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Global scale modeling of riverine sediment loads: tropical rivers in a global context

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A global scale riverine sediment flux model (termed WBMsed) is introduced. The model predicts spatially and temporally explicit water, suspended sediment and nutrients flux in relatively high resolutions (6 arc-min and daily). Modeled riverine suspended sediment flux through global catchments is used in conjunction with observational data for 35 tropical basins to highlight key basin scaling relationships. A 50 year, daily model simulation illuminates how precipitation, relief, lithology and drainage basin area affect sediment load, yield and concentration.

Tropical river systems, wherein much of a drainage basin experiences tropical climate are strongly influenced by the annual and inter-annual variations of the Inter-tropical Convergence Zone (ITCZ) and its derivative monsoonal winds, have comparatively low inter-annual variation in sediment yield. Rivers draining rainforests and those subjected to tropical monsoons typically demonstrate high runoff, but with notable exceptions. High rainfall intensities from burst weather events are common in the tropics. The release of rain-forming aerosols also appears to uniquely increase regional rainfall, but its geomorphic manifestation is hard to detect. Compared to other more temperate river systems, climate-driven tropical rivers do not appear to transport a disproportionate amount of particulate load to the world's oceans, and their warmer, less viscous waters are less competent. Multiple-year hydrographs reveal that seasonality is a dominant feature of most tropical rivers, but the rivers of Papua New Guinea are somewhat unique being less seasonally modulated.

Local sediment yield within the Amazon is highest near the Andes, but decreases towards the ocean as the river's discharge is diluted by water influxes from sediment-deprived rainforest tributaries