Geophysical Research Abstracts
Vol. 19, EGU2017-3840, 2017
EGU General Assembly 2017

The case for 6-component ground motion observations in planetary seismology

Rakshit Joshi (1), Martin van Driel (2), Stefanie Donner (1), Ceri Nunn (1), Joachim Wassermann (1), and Heiner Igel (1)

(1) University of Munich, Earth an Environmental Sciences, Munich, Germany , (2) Geophysics Institute, ETH Zurich, Switzerland

The imminent INSIGHT mission will place a single seismic station on Mars to learn more about the structure of the Martian interior. Due to cost and difficulty, only single stations are currently feasible for planetary missions. We show that future single station missions should also measure rotational ground motions, in addition to the classic 3 components of translational motion. The joint, collocated, 6 component (6C) observations offer access to additional information that can otherwise only be obtained through seismic array measurements or are associated with large uncertainties. An example is the access to local phase velocity information from measurements of amplitude ratios of translations and rotations. When surface waves are available, this implies (in principle) that 1D velocity models can be estimated from Love wave dispersion curves. In addition, rotational ground motion observations can distinguish between Love and Rayleigh waves as well as S and P type motions. Wave propagation directions can be estimated by maximizing (or minimizing) coherence between translational and rotational motions. In combination with velocity-depth estimates, locations of seismic sources can be determined from a single station with little or no prior knowledge of the velocity structure. We demonstrate these points with both theoretical and real data examples using the vertical component of motion from ring laser recordings at Wettzell and all components of motion from the ROMY ring near Munich. Finally, we present the current state of technology concerning portable rotation sensors and discuss the relevance to planetary seismology.