



WATER TEMPERATURE MONITORING

THERMISTOR



Water temperature monitoring in streams typically involves placing a sensor in a stream and recording temperature over time using careful, consistent methods. It is helpful for understanding stream health and how environmental changes affect aquatic life. Thermistors are a commonly used instrument for measuring temperature. They are often highly sensitive to small temperature changes, accurate over a limited temperature range, and small and inexpensive. It is common for thermistors to come with built-in data loggers.

SUMMARY OF METHOD

There are six main steps involved with temperature monitoring using a thermistor:

1. **Calibration:** Calibrate the thermistor at several points (e.g., 5-10) through the expected temperature range. Place the thermistor in water having a stable, consistent temperature alongside a high resolution, accurate thermometer and compare values.
2. **Site selection:** Select a site where the thermistor is in flowing water (not a stagnant pool), shaded or under cover (to avoid direct sunlight overheating the sensor), and shielded from debris and direct impacts.
3. **Installation:** Ensure the battery and memory are sufficient for the deployment period. Attach the thermistor to a boulder or a metal stake pounded deep into the streambed (e.g., heavy rebar), or to a weight (e.g., concrete) that is tethered to a tree. Consider enclosing the thermistor within a protective housing (e.g., perforated PVC pipe).
4. **Recording:** Program the logger to record at a regular time interval (e.g., 10 min, hourly).
5. **Data retrieval and maintenance:** Periodically download the logger data (e.g., at least monthly during summer to check for dewatering). Inspect for damage, sediment or algae buildup, and movement from the original position. Re-calibrate after long deployments.
6. **Data processing:** Inspect the data for errors and gaps.

IMPORTANT CONSIDERATIONS

It is important to choose a Negative Temperature Coefficient (NTC) thermistor designed for waterproof or submerged use. It should have a suitable temperature range (e.g., 0–30 °C) and good accuracy (e.g., ± 0.2 °C).

Thermistors can have a bias between the measured and actual temperatures that varies with temperature. All readings should be adjusted for this bias based on the calibration results.

It is important to choose an appropriate logging frequency. Short intervals capture rapid temperature changes but use more memory and battery, and require more data processing.

An alternative to a stand-alone thermistor is to use the temperature sensing capability of an automated water level logger (see related summary), particularly wherever water level monitoring is also important. Level loggers typically use either a thermistor or a platinum resistance temperature detector (RTD).

STREAM CHARACTERISTICS

- Safe access for installation may be impeded by deep water and/or a muddy streambed
- May be problematic for streams with frequent channel changes (unstable bed)
- May require periodic cleaning of sediment and/or algae build-up around thermistor
- Ice may need clearing for winter downloading

MEASUREMENT CHARACTERISTICS

- Automated data acquisition
- Can be connected to telemetry system for real-time monitoring
- Point measurement along stream network and within the cross-section
- Data frequency set during logger programming
- Accuracy and data storage are product-specific

SITE ACCESSIBILITY FACTORS

- Suitable for remote foot access
- Can avoid entering stream during high flow
- Initial set up involves medium-sized equipment (e.g., rebar, rock drill, hammer, wrench)
- Ongoing monitoring involves small equipment (e.g., downloading console)

SCALE OF EFFORT: INITIAL SET UP

Equipment cost: very low

Field time: low; 1–4 hours

Field expertise: moderate; knowledge of flow hydraulics, logger programming, construction skills

SCALE OF EFFORT: ONGOING MONITORING

Equipment cost: negligible

Field time: very low; <15 minutes

Field expertise: low; requires basic training

Analysis time: low or moderate; varies with amount and quality of data (e.g., dewatering)

Analysis expertise: low; requires basic training

PRODUCTS TO CONSIDER

Thermistor: HOBO TidbiT MX2203 (bluetooth enabled); HOBO TidbiT v2 UTBI-001 (manual connection)

ADDITIONAL RESOURCES

Quilty et al., 2010

Resources Information Standards Committee, 2018

Sowder & Steel, 2012

Stamp et al., 2014