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Fluvial Discharge to the Global Ocean: The Importance of Large and Small Rivers

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Rivers annually discharge $\sim$37,000 km^3 of water and 20 MT of suspended and dissolved solids to the global ocean. Despite their cumulative magnitude ($\sim$65% of the global land area draining into the coastal ocean), the $\sim$100 present-day rivers with drainage areas $>$100,000 km^2 collectively account for only about 1/2 the global freshwater and 1/3 of the sediment discharged annually. By contrast, rivers with basin areas $<$10,000 km^2 account for only $\sim$10% of the global land area, but – in part because many drain high-standing mountains - they account for $\sim$25% of the sediment reaching the ocean. The disparity between large and small rivers also can be seen in the fate of their respective sediments: large rivers generally discharge onto passive margins on which deltas and clinoforrms are more likely to form. Moreover, by virtue of their size, large drainage basins are more likely to modulate episodic events such that short-term and longer-term fluctuations tend to be more muted in sedimentary sequences deposited off large rivers. In contrast, many small mountainous rivers discharge their loads onto active margins, much of the sediment reaching deep troughs and trenches from which an appreciable amount may be ultimately recycled back into terrestrial land forms. Sea-level fluctuation also may play a less defining role in sedimentary sequences than short-term changes, such as floods. Unfortunately, over the past few centuries fluvial processes in many river basins - particularly those with high sediment yields - have been increasingly affected by landuse, deforestation, agriculture and urbanization, counter-balanced in large part by increased water storage and diversion. The simple story for natural rivers outlined above is thus becoming increasingly difficult to witness regardless of the river's size.