EGU 2024 abstract

**DeepSoil2100 and SWÆDIE (the Soil WArming Experiment Data Integration Effort)**

How do soils respond to warming temperatures? The importance of soils in the global carbon cycle and as hotspots of biogeochemical processes in terrestrial ecosystems underscores the imperative of understanding this response. Soil warming experiments have proved to be a key tool for probing the mechanisms underlying warming responses. However, climate, mineralogy, flora, fauna, and methodology specific to each experimental site hamper efforts to generalize and upscale these findings. The DeepSoil 2100 project was initiated to synthesize data from soil warming experiments worldwide through the creation of a harmonized database (SWÆDIE, the Soil WArming Experiment Data Integration Effort). SWÆDIE emphasizes experiments in which soils have been warmed ≥ 1 m, and will enable us to explore depth-dependence and coupling between above and belowground processes, assess feedbacks and interactions between C stocks, nutrients, and soil moisture, compare short versus long-term warming responses, and identify global patterns.

Collaborative projects such as SWÆDIE require establishing clear guideline for data sharing and attribution of credit, for which we are building on the models provided by Ameriflux and NutNet. We have also drawn from other soil carbon-focused synthesis efforts such as ISRaD, SoDaH, and ISCN to construct a transparent and flexible data model with a user-friendly data access interface. Data are organized hierarchically, with a static site-level table and dynamic subordinate data tables, e.g., time series of fluxes, moisture, and temperature, resolved by depth. We maintain raw data files that are harmonized in a scripted data entry pipeline with the aid of separate metadata files describing variable names and units. Such an approach facilitates new data ingestion while also ensuring reproducibility and transparency.

We will present the results from the initial site characterization, including quantification of heating efficacy and the relationship to changes in soil moisture with depth and across sites. This initial site characterization will also allow us to compare data coverage and define the scope of soil, climatic, and vegetation gradients across the database. On the basis of this comparison, we will present plans for coordinated future sampling. Finally, we will present initial work on establishing improved metrics for model benchmarking, i.e., which modellable response variables are both sensitive and robust when measured across sites?