Paper ID: 39259
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MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

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THE EFFECTS OF THE SPACE ENVIRONMENT ON SEISMIC DATA COLLECTION: REGOLITH TYPE, ATMOSPHERE AND GRAVITY

Abstract

In this paper, seismic experiments have been performed in various environments in an attempt to simulate seismic data collection in a planetary science environment (e.g. Mars, Moon and asteroids). This allows an examination of whether different space environments such as a significantly altered atmosphere or gravity impact the feasibility of collecting seismic data or its quality. Data was collected in regolith using a single piezoelectric source/receiver pair with frequencies ranging from 24 – 500 kHz for a P-wave source and 250 kHz for an S-wave source. Regolith used for the experiments included a range of terrestrial sands, clays and soils, and Mars, Lunar and asteroid simulant materials. Low gravity data was generated by undertaking the experiments in a parabolic jet. Low atmosphere data was generated by undertaking the experiments in a vacuum chamber. Parameters not considered in this work that future research should examine include temperature (steady-state and fluctuations), electrostatic properties and background seismic activity which may vary on a planetary body compared to Earth. Efforts were made to control and account for background seismic activity. Relationships were developed for each material tested to relate parameters such as the seismic velocity of the material at different levels of atmospheric pressure and gravitational strength. This will allow future experiments performed in terrestrial conditions to be related to their results if performed in space conditions, enabling researchers to cheaply and easily test the feasibility of different seismic devices for space exploration. This research has not been previously performed with a focus on seismic data.