



Carbon stabilization on terrestrial landscapes

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While terrestrial climate models view C budgets through time-slices of environmental reconstructions, yet during climate transitions, pervasive geomorphic response to climate likely dictate the direction and magnitude of C exchange. Geomorphic processes therefore act as disturbance events that have the potential to create large feedbacks to climate regulation through carbon burial or carbon release. Quantifying the rates of carbon accumulation in various types of deposits allows us to assess intensities of C burial, whereas the spatial extent and timing of geomorphic processes allows us to quantify the net impact on atmospheric CO₂ budgets. Mechanisms and forms of C that are buried or stored lend insights into the longevity of these geomorphic events that dictate land-atmosphere C exchange.

Chronosequences of fluvial, loess, and coastal deposits dated by various chronologic tools were used to calculate carbon intensities, or accumulation rates, into soil and deep sediment. Vertical cores of peat and permafrost provide such rates through direct aging of organic carbon preserved in the cores. Rates of input to soil and surface sediment varied by 4 orders of magnitude, which reflects variations in both plant production and decomposition over various timescales of decades to millennia. In general, shallow and shorter term rates are higher than deep, long term rates. Based on the soil property that best predicts C storage and turnover, we hypothesize different mechanisms of stabilization for selected soil profiles: For example clay content, free iron oxides, freezing temperatures were key in C stabilization within the upper meter of Alfisols, Ultisols, and Cryosols, respectively.