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Molecular DYNAmics of Soil Organic carbon (DYNAMOS): a project focusing on soils and carbon through data and modeling

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Here we present the first results of the DynaMOS project whose main issue is the build-up of a new generation of soil carbon model.
The modeling will describe together soil organic geochemistry and soil carbon dynamics in a generalized, quantitative representation. The carbon dynamics time scale envisaged here will cover the 1 to 1000 yr range and describe molecule behaviours (i.e.)carbohydrate, peptide, amino acid, lignin, lipids, their products of biodegradation and uncharacterized carbonaceous species of biological origin.
Three main characteristics define DYNAMOS model originalities: it will consider organic matter at the molecular scale, integrate back to global scale and account for component vertical movements. In a first step, specific data acquisition will concern the production, fate and age of carbon of individual organic compounds.
Dynamic parameters will be acquired by compound-specific carbon isotope analysis of both 13C and 14C, by GC/C/IR-MS and AMS. Sites for data acquisition, model calibration and model validation will be chosen on the base of their isotopic history and environmental constraints: 13C natural labeling (with and without C3/C4 vegetation changes), 13C/15N-labelled litter application in both forest and cropland. They include some long-term experiments owned by the partners themselves plus a worldwide panel of sites. In a second step the depth distribution of organic species, isotopes and ages in soils (1D representation) will be modeled by coupling carbon dynamics and vertical movement. Besides the main objective of providing a robust soil carbon dynamics model, DYNAMOS will assess and model the alteration of the isotopic signature of molecules throughout decay and create a shared database of both already published and new data of compound specific information.
Issues of the project will concern different scientific fields: global geochemical cycles by refining the description of the terrestrial carbon cycle and entering the chemical composition of organic matter in carbon models; forestry or agriculture by offering a chemical frame for the management of crop residues or organic wastes; geochronology, paleoecology and paleo climatology by modeling the alteration of isotope signature and the preservation of terrestrial biomarkers.