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Relative availability of satellite imagery and ship-based sampling for assessment of stormwater runoff plumes in coastal southern California

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ABSTRACT

Information about the size and intensity of urban runoff plumes in the ocean has traditionally been collected through ship-based surveys, but sampling from ships in the nearshore zone is weather-dependent because of the rough sea conditions that often accompany storms. High-resolution satellite imagery is an alternative approach for assessing plume properties, but the availability of satellite imagery can also be weather-dependent. Here we compare the logistical availability of ship-based sampling and the quality of satellite imagery for assessing rainstorm-mediated freshwater plumes. The availability of ship-based sampling was assessed by correlating deployment success of three local ships with wind and wave data and then applying those relationships to a longer wind and wave data record. The quality of satellite imagery was assessed by correlating cloud cover and expert opinion about the usefulness of Level 2 SeaWiFS imagery, then analyzing those relationships with respect to cloud cover found in Level 3 AVHRR, SeaWiFS, and MODIS imagery. In the 10 days following storm events, ships were found to be capable of deployment for sampling about 70% of the time, while SeaWiFS produced high quality images only about 23% of the time. The days for which satellite imagery and shipbased data were available often differed, yielding complementary, rather than redundant, information. As a result, plume data was available for about 80% of the study period using one the methods. The probability of obtaining usable satellite imagery was lowest on the day of a rainstorm and increased during the next five days, whereas the probability of obtaining ship-based data was highest on the day of the storm and typically declined in the days following a storm. MODIS sensors provided better coverage than SeaWiFS or AVHRR due to better spectral, spatial, and particularly temporal resolution (twice a day), thereby significantly improving information about plume dynamics.

Full Text

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