



EPSP Connects

Ken Ferrier, UW-Madison

Sea level, sediment, and soil chemical weathering: Transient behavior at source and sink

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Changes in sea level are of wide interest because they affect many geomorphic features and geologic processes: they reshape coastlines, reorganize river networks, regulate sediment deposition and organic carbon burial, set the boundary condition for landscape evolution, and influence geodynamic and magmatic processes. Here I review recent modeling work on the sensitivity of sea-level change to sediment erosion and deposition, with a focus on sites that are subject to rapid sediment redistribution. Our simulations reveal complex fingerprints of sediment redistribution on sea-level change, with spatial and temporal variations in the magnitude and even the sign of sea-level responses. Motivated by the observation that such changes can produce topographic changes that propagate to the tips of channel networks, I discuss new simulations of the coupled evolution of topography and soil chemistry in first-order basins. These simulations show that soil chemical erosion rates can exhibit distinct responses to climatic and tectonic perturbations. They further imply that hillslope length is the dominant control on the response time of soil chemical erosion rates, implying a potential control of climate, lithology, and biota on the lag time of solute exports from soil-mantled basins. Together, these model results highlight feedbacks in the transient evolution of topography, sea level, and soil composition, and they illustrate some challenges in linking patterns in sedimentary sinks to transient changes at sedimentary sources.

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