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**DI026-01****New seismological constraints on the crustal structure of Mars and the Moon**

Tuesday, 15 December 2020: 10:04

Virtual

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**Abstract:**

Planetary crusts are the results of mantle differentiation, so their thickness provides important constraints on the thermochemical evolution of a planet, including its heat budget and mantle rheology. Information on crustal layering and seismic velocities can also provide important constraints on porosity and geochemistry of the crust.

Here, we use data from the InSight mission, which landed in November 2018, to provide seismological constraints on the crustal layering and thickness of Mars for the first time. Results are mainly based on Ps-receiver functions from three events with magnitudes between 3.1 and 3.6 at distances between 27.5° and 47° ( $\pm 10^\circ$ ) from the lander, originating in the Cerberus Fossae region, the only events, so far, with clear, impulsive P-wave onsets and known epicenter. Ps-receiver functions use converted phases in the P-wave coda to derive information on discontinuities beneath the seismometer. Due to the limited number of events and the small epicentral distance range covered, inversions of the data are still ambiguous. Two sets of models can explain the waveforms, one consisting of a two-layer crust of about 20 to 23 km thickness, the other having a three-layer crust of about 40 to 45 km thickness. By excluding crustal thicknesses in excess of 45 km at the landing site, we can constrain the global average crustal thickness of Mars to be less than 70 km. Both model types also agree with S-receiver functions for two events and seismic P-waves reflected in the crust and extracted from autocorrelations using the coda of different types of marsquakes as well as the background wavefield. Furthermore, the results are compatible with independently conducted moment tensor inversions for a limited number of events as well as modeling of the wave-propagation of high-frequency events. We find low seismic P-wave velocities below 3.4 km/s within the upper approximately 10 km, likely indicating a high porosity.

For the Moon, we present Sp-receiver functions for three Apollo landing sites, including the first application of this method to Apollo 15 and 16 data. Data are compatible with a two-layer crust beneath a thin, low-velocity regolith layer and a crustal thickness of 35 to 45 km, with an increased thickness at the Apollo 15 and 16 sites compared to the Apollo 12 location.

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