Steady Transfer of Sediment from Drainage Basins to the Deep Ocean over Thousands of Years of Climate Change

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Changes in climate and sediment characteristics within terrestrial source regions affect changes in sediment deposition rates, architecture, and character, but transient sediment storage and dynamics may introduce significant lags between onshore changes and offshore deposition. These effects have been difficult to assess as a result of the lack of comprehensive source-to-sink studies that measure changes on- and offshore over similar time scales. Here, we provide the first such sediment balance using cosmogenic radionuclide-derived erosion rates and submarine-fan deposition rates measured during the latest Pleistocene to Holocene marine transgression in southern California. We find remarkable similarity between deep-sea deposition rates and terrestrial erosion rates in southern California. This indicates that sediment fluxes measured over ~ 13 ky do not show imbalances that might be expected in the wake of major depositional changes associated with sea-level fluctuations. Therefore, it appears that this system adjusted to changing conditions in relatively short order, which suggests that sediments are rapidly routed from source to sink in this system and, over thousands of years, the majority of sediment reaches the deep basin. This is, in part, a result of the small size and proximity of terrestrial and deep-sea components of the system, which lacks sufficient space for sediment to accumulate on the shelf or coastal plain over time scales in excess of thousands of years. Thus, at least in confined, spatially restricted systems such as southern California, changes in the rates and character of deposition offshore may faithfully reflect onshore changes when viewed over several-thousand-year time scales.