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Compound-specific stable carbon isotope composition as a fingerprint for sediment transport: Reproducibility, homogeneity and application in a catchment of the Swiss plateau.

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A new field for the applications of compound-specific isotope analyses (CSIA) has opened in the recent years. The isotopic signature in fatty acids (FA) can be used to track sediment transport pathways from erosional areas to river systems. In this approach distinct FA d13C values of even numbered saturated and/or unsaturated FAs from soils are traced in suspended river sediments, ie. the place of deposition. CSIA has been shown to be particularly useful in catchment areas with C4 plant crops because, compared to the regularly occurring C3-plants, they are (naturally) depleted in 13C. However, in theory, all plant species even among C3 plants should inherit significant differences in their d13C of FAs. Thus, we tried to differentiate between source areas for suspended sediments from three different land use types: forest (C3 plants), grassland (C3 plants) and arable land (mixture of C3 and C4 plants).
Statistical geo software (eg. Isosource) can be used to additionally model the spatial and temporal variability of erosion. We present d13C values of FAs from 8 erosion areas from the Enziwigger catchment of the Swiss plateau (Canton of Lucerne). Each area was assessed through randomised triplicate sampling to test the spatial homogeneity of each one. The homogeneity of a single sample, as well as the reproducibility of our measurements was tested by extracting and analysing the same sample bag in triplicates. We compare compound-specific stable isotope (CSSI) fingerprints of source areas to d13C-values of FAs from suspended sediments of two high-flow events and one base flow period at 3 different sites of the Enziwiger river (upstream, midstream, downstream).