Geophysical Research Abstracts
Vol. 12, EGU2010-3248, 2010
EGU General Assembly 2010

A method to detect soil carbon degradation during soil erosion

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Soil erosion has been discussed intensively but controversial both as a significant source or a significant sink of atmospheric carbon possibly explaining the gap in the global carbon budget. One of the major points of discussion has been whether or not carbon is degraded and mineralized
to CO2 during detachment, transport and deposition of soil material. By combining the caesium-137 (137Cs) approach (quantification of erosion rates) with stable carbon isotope signatures (process indicator of mixing versus degradation of carbon pools) we were able to show that degradation of carbon occurs during soil erosion processes at the investigated mountain grasslands in the central Swiss Alps (Urseren Valley, Canton Uri). Transects from upland (erosion source) to wetland soils (erosion sinks) of sites affected by sheet and land slide erosion were sampled. Analysis of 137Cs yielded an input of 2 and 4.6 $tha^{-1}\ yr^{-1}$ of soil material into the wetlands sites. Assuming no degradation of soil organic carbon during detachment and transport, carbon isotope signature of soil organic carbon in the wetlands could only be explained
with an assumed 500–600 and 350–400 years of erosion input into the wetlands Laui and Spissen, respectively. The latter is highly unlikely with alpine peat growth rates indicating that the upper horizons might have an age between 7 and 200 years. While we do not conclude from our data that eroded soil organic carbon is generally degraded during detachment and transport, we propose this method to gain more information on process dynamics during soil erosion from oxic upland to anoxic wetland soils, sediments or water bodies.