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Factors controlling spatial variability of DOC concentrations in soil solution at European level

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The lateral transport of dissolved organic carbon (DOC) is an important and not well-understood process linking terrestrial and aquatic ecosystems. Up to day very few Earth System Models (ESMs) represent explicitly this process despite its crucial role in the global carbon cycle. However, to be able to integrate DOC leaching in ESMs, more accurate information is needed in order to better understand and predict DOC dynamics. DOC concentrations mainly vary by geographical location, soil and vegetation types, topography, season and climate. Within this framework, a database was designed to compile data on DOC in soil solution at different depths in different ecosystems around the world, with special focus on European sites. The database contains information on 349 sites, with 304 being forest, gathered from published literature and datasets accessible on the internet. A substantial dataset was provided by International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests). The database also includes other meta-data related to the sites, such as land cover, soil properties, climate, annual water balance and other soil solution parameters.
The analysis of the database has been focused on: 1) the study of the environmental and physical factors that are acting as drivers of DOC concentrations changes in soil solution across sites at European level , and 2) the DOC distribution through the soil profile and how this varies with different vegetation types and soil properties. The preliminary results show that variables related to biological processes (Dry weight of the organic layer, for example) are the most important in explaining the spatial distribution of the DOC concentration in soil solution at the European scale. However, the interactions between variables are complex and we will need further analysis in order to draw more robust conclusions. With regards to the vertical profile of DOC, we found that there is a pronounced decrease of DOC concentrations with depth in forests with specific patterns for broadleaved and coniferous forests, while in organic soils the opposite pattern is observed.
This new database offers an unique opportunity to improve our understanding of the process controlling the DOC dynamics. Based on such results we developed statistic models linking DOC content and biophysics parameters that can be easily used in ESMs. The relationships achieved from this analysis will shed light on the most important drivers of DOC concentrations variability, and can therefore help in the design, parameterization and validation of current and future DOC models. This model development will allow to account for lateral DOC fluxes in ESMs and thus will improve the predictions of responses to climate change.