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Sediment aggradation and erosional dynamics of intermontane basins in NW Argentina

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The NW Argentine Andes constitute the Andean Plateau (Altiplano-Puna), the second-largest orogenic plateau on Earth, an internally drained highland with a mean elevation of 4.0 $\pm$ 0.5 km ($\pm$2 sigma). The Puna is flanked by the externally drained Eastern Cordillera thrust belt and the adjacent broken foreland that are connected to the Atlantic Ocean. These mountain ranges lie in the south-central Andes and are characterized by steep topographic and climatic gradients: The first windward topographic rise east of the Puna forms a significant orographic barrier resulting in high orographic rainfall causing some of the wettest places on Earth. In contrast, the higher-elevation areas of the windward flanks become progressively drier westward, until arid conditions are attained in the central Puna. During the Quaternary the south-central Andes have repeatedly experienced significant paleoclimatic changes associated with deeper penetration of moisture into the orogen, and thus an orogenward shift of the climate gradient. This mechanism has resulted in large variations in erosion dynamics and sediment transfer toward the foreland, resulting in thick valley fills and multiple terrace levels. At much shorter timescales, climate variability during the Holocene has caused similar, yet less pronounced hydrologic trends and associated sedimentation- and erosion processes. Here, we use a time series of Digital Elevation Models (DEMs) to reconstruct land-level changes in the intramontane basins in NW Argentina. We generated the DEMs and height measurements based on stereo airphotos from the 1980s, ASTER satellite imagery, ICESat and dGPS measurements during the past decade, and several TerraSAR-X and TanDEM-X CoSSC pairs starting in 2013. Our data show a strong signal of fluvial sediment aggradation during the past 30 years, in places up to 0.5m per decade, which explains the regionally observed, modern sediment accumulation in basins that has caused major infrastructural problems. We link the increased sediment flux to cascading processes reflecting environmental and climatic changes of the southern-central Andes.