sors and systems at the BATS site where complementary ship-based sampling was being conducted on a regular basis. Several of the optical systems (e.g. instruments for measuring spectral AOPs and IOPs including backscatter) that have been tested using the BTM have also been used for coastal experiments (e.g. Coastal Mixing and Optics and HyCODE as described below). Spectral water-leaving radiance data collected from the BTM (Figure 3) and the complementary BBOP program have been used for validation and algorithm development for the SeaWiFS ocean color satellite (Dickey, 2001). The BTM optical data have at times been collected almost continuously (and transmitted to shore in near real-time) and provided a very large number of match-up/intercomparison data between the BTM and SeaWiFS. Further, high temporal resolution radiometric data are especially important since satellite-derived ocean color data are limited to the uppermost ocean layer (roughly one optical depth) and the number of viewing days is limited by cloud obscuration. Other new optical systems tested using the BTM have included a spectral volume scattering function instrument and a spectral fluorometer (SAFire: 6 excitation and 16 emission wavelengths). A limitation of moored optical systems has been biofouling. Recently, copper shutter systems and copper tubing for pumped systems have been engineered and tested and deployments of optical systems can now be done for periods of up to about 6 months in oligotrophic waters (e.g. Chavez et al., 2000; Dickey et al., 2000).

It is important to note that other instruments and systems have been developed to obtain time series of chemical (e.g. carbon dioxide, oxygen, nitrate, trace elements, etc.) and biological (e.g. primary production from ^{14}C measurement systems, acoustic backscatter for zooplankton, genetic probes, etc.) data. These complementary chemical, biological, and physical measurements are critical for understanding optical and bio-optical variability and vice versa. The BTM project has also tested a variety of telemetry systems (Dickey et al., 1998a). The data sets collected by the BTM and ALOHA-HOST moorings have also been used for several modeling studies.

Examples of Coastal Ocean Time-Series

Improved understanding of coastal ocean physical processes and their effects on biology is especially important since the majority of the world's primary production occurs on continental shelves and the coastal ocean is most utilized and impacted by humans. Nearshore research is difficult because physical and biological processes in the coastal ocean are generally

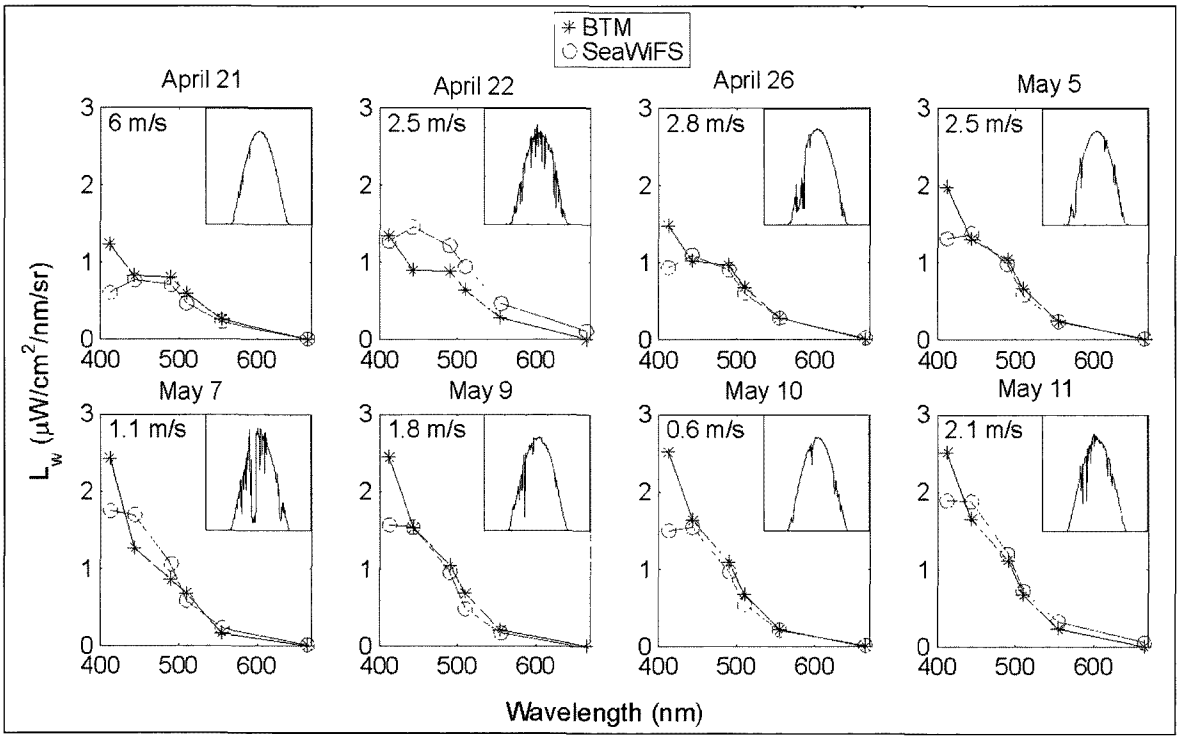

Figure 3. Representative subset of spectral water-leaving radiance, L_w, observations (near noon) that were derived from Bermuda Testbed Mooring radiometers (asterisks) and from SeaWiFS ocean color satellite radiometers (circles) for the period April 21 to May 11, 1999. Wind speed (1-hour average) during noontime observations and daytime time series of incident shortwave radiation for the day of interest are also shown. Cloudy days are evident in jitteriness in the shortwave curves. Agreement is generally quite good except at 412 nm where the SeaWiFS values are typically lower. This is likely due to atmospheric effects that were not completely removed by the SeaWiFS algorithm.