Session: C16 Poster: T159A

Measuring the climate of soils for the next 30 years

Edward Ayres[†]; Henry Loescher; Hongyan Luo; Jeff Taylor
[†] National Ecological Observatory Network (NEON), USA
Leading author: eayres@neoninc.org

Soils can both mitigate and exacerbate the effects of climate change, but our current understanding of the role of soils in influencing climate is limited by a paucity of long term data from a range of ecosystems. To date, experimental studies have demonstrated many different mechanisms that link climate and soils; however, the artificial nature of these experiments limits their applicability to "real" ecosystems. Soils data from long-term observational studies of ecosystems are needed to complement findings from experimental studies in order to assess impacts of, and feedbacks to, climate in the real world. Here we present an overview of the soils data that will be collected across the US for the next 30 years as part of the National Ecological Observatory Network (NEON; www.neoninc.org). In addition, we present case studies of how this data could be used to address current uncertainties in climate-soil interactions in relation to warming, rising atmospheric CO2 concentrations, and altered precipitation patterns. Soil data will be collected continuously at all 60 NEON sites across the US (18 to 71^{o}N; 72 to 156^{o}W), which include examples of every major ecosystem and soil type found in the US, as well as many major land uses (e.g. wildland, urban, agricultural, and forestry). Measurements will include soil temperature and moisture profiles up to 3 m deep, soil respiration rates, fine root production and turnover, and energy fluxes into and out of the soil. Moreover, all data will be made freely available in near-real time at several different spatial scales, including point measurements and maps at the local (~1 ha), regional (hundreds of km2), and continental scale (millions of km2). These data will be ideally suited to assess the impacts of climate change on soils, which are often expected to trigger both positive and negative feedbacks to climate. For instance, warming in polar regions is expected to melt permafrost, potentially allowing previously protected soil carbon to be decomposed and returned to the atmosphere as CO2, thereby causing additional warming in the future. However, warming may also increase net primary production and carbon inputs to soils resulting in the sequestration of recently fixed carbon in these regions, thereby partially offsetting carbon release caused by melting permafrost. The net effect of these opposing mechanisms on carbon storage in real ecosystems is currently unclear, but NEON data on soil temperatures, soil respiration rates, and fine root turnover will be ideally suited to address this uncertainty. Other examples of how NEON data could be used to assess climate-soil interactions and feedbacks will be presented.