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Diatoms as a fingerprint of sub-catchment contributions to meso-scale catchment runoff

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In recent years, calls were made for new eco-hydrological approaches to improve understanding of hydrological processes. Recently diatoms, one of the most common and diverse algal groups that can be easily transported by flowing water due to their small size ($\sim$10-200 μm), were used to detect the onset and cessation of surface runoff to small headwater streams and constrain isotopic and hydro-chemical hydrograph separation methods. While the method showed its potential in the hillslope-riparian zone-stream continuum of headwater catchments, the behavior of diatoms and their use for hydrological process research in meso-scale catchments remains uncertain. Diatoms can be a valuable support for isotope and hydro-chemical tracer methods when these become ambiguous with increasing scale. Distribution and abundance of diatom species is controlled by various environmental factors (pH, soil type, moisture conditions, exposition to sunlight, etc.). We therefore hypothesize that species abundance and composition can be used as a proxy for source areas.

This presentation evaluates the potential for diatoms to trace source-areas in the nested meso-scale Attert River basin (250 km2, Luxembourg, Europe). We sampled diatom populations in streamwater during one flood event in Fall 2011 in 6 sub-catchments and the basin outlet - 17 to 28 samples/catchment for the different sampling locations. Diatoms were classified and counted in every individual sample. In total more than 400 diatom species were detected.

Ordination analysis revealed a clear distinction between communities sampled in different sub-catchments. The species composition at the catchment outlet reflects a mixing of the diatom composition originating from different sub-catchments. This data suggests that diatoms indeed can reflect the geographic origin of stream water at the catchment outlet. The centroids of the ordination analysis might be linked to the physiographic characteristics (geology and land use) of the catchments.

In a next step we will increase sample size of catchments to further evaluate if these distinct species assemblages are characteristic for different physiographic units and can indeed unambiguously trace catchment source areas. We will compare the results with classical source area hydrograph separations.