Geophysical Research Abstracts
Vol. 21, EGU2019-8125, 2019
EGU General Assembly 2019

Locating a harmonic tremor beneath Gornergletscher (Switzerland)

Josefine Umlauft (1), Fabian Lindner (2), Fabian Walter (2), Philippe Roux (3), and Michael Korn (1)

(1) Leipzig University, Institute of Geophysics and Geology, Leipzig, Germany (josefine.umlauft@uni-leipzig.de), (2) ETH Zurich, Laboratory of Hydraulics, Hydrology and Glaciology (VAW), Hönggerbergring 26, 8093 Zurich, Switzerland, (3) ISTerre - Maison des Géosciences, 1381 rue de la Piscine, 38041 Grenoble, France

Gornergletscher (Switzerland) is one of the largest glacial systems in the Alps. At the confluence of Gornergletscher and Grenzgletscher, one of its main tributaries, it hosts Gornersee, an ice-marginal lake. For many years, Gornersee has typically filled at the onset of the melt season and drained in the following summer via supraglacial overspill and/or subglacial discharge. In summer 2007, including the drainage period of Gornersee, a seismic array (Ø < 300 m, 6 stations) was installed on the surface of Gornergletscher. In the end phase of the drainage, continuous recordings show a harmonic tremor signal between 20-30 Hz which is stable over several hours.

To locate the tremor source, we applied matched field processing (MFP) polarity optimization. Conventional MFP does not provide a stable source location as azimuthal polarity patterns associated with a double couple source are not considered, but appear to be present. We developed a new tool that takes varying polarities into account and found a focal spot, which is located near the glacier bed. From the derived station polarities and the source location we subsequently calculated a set of potential focal mechanisms which we evaluated in the light of the local ice flow over the bedrock. To test the robustness of our approach and to interpret the polarity optimization, we furthermore modelled waveforms of the calculated double couple sources using the finite difference software FD3D. We applied MFP polarity optimization to the synthethic seismograms, and compared the retrieved polarity pattern to the one retrieved from the glacier data. The MFP inversion of both glacier and synthetic seismograms reveals the most probable source mechanism, which we assume to be a stick-slip motion on the glacier bed of Gornergletscher.