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Real time high frequency monitoring of water quality in river streams using a UV-visible spectrometer: interest, limits and consequences for monitoring strategies

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Stream water chemistry is highly variable in space and time, therefore high frequency water quality measurement methods are likely to lead to conceptual advances in the hydrological sciences. Sub-daily data on water quality improve the characterization of pollutant sources and pathways during flood events as well as during long-term periods [1]. However, real time, high frequency monitoring devices needs to be properly calibrated and validated in real streams.
This study analyses data from in situ monitoring of a stream water quality. During two hydrological years (2010-11, 2011-12), a submersible UV-visible spectrometer (Scan Spectrolyser) was used for surface water quality measurement at the outlet of a headwater catchment located at Kervidy-Naizin, Western France (AgrHys long-term hydrological observatory, http://www.inra.fr/ore_agrhys/). The spectrometer is reagentless and equipped with an auto-cleaning system. It allows real time, in situ and high frequency (20 min) measurements and uses a multiwavelengt spectral (200-750 nm) for simultaneous measurement of nitrate, dissolved organic carbon (DOC) and total suspended solids (TSS).
A global calibration based on a PLS (Partial Least Squares) regression is provided by the manufacturer as default configuration of the UV-visible spectrometer. We carried out a local calibration of the spectrometer based on nitrates and DOC concentrations analysed in the laboratory from daily manual sampling and sub-daily automatic sampling of flood events. TSS results are compared with 15 min turbidity records from a continuous turdidimeter (Ponsel).
The results show a good correlation between laboratory data and spectrometer data both during basis flows periods and flood events. However, the local calibration gives better results than the global one. Nutrient fluxes estimates based on high and different low frequency time series (daily to monthly) are compared to discuss the implication for environmental monitoring strategies.
Such monitoring methods can therefore be interesting for designing monitoring strategy of environmental observatory and provide dense time series likely to highlight patterns or trends using appropriate approaches such as spectral analysis [2].

1. Wade, A.J. et al., HESS Discuss., 2012. 9(5), p.6458- 6506.
2. Aubert, A. et al., submitted to EGU 2013-4745 vol. 15.