

Ambient Light

Hydrolab Technical Note #205 - 4/97



What is ambient light?

Ambient light measurement, in the context of water quality monitoring, is a measurement of sunlight intensity at a certain point in the water column. There are many influences on sunlight intensity, including season, latitude, time of day, cloudiness, air pollution, water depth, water pollution, biological activity, etc.

Ambient light is often analyzed in a differential mode - sunlight intensity is measured both at the surface of the water and in the water column. This way, light availability and attenuation can be monitored.

How is ambient light measured?

Ambient light is measured by a semiconductor material that generates a voltage (just as a solar electricity cell does) that can be related to ambient light. The sensor is normally factory calibrated against a known light source.

A light sensor located at, say, 30 feet below the surface of the water will tell you how much light energy is available at that depth. But the only way to determine how much light is lost in the water itself is to measure light at the surface, too. That way, if a cloud passes over the sun, or it's just a hazy day, the sensor at the surface

would show you that low light levels underwater were caused by atmospheric conditions, and not necessarily because the water was "dirtier" than normal. Conversely, a discharger of polluted water could not necessarily claim that low light levels in the receiving waters were caused by bad weather if a monitor at the surface of the polluted water body produced data to show otherwise.

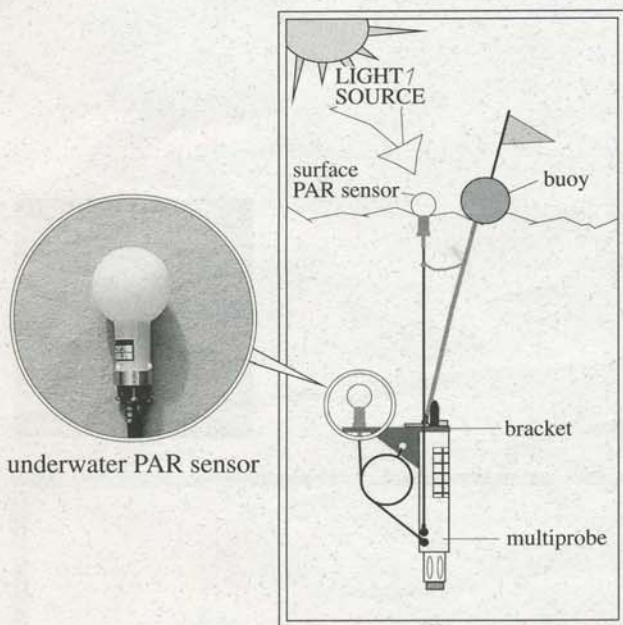
A term often associated with ambient light measurement is photosynthetically active radiation (PAR). Sunlight consists of a wide spectrum of light colors (i.e., wavelengths), but only a small band (400 to 700 nanometers) of colors represents light energy that can be used in photosynthesis. The intensity of light energy in that small band is called PAR. Hydrolab's ambient light sensor is a PAR sensor - it is calibrated to measure only that light useful to green plants.

Two other terms associated with ambient light measurement are upwelling (light that has been reflected somehow - maybe off a white-sand river bottom - and is now generally pointed back toward the surface of the water) and downwelling (light that is generally pointed downward through the water).

How is ambient light measurement useful in water quality monitoring applications?

Sunlight intensity influences biota that rely on photosynthesis for nutrition - these include photosynthetic phytoplankton (green and blue-green algae, some diatoms), and both submerged and emergent macrophytes (larger plants that grow underwater or partially underwater).

Applications include drinking water reservoir management (algae blooms can be very expensive to remediate), monitoring of primary production (growth of organisms at the lower end of the food chain), and general study of aquatic habitat (submerged grasses and other plants).



How is ambient light measurement implemented in Hydrolab instruments?

Hydrolab's ambient light sensor is bracketed alongside a DataSonde®4 Water Quality Multiprobe, with a detachable connector used for power and data transmission. The readings are integrated with the standard DataSonde 4 Multiprobe data stream or logging records.

A surface light sensor (if needed) is connected to a cable running from the DataSonde 4 Multiprobe to a remote sensor mount. The surface sensor's readings are also integrated with the standard DataSonde 4 Multiprobe data stream or logging records.

Hydrolab offers two types of light sensor. The first is a flat-faced, "cosine-corrected" sensor, for which the angle of the sensor relative to the sun is important. The cosine-corrected sensor is used when measurement of sunlight extinction in the water column is important: normally the sensor is always pointed vertically upward so that it measures only unreflected sunlight.

But sunlight does not necessarily travel in only one direction – reflected sunlight is also available for photosynthesis. Hydrolab's second type of ambient light sensor is a "spherical" sensor that collects light from all directions (not just "up", as does the cosine-corrected sensor). The spherical sensor is used when total light energy available for photosynthesis at a certain depth in the water column (including reflected light) is important.

Calibration of the light sensors by the user is not required, but factory recalibration every two years is recommended.

Both sensor types are available in surface and submersible configurations.

Should I consider Hydrolab ambient light measurement?

Hydrolab ambient light measurement provides these benefits:

- ◇ PAR measurements from the water column and the surface integrated into the DataSonde 4 Multiprobe data stream or logging record;
- ◇ range: 0 to 10,000 micromoles of photons per second per square meter, for photons in the photosynthetic bandwidth (same as micro-Einsteins per second per square meter);
- ◇ Typical accuracy is 5% of reading, or $\pm 1 \mu\text{mol s}^{-1} \text{m}^{-2}$, whichever is greater

Note: See Technical Note #204 for further parameter specifications and qualifications.



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