Ocean Optics Protocols (Mueller and Austin, 1992) that optical measurements from moorings would provide new insight into optical, oceanographic and biophysical measurements in the field and be important platforms for the validation of SeaWiFS. In particular, optical moorings were recommended as important platforms for the collection of long-term, *in situ* data that could be used, together with satellite ocean color data, for:

- Radiometric validation of SeaWiFS normalized water-leaving radiance. This concept has been implemented in the Moored Optical Buoy observatory off Lanai, Hawaii (Vol. VI, Chapter 2), data from which have been used as the primary reference for vicarious calibration of SeaWIFS and other satellite ocean color sensors (Gordon and Wang, 1994; Clark *et al*. 1997; McClain *et al*. 2000a, 200b).
- Developing and validating algorithms for pigment biomass and phytoplankton primary productivity (Dickey *et al*. 1998a, 2001; Chavez *et al*. 1999).
- Providing long-term, virtually continuous, time series of *in situ* observations characterizing biogeochemical processes in the upper ocean.

Chavez *et al.* (1999) and (Dickey *et al*. 1998a, 2001) expanded these ideas as they relate to combining satellite ocean color time series data with measurements from moored and drifting buoys to obtain regional and global descriptions of biological variability. These applications require the use of *in situ* radiometers, and other bio-optical sensors, for long periods of time to evaluate and correct for inherent satellite under-sampling and degradation of satellite color sensors.

Multi-year deployments of optical moorings and frequent drifter deployments are now realistic as a result of recent technological advances such as in hardware, power sources, and anti-fouling devices (Dickey *et al*. 1998a, 2001; Chavez *et al*. 1997, 2000; Manov *et al*. 2003). In order to assure that radiometric and bio-optical data acquired from various optical moorings meet uniform standards of quality and accuracy, clear and rigorous sampling and data processing methods must be used consistently throughout the community.

The purpose of this chapter is to describe protocols covering:

1. Strategic principles for the location and deployment duration of moored instrument arrays, and for numbers, locations and frequency of deploying instrumented drifting buoys, to augment satellite ocean color imagery and shipboard sampling (or vice versa) in studies of mesoscale and regional scale oceanographic phenomena.
2. State of the art design and fabrication of bio-optical moored and drifting data buoys
3. Methods for maintaining and operating moored instrument arrays, including:
    a. Mooring deployment
    b. Periodic maintenance during deployments and replacement of moorings and instruments.
4. System operation methods, including:
    a. Instrumentation
    b. Bio-fouling avoidance and mitigation
    c. On-board autonomous instrument operations, data acquisition, data storage, sampling schedules, time base methods (*e.g.* GPS on on-board clock), and time synchronization of data records from multiple instruments.
    d. On-board data processing and near-real-time data communications
    e. Platform geo-location, for tracking drifting buoys, and as a safety measure should a mooring come adrift.
5. Methods of data processing, quality control and analysis.
6. Data archival and retrieval.

The chapter concludes with insights into future directions for the design and applications of moored and drifting bio-optical buoys, together with satellite ocean color imagery, in studies of oceanographic biogeochemical phenomena.