

Rise of the Andes and the Evolution of South American Climate and Hydrology

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Orogens are a major forcing on terrestrial climate and water cycling through their influence on atmospheric dynamics and circulation, vapor transport, and precipitation processes. The uplift of the South American Andes, the second largest topographic feature on Earth, reshaped regional climate and hydrology, establishing modern climate patterns and driving widespread changes in river discharge, landscape evolution, and biodiversity. However, the history of Andean surface uplift from geological data is contradictory and uncertain. Proxy estimates of past elevations, based on the stable isotopic compositions of authigenic carbonates, suggest a very late and rapid rise of the central Andes but are at odds with structural and thermochronologic evidence. Isotope-enabled climate model experiments that simulate Andean surface uplift and analyses of the isotopic compositions of modern meteoric waters largely reconcile these records and provide evidence for changes in continental-scale hydrological cycling through time.