Radiocarbon constraints imply reduced carbon uptake by soils during the 21st century

Objective:

Use radiocarbon data to constrain the mean age of soil carbon in Earth system models (ESMs)

Approach:

- Compiled 157 vertical profiles of the radiocarbon content of soils from around the world
- Created reduced complexity models that mimic the behavior of the original ESMs using carbon cycle simulations from the 5th phase Coupled Model Intercomparison Project (CMIP5)
- Adjusted the reduced complexity models so they match the radiocarbon from the observed profiles and then use these models to estimate future carbon uptake

Results/Impacts:

- ESMs underestimated the mean age of soil carbon by about a factor of six
- Soil carbon uptake of atmospheric CO_2 decreased by 40 ± 27%
- More carbon from fossil fuel emissions may accumulate in the atmosphere than expected, contributing to climate warming

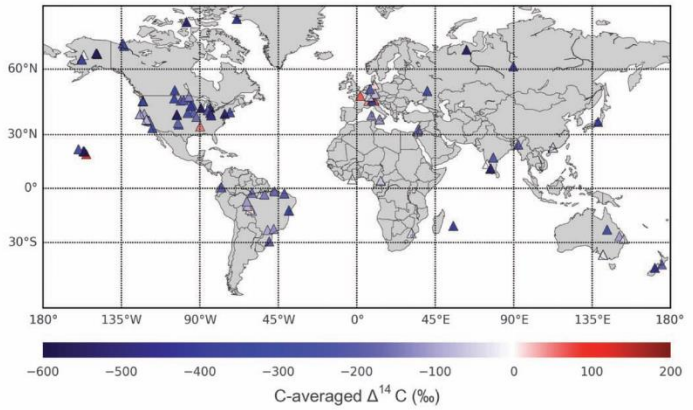

Fig. 1. Locations of soil profiles

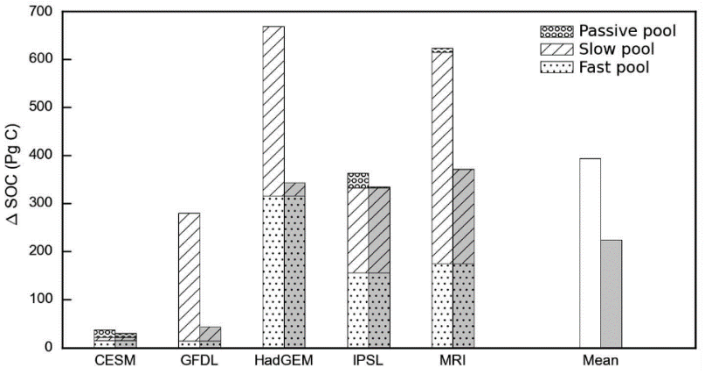

Fig. 2. Soil carbon accumulation before (white) and after (grey) application of the radiocarbon constraint

He, Y., S. E. Trumbore, M. S. Torn, J. W. Harden, L. J. S. Vaughn, S. D. Allison, and **J. T. Randerson** (2016), Radiocarbon constraints imply reduced carbon uptake by soils during the 21st century, *Science*, 353(6306):1419–1424, doi:10.1126/science.aad4273.