Real-time assimilation using a dense array of directional wave observations

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ABSTRACT IN-DEPTH

Wave conditions along our coastlines are monitored using networks of wave buoys. Augmented with regional wave now- and hind-casts from operational wave models, these data networks provide detailed regional information of wave conditions providing vital updates of wave conditions for maritime, engineering, recreational and scientific purposes. Currently, the observational networks are mostly used to initiate models and assess model performance, but are usually not directly integrated into the modeling system.

Recent work by Crosby *et al.* (2017) explores the integration of buoy data into models and shows that data assimilation of buoy observations into models can improve predictions and wave hindcasts. The results suggest that assimilation of dense observational networks results in significant and important improvements in model performance.

In the current work we leverage these modeling advances with the recent development of low-cost directional wave buoys (such as the Spoondrift Spotter, www.spoondrift.co). The use of low-cost and solar-powered instruments allows for much denser long-term arrays of instruments than was previously possible. The availability of large numbers of independent observations, in turn, can provide excellent constrains on models and model boundary conditions.

Here we will present results from a new real-time wave assimilation system where we integrate a dense array of Spotters. The Spotter array consists of 18 Spotters deployed along a 60 km stretch of coastline, seaward of Point Sal, as part of the ONR Inner Shelf DRI experiment. The array was deployed along the 20, 50 and 100m depth contours during a two-month period from September through November, 2017 (see Figure 1). The hourly 2D spectra provided by each Spotter in the array is assimilated using an efficient back-ray tracing algorithm into a regional wave model (SWAN, booij *et al.*, 1999) forced with predictions from the global NOAA WAVEWATCH III model (WW3DG, 2016). We will discuss the implementation of the data-assimilation framework (following Crosby *et al*, 2017), and compare assimilated results with observations and conventional model predictions.

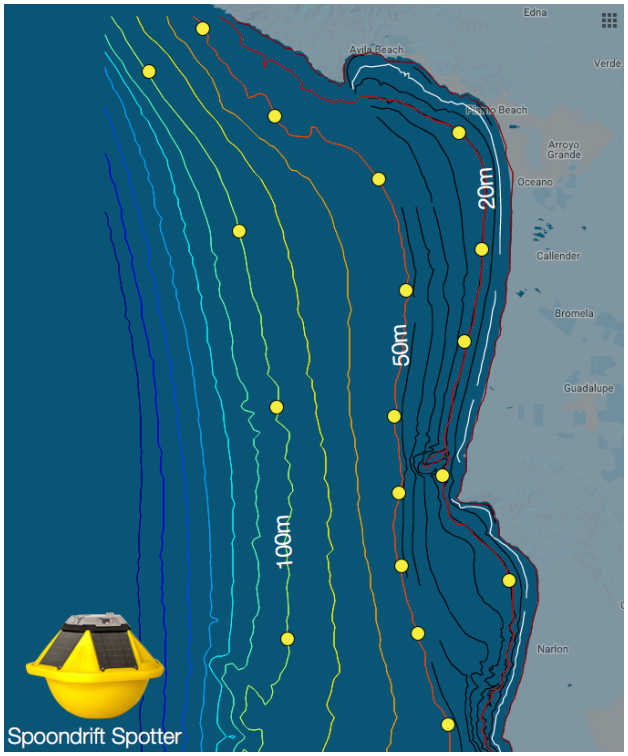

Figure 1 High-density array of Spotters deployed along 60km of coastline near Point Sal, CA

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