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Topic for Master Thesis

"Characterization of dissolved organic matter by fluorescence spectroscopy along a soil moisture gradient in the Dübener Heide – BENEATH Project"

The BENEATH Project (Soil carbon storage in semi-natural beech forests – soil moisture regime and coarse woody debris as the main controls in a changing climate) aims at quantify and evaluate the climate protection performance of near-natural beech forests. The research is carried out in the "Dübener Heide" in a near-natural beech forest, which extends over a gradient of soil moisture conditions ranging from wet to dry and has a significant proportion of coarse woody debris due to low management intensity. In the project, soil solution samples have been obtained using suction cups and plate lysimeters.

Dissolved organic matter (DOM) is a key component of the global carbon cycle. The transport of DOM throughout the soil profile is important for the cycling and distribution of elements in ecosystems (Kalbitz, et. al, 2005). The composition of DOM can be related to different organic matter sources (plants, mircoorganisms) and it determines many functions in soil and water, e.g. forming soil organic matter, providing nutrients for microorganisms. For the analysis of the DOM composition a widely used, non-destructive, and cost-effective method is fluorescence spectrometry (Sciscenko, et.al, 2022). It is a method for characterizing chromophores in dilute

Figure 1 Analysis of soil solution samples with Aqualog

mixtures in the ultraviolet-visible (UV-vis) wavelength range (Wünsch et al. 2019). The matrixes obtained are used afterwards for PARAllel FACtor analysis (PARAFAC), which is increasingly used to decompose fluorescence Excitation Emission Matrices (EEMs) into their underlying chemical components.

To analyze fluorescence and absorbance data of DOM a new R package StaRdom has been developed. The package provides several tools for preprocessing Excitation Emission Matrices (EEMs) for PARAFAC. The overall aim of the master thesis is to analyze the composition of DOM from the three investigated sites along the soil moisture gradient in order to

gain deeper insights into the processes occurring during organic matter decomposition in dependence on soil moisture. Differences in the contribution of plant- and microbial-derived compounds to DOM should be evaluated.
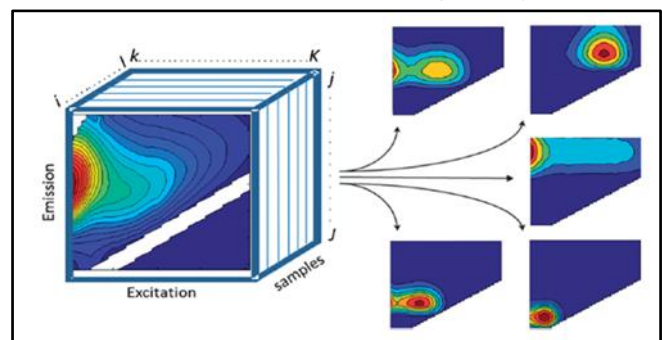
The master thesis includes the following tasks:
- Data preparation and correction.
- Picking of peaks and indices.
- Creating and formatting the PARAFAC model.
- Model export and interpretation.

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