ID: **O4.1-624** Type: **Oral**

localization of infrasound events with propagation metamodels

Wednesday, June 30, 2021 3:34 PM (15 minutes)

Infrasound has proven to be useful for localizing events, especially in the context of the CTBT. Among the usual approaches, the Bayesian inference is often favored as it provides the posterior probability density function (PDF) for source parameters. In these methodologies, propagation models are constructed by numerically propagating signals through a set of plausible atmospheric specifications so as to obtain distributions for arrival characteristics. These approaches, however, drastically increases the number of model runs and for this reason, automatic network processing is often based either on simplified stochastic models or generative models. Such models, however, do not include the current atmospheric specifications and additional analysis is often necessary to better refine the source location estimate. In this work, we combine the Bayesian framework and recent developments in metamodeling to update the posterior PDF describing the source localization. The main difference with the standard Monte Carlo method lies in the fact that the sampling is carried out over the metamodel, which is built from an experimental design of limited size. This makes such propagation metamodels more efficient than their stochastic counterparts and better suited for real-time monitoring. The performance of the method is demonstrated through reanalyzing several recent events.

Promotional text

In this work, localization is obtained using a metamodel which offers a way to compute source characteristics at a low numerical cost from the signals recorded at several IMS stations. Such a metamodel is more efficient than the stochastic models used in the BISL approach.

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Session Classification: T4.1 - Performance Evaluation and Modelling of the Full Verification System and its Components

Track Classification: Theme 4. Performance Evaluation and Optimization: T4.1 - Performance Evaluation and Modelling of the Full Verification System and its Components