experiments to address the various biogeochemical mechanisms that can lead to enhanced carbon export. This paper reviews the general background of each of the three separate field experiments, the sampling strategies and methods employed, and general observational results with emphases on physical and bio-optical aspects. A conclusion section ends the report. This paper is intended as an introductory document that allows other papers, including several in the present volume, to focus on more specific problems, analyses, and results.

Observational Site, Objectives, and Methods

Site

Although mesoscale eddies are rather ubiquitous in the ocean, they remain difficult to study in sufficient detail because they are generally ephemeral and evolve too quickly in geographically diverse locations to be easily sampled using present-day observational tools (e.g., Bidigare et al., 2003; Dickey and Bidigare, 2005). With these constraints in mind, the site for the E-Flux field experiments, to the west of the southeastern Hawaiian islands of Maui and Hawai‘i, was chosen on the basis of several criteria. First of all, it was deemed important to choose a region where mesoscale eddies regularly form. Historical hydrographic and satellite data sets (e.g., Patzert, 1969; Lumpkin, 1998; Chavanne et al., 2002; Seki et al., 2001, 2003; Bidigare et al., 2003) indicated that mesoscale eddies typically develop and persist for weeks to months to the west of the Hawaiian Island chain during persistent trade wind conditions (winds generally from the northeast). In addition, previous studies in this portion of the ocean have indicated that regional cyclonic eddies have significant biological and biogeochemical signatures (i.e., Seki et al., 2001, 2003; Bidigare et al., 2003; Vaillancourt et al., 2003). From a practical standpoint, it was also desirable to conduct our experiment in a region which was readily accessible from a port to minimize ship transit times and thus to maximize ship sampling capabilities. Moreover, the observations needed to be conducted in deep oceanic waters that are relatively uninfluenced by coastal processes (i.e., coastal upwelling, jets, and filaments as well as runoff) so that the results would have general applicability to open ocean settings. All of these criteria were met by the region to the west of the islands of Maui and Hawai‘i. The three E-Flux field experiments, which lasted approximately three weeks each, spanned the period of November 4, 2004 to March 28, 2005; specifically, E-Flux I – November 4 - 22, 2004; E-Flux II – January 10-28, 2005; and E-Flux III – March 10 - 28, 2005. The periods selected for the experiment were based on wind climatology, essentially optimizing the chances for strong and persistent trade winds. It is worth noting that a multi-platform approach was used to optimally sample mesoscale features with the best possible temporal and spatial resolution under the financial and logistical constraints of the project. Thus, satellites, ships, and drifters were utilized in the collection of our data sets.

Observational Objective and Methods

The primary observational objective for the three E-Flux field experiment was to obtain interdisciplinary data to enable the location, characterization, and interpretation of the physical, optical, biogeochemical, and biological structure and dynamics of mesoscale eddy features off Maui and Hawai‘i. The R/V *Ka‘imikai-O-Kanaloa (KOK)* was used for the E-Flux I experiment and the R/V *Wecoma* was used for the E-Flux II and III cruises. The methods used for the physical and bio-optical measurements during the three E-Flux field experiments were quite similar although some instrumentation differed between the two research vessels. For convenience, the general methodologies used for the three experiments are presented within the following subgroups: 1) ship-based profile measurements, 2) ship-based acoustic Doppler