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Is their a distinctive difference between climate and tectonically driven increases in sediment flux?

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The sedimentary record contains the only time dependent record of past climate and tectonics. As we increasingly probe this archive for information of change in the Earth's past, it is becoming essential to understand how this system responds to change. As an example, during the middle Miocene both the Eastern North American Margin and the northern margins of the South China Sea recorded a rapid increase in sediment accumulation, which may be a signal of global change in the Earth's climate leading to increased precipitation derived run-off.

Variations in sediment flux can be estimated from preserved stratigraphy, cosmogenic nuclitide methods and low-temperature thermochronolgy, but a general quantative model of sediment fluxes remains a research challenge. There exist an array of complex models of sediment transport, which are capable of re-creating realistic morphologies. However, all that remains of the ancient landscape are the sediments deposited, and this record is a partial one at best. Given that observations are incomplete, it is difficult to justify the use of hydrological models for geological problems. Instead we present a simple, somewhat heuristic, advective-diffusive model of sediment transport coupled to lithosphere flexure with the aim of capturing the basics of landscape evolution.

For this idealised system, an increase in surface uplift causes a gradual increase in sediment flux as erosion takes time to react to the new topography. In contrast, when the system is subject to a increase in surface run-off, there is a rapid increase in sediment delivery to the basin. This is due to the erosive power instantly increasing, causing increased removal of sediment. Interestingly, if the elastic thickness of the lithosphere is low, the unloading of the upland areas causes a flexural response that balances erosion and maintains high sediment discharge. If the thickness is high, the flexural response does not keep pace with erosion, and sediment fluxes reduce as topography is eroded down. The rapid response of the predicted sediment delivery out of the catchment to change in run-off versus the slow response to uplift may prove to be a diagnostic tool to decode the sedimentary record.