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Wind inference by a real-time global ocean weather sensor network

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A distributed sensor network of several hundred free-drifting, real-time marine weather sensors was deployed beginning in early 2019 initially focused in the Pacific Ocean and expanding globally. The Spotter buoys used in the network represent a next generation ocean weather sensor designed to measure surface waves, wind, currents, and sea surface temperature. Despite the demand for better weather forecasts and climate data in our oceans, direct in situ measurements of marine surface weather (waves, winds, currents) remain exceedingly sparse in the open oceans. Due to the large expanse of our oceans, distributed paradigms are necessary to create sufficient data density at global scale, similar to advances in sensing on land and in space. Here we discuss findings from this long-dwell open ocean distributed sensor network, specifically significant wave height accuracy and advancements in wind inference from the wave spectrum. The delivery of full-spectra data by the buoys beginning in 2020 facilitated improved calculation of surface wind derived from wind-sea interaction dynamics. Through triple-collocation analysis, we are able to determine errors in collocated satellite-derived observations and model estimates for both wind and waves. Altogether, we present a completely new open ocean weather data set, characterize the data quality against other observations and models, and further utilize the data collected to improve upon wind inference algorithms. In this work, we demonstrate the broad value for ocean monitoring and forecasting that can be achieved using large-scale distributed sensor networks in our oceans.