NETLAKE guidelines for automated monitoring system development

001 Options for buoy design

Objective

In this factsheet, we describe some of the options that can be used to house an automatic monitoring station (AMS) on a lake.

AMS types

Automatic monitoring stations (AMS) can be divided into two different types:

- Fixed AMS – in which the aquatic monitoring sensors are fixed in position relative to the water surface or relative to the lake bottom using an immobile structure, and meteorological sensors are fixed on a solid structure.
- Floating AMS – in which the monitoring sensors are attached to a floating device that is anchored in position.

Considerations

The selection of station types and configuration depends mainly on the settings of the monitoring location and the design requirements to comply with the monitoring objectives and data quality. Some considerations might be:

Sampling depth	Duration of monitoring (duration of project)
Water depth	Set-up cost
Wind (speed, direction)	Maintenance cost
Wave action	Safety-Security for personnel and equipment
Tidal range (if applicable)	Water activity near the location (i.e. water sports)
Seasonal water levels	Are there existing structures in the location?
Bio-fouling potential	Data transfer possibilities
Site accessibility	Permits
Interference from animals or plants	Concerns from local community or interested parties

Examples of fixed AMS

- **Designed structure** – designed by the user to fulfil the monitoring needs – generally deployed offshore, with sensors placed in a fixed vertical position, sits on and is fixed to the lake bottom (Fig. 1).
- **Existing structure** – where a bridge, island, pier or wall already exist at the monitoring site and the user takes advantage of them to fix the monitoring station – sensors generally placed in a fixed vertical position (Fig. 1). In the case of meteorological measurements, the sensors can be placed on land near to the shore (Fig. 2).
- **On a river bank structure** – located on or close to the river or stream bank – sonde generally placed on an angle to the waterbody monitored
  - **Without equipment shelter** (e.g. anchored pipe)
  - **With equipment shelter** (flow-through and sensor in-situ AMS)

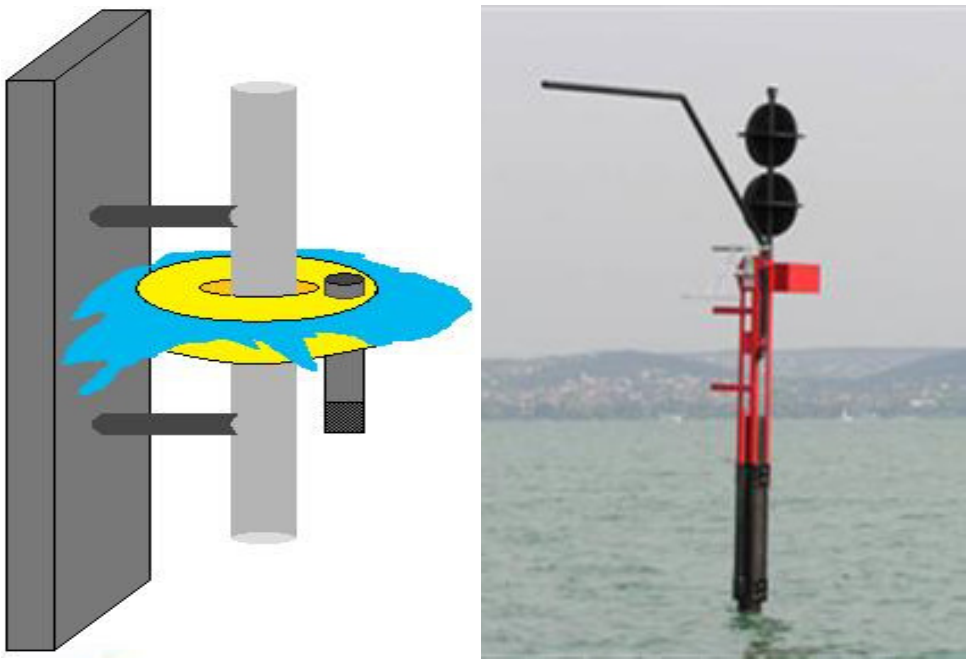

Figure 1. Aquatic fixed automated monitoring systems. Designed structures (left) and fortuitous use of exisiting structures (right) are two options.

Figure 2. A terrestrial fixed automated monitoring system comprising several meteorological sensors.

Examples of floating AMS

- **Buoy** – two basic designs
  - **Surface –** this is the most common design, being relatively simple to procure and deploy (Fig. 3). Most surface AMS are based on the idea of a large float, anchored in two or more places (Fig. 6).
  - **Subsurface** - where you have navigational hazards or security issues, and you don't want the station to be conspicuous, consider anchoring the sensors from the bottom (Fig. 4). This may also be useful where water fluctuations are large, or when issues associated with lake ice want to be avoided. Subsurface moorings are also less affected by surface waves, which can be important when measuring water currents or turbulence.
- **Platform** – when you need a bit more space to enable housing more extensive systems, consider having a larger platform (Fig. 5). These offer protection from the weather and a large workspace, but are harder to moor and may be less resistant to stormy weather than a buoy.

