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Suspected seismic signals from DFN fireballs

The Desert Fireball Network (DFN) is the world's largest fireball camera network and is located in the Australian outback. It consists of 52 observatories, covering an area of 3 million km^2 aimed to detect fireballs, recover meteorites and to calculate their orbits [1]. The observatories are optimised to image 1-100 m size objects having a brightness between 0 to 15 magnitudes [1].

The aim of this study is to search for seismic signals from fireballs observed by the DFN. Data of the DFN was used together with data from several stations of the Australian National Seismograph Network operated by Geoscience Australia. The DFN provides information of major fireball events including their exact time and location. The nearest seismic station(s) for each fireball event within a distance of 200 km was searched and the data was checked for marking seismic signals. Seismic signals were searched for 1161 fireball events observed by the DFN. About 12 weak seismic events were found that could be associated with fireballs. The peaks in the time series data are consistent with the calculated arrival times of the direct airwave, suspected to have originated from the meteoroid break-up. These signals cannot be explained through earthquakes or other sources of seismic signals.

Through the study of fireballs on Earth we can get more information on Martian fireballs as the atmospheric pressure on Mars is compatible to Earth's atmospheric pressures at 30-60 km where meteors, fireballs and bolides break-up. However, the effect of attenuation of such signals due to the different atmospheric composition on Mars is yet unknown, but we can focus on the fragmentation of these meteoroids. This is the general direction the future work will focus which may also help with the analysis of data from the InSight mission.

References:

[1] Devillepoix H. A. R. et al. (2019) MNRAS, 483:5166-5178.

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