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Observations for climate: NOAA's Global Drifter Program

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NOAA's Global Drifter Program (GDP) maintains an array of approximately 1250 satellite-tracked surface drifting buoys to meet the need for an accurate and globally dense set of in-situ observations, and provides a data processing system for the scientific use of these data. These data support seasonal to interannual climate predictions as well as climate research and monitoring. The global array of drifters is a critical component of the sea surface temperature (SST) in-situ observing system, covering a larger area than any other component. These observations are used to validate and determine biases in satellite observations of SST. Barometer measurements from a subset of the array are used in numerical weather forecasting. A small number of drifters include wind or near-surface salinity measurements. Some drifters include a thermistor chain for temperature profiles of the upper 150m. Near-surface currents are measured by the subset of the global array with holey-sock drogues attached at a depth of 15m. Drifter velocity measurements can be difficult to use because they are inhomogeneous in space and time, and simultaneously measure both geostrophic and ageostrophic components of the flow. Other components of the observing system can be used to complement these measurements, gain dynamical insights, and cover gaps in drifter array coverage. High precision altimetric missions, such as TOPEX/Poseidon, measure time-varying anomalies of geostrophic velocity. High-resolution satellite winds, particularly scatterometer wind missions such as QuickSCAT, allow ageostrophic components of the flow to be estimated. At seasonal time scales, surface currents have been mapped globally at high resolution using the drifters, and variability across a broad range of time and space scales is evident in the data. The synthesis of drifters, altimetry and winds produces weekly, ~1/3^{o} resolution current maps; such syntheses have been used to examine variability of the Kuroshio Current system, the Brazil/Malvinas Confluence, and the North Equatorial Countercurrent of the tropical Atlantic Ocean. Because of their innately Lagrangian nature, drifter trajectories can be used to trace sources and downstream fate of water or passive tracers such as pollutants, marine debris and plankton. Pairs or clusters of drifters reveal how quickly turbulence spreads particles in the upper ocean, with profound implications for oil spills and search-and-rescue efforts. Since January 2005, drifters have been providing measurements of ocean currents and SST at approximately hourly resolution. This permits high frequency ocean features such as inertial oscillations to be studied on a global basis. Initial results from these studies have revealed how the background mesoscale vorticity field affects the frequency and energy levels of near-inertial oscillations. Results presented here indicate the need for sustained drifter observation at hourly resolution, along with high-resolution satellite wind and altimetry missions to complement the in-situ observations.