Geophysical Research Abstracts
Vol. 21, EGU2019-7097, 2019
EGU General Assembly 2019

Suspended sediment source apportionment using compound-specific isotope analysis: a case study from a Scottish agricultural catchment

Pranav Hirave (1), Miriam Glendell (2), Axel Birkholz (1), and Christine Alewell (1)

(1) Environmental Geosciences, Department of Environmental Sciences, University of Basel, Switzerland, (2) The James Hutton Institute, Environmental and Biochemical Sciences, Aberdeen, United Kingdom

The River Dee is one of the major river systems in Scotland, renowned for its economically important Atlantic salmon (*Salmo salar*) population. The Tarland Burn (51 km^2), an intensively managed agricultural catchment is a significant source of organic pollutants, suspended sediments and particulate phosphorous to the River Dee. To trace the suspended sediment (SS) sources in the Tarland Burn catchment, we used compound-specific isotope analysis (CSIA) fingerprinting technique. The stable carbon isotopic signal in vegetation specific organic compounds (in this case the $\delta^{13}C$ of long-chain fatty acids) was used as a tracer for land-use/ land-cover based quantitative apportionment of SS sources. The time-integrated SS samplers were employed in a headwater catchment (4.3 km^2) of Tarland Burn, with 21% arable land, 25% improved grassland, 33% heathland/rough grass and 21% forest (coniferous and mixed broadleaved forest). We identified the connectivity patterns in the headwater catchment using a modified sediment connectivity index (IC) model (Cavalli et al., 2013). After orientation from the IC model and land-use data, surface soil samples were collected from potential erosion sources, representing all land-use categories present in the headwater catchment. SS samples were collected not only from the headwaters and second order streams, but also from the outlet of the Tarland Burn catchment, representing a nested sampling approach. Time-integrated SS sampler was placed side by side with a plankton net (mesh size 100 μm) at the catchment outlet to compare two SS sampling techniques and ensure adequate sampling even at higher flow throughput. SS were sampled bimonthly over a period of 14 months.

The long-chain fatty acids were separated from soil and sediment and their $\delta^{13}C$ values are being analysed. We used the CSIA fingerprinting technique in combination with stable isotope mixing model to apportion the relative contributions of sediment sources in the Tarland Burn catchment. This study advances the CSIA technique further as we test its ability to unmix the SS from variety of land-use types for e.g. quantifying heathland and moorland as a source of erosion compared to other land-uses, and the variability arising from different SS sampling techniques. We further test the possibility of upscaling the CSIA results from headwater catchment to the larger Tarland Burn catchment and find the challenges associated with it.