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Abstract

This paper will build on the findings from Teanby, 2015, which explores the seismic detectability of impacts on Mars. In 2018, NASA will launch a Discovery mission; InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) which will have two seismometers as part of its payload. In advance of the deployment, Teanby estimates the number of impacts that could create detectable seismic events. He uses previously estimated impact rates coupled with empirical data on impact energy, distance between source and receiver, and peak seismogram amplitude to estimate how many detectable regional events could occur per year.

Teanby begins his analysis by setting up two basic models, based on the lower bound of impact rates and his attempted best guess of an impact rate. In lieu of marsquakes, he uses terrestrial analogs to find the relationship between the size of the impact crater, the energy released by the impact, and the resulting amplitudes of the P wave (first arriving wave). He further extrapolates to see how the amplitude decreases with distance, to measure the detectability with respect to distance. Using the detectability distance, he estimates how many impacts are likely to occur in a region where the receiver can detect them. He concludes that roughly 1-3 impacts per year could be detected by InSight.

Teanby is mainly considered with P waves, the first arriving, compressional, waves. My project aims to look at additional waveforms, particularly core-reflected body waves such as ScS. Core-reflected phases have longer periods, and lower frequencies than surface waves, and will be better detected using the SEIS broadband seismometer (SEIS VBB). Using the equations that Teanby provides, the SEIS Short Period's (SEIS SP) detectability will be compared to SEIS VBB's. I will then compare the amplitudes of core-reflected waves, to the first arriving body waves to account for the smaller expected amplitudes, and adjust my predictions. I will replicate the plots from Teanby's paper to show how the detection range, and overall detectable impacts change for the core-reflected phases.

References

Teanby, N.A., 2015. Predicted detection rates of regional-scale meteorite impacts on Mars with the InSight short-period seismometer. Icarus 256, 49-62.