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Towards real-time association of infrasound events using full-wave modeling

One important limitation of infrasound technology is due to the uncertainties that are associated to any available atmospheric specifications. While these uncertainties should be implemented in operational products, the problem of calculating plausible waveforms requires a high CPU load that exceeds available resources. For this reason, the current association procedure neglects some important physical aspects of wave propagation, which leads both to high false alarm rates and uncomplete events. The latter often occurs when a candidate event sufficiently close to a true event is lacking. In this work, we present a new statistical model for analyzing and interpreting the data from the International Monitoring System. The method is based on Bayesian inference using a parallel Markov chain Monte Carlo algorithm and a computationally efficient full-wave propagation model. The method provides simulation-based probabilities of detection in a random atmosphere and can associate detections when multiple, interacting events are present in the data along with both sources of coherent and incoherent noise. In turns, the posterior probability of no association can be estimated, thereby providing a way to reduce the false alarm rate in operational-like environments such as that encountered by the International Data Center.

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