ID: Type: **Oral**

A Sensitivity Analysis of Meteor-Generated Infrasound

In recent years, numerous bolide sources have been detected by the IMS infrasound arrays. Even though waveform data can be extracted from recorded signals, only a few parameters are used throughout infrasound research. A majority of results are obtained by employing energy estimates that are based on semi-empirical relations which possess errors. The justification of such estimates is questionable given that no analysis of the significant error has been performed. In our goal of understanding how the dynamical and structural properties of a meteor (during atmospheric entry) affect the emitted ballistic shockwave, we have developed a propagation model and have performed a sensitivity analysis of all unknown parameters. This model is applied to the Carancas meteor event in 2007. The core results of this study demonstrate that the variation in the trajectory, entry angle, initial velocity, diameter of the meteor as well as the atmospheric environment completely govern the variation within the emitted waveform, whereas the variation of the density and drag coefficient of the meteor have little effect on the waveform. Moreover, we show how the dominant input factors change over the parameter space, thereby leading to new advanced waveform data which consequently improves the characterization of the meteor.

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Track Classification: Theme 2: Events and Their Characterization