Quantitative sediment source attribution with compound-specific isotope analysis in a C3 plant-dominated catchment (central Switzerland)

ID 3629805
Author(s) Alewell, C.; Birkholz, A.; Meusburger, K.; Wildhaber, Y. S.; Mabit, L.
Author(s) at UniBasel Alewell, Christine ; Di Bella, Katrin ; Birkholz, Axel ;
Year 2016
Title Quantitative sediment source attribution with compound-specific isotope analysis in a C3 plant-dominated catchment (central Switzerland)
Journal Biogeosciences
Volume 13
Number 5
Pages / **Article-Number** 1587-1596
As sediment loads impact freshwater systems and infrastructure, their origin in complex landscape systems is of crucial importance for sustainable management of agricultural catchments. We differentiated the sediment source contribution to a lowland river in central Switzerland by using compound-specific isotope analysis (CSIA). We found a clear distinction of sediment sources originating from forest and agricultural land use. Our results demonstrate that it is possible to reduce the uncertainty of sediment source attribution in: (i) using compound content (in our case, long-chain fatty acids; FAs) rather than soil organic matter content to transfer delta C-13 signal of FAs to soil contribution and (ii) restricting the investigation to the long-chain FAs (>C22 : 0) not to introduce errors due to aquatic contributions from algae and microorganisms. Results showed unambiguously that during base flow, agricultural land contributed up to 65% of the suspended sediments, while forest was the dominant sediment source during high flow. This indicates that connectivity of sediment source areas within the river changes between base and high flow conditions. Uncertainty, which might occur in complex, large-scale studies due to undetected source attribution and/or CSSI signature degradation, is low because of limited data complexity in our study (i. e., two-three sources and two tracers). Our findings are the first published results highlighting (i) significant differences in compound-specific stable isotope (CSSI) signature of sediment sources from land uses dominated by C3 plant cultivation and (ii) the use of these differences to quantify sediment contribution to a small river.
Publisher COPERNICUS GESELLSCHAFT MBH
ISSN/ISBN 1726-4170
edoc-URL http://edoc.unibas.ch/44349/
Full Text on edoc No;
Digital Object Identifier DOI 10.5194/bg-13-1587-2016
ISI-Number 000372082500013
Document type (ISI) Article