ID: Type: **Oral**

quantification in infrasound propagation modeling

The main aspect of uncertainty quantification that is studied in infrasound research community is propagation of atmospheric uncertainty, which is due to the random nature of small-scale flows (e.g. gravity waves). A simple approach to this problem is to use Monte Carlo sampling, which involves a large random sample of plausible atmospheric specifications from a given distribution. However, the classical full-wave propagation models take computing time to evaluate, so that the large number of runs required is impractical. The approach which is developed in this work, is to use chaos polynomial expansions and low-order reduced models to describe both the input uncertainty (gravity waves, source specifications) and the acoustic field. This approach is motivated by two observations. First, acoustic propagation in the atmosphere often involves a few modes that are confined within waveguides. Second, recent observations in the lower stratosphere show that the gravity wave field is dominated by large-amplitude wave packets, that can be described with normal modes of a suited wave equation. Numerical results are obtained using the FLOWS simulation platform, that integrate advanced spectral numerical methods and realistic representations of atmospheric disturbances. The method is used to revisit infrasound signals recorded during campaigns of ammunition destruction explosions.

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Track Classification: Modelling & Network Processing