Geophysical Research Abstracts
Vol. 12, EGU2010-12535, 2010
EGU General Assembly 2010

Linking the flux of water to soil development and carbon storage in the critical zone. Examples from the Marine Terrace Chronosequence, Santa Cruz, CA, USA.

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The flux of water through the critical zone can be viewed as the engine driving the development of soil physical, mineral, and geochemical properties. To the extent that these soil properties control the capacity of the soils to store carbon, water flux also influences the carbon sequestration potential of the soil systems over long timescales. In addition, over comparatively shorter timescales, the water flux is an essential transport mechanism of organic carbon in the critical zone, directly influencing the supply of carbon to regions of stabilization within soil profiles. In the face of global and regional changes in the hydrologic cycle, it is useful to better quantify the role of water flux for long-term soil carbon stability.

We explored linkages between water flux, soil development, and carbon stabilization in the critical zone. Specifically, we integrated estimates of carbon-mineral stabilization within a geochemical reactive transport model. Building on the work of Maher et al. (2009), who simulated the weathering of parent material and the subsequent precipitation of clay minerals of the Marine Terrace Chronosequence in Santa Cruz, CA, we attempted to simulate measured storage and turnover time of carbon in soils ranging in age from $\sim$90 to $\sim$225 ka. The results of this work provide gauge of the importance of soil mineral controls of carbon cycling relative to other mechanisms of long-term carbon stabilization and lend insight into the potential influence of climate change and other disturbance on the stability of organic carbon in soils.