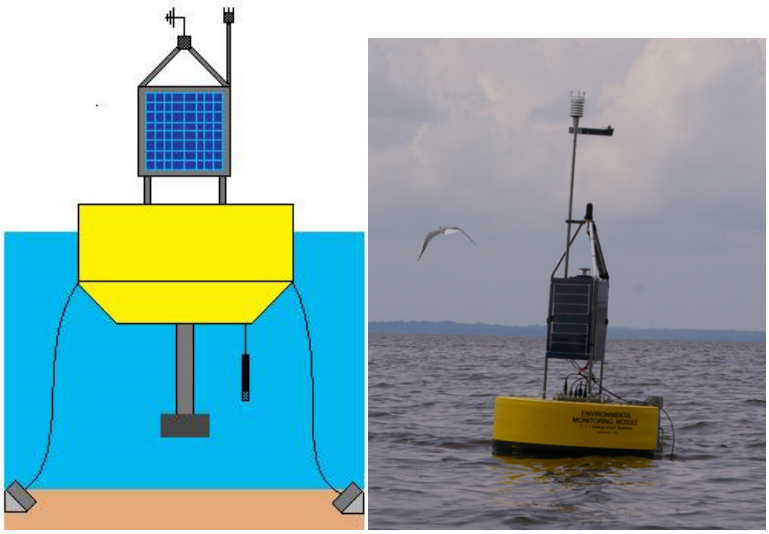

Figure 3. Surface automated monitoring system.

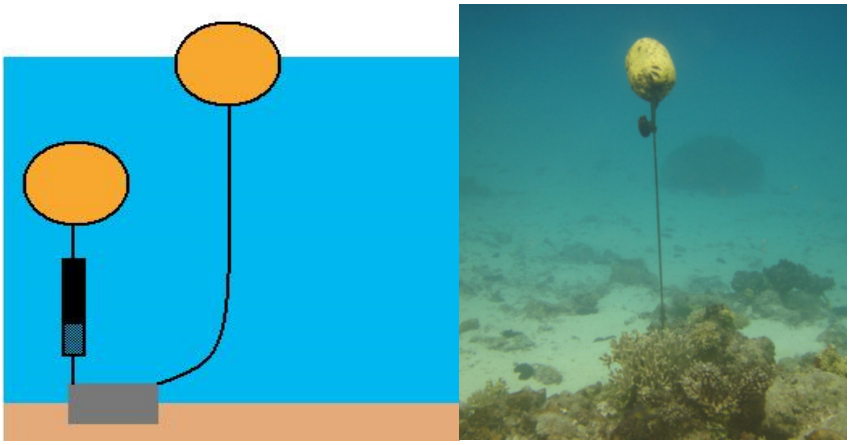

Figure 4. Subsurface automated monitoring system.

Figure 5. Floating platform as an automated monitoring station.

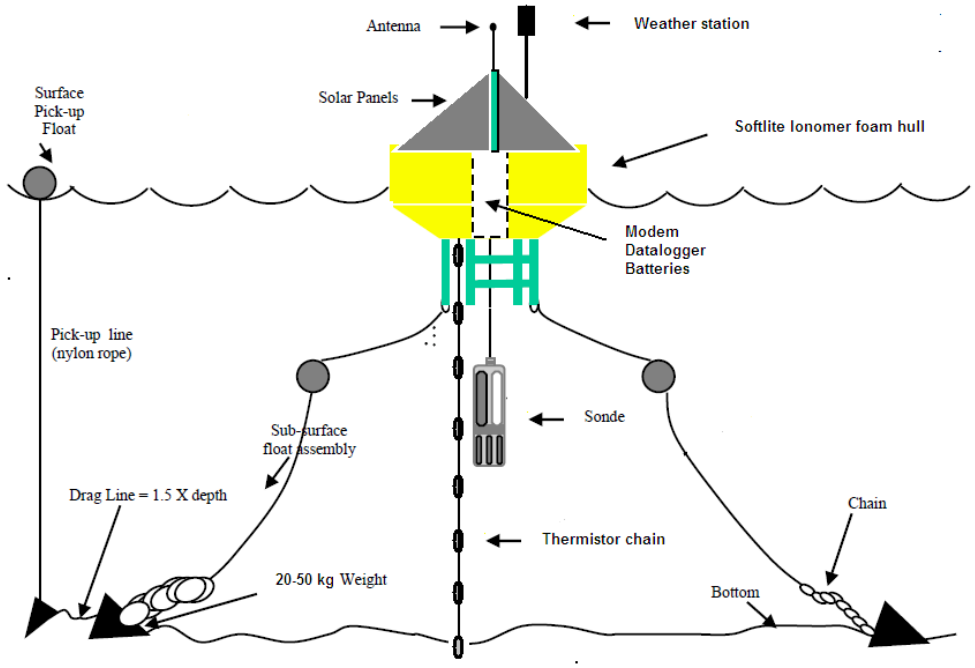

Figure 6. An example of a surface automated monitoring station.

Likely Problems

- Underestimating your water body, and deploying a system that is not suitable for the weather conditions. Bear in mind that, in very extreme conditions, a simple rope and buoy system (potentially subsurface) may be more resilient than a larger station.
- If you are likely to have a problem with birds using the station as a roost, try deterrent devices.
- If you suspect that the station will be prone to vandalism, you should either make it as

inconspicuous as possible (subsurface), or else use a platform design that can have a lock.

More information

http://www.vims.edu/cbnerr/resources/guidelines_shallowwater.php

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