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# Study on the Structural Characteristics of Martian Regolith by Ambient Noise Data from SEIS Observation

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For Earth and Moon, the seismic observation data is the most direct and effective means to detect their internal structure. However, due to the long distance between Mars and Earth and the harsh observation conditions on Mars, the exploration of Martian velocity structure model is a very challenging task. The InSight lander deployed the first seismic observation instrument SEIS (Seismic Experiment for Internal Structure) on the Mars' surface after its successful landing on Mars on November 26, 2018. In this study, we performed horizontal-to-vertical spectral ratio (HVSR) and polarization analysis of three component VBB seismic waveforms recorded by the SEIS station released on the IRIS website. We are trying to constrain the thickness of the Martian regolith at the landing site of InSight from the SEIS data. The VBB ambient noise data we used are in HHV/HHU/HHW channels of ELYSE station in 30 Martian days. These data are predominantly ambient noise data caused by wind effects and do not contain any known marsquake data. We found that the HVSR curves from nearly all released data show two distinct peaks at 11.9 Hz and 24.5 Hz, respectively. Furthermore, we conducted particle motion and polarization analysis on these data in various frequency bands, which indicate that the ground motion at the highest peak show linearly polarized and vertically incident motion with a fixed azimuth. This could be explained by the S-wave resonance of the Martian regolith at the InSight landing site caused by the wave motion source from the wind induced motion of the lander. Using the possible S-wave velocity of the Martian regolith proposed by previous studies and the peak frequencies of the HVSR results in this study, thickness of the Martian regolith at the InSight landing site was obtained that is smaller than the pre-evaluated thickness (3~5 m) for the InSight mission.