Near-surface investigation of a slow moving landslide by means of broad-band ambient seismic noise monitoring

Steiner, Matthias (Research Group Geophysics, Department of Geodesy and Geoinformation, TU-Wien, Wien, AUT);
Gallistl, Jakob (Research Group Geophysics, Department of Geodesy and Geoinformation, TU-Wien, Wien, AUT);
Aigner, Lukas (Research Group Geophysics, Department of Geodesy and Geoinformation, TU-Wien, Wien, AUT);
Stumvoll, Margherita (Department of Geography and Regional Research, University of Vienna, Wien, AUT);
Ottowitz, David (Department of Geophysics, Geological Survey of Austria, Wien, AUT);
Glade, Thomas (Department of Geography and Regional Research, University of Vienna, Wien, AUT);
Flores-Orozco, Adrian (Research Group Geophysics, Department of Geodesy and Geoinformation, TU-Wien, Wien, AUT)

Landslides situated in inhabited areas are geohazards posing a serious threat to those human settlements and the associated infrastructure. Commonly, the investigation and monitoring of landslides follow a multidisciplinary approach integrating geotechnical, hydrological and geophysical methods, amongst others. Such a multidisciplinary monitoring network has been deployed at the Salcher landslide located in the municipality of Gresten (Lower Austria) since 2014, aiming at the collection of long-term observational data sets. Since March 2018, a broad-band seismic monitoring network has been installed at the Salcher landslide to complement the existing geotechnical and geoelectrical monitoring systems. The seismic network consists of three stations within the landslide and one reference station installed in the vicinity, at the stable counter slope. Each station is equipped with a Geospace 4.5 Hz 3C geophone, with one of the stations also including three additional Geospace 4.5 Hz vertical geophones. Furthermore, to investigate events over a broad frequency bandwidth extending two orders of magnitude below the natural frequency of the geophones (periods ~ 100 s), we deployed two Nanometrics Trillium 240 broad-band seismometers, one installed within the landslide, and the second one at the reference station. All sensors are connected to Trimble REF TEK 130 broad-band seismic recorders. We analyzed the seismic monitoring data to discriminate events associated with the landslide activity and hydrological processes, such as precipitation and groundwater flow. Events of teleseismic origin were excluded based on earthquake catalogues, whereas local anthropogenic events were identified by a novel event detection algorithm relying on microphone recordings. Information regarding the spectral content and the incidence of landslide-related seismic events were the base for a better understanding of the landslide dynamics whereas the correlation with complementary data sets might help to define precursors for an imminent acceleration phase. Furthermore, we plan on the analysis of ambient seismic noise interferometry by means of computing cross-correlations of the seismic records at different frequency ranges to reveal changes of the seismic velocity within the landslide.