# Modeling controls on the decomposition of Soil Organic Matter

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Arctic and sub-Arctic soils store vast amounts of carbon, approximately 1700 billion metric tones of frozen organic carbon. This carbon is susceptible to release to the atmosphere due to environmental changes, including those expected under 21st century climate change (e.g., rapidly evolving topography, warming). However, the mechanisms responsible for this susceptibility of soil organic matter (SOM) are not well understood, and uncertainties exist in their representation in Earth System models. To analyze the impacts of these mechanisms on SOM dynamics, we have developed two SOM reaction networks: (1) a relatively simple CENTURY-like network (with labile and recalcitrant pools) and (2) a more complex reaction network (with multiple archetypal polymers and monomers C substrate groups). We test and compare these reaction networks, integrated in the PFLOTRAN and TOUGHREACT models, and their predictions of depth-resolved soil organic matter (SOM). We investigated how the decomposition of SOM depends on various interacting processes (e.g., microbial activity, surface interactions, aggregation, and input C and SOM chemistry). Results indicate that a reasonable combination of sorption parameters, microbial biomass and necromass dynamics, and advective transport can match observations without resorting to an arbitrary depth-dependent decline in SOM turnover rates.