VARIABILITY IN THE TRACER SIGNAL TO BE CONSIDERED IN COMPOUND-SPECIFIC ISOTOPE ANALYSIS BASED SEDIMENT FINGERPRINTING TECHNIQUE

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Compound-specific isotope analysis (CSIA) is recently applied as a technique for tracing freshwater sediment sources. It has an advantage of being capable to discriminate source-soil contributions according to the land-use compared to other conventional methods such as using variability in geochemical composition or fallout radionuclides (FRNs) as tracers. The method uses plant biomarkers isotopic signal (in this study long-chain fatty acids $\delta^{13}C$) as a tracer.

While it is believed that plant functional groups are connected to their characteristic biomarker isotopic signal, the difference between plant species of mid-European land use management interest (e.g. cereal versus legume, beech versus oak versus coniferous) has not been rigorously tested yet. Furthermore, the influence of climate and/or geographic origin on tracer signals needs to be defined.

For the refinement of the CSIA method, we assessed the variability of source soils and suspended sediments regarding the employed organic tracer (fatty acids). To understand inherent biological variability in the sources of fatty acids, we collected leaves from various plant types (conifers, angiosperms, mosses, shrubs etc.). To understand the degree of resistance of biomarkers to decomposition, distinct humus layers were collected from well-developed soil horizons in the Black Forest (Germany), the catchment Upper Sûre Lake (Luxembourg) and from the Baldegg Lake catchment (Switzerland). The overall assessment from three different geographical settings aims to understand the effect of environmental variability such as rainfall, temperature and altitude on the tracer signal. The uncertainties potentially caused by transport processes were investigated by analysing fatty acid isotopic signatures from different grain size fractions (<63µm and <2mm) in source-soils.

This multidimensional study could greatly optimize the promising CSIA technique for sediment source fingerprinting with improved understanding in biological and environmental variation in the tracer signal.