Radiometers

The buoy instrumentation arrays listed as examples in Tables 3.3 and 3.4 incorporate a variety of commercially available radiometers, listed by the manufacturers model nomenclature. The wavelength characteristics of these sensors comply with those specified in Volume II, Chapter 2 (Table 2.1), and all comply with the other performance characteristics specified Volume II, Chapter 2. Several of the irradiance sensors may be configured to measure irradiance either in air, *i.e.* $E_S(\lambda)$, or in water, *i.e.* $E_d(z, \lambda)$ or $E_u(z, \lambda)$. The reader is referred to Vol. II, Chapter 3, Sects. 3.5 and 3.7 for more information on irradiance immersion factors and cosine response functions in water and air.

The filter radiometers appearing in Tables 3.3 and 3.4 are the:

- **OCR-100:** A 7-channel analog spectral radiance sensor manufactured by Satlantic, Inc.
- **OCR-200:** A 7-channel analog spectral radiance sensor manufactured by Satlantic, Inc.
- **OCI-200:** A 7-channel spectral irradiance radiometer, counterpart to the **OCR-200**, also manufactured by Satlantic, Inc. The cosine collectors on this instrument – a separate one is used at each wavelength - may be ordered to measure spectral irradiance either in air [*i.e.* $E_S(\lambda)$], or in water [*i.e.* $E_d(z, \lambda)$ or $E_u(z, \lambda)$].
- **OCR-504/507:** A 4 or 7 channel digital spectral irradiance or radiance sensor manufactured by Satlantic Inc. The cosine collectors on this instrument – a separate one is used at each wavelength - may be ordered to measure spectral irradiance either in air [*i.e.* Es(l)], or in water [*i.e.* Ed(z, l) or Eu(z, l)].
- **ED-100:** A single-channel (usually 490 nm) radiometer manufactured by Satlantic, Inc. and configured to measure $E_S(490)$ in air.
- **PRR-600:** A filter radiometer manufactured by Biospherical Instruments, Inc., configured to measure $E_d(z, \lambda)$ and $L_u(z, \lambda)$ in water at 7 wavelengths.
- **PRR-620:** A filter radiometer manufactured by Biospherical Instruments, Inc., configured to measure $E_S(\lambda)$ in air at 7 wavelengths.
- **MER-2020A:** A filter radiometer manufactured by Biospherical Instruments, Inc., configured to measure $E_d(z, \lambda)$ and $L_u(z, \lambda)$ in water at 8 wavelengths.

Also used with moored and drifting buoys are two commercially available hyperspectral radiometers, both of which are based on miniature fiber-optic monochromators:

- **HR-3**: The HydroRad-3 manufactured by HobiLabs, Inc. In the examples given in this chapter, the HR-3 is configured with collector optics to measure $E_S(\lambda)$, $E_d(z, \lambda)$ and $L_u(z, \lambda)$ from 400 to 700 nm, with approximately 2 nm resolution in each variable.
- **MiniSpec**: A series of Satlantic hyperspectral radiometers configured to measure irradiance (**MiniSpec I**) $E_S(\lambda)$ or $E_d(z, \lambda)$, and radiance (**MiniSpec R**) $L_u(z, \lambda)$, from 350 nm to 800 nm with a spectral resolution of approximately 10 nm, sampled at 3.3 nm intervals.

Inherent Optical Properties Measurement Methods

Some buoy instrument arrays incorporate sensors to measure inherent optical properties (IOP): the volume beam attenuation coefficient $c(z,\lambda)$, the volume absorption coefficient $a(z,\lambda)$, and the backscattering coefficient $b_b(z,\lambda)$, as defined in Volume I, Chapter 2 (Section 2.4). Given these IOP measurements, the volume scattering coefficient may be calculated as $b(z,\lambda) = c(z,\lambda) - a(z,\lambda)$.

IOP sensors often used on buoys (Tables 3.3 and 3.4) include the:

- **AC9**: An instrument manufactured by WETLabs, Inc. that may be used to measure the absorption coefficient, using a reflecting tube to capture forward-scattered photons, and beam attenuation at 9 wavelengths. Water must be pumped through the enclosed optical paths of this instrument. The instrument