Geophysical Research Abstracts
Vol. 20, EGU2018-19270, 2018
EGU General Assembly 2018

Investigating hillslope processes in the hyper-arid zone of the Atacama Desert – different forms, preliminary results, and future perspectives

Simon Matthias May (1), Dirk Hoffmeister (1), Lennart Meine (1), and Olaf Bubenzer (2)

(1) University of Cologne, Institute of Geography, Cologne, Germany (mays@uni-koeln.de), (2) Heidelberg University, Institute of Geography, Heidelberg, Germany

The DFG-funded Collaborative Research Centre 1211 (CRC 1211) "Earth – Evolution at the dry limit" pioneers the research on the mutual evolutionary relationships between earth surface processes and biota in arid and hyper-arid areas of the Earth. In the Atacama Desert, a number of studies have pointed out the remarkable slowness of earth surface processes and landscape formation, for instance reflected in the persistence of (up to) several million-year-old landforms; comparisons with Martian landscapes are evident. Since hillslopes generally represent areas of predominant denudation and constitute the transition/trajectory to floodplains, they play a crucial role in understanding the long-term landscape evolution of desert environments. However, while hillslope processes are known to be very slow or even stagnant in (hyper-)arid environments, process mechanisms under the absence of water are only poorly understood, and process rates are essentially unknown.
Sub-project C03 of the CRC 1211 is dedicated to the investigation of hillslope processes in the hyper-arid and arid zones of the Atacama Desert, where comparable studies are rare. It aims at contributing to a better understanding of controls and processes of hillslope dynamics in the driest parts of the earth on both recent and geological time scales. Thereby, we try to quantify related process rates by means of different methods including high-resolution TLS- and drone-based monitoring, structure-from-motion and photogrammetry techniques, artificial irrigation experiments, as well as geomorphological, stratigraphical, geochronological, sedimentological and geochemical investigations. Our contribution presents preliminary findings and results from the first field season of the CRC 1211, during which various hillslope forms were identified in the northern part of the Atacama suggesting hillslope activity rather than stagnancy. Ripple-shaped structures decorating slopes north of the Rio Loa canyon seem to be controlled by local fog frequency and wind patterns. At Salar Grande, tongue-like, 70 m-long and 30 m-wide fine sediment lobes stretching along a 10-20° steep and thrust-related slope show a distinct stratigraphical pattern with buried palaeo-surfaces and palaeo-surface crusts, suggesting slump-like hillslope dynamics potentially driven by fog-induced humidity and/or salt and gypsum shrink and swell processes. Here, artificial irrigation experiments resulted in 100 % infiltration without any surface runoff or detectable surface displacements (cf. EGU2018-18419). Future investigations will additionally focus on the prominent Atacama-specific zebra stripes and other hillslope forms, which are related to patterned ground (Gilgai).