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# Technical note: High-frequency, multi-elemental stream water monitoring – experiences, feedbacks and suggestions from 7 years of running three French field laboratories (Riverlabs)

**Nicolai Brekenfeld et al.**

*Correspondence to:* Nicolai Brekenfeld (nicolai.brekenfeld@gmail.com) and Ophelie Fovet (ophelie.fovet@inrae.fr)

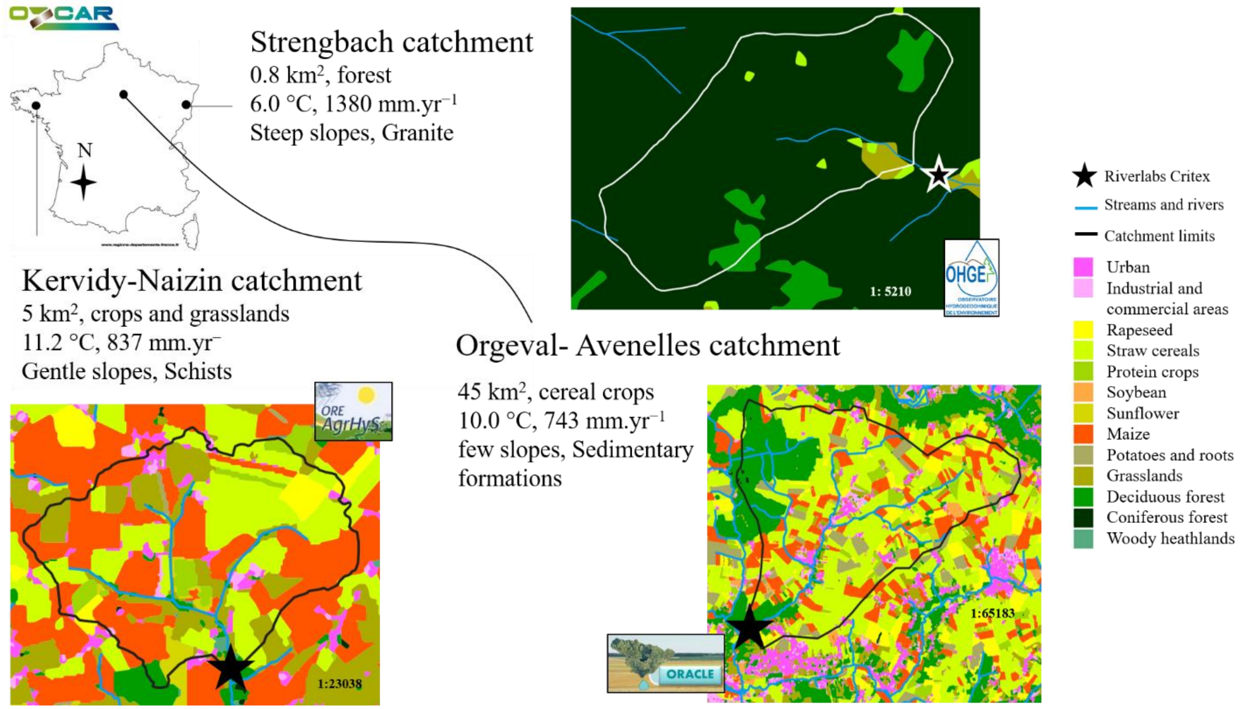


**Figure S1: Location maps of the three Riverlabs in the Critical Zone Observatories of AgrHyS, Orgeval and OHGE.** Sources: OSO (Inglada, Jordi, Vincent, Arthur, & Thierion, Vincent. 2019. Theia OSO Land Cover Map 2019 (Version 1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.6538321); BD TOPAGE®, (https://www.sandre.eaufrance.fr/atlas/srv/fre/catalog.search#/metadata/a535c474-eca0-4295-880e-a95c8e633a51, 28 April 2023)

**Figure S2: State of the submersible pump after running for five months during the high flow, winter period at the Naizin catchment. Deposition of primarily organic material within the hydraulic parts of the pump and strong wear of the mechanics can be seen.**

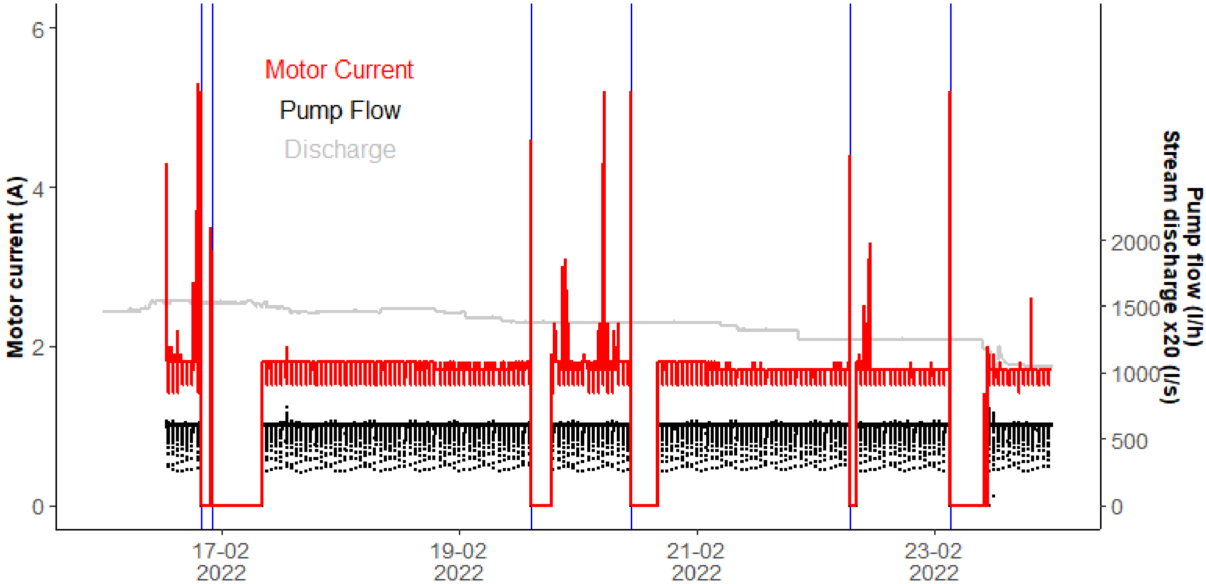


**Figure S3: Motor current (as output from variable frequency drive) measured every second (red), pump flow (black) and stream discharge (grey) at the Naizin catchment. Blue bars indicate moments when the pump was stopped by the variable frequency drive due to motor overload. This is an example of some irregular pump failures during baseflow conditions.**

## Additional technical issues

In this section, we outline three additional technical points related to the functioning of the Riverlabs. These are related to a) technical problems of the variable frequency drive, b) technical requirements necessary at locations with freezing temperatures and c) the interference between the ventilation system and the water level measurements.

A variable frequency drive is controlling the pump speed and needs to be chosen in function of the pump properties and following the recommendations of the suppliers (we used Eaton Industries, DC1-127D0FN-A20N). In case a pump needs to be changed, the compatibility of the variable frequency drive with the new pump needs to be evaluated or changed, if necessary. Equally, the variable frequency drive needs to be checked for damages and malfunctioning regularly, as it can be the hidden cause of erratic pump failures. For example, at Naizin, we observed very irregular and more or less frequent pump failures during baseflow periods (Figure SI 2). Only after a long diagnostic phase, we realized that a malfunctioned variable frequency drive was the primary cause.

Locations with freezing winter temperatures might require specific water evacuation systems to avoid freezing of water in some slow flowing parts of the system. At Strengbach, for example, a temperature-regulated valve opens and drains the whole pipe system of the field laboratory, if the water temperature drops below a certain threshold. In addition, a small part of the intake hose is heated, whereas the remaining part has been buried into the streambed in order to reduce the risk of freezing.

In the Riverlab at Naizin, the water level measurements were artificially modified by the ventilation system. A vented water-level sensor was used to measure the stream water level, with the opening of the vent located inside the Riverlab. The sensor therefore measured the pressure difference between the stream (water level pressure) and the inside of the Riverlab (barometric pressure). Under normal conditions, the atmospheric pressure inside and outside of the Riverlab is sufficiently similar. However, a ventilation system, that expelled air from inside the Riverlab to create an airflow, reduced slightly the air pressure in the Riverlab, relative to the outside pressure. Even though this artificial pressure difference was likely only about 0.1 mbar, it created an artificial water level increase, based on the vented level sensor, of around 1 mm, which was noticeable especially during the summer low-flow period. To avoid this problem, we advise to install the opening of the vent outside of a ventilated field laboratory.