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# Soil carbon responses to environmental change across temporal scales

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Different biotic and abiotic factors modify the rates of soil carbon cycling at a variety of temporal scales, posing challenges in determining appropriate model abstractions to represent soil carbon dynamics in the context of global environmental change. Although a large variety of models of soil organic matter dynamics have been proposed previously, it is difficult to compare different model structures and their scale of application. We present here a mathematical framework that can be used to synthesize models with different structure, i.e. number of distinctive pools, their cycling rates and their connection. This framework can also be used to identify the scale of operability of a model and how carbon stocks and respiration fluxes would respond to external perturbations. In this contribution, we present the main concepts behind our mathematical framework and how through eigenvalue analyses we can identify the scale of operability of a model. We also present an analysis of the potential sensitivity of soil carbon stocks to changes in temperature and moisture, and identify regions with larger sensitivities to climate change. Although different models provide very diverse responses, we predict larger sensitivities of soil C stocks in humid tropical regions to increases in temperature and decreases in soil moisture.