*Sun Photometer and Sky Radiance Measurements (on Lanai and Oahu)*

The AERONET Project at NASA GSFC operates the CIMEL[1] sun photometers on Lanai and Oahu, and retrieves the data, remotely. The aerosol optical thickness and sky radiance distribution data measured at these sites are needed as input to atmospheric correction models when the MOBY water leaving radiances are used for vicarious calibration of the satellite ocean color sensor. The data are archived by, and may be obtained from, the AERONET Project at NASA GSFC. MOBY support personnel visit the photometer sites at monthly intervals to check and clean the instruments.

# 2.4 CALIBRATION AND QUALITY CONTROL

The MOBY radiometers are characterized and calibrated using procedures that conform to the protocols described in Vol. II, Chapter 3. The unique role of MOBY as a primary, long term, and daily reference for vicarious calibration of satellite ocean color sensors requires radiometric measurements of the highest possible quality, and this in turn places stringent demands on the methods of traceability to NIST radiometric standards. For example, the MOBY team uses exclusively irradiance standards acquired directly from NIST, NIST recalibrates these sources frequently (see below), and NIST investigators validate the team's radiometric sources at annual intervals.

The MOS radiometers are calibrated before and after each deployment, and stability tests are made during deployments using both on-board and diver-deployed sources. These calibrations, tests and comparative measurements are illustrated schematically in Figure 2.10. The special aspects of the MOBY radiometric calibration, characterization and stability test procedures are described in this section.

*Radiometric Calibration and Characterization of MOS*

The spectral irradiance responsivities of the MOS $E_d(z,\lambda)$ and $E_s(\lambda)$ channels are calibrated using FEL-type lamp standards of spectral irradiance, and the $L_u(z,\lambda)$ channels are calibrated using lamp-illuminated integrating sphere sources. The wavelength calibration is performed using spectral line emission lamps, and every calibration cycle includes a measure of three internal sources (see below). Each instrument, whether for a MOCE or for a MOBY deployment, is calibrated at the support facility site in Honolulu before and after the in-water deployment. The standards of spectral irradiance and radiance are recalibrated every 50 h of operation. The irradiance standards, 1000 W quartz-halogen lamps (model number FEL), are calibrated by NIST. The integrating sphere source radiance standards are calibrated by their manufacturer, Optronic Laboratories, Inc. The MOS irradiance responsivity assignments are NIST-traceable using the NIST-issued FEL lamps. During the MOS irradiance calibration, the lamps are operated at the correct current using a calibrated shunt resistor in series with the lamp. The lamp is operated in an enclosed housing at the same distance and with the same collection area as at NIST (50 cm and 1 $cm^2$, respectively). A reference mounting plate ensures the alignment of the lamp to the irradiance collector. The validity of this approach was verified by NIST (Mueller *et al.* 1996).

The radiance assignment is NIST-traceable via the commercial standards laboratory's calibration of integrating sphere sources (ISSs). Two ISSs are used: model OL420 and model OL425. They are externally illuminated, with an aperture wheel to vary the radiant output in discrete amounts. However, the two ISS units differ in the designs of their internal baffles, and in the method used by each to continuously vary the output. The ISSs are operated at constant current. The OL425 has, additionally, an internal illuminance monitor detector that is used to relate the output to that during the calibration measurements at Optronic Laboratories. The ISSs are re-lamped by Optronic Laboratories, and calibrated before and after this procedure, so for each sphere and lamp configuration, there is an initial and a final radiometric calibration; to date, only the initial calibration values have been used for the MOBY calibrations.

In addition to the routine calibration of the MOBY radiometric standards, two single-channel, dual-mode radiometers were designed and built by NIST to verify the calibrations of the FELs and ISSs and to monitor their stability at the support facility site in Honolulu. These Standard Lamp Monitors (SLMs) (Clark *et al.* 2001) have interchangeable foreoptics for operation in either radiance or irradiance mode. The narrowband (approximately 10 nm bandwidth) interference filters are centered at 412 nm and 872 nm. During every radiometric calibration at the support site, the SLMs are used to record the output of the radiometric standards. The absolute radiometric