# Developing hydrological monitoring networks with Arduino

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The open source hardware platform Arduino is very cost-effective and versatile for the development of sensor networks. Here we report on experiments on the use of Arduino-related technologies to develop and implement hydrological monitoring networks. Arduino Uno boards were coupled to a variety of commercially available hydrological sensors and programmed for automatic data collection. Tested sensors include water level, temperature, humidity, radiation, and precipitation.

Our experiments show that most of the tested analogue sensors are quite straightforward to couple to Arduino based data loggers, especially if the electronic characteristics of the sensor are available. However, some sensors have internal digital interfaces, which are more challenging to connect. Lastly, tipping bucket rain gauges prove the most challenging because of the very specific methodology, i.e. registration of bucket tips instead of measurements at regular intervals.

The typically low data generation rate of hydrological instruments is very compatible with available technologies for wireless data transmission. Mesh networks such as Xbee prove very convenient and robust for dispersed networks, while wifi is also an option for shorter distances and particular topographies. Lastly, the GSM shield of the Arduino can be used to transfer data to centralized databases. In regions where no mobile internet (i.e. 3G) connection is available, data transmission via text messages may be an option, depending on the bandwidth requirements.