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Tectonic uplift at the andean subduction margin inferred from North Chilean landscape morphology

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The western topography of the Central Andes in North Chile is marked by the large flat surface of the Atacama bench (AB), the top surface of a sedimentary basin hanging 1 km above sea level, limited to the West by a 1-km-high cliff - the Coastal Scarp (CS) - nearly continuous over a distance of 700 km. These features form a coastal topographic step in the morphology at the foot of the Altiplano plateau. A broad river network has developed from South Peru (15°S) to North Chile (22°30'S) and deeply incised the coastal step since the last 10 My. The morphological features (AB, CS and river network) are suspected to result from recent tectonic uplift and erosion. We test this hypothesis using a landscape evolution model (APERO, Carretier & Lucazeau, 2005). We use an initial lower topography with a constant uplift rate, producing a coastal morphology similar to the coastal step over 7 My and precipitation values derived from present-day precipitation rates. These latest show a rainfall gradient crossing through the west andean topography. Annual precipitation rates are higher in the northern studied area (18°30'S) where rivers are exoreic than in the southern area (22°S), towards the Atacama Desert, where rivers are endoreic. Our results show that (1) a drainage system very similar to the northern Chile one is developed with modelling tectonics and climatic conditions and that (2) precipitation rates variations influence the endoreic or exoreic behaviour of rivers towards the ocean on an uplifting topography, as observed in North Chile. The morphology (Atacama bench and Coastal Scarp) and the drainage system of the northern Chile area can therefore be well explained by recent tectonic surface uplift of the topography associated with present day precipitation rates distribution over the last 10 My.