(4) *Satellite measurements*: Satellite-based sensors provide generally synoptic views of the ocean surface on scales relevant to mesoscale eddies. Satellite sensors that were useful for the E-Flux field experiments included NASA's QuikScat scatterometer for surface winds, NOAA's Geostationary Operational Environmental Satellites (GOES) for SST, and NASA's MODIS for SST and ocean color (surface chlorophyll). Satellite altimetry data were inspected, but were generally found to have insufficient spatial (between tracks) resolution to provide useful quantitative information for our study region and moreover for oceanic mesoscale processes (Alsdorf et al., 2007). However, it is worth noting that a composite image (TOPEX/JASON/ERS) obtained during E-Flux III does appear to show Cyclone *Opal* and warm anti-cyclonic features to the northwest and south of *Opal* (see Nencioli et al., 2008). QuikScat, which is a polar orbiting satellite, provided wind data over a 1800 km wide swath for our study region (see QuikScat website: http://podaac-www.jpl.nasa.gov/cgi-bin/dcatalog/fam_summary.pl?ovw + qscat). The retrievals of wind speed and direction from QuikScat gave twice-daily data with spatial resolution of 25 km × 25 km on the earth's surface.

NOAA's OceanWatch Central Pacific program (see website: http://oceanwatch.pifsc.noaa.gov/) provided SST products derived from NOAA's GOES. These products were created by combining three separate images with 6-m pixel resolution, each created 1 h apart and retaining the most recent temperature value. Therefore, near real-time NOAA SST image products were updated every 3 h. Because of the variable and often persistent cloud cover near the Hawaiian Islands, these 3-h products were then collated by the Central Pacific Ocean Watch to provide a 24-h SST composite image that was updated daily. NASA's MODIS SST product was created with 4.6-km pixel resolution with daily and eight-day composites. For tracking the eddy formation and decline, the daily products were used. The MODIS Aqua satellite images the full earth every 1–2 days, therefore the daily composites usually provided coverage over our study area every other day. The NASA Ocean Color group provided binned, daily mapped, and eight-day composite surface chlorophyll *a* imagery derived from MODIS Aqua optical imagery. This imagery had 4.6-km ground pixel resolution with chlorophyll *a* concentration being calculated using the standard NASA data processing routines and algorithms (see http://oceancolor.gsfc.nasa.gov/PRODUCTS/; Campbell et al., 1995).

The collective satellite-derived data products were used for identifying periods when trade winds occurred and persisted, approximating when mesoscale eddies formed and dissipated, and estimating the scales of the surface manifestations of the eddy features. These data also enabled the optimal initiation of ship-based sampling, placement of drifters in the proximal centers of eddies, and tracking of the movements of the eddies during the field experiments. It should be noted that satellite-derived chlorophyll *a* and SST imagery were often unobtainable due to cloud cover. In addition, only near-surface expressions of the eddies' physical and biological effects could be monitored and subsurface features could not be discerned. Thus, our satellite-based determinations of initiation and cessation times of mesoscale eddies are only estimates with likely uncertainties of roughly 1–2 weeks.

(5) *Measurement overview*: The multi-platform sampling approach used for the E-Flux study was essential and enabled the collection of interdisciplinary data spanning multiple time and space scales as synoptically as possible under the experimental constraints (Dickey and Bidigare, 2005). One of the greatest in situ sampling challenges for E-Flux was to locate the centers of the mesoscale eddies. The three primary methods follow:

- GOES satellite SST images (and MODIS chlorophyll *a* when available) were inspected and the coordinates of the geometrical center of each eddy were estimated. These images along with the MODIS SST images were also useful for estimating the lifetime of each eddy since ship time and thus experiment duration were necessarily limited. However, it is important to emphasize that the satellite-derived lifetimes of the eddies were probably underestimates as they likely existed before and after their appearances in SST and color imagery. Also, cold-core mesoscale eddies can be capped by relatively warm waters and thus hidden or even appear as warm-core eddies. A dramatic example of this latter situation is described by Seki et al. (2002), who suggest that the cyclonic eddy of their study moved into the wind shadow of Hawai'i where diurnal heating acted to form a very near-surface warm-water cap over the cold-core eddy. It also should be noted that the surficial manifestations of horizontal scales of the eddies were smaller than their subsurface signatures (by at least a factor of 2 or more in scale).
- Ship-based real-time underway surface sampling systems measured several variables including temperature (and chlorophyll *a*) from water flowing through the ship's intake system. The continuously ship-sampled SST values along transects were used to determine if the research ships were near the centers of the cyclones.
- The ships' near real-time ADCP horizontal current recording systems were used for several purposes. The transect data (usually 40-m depth record) were inspected and the centers of the cyclones were deemed to be located where the ADCP-determined currents were minimal or near zero (see Nencioli et al., 2008, for details). Useful information was also retrieved from the directions of the current vectors, as they reversed direction after passing through the