EPISODIC, ENSO-ORCHESTRATED SEDIMENT ACCUMULATION ON AMAZONIAN FLOODPLAINS

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Large, sand-bedded rivers sequester a significant proportion of their sediment load in floodplains, but the magnitudes and mechanisms of storage are undocumented and unpredicted. The Beni River, which drains 70,000 km$^2$ of the northern Bolivian Andes into the Amazon Basin, interacts with its 50,000 km$^2$ of pristine forested floodplain, depositing ~100 Mt/yr of sediment (net loss) as it traverses a large foreland basin. An adjacent river, the Mamore, drains an additional 600,000-km$^2$ basin, much of which is floodplain. For the Beni, this study quantifies system-wide floodplain accumulation rates with a novel methodology for $^{210}$Pb geochronology. Locations within 300 m of the channel average at least 5 cm of annual accumulation, with rates declining to 1 cm/yr at more than 3 km distance. For both the Beni and Mamore, particulate loss is dominated by episodic sedimentation on the large expanse of distal floodplain, and predominately occurs as 20- to 120-cm thick lenses, interpreted as crevasse splays, with system-wide recurrence intervals of about a decade. Tropical ocean temperature, rainfall, and streamflow records link these episodic accumulation events to the largest ENSO cold phase floods, which are also significant conveyors of particulate flux. Unlike previously studied floodplains, study sites rarely exhibit quasi-annual accumulation (only 5 out of 112 dated cores portray constant sedimentation); the dense tropical rainforest, standing water on the floodplain, and natural levees may impede sediment transport overbank during all but the most extreme levee-breaching floods, and even then only near discrete splays. For the Mamore River, accumulation of sediment on floodplains appears to have ceased around 1971, coincident with a major regional cli-
mate change. Because the Beni and Mamore are the principal sediment and water sources of the Madeira River (and analogous to similarly important Peruvian rivers), in turn the largest sediment source for the Amazon, these significant floodplain processes modulate and record the delivery of sediment, water, and associated carbon to lower main-stem environs.