Geophysical Research Abstracts
Vol. 15, EGU2013-10256, 2013
EGU General Assembly 2013

Molecular characteristics of continuously released DOM during one year of root and leaf litter decomposition

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Dissolved organic matter (DOM) is one of the most dynamic carbon pools linking the terrestrial with the aquatic carbon cycle. Besides the insecure contribution of terrestrial DOM to the greenhouse effect, DOM also plays an important role for the mobility and availability of heavy metals and organic pollutants in soils. These processes depend very much on the molecular characteristics of the DOM.
Surprisingly the processes that determine the molecular composition of DOM are only poorly understood. DOM can originate from various sources, which influence its molecular composition. It has been recognized that DOM formation is not a static process and DOM characteristics vary not only between different carbon sources. However, molecular characteristics of DOM extracts have scarcely been studied continuously over a longer period of time. Due to constant molecular changes of the parent litter material or soil organic matter during microbial degradation, we assumed that also the molecular characteristics of litter derived DOM varies at different stages during root and needle decomposition.
For this study we analyzed the chemical composition of root and leaf samples of 6 temperate tree species during one year of litter decomposition in a laboratory incubation. During this long-term experiment we measured continuously carbon and nitrogen contents of the water extracts and the remaining residues, C mineralization rates, and the chemical composition of water extracts and residues by Curie-point pyrolysis mass spectrometry with TMAH
We focused on the following questions:
(I) How mobile are molecules derived from plant polymers like tannin, lignin, suberin and cutin?
(II) How does the composition of root and leaf derived DOM change over time in dependence on the stage of decomposition and species?
Litter derived DOM was generally dominated by aromatic compounds. Substituded fatty acids as typically cutin or suberin derived were not detected in the water extracts. Fresh leaf and needle samples released a much higher amount of tannins than fresh root samples. At later litter decomposition stages the influence of tannins decreased and lignin derived phenols dominated the extracts. With ongoing litter degradation the degree of oxidation for the litter material increased, which was also reflected by the water extracted molecules.