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learning for atmospheric turbulence modeling using seismo-acoustic signals

The International Monitoring System comprises four technologies: seismological, radionuclide, hydroacoustic, and infrasound. An important limitation of these technologies is due to the fact that the structure of the propagation medium is partially known. This is especially true for infrasound and indeed, a current trend is to take into account the impact of atmospheric small-scale structures on the waveforms using computational models. The goal of this study is to learn about these structures using infrasound stations that have recorded the same event. Recurrent explosive events can be exploited for this task, through combining full-wave modeling with Convolutional Neural Networks (CNNs). A previously derived stochastic Gravity Wave (GW) model for the small-scale structures is used to generate ensembles of atmospheric states, from a common atmospheric