Chapter 3

Radiometric and Bio-optical Measurements from Moored and Drifting Buoys: Measurement and Data Analysis Protocols

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3.1 INTRODUCTION

No single type of observational platform provides radiometric and other bio-optical measurements at all scales of spatial and temporal variability that are important for research in oceanic primary productivity and regional, or global, carbon cycles, for example (Figure 3.1). Traditional shipboard observations enable detailed regional studies, but provide limited spatial and temporal coverage. Observations from instruments on moored and drifting buoys afford excellent temporal and vertical resolutions, but are limited to Eulerian and Lagrangian spatial contexts, respectively. Ocean color satellites offer excellent spatial and daily-to-weekly coverage, but are limited to clear-sky conditions and cannot account for variations with depth in the water column. In recent years, it has become increasingly clear that the combined data from moorings, drifters, ships and satellites provide a powerful tool for identifying and describing oceanographic processes (Dickey, 1991, 2003). The purpose of this chapter is to provide protocols describing methods for making and applying time-series measurements from moored and drifting buoys in this context.

The deployment and operation of moored and drifting observation platforms has proven to be a successful and reliable means of acquiring oceanographic and meteorological data (Dickey 1991, 2003; Smith *et al*. 1991; Chavez *et al*. 1997). Bio-optical, radiometric and physical time-series measurements, made at high temporal resolution throughout periods of several months duration from moored platforms, provide data describing important episodic and periodic oceanographic processes that are difficult to observe using other methods. Moorings have formed the foundation of several long term ocean monitoring projects, including the Tropical Ocean Global Atmosphere (TOGA) observing system (McPhaden *et al*. 1998), the Hawaii Ocean Time-series (HOT; Karl and Lukas, 1996), and the Bermuda Testbed Mooring (BTM; Dickey *et al*. 1998a, 2001) at the Bermuda Atlantic Time Series (BATS; Siegel *et al*. 2001) site, as well as several ONR and NSF JGOFS funded process studies of one or more years duration, including Biowatt (Dickey *et al*. 1987), Marine Light in the Mixed Layer (Dickey *et al*. 1991), JGOFS/ONR Arabian Sea Experiment (Dickey *et al*., 1998b), JGOFS Equatorial Pacific Study (Foley *et al*., 1998), and the ONR Coastal Mixing and Optics Experiment (Dickey and Williams, 2001). Moored bio-optical arrays were used in the Antarctic Environment Southern Ocean Process Study as part of the U.S. Joint Global Ocean Flux Study (JGOFS) to study mesoscale processes in the Antarctic Polar Front (Abbott *et al*., 2000). Instrumented drifting buoys of many different types have also been used in a variety of field campaigns including the TOGA-TAO project (McPhaden *et al*., 1998), the IronEx cruises (Kudela and Chavez, 1996) and the World Ocean Circulation