that commonly follow discharge events, plumes were observed to flow from their respective river mouths to down-coast waters at rates of 20–40 km/d. Lastly, we note that suspended sediment concentration and beam-attenuation were poorly correlated with plume salinity across and within the sampled plumes (mean $r^2 = 0.12$ and 0.25, respectively), while colored dissolved organic matter (CDOM) fluorescence was well correlated (mean $r^2 = 0.56$), suggesting that CDOM may serve as a good tracer of the discharged freshwater in subsequent remote sensing and monitoring efforts of plumes.