Deep C: Deep soil carbon cycling in a warming world – the molecular marker perspective.

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Summary: Molecular markers are analyzed in soils and peat deposits to quantify the contribution of organic matter originating from different biological and anthropogenic sources (Jansen and Wiesenberg, 2017). Combined with isotopic measurements, molecular markers also provide a powerful tool to identify changes in the environment and in the timescales of organic matter degradation. The Deep C project will apply the rapidly evolving methodologies of molecular markers and isotopic techniques in three established multiyear deep soil warming field experiments maintained by the US Department of Energy. These sites represent three biomes: a mediterranean grassland (Hopland, CA), a temperate forest (Sierra Nevada, Blodgett, CA) and a boreal, forested peatland (SPRUCE experiment, Grand Rapids, MN). Deep C will answer the following research questions: Does warming change the ratio between above and belowground plant-derived organic matter in soils? Will warming favour bacteria over fungi and consequently the build-up of bacterial necromass deeper in the profile? In mineral soils: are new mineral sorption sites filled (deeper in the soil profile), potentially stabilizing soil organic carbon for longer? At the SPRUCE experiment: the $^{13}CO_2$ added through the FACE treatment will be used to distinguish old (pre-FACE treatment) and new organic carbon (formed during the FACE treatment). The study will be integrated into the next generation of vertically-resolved soil organic carbon models e.g. Tang et al. (2013), as a tool for understanding and predicting soil biogeochemical responses to global change. As part of the SPRUCE program, Deep C combined with other on-site measurements will provide new insights into the responses of peatland ecosystems to the predicted increases in global temperatures.

Jansen, B. & Wiesenberg, G. L. B. 2017. Opportunities and limitations related to the application of plant-derived lipid molecular proxies in soil science. *SOIL*, 3**,** 211-234.

Tang, J. Y., Riley, W. J., Koven, C. D. & Subin, Z. M. 2013. CLM4-BeTR, a generic biogeochemical transport and reaction module for CLM4: model development, evaluation, and application. *Geosci. Model Dev.*, 6**,** 127-140.