ID: Type: **Oral**

# events revisited with bayesian localization and machine learning

Long-range infrasound propagation is characterized by large variances due to factors such as stratospheric jet variability, turbulence, and the fact that the atmospheric specifications fail in representing small-scale fluctuations. In numerous situations, the atmospheric ducts are poorly formed, in the sense that they just barely return sound to the ground. In such cases, the proper numerical methods to use (e.g. finite element method or range-dependent normal mode method) are costly in computational memory and time. This is why acoustic source localization problem in the atmosphere is often solved using the ray tracing technique. This approach, however, is limited in most realistic situations, due to its sensitivity to the mismatch between model-generated signals and measurements. An alternative approach, which is addressed in this study, is to use surrogate data obtained from low-cost full-wave propagation models and recorded signals to infer finer, updated probability distributions of unknown parameters. This approach can be applied using a parallel MCMC (Markov chain Monte Carlo) algorithm to obtain a fast prediction of source location, given a few recorded signals. In turns, the posterior distributions of small-scale fluctuations can be estimated and updated, thereby providing a classification of infrasound events, in a complete machine-learning framework.

**Primary author:** BERTIN, Michaël (Commissariat à l'énergie atomique et aux énergies alternatives (CEA))

**Presenter:** BERTIN, Michaël (Commissariat à l'énergie atomique et aux énergies alternatives (CEA))

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