Geophysical Research Abstracts
Vol. 17, EGU2015-3593, 2015
EGU General Assembly 2015

Mining nitrate concentration patterns from high-frequency in situ monitoring: a step towards more detailed understanding of hydrological processes?

Alice Aubert, Tobias Houska, Ina Plesca, Philipp Kraft, and Lutz Breuer

Justus Liebig Universität, Institute of Landscape Ecology and Resources Management, Landscape, Water and Biogeochemical Cycles, Gießen, Germany (alice.aubert@umwelt.uni-giessen.de)

Recently developed sensing technics allow collecting a considerable amount of high-frequency data; not only for hydrologic parameters (water levels, rainfall, etc.) but also for water chemistry. With devices such as in situ spectrophotometer, nitrate concentration can be monitored down to sub-hourly intervals. Thus, opening the way to new questions: what about daily or sub-daily instream nitrate concentration variations? What do these newly observed variations tell us about hydrological processes?

In the Vollnkirchener Bach catchment, a headwater creek flows through a human impacted landscape dominated by agricultural and forest use and including a small settlement. Since March 2013, a Pro-PS device has been installed at the gauging station (monitored since 2011). Nitrate concentration is measured every 15 minutes, discharge and water temperature every 5 minutes. Data mining, more precisely motif discovery, is performed on these time series to identify high-resolution patterns.

Spectral analysis highlighted that, in data measured at sub-hourly sampling frequency, variations up to a few hours are more likely to be dominated by measurement noise rather than real-world fluctuations. Therefore, we focus on daily motifs and flood patterns (given the fact that hydrological conditions are changing during flood events, we assume that nitrate concentration changes are depicting real processes).

Various flood motifs were extracted: (1) nitrate can either be diluted or (2) concentrated, or (3) both (dilution followed by a bumpy recession curve indicating nitrate enrichment at the end of the flood). In addition to these classical nutrient-discharge behaviors, a variety of other interesting motifs were highlighted. (4) A daily nitrate cycle is clearly observed, but only during a specific year period. (5) Lag to peak time between parameters differentiate flood patterns: sometimes nitrate peaks first, sometimes discharge peaks first. (6) Furthermore, we are able to pinpoint the contributions of a combined sewer overflow, as it creates a different motif from diffuse nitrate inflows from adjacent agricultural fields. We look into the other hydrological parameters to explain this variety of patterns and their occurrence time.