ID: Type: **oral**

Learning Long-Range Infrasound Propagation Using Neural Operators

Wednesday, November 6, 2024 9:55 AM (25 minutes)

Recent advances in machine learning have shown that neural networks can approximate operators through specialized architectures known as neural operators. In this work, we investigate the use of Fourier Neural Operators (FNOs) to model the physics of infrasound propagation in randomly layered media, mapping sound speed fields to acoustic waveforms. This method is evaluated by predicting the scattering of both broadband and narrowband acoustic wave packets by stochastic Gravity Wave (GW) fields, which are known to significantly influences atmospheric infrasound variability. We compute GW fields using a stochastic multiwave series that captures the vertical wavenumber power spectral density and introduces intermittency. Inspired by reduced-order modeling, we propose a variant of FNOs that learns the optimal number of modes for representing the integral kernel in the Fourier layers. These modes enable the FNOs to accurately capture the complex interactions between incoming infrasound and vertically distributed small-scale structures in the sound speed profile. When applied to the inverse problem of estimating GW fields from acoustic waveforms, this approach proves to be orders of magnitude more efficient compared to traditional finite-difference solvers.

E-mail

christophe.millet@cea.fr

Primary authors: Mr MILLET, Christophe (Commissariat à l'énergie atomique et aux énergies alternatives (CEA)); Dr LEHMANN, Fanny (ETH Zurich); Ms NOELE, Elodie (CEA)

Session Classification: Modelling and Network Processing

Track Classification: Modelling and Network Processing