WISPstation

Water Insight SPectrometer Station

Zealquest Asia

Water Insight

Water Insight produces surface water quality spectrometers for the purpose of monitoring water leaving reflectance, water colour, Chlorophyll-a (phytoplankton), Phycocyanin (cyanobacteria), the presence of algal scums, transparency/ turbidity, suspended matter and vertical diffuse attenuation. The fixed-position sensors and hand-held instruments are manufactured entirely in-house. Additionally, Water Insight provides water quality mapping services based on satellite data for scientific research, water management, aquaculture and dredging. The optical instruments and earth observation information services support the digital monitoring of water quality, and enable both real-time mitigation measures and the validation of satellite-based maps. Water Insight's satellite services are tailored to areas all over the world and support most public and commercial satellite data formats.

The fixed-position WISPstation spectrometer measures water quality parameters fully autonomously, without using any chemicals and at a high frequency. It produces results in near real-time. The results of the WISPstation are not affected by bio-fouling because the optical sensor is applied above the water surface. As a result, it requires little maintenance.

The WISPstation automatically measures at certain intervals (e.g. every 15 minutes, during daytime) and sends the results to a cloud-based data management system. After collecting the data, a calibration procedure is applied, quality control is performed, and concentrations of water quality parameters are calculated before being made available online. The ability to measure water quality parameters for a prolonged period of time without human intervention makes the instrument suitable for routine (early warning) monitoring, and for providing input to data-driven (machine learning) forecasting models.

Water Insight's claims

In contrast to submersible probes, the WISPstation is used above the water surface and therefore is not affected by biofouling. As a result, the sensor requires minimal maintenance.

The WISPstation can also be used to validate or calibrate satellite images, and thus enhance the quality of the data obtained with satellites for large surface areas.

For whom?

Scientists, water managers, aquaculture farmers, dredging companies

Technology

Sensor technology & satellite monitoring services

Keywords

Optical sensor, Surface water, Chlorophyll-a, Cyanobacteria, Scums, Aquacultures, Dredging, Suspended matter

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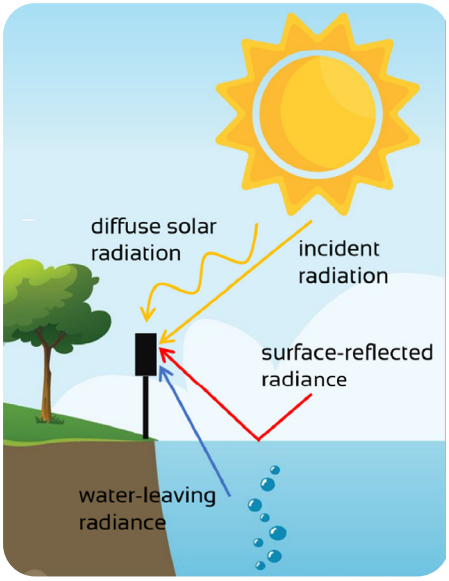
How does it work?

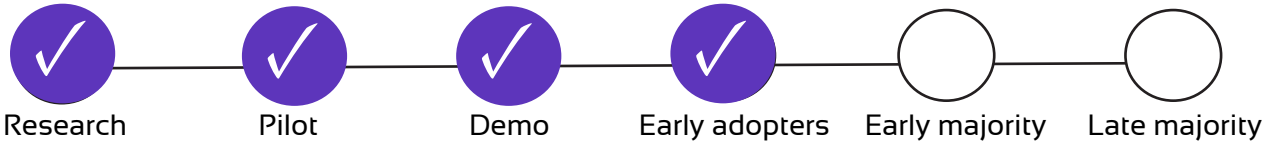
The WISPstation is a field spectrometer which measures the colour of the water within the visible and near infrared light spectrum (350 – 900 nm) with a spectral resolution of 4.6 nm, and derives the bio-chemical parameters from the detected light frequencies and intensities. For example: Phytoplankton absorbs blue and red light, and reflects green light which is detected by the sensor. The instrument is deployed above the water and measures light leaving the water as a ratio of the incoming light. Concentration levels of specific parameters can be derived using algorithms based on specific features of these parameters. For example, chlorophyll-a strongly absorbs light at around 672 nm, and the ratio of light reflected at 672 nm and in the near-infrared is an indication of the concentration of Chlorophyll-a in the water. The total amount of light leaving the water depends on the total amount of incoming radiance from the sun. In order to enable the derivation of components in the water, the light leaving the water is measured as reflectance: the ratio of the light from the water and the light from the sky.

The radiometer in the WISPstation is connected to two sets of cosine correctors via optical fibres and a switch in order to measure the diffuse solar radiation, and two sets of lenses to measure the incident radiation from the sky, the surface-reflected radiation and the water-leaving radiance. The WISP-station compensates for the movement of the position of the sun over the day, and automatically selects the parameter sets with the least amount of direct sun reflection on the surface.

Currently, the WISPstation is built around the Avantes Mini mk-1 spectrometer with a maximum wavelength range between 220 and 1100 nm. The grating has 300 lines per mm with a blaze of 300 nm. Together with a slit of 100 µm this leads to a spectral resolution (FWHM) of 4.65 nm. Stray light is reported to be lower than 0.2%. The WISPstation spectral characteristics are to some extent configurable. The Avantes Mini is a rugged spectrometer designed for use outside laboratories.

The WISPstation is watertight and built into a highly climate-resistant case. The temperature of the sensor and humidity in the case is registered with every measurement. Data are transmitted to the database ("WISPcloud") autonomously through a cellular connection. The instrument can be remotely accessed and updated or configured to a specific time interval or measurement frequency. It is autonomously powered by a solar panel and a large battery. All necessary calibrations are applied in WISPcloud, as well as quality control and the calculation of water quality parameter concentrations. All data are made available online via an API-connection. While the standard measurement frequency is set to once per 15 minutes, it can be increased to once per two minutes if required, e.g. in time windows around satellite overpasses.





Sensileau verdict

The WISPstation spectrometer forms an important link between satellite monitoring on the one side and depth profiling on the other. Its fixed position has benefits over satellite monitoring, whereas its position above the water has benefits over submersible probes. Although satellites can cover a larger area of a water body and submersible probes can detect parameters deeper into the water column, the combination of various methodologies including the WISPstation spectrometer provides the most complete picture of water quality developments in four dimensions (length, width, depth and time).

More info?
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