Temporal variation and frequency dependence of ambient noise on Mars from polarization analysis

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NASA’s Interior Exploration using Seismic Investigations, Geodesy and Hear Transport (InSight) lander touched down on Mars on 26 November 2018. The Seismometer within the InSight lander has detected several hundred marsquakes and continuous ambient noise records. Here, we apply a polarization analysis of InSight seismic data to estimate temporal variation and frequency dependence of the Martian ambient noise field (Suemoto et al., 2020). The applied polarization analysis can extract the dominant back-azimuth and directional intensity of ambient noise by using one seismic station data. An autocorrelation analysis suggests that a lithological boundary beneath the seismometer influences ambient noise characteristics. High-frequency (4–8 Hz) P-waves show a diurnal variation in the dominant back-azimuth that appears to be related to wind and direction of sunlight in a distant area. High-frequency Rayleigh waves (4–8 Hz) also show diurnal variation and a dominant back-azimuth related to wind direction in a nearby area. Therefore, the higher frequency signal could be derived mainly from wind. However, the dominant back-azimuths of P-waves of <4 Hz and Rayleigh waves of 2–4 Hz are constant. Although the temporal variation of dominant back-azimuth of Rayleigh waves below 2 Hz shows same diurnal pattern, the results at 0.125–0.25 Hz are relatively scattered. These results point to the presence of several ambient noise sources as well as site amplification effects related to geologic structure at the InSight landing site. In addition, the high repeatability of P- and Rayleigh waves derived from ambient noise may be utilized to image and monitor the subsurface and find resources such as ice deposits on Mars in the future.

Reference

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