Geophysical Research Abstracts
Vol. 13, EGU2011-11699-2, 2011
EGU General Assembly 2011

Effect of leaf litter degradation and seasonality on D/H isotope ratios of n-alkane biomarkers

Michael Zech (1,2,3), Nikolai Pedentchouk (4), Björn Buggle (2), Katharina Leiber (2), Karsten Kalbitz (5), Slobodan Markovic (6), and Bruno Glaser (3)

(1) Chair of Geomorphology, University of Bayreuth, 95440 Bayreuth, Germany (michael_zech@gmx.de), (2) Department of Soil Physics, University of Bayreuth, 95440 Bayreuth, Germany, (3) Department of Terrestrial Biogeochemistry, Martin-Luther University Halle-Wittenberg, 06120 Halle, Germany, (4) School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom, (5) Earth Surface Science, Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, 1018 WV Amsterdam, The Netherlands, (6) Chair of Physical Geography, University of Novi Sad, 21000 Novi Sad, Serbia

During the last decade, compound-specific hydrogen isotope analysis of plant leaf-wax and sedimentary n-alkyl lipids has become a promising tool for paleohydrological reconstructions. However, with the exception of several previous studies, there is a lack of knowledge regarding possible effects of early diagenesis on the deltaD values of n-alkanes. We therefore investigated the n-alkane patterns and deltaD values of long-chain n-alkanes from three different C3 higher plant species (Acer pseudoplatanus L., Fagus sylvatica L. and Sorbus aucuparia L.) that have been degraded in a field leaf litterbag experiment for 27 months.
We found that after an initial increase of the total long-chain n-alkane mass (up to ∼50%), decomposition took place with mean turnover times of 11.7 months. Intermittently, the total mass of mid-chain n-alkanes increased significantly during periods of highest mass losses. Furthermore, initially high odd-over-even predominance declined and long-chain n-alkane ratios like n-C31/C27 and n-C31/C29 started to converge to the value of 1. While bulk leaf litter became systematically D-enriched especially during summer seasons (by ∼8‰ on average over 27 months), the deltaD values of long-chain n-alkanes reveal no systematic overall shifts, but seasonal variations of up to 25‰ (Fagus, n-C27, average ∼13‰).
These findings suggest that a microbial n-alkane pool sensitive to seasonal variations of soil water deltaD rapidly builds up. We propose a conceptual model that accounts for the decomposition of plant-derived n-alkanes and the build-up of microbial n-alkanes. Model results are in good agreement with measured n-alkane deltaD results. Since microbial 'contamination' is not necessarily discernible from n-alkane concentration patterns alone, care may have to be taken not to over-interpret deltaD values of sedimentary n-alkanes. Furthermore, since leaf-water is generally D-enriched compared to soil and lake waters, soil and water microbial n-alkane pools may help explain why soil and sediment n-alkanes are D-depleted compared to leaves.