Scientific background of the project

Please provide a detailed description of the project on a separate sheet, giving evidence of the specific purposes for which the data shall be used e.g. hypotheses to be tested, statistical methods to be applied, further data involved in the evaluations etc.

Dissolved organic matter (DOM) is produced through microbial decomposition of organic materials. The unique functionality of DOM in transporting terrestrial-derived organic carbon to aquatic system has recently attracted wide attentions. The consideration of DOM in this study includes dissolved organic carbon (DOC) and dissolved organic nitrogen (DON). DOM fluxes represent an important fraction of terrestrial net ecosystem exchange of carbon and nitrogen in many ecosystems (Tranvik and Jansson, 2002; Cole et al., 2007). A range of models depicting DOM fluxes and concentration in soil and aquatic system exist, including both statistical (Boyer et al., 1996; Frolking et al., 2002) and process-based models (Currie and Aber, 1997; Neff and Asner, 2001; Yurova et al., 2008; Wu et al., 2013). The statistical-based model normally requires strong experimental data to support the empirical relationship and often works on site-specific study where experiment is conducted. However, the process-based models are generally built on general process-understanding and have been tested in different spatial scales. For site-specific studies, parameters controlling DOM dynamics can be calibrated based on site data.

In this study, a process-based dynamic ecosystem model, LPJ-GUESS (Smith et al., 2014) has been chosen as a platform to study soil DOC dynamics. LPJ-GUESS is a climate-driven model optimized for regional application and includes individual-level vegetation dynamics and soil biogeochemical processes as well as C and water cycling between atmosphere, vegetation and soil (Smith et al., 2001; Sitch et al., 2003). Vegetation dynamics in LPJ-GUESS explicitly include stochastic establishment, mortality and disturbance, operating in a number of independent, replicate patches in each grid cell to capture heterogeneity in stand age, biomass and successional stage across the landscape of a modelled grid cell (Hickler et al., 2012). The model has been widely and successfully applied for simulation vegetation and soil carbon fluxes as well as vegetation dynamics at different spatial scales (Wolf et al., 2008; Hickler et al., 2012; Smith et al., 2014; Tang et al., 2014).

In the latest version of LPJ-GUESS, modelling DOC and DON fluxes has been only linked to soil sand fractions and hydrology, lacking of explicit consideration of sources from plant litter and soil sorption-description process {Smith, 2014 #11}. Recently, the model has been developed to specifically consider different sources of DOM, DOM mineralization, percolation at different soil depths, sorption and desorption and DOM leaching. The developed model requires to be tested in different sites to sort out the key processes controlling soil DOM concentration at different depth as well as DOM leaching in different ecosystems.

So, we would like to collect site measurements from ICP Forests to calibrate and evaluate our model. The more sites data we have, the more information we could sort out in terms of processes controlling DOM dynamics in different ecosystems. The details about how each data will be used are listed below:

Data variables	**Usage**
I. Meteorological Measurement	Used as LPJ-GUESS inputs

I-1. Daily temperature	
I-2. Daily precipitation	
I-3. Daily radiation	
II. Soil Solution	Part of data will be used as model calibration, and part as model evaluation
II-1. Soil DOC concentration at different depths	
II-2. Soil DON concentration at different depths	
III. Soil water	Soil water content will be used for checking hydrology processes in the model before accounting DOM concentration.
III-1. Soil water content and temperature	
III. Leaf area index LAI	
III-1. Either monthly LAI or annual LAI	Used for evaluating whether the model simulated vegetation growth status and density are correct
III-2. Dominant vegetation	Used for model validation. Litter quantity and quality could vary between different vegetation, which could bring differences in terms of DOM sources. So, it is important to check if the model has simulated the correct forest type in each site before looking at soil DOM.
IV. Phenological Observation	Used for checking if the model has correct seasonal pattern.
V. Ground Vegetation Biomass	LPJ-GUESS is able to simulate different vegetation at different growth height and ground vegetation could also contribute DOM production. So, this data will be used for evaluating the modelled low-statured vegetation.

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