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Rapid fluvial aggradation in response to climate change in northwestern Argentina

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River channels near the edge of the northwestern Argentine Andes are rapidly aggrading at present, with preliminary estimates suggesting rates of $\sim$20 cm yr^{-1}. This mirrors cycles of extensive aggradation over the past 100,000 years that formed pronounced fill terraces along regional valley networks and record periods in which in which climate-driven sediment supply overcame uplift-driven river incision (Robinson et al, 2005). Here we use the new SedFlow model (Heimann et al., 2014) to help us understand the causes and spread of aggradation across these basins in the modern system, with the additional eventual goal to better interpret the geologic record. We provide field-derived grain-size distributions, field-measured and remotely-sensed channel widths and valley slopes, and a variety of possible sediment source locations and amounts as inputs to SedFlow, which routes sediment through the fluvial channel network to produce time-evolving predictions of aggradation and incision. We compare these predictions against changes in topography measured by IceSAT (Zwally et al., 2014) and field surveys. We initially test the system response to a series of isolated sediment inputs to observe interactions between tributary systems and the mainstem river. Recent observations indicate that debris-flow induced landslides are important contributors to aggradation in these rivers (Cencetti and Rivelli, 2011). These and other sediment production and transport processes are likely driven by variations in the El Niño Southern Oscillation (ENSO) (Bookhagen and Strecker, 2009). Therefore, we then run SedFlow with sediment inputs distributed across the landscape based on locations where ENSO influences may trigger enhanced landsliding. These model experiments help us towards our end goal of providing a more quantitative basis to interpret field observations of landscape response to changing patterns of precipitation.

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