AGU abstract

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Soil warming experiments are critical for understanding the response of the soil C reservoir to rising temperatures. From the longest running experiment at Harvard Forest (32 y) to new experiments coming on line, there are > 20 such experiments worldwide situated in biomes ranging from tundra to tropical forest, and peatlands to temperate salt marshes. These experiments have yielded new insights into the response of the microbial community to warming via metabolomic changes, interactions between stoichiometry, elevated CO2, and warming, and the differential responses of vegetation, fungi, and microbes. Here, we present the initial efforts to synthesize data from these experiments in a single harmonized database with a streamlined data entry pipeline, flexible and transparent data structure, and user-friendly data access interface. In tandem with the data synthesis effort, we will implement uniform sampling protocols for collecting and processing new data at participating sites. The project has already generated substantial interest, with a workshop held in March 2023 with over 50 participants from more than 10 countries, and a similarly attended meeting at EGU 2023. We welcome collaboration and intend to build an interactive platform for a broad audience with an active community. One of the first questions we seek to answer is how soil warming affects transit times of soil C. Soil C transit time diverges from the simple calculation of stock over flux as it accounts for the age distribution of C in the release flux, yielding unique insight into soil C persistence mechanisms. Using 14C measurements of respired CO2, and leveraging existing data, we will constrain soil C models at key sites to assess how warming affects soil C turnover in different compartments, as well as the contribution of different depth layers to whole profile soil C fluxes. The vulnerability of deep soil C to warming remains a key uncertainty for predicting future changes in the size of the soil C reservoir, and reducing this uncertainty is a primary goal of building the soil warming experiment synthesis database. This is just one example of the types of questions that the forthcoming database can be used to answer, and we hope to stimulate many more new studies, synthesis efforts, and continued engagement with these important experiments in the future.