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Estimation of the marsquakes' location and the interior structure of Mars using InSight data

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The InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) lander successfully delivered a geophysical instrument package to the Martian surface on November 26, 2018, including a broadband seismometer called SEIS (Seismic Experiment for Interior Structure). After two years of recording, seismic body waves phases of a small number of high-quality marsquakes have been clearly identified. In this work, we will present how we estimate the body waves arrival times, and how we handle them to constrain the locations of the marsquakes and the interior structure. The inverse problem relies on a Bayesian approach, to investigate a large range of possible locations and interior models. Due to the small number of data, the advantage of using such a method is to provide a quantitative measure of the uncertainties and the non-uniqueness. In order to take into account the strong variations of the crustal thickness due to the crustal dichotomy, and thus consider the seismic lateral variations, which could cause significant misinterpretations, arrival times corrections are added using crustal thickness maps obtained from gravity and topography data.

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