Geophysical Research Abstracts
Vol. 15, EGU2013-7053, 2013
EGU General Assembly 2013

Low vertical transfer rates of carbon inferred from radiocarbon analysis in an Amazon podzol

Carlos Sierra (1), Eliana Jimenez (1,3), Björn Reu (2), and Angelika Thuille (1)

(1) Max-Planck-Institute for Biogeochemistry, Department of Biogeochemical Processes, Jena, Germany (csierra@bgc-jena.mpg.de), (2) AG Spezielle Botanik und Funktionelle Biodiversität, Universität Leipzig, Germany, (3) Research Group in Ecology of Tropical Terrestrial Ecosystems, National University of Colombia, Sede Amazonia. Leticia, Colombia

Hydromorphic podzol soils in the Amazon basin generally support low-stature forests with some of the lowest amounts of aboveground net primary production (NPP) in the region. However, they can also exhibit large values of belowground NPP that can contribute significantly to the total annual inputs of organic matter into the soil. These hydromorphic podzol soils also exhibit a horizon rich in organic matter at around 1 m depth, presumably as a result of elluviation of dissolved organic matter and sesquixides of Fe and Al. Therefore, it is likely that these ecosystems store large quantities of carbon by a) large amounts of C inputs to soils dominated by their high levels of fine-root production, b) stabilization of organic matter in an illuviation horizon due to significant vertical transfers of C. To assess these ideas we studied soil carbon dynamics using radiocarbon in two adjacent Amazon forests growing on contrasting soils, a hydromorphic podzol and a well-drained alisol supporting a high-stature terra-firme forest. Our measurements showed similar concentrations of C and radiocarbon in the litter layer and the first 5 cm of the mineral soil for both sites. This result is consistent with the idea that the hydromorphic podzol soil has similar soil C storage and cycling rates than the well-drained alisol that supports a more opulent vegetation. However, we found important differences in carbon dynamics and transfers along the vertical profile. At both soils, we found similar radiocarbon concentrations in the subsoil, but the carbon released after incubating soil samples presented radiocarbon concentrations of recent origin in the alisol, but not in the podzol. There were no indications of incorporation of C fixed after 1950 in the illuvial horizon of the podzol. With the aid of a simulation model, we predicted that only a minor fraction (1.7%) of the labile carbon decomposed in the topsoil is transferred to the subsoil of the podzol, while this proportional transfer is about 90% in the alisol. Furthermore, our estimates were 8 times lower than previous estimations of vertical C transfers in Amazon podzols, and question the validity of these previous estimations for all podzols within the Amazon basin. Our results also challenge previous ideas about the genesis of these soils and suggest that either these soils are not true podzols or the podzolization processes had already stopped.