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Large wavelength deformation across plateaus of subduction systems, case study at Salar de Uyuni, Central Andes

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The distributed deformation across plateaus reflects lithospheric processes. So far, the discrimination of the driving factors for plateau deformation are poorly understood and quantified on millennial to orbital timescales. Here, we use TanDEM-X DEM data to gain insight into the plateau interior deformation of the Salar de Uyuni in the Southern Bolivian Altiplano. We focused on lacustrine paleo-shorelines and used them as strain markers to quantify deformation rates.

The Andean orogen constitutes natural laboratories spanning the highly dynamic active western plate margin, the less tectonically active orogen interior, the tectonically active foreland, and the volcanic arc. Despite being spatially diverse, the unifying characteristic of all those areas are extreme tectonic, topographic, climatic, and surface process gradients, which render them premier sites for the analysis of rapid environmental change, tipping points in the climatic and tectonic system, and transitions into new states. In particular, when the active zone of deformation has propagated in the foreland, the interior of an orogen might be subject to a new pulse of deformation. This deformation might either appear localized at weakness zones or might also affect the complete orogen interiors describing large scale crustal bending. We investigated the lower temporal and spatial scales at which large wavelength tectonic processes in an orogen can be detected with morphological markers like ancient shorelines. We correlated lacustrine terraces using 12-m-resolution TanDEM-X data in the Salar de Uyuni region. This area is well studied regarding the deeper structures, contains well preserved and dated lacustrine shorelines reflecting lake highstands of late Quaternary age on the Altiplano, and is well characterized with established geological map and detailed studies from erosion-deformation feedbacks in the Cordilleras and Altiplano.

Preliminary results indicate up to 15 distinct shorelines with an elevation range reaching 85 m and an increase in absolute elevation of more than 10 m for the uppermost shoreline from western to eastern shores across $\sim$200 km. We interpret these observations as reflecting the deformation of the plateau interior at the millennial timescale across the southern Altiplano. We compare this inferred deformation pattern with data sets obtained at different timescales such as GPS velocities, thermo-chronological data, and sedimentation rates in the Altiplano and associate these data with lithospheric processes deforming the plateau.

To unravel the spatiotemporal character of deformation and its impact on surface processes in the orogen interior and based on these preliminary results, we propose to study in more detail: the large wavelength deformation across the southern Altiplano (i.e. the deformation distributed or accommodated along distinct faults), the mechanical causes of the deformation of plateau interior, and the changes in deformation rate.