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Meteor infrasound recordings at a dense seismic broadband transect in Spain

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With the densification of seismic networks, recordings of atmospheric infrasound events through ground coupled signals are becoming more numerous. In particular, there's an increasing probability of detecting direct arrivals at near distances from the source. Here, we analyze a meteor event with absolute magnitude m = −17 on December 11th 2016 that was recorded coincidentally along a dense seismic broadband transect near Granada, Spain. Using 44 near-field detections and the ERA5 atmospheric temperature and wind speed model, we can locate the acoustic source at 38 km height, consistent with the triangulation of the meteor terminal explosion from camera recordings.

The waveforms recorded along the seismic transect reveal important differences between nearby stations, emphasizing the importance of local conditions for acoustic wave propagation and acousto-seismic coupling. A common component of all waveforms are ~0.5 s long N-waves, inherited from the atmospheric shock wave, however waveform attributes such as peak velocity amplitudes and frequencies, signal duration and signal energy show variations of one order of magnitude. Also, the three-component signal polarization shows large variability among stations, suggesting that waveform complexity and the repetitions of N-waves reflects the interaction with local topography, in addition to multipathing through the small-scale structure of the atmosphere along the path. Our observations shed light on various causes of complexity in the conversion of the free-atmosphere acoustic wavefield to ground motion, and point to the difficulties involved in estimating the original pressure signal from acousto-seismic data.