measurements *per se*, must be summed in quadrature to yield the combined standard uncertainty of the MOBY $L_{WN}(\lambda)$ determinations.

The estimated combined standard uncertainty of MOBY radiance measurements is between 4 % and 8 % (Clark *et al.* 2001). This estimate is based on uncertainties of MOBY calibrations at less than 3 %, changes in pre- and post-deployment calibrations ranging from 1 % to 6 %, radiometric stability tests during deployments using internal reference sources that show changes less than 1 %, and diver-deployed external reference lamp responses that are stable within less than 3 % (the estimated uncertainty of the method) (Clark *et al.* 2001). The 8 % upper limit on the combined standard uncertainty estimate does not include preliminary results of recently undertaken stray light characterization of the MOBY spectrographs, which indicate systematic stray light offsets in $L_{WN}(\lambda)$ may have approximate magnitudes of +5 % and -3 % at blue and green wavelengths respectively (Sects. 2.4 and 2.8 below, and Clark *et al.* 2001). Once the stray light characterization is completed on all MOBY spectrographs, the entire MOBY $L_{WN}(\lambda)$ time series will be reprocessed with an expected combined standard uncertainty of less than 5 %. Variations in the measurement environment may add additional uncertainty.

The nature of, and data requirements for, vicarious calibration of a satellite ocean color sensor are briefly described in Vol. I, Chapter 1 (Sect. 1.5), and in more detail by Gordon (1981, 1987, 1988, 1997), Gordon *et al.* (1983), Evans and Gordon (1994), and Clark *et al.* (1997). A critical element of the procedure is the ability to monitor a satellite sensor's performance at daily to weekly intervals by comparing its derived $L_{WN}(\lambda)$ with concurrently derived *in situ* $L_{WN}(\lambda)$ meeting the uncertainty criteria described above. The most direct way of measuring $L_{WN}(\lambda)$ on a continuing daily basis over periods of several years is to utilize a specially designed array of radiometers mounted on a moored buoy. This buoy must be designed to mount the optical collectors well away from platform shading and reflections, artifacts similar to ship shadow, as discussed in Vol. III, Chapter 2 (Sect. 2.2). To minimize uncertainties due to extrapolation of upwelling radiance $L_u(z,\lambda)$ to the sea surface, the buoy must be moored at a location with consistently transparent case 1 waters and with negligible mesoscale to sub-mesoscale spatial variability. To assure frequent occurrences of matched satellite and buoy measurements, the site must be cloud free throughout most of the year. The mooring must be located close to an island based sun photometer and sky radiance sensor to allow concurrent determinations of aerosol optical thickness and sky radiance distribution. On the other hand, the atmospheric conditions at the mooring location must not be significantly influenced by the island's wake. Extraordinary calibration maintenance procedures are needed to assure low uncertainties in the buoy's radiometric measurements. In addition, comparative shipboard measurements must be made near the buoy to check the radiometric stability of its instrumentation, to determine spatial variability surrounding the buoy location, and to develop and validate bio-optical algorithms. Some of these measurements can be made during cruises staged to replace the mooring at 3 to 4 month intervals, but dedicated cruises of 1 to 2 week duration are also required. The logistical demands of buoy maintenance, calibration activities, deployment and relief, and ship support operations strongly argue for placing the buoy conveniently near a permanent support facility. The locations of the MOBY mooring, near the island of Lanai, and the associated support facilities in Honolulu, Hawaii closely satisfy all of the above conditions.

The radiometric measurements at a primary reference site for vicarious calibration of satellite ocean color sensors differ in several aspects from the radiometric in-water profiling methods described in the Vol. III, Chapter 2. A primary reference data set must consist of *in situ* determinations of band-averaged $L_{WN}(\lambda)$'s that reproduce the spectral response functions of each satellite sensor's bands with more accuracy than can be realized using off the shelf radiometers. The need for flexibility in the choice of spectral response weighting functions used to determine band-averaged $L_{WN}(\lambda)$ imposes a requirement for full-spectrum measurements with resolutions <1 nm. Instead of measuring radiometric profiles resolved at several samples per m (Vol. III, Chapter 2, Sect. 2.2), downwelling irradiance $E_d(z,\lambda)$ and upwelling radiance $L_u(z,\lambda)$ can be measured on a buoy at only a few fixed depths, which complicates the problem of accurately determining $L_u(0^-,\lambda)$ (just below the sea surface).

To be affordable, a moored array must typically be deployed and operated semi-autonomously for periods of 3 to 4 months. Provisions to assure radiometric stability through these extended period operations should include, as a minimum, pre- and post-deployment calibrations of all radiometers, combined with continuous monitoring of on-board light sources of known stability. Moreover, instruments suspended in seawater for periods of this duration experience fouling by biological organisms that, if not countered effectively using antifouling methods and frequent cleaning by divers, seriously degrade the performance of optical sensors. Affordable servicing and maintenance