EGU2020-11577
https://doi.org/10.5194/egusphere-egu2020-11577
EGU General Assembly 2020


# Monitoring Seismicity on Mars - the Marsquake Service for InSight

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InSight landed on Mars in late November 2018, and the SEIS seismometer package was fully deployed by February 2019. By January 2020, SEIS continues to exceed performance expectations in terms of observed minimum noise. The Marsquake Service (MQS) has been setup to create and curate a seismicity catalogue for Mars over the lifetime of the InSight mission. Seismic waveforms are downloaded daily from the station and are analysed and processed by the MarsQuake Service, with the goal of detecting seismic vibrations not due to local ambient sources. To this end, every precaution is applied to eliminate possible non-seismic sources, such as noise induced by atmospheric phenomena, lander vibrations and orbiter activity. At the date of submission, we have detected 365 events, of different quality and SNR levels. Signal amplitudes remain small and signal can generally only be detected at night. Some events show only low-frequency waves in the 1-10 sec band, others have a high-frequency content up to several Hz, and others have a more broad-band character. A special class of events involves the excitation of a very prominent ambient vibration at 2.4Hz. Despite the scattered nature of the energy, in many cases, distinct phases can be inferred in the waveforms. Body wave character, and back-azimuth, can only be confirmed for 3 broadband events so far. The MQS approach for determining distances from broadband events identifies phases as mantle P and S-phases and uses an a priori set of several thousand martian models, derived from geophysical, mineralogical and orbital constraints. High frequency events are currently located assuming phases are trapped crustal Pg and Sg and using a simple crustal layer. The MQS works in conjunction with the Mars Structural Service (MSS) on building and adopting updated models. The MQS consists of an international team of seismologists that screen incoming data to identify and characterise any seismicity. In this presentation, we present the MQS, demonstrate how we detect and characterise marsquakes, and describe the challenges we face dealing with the Martian dataset.

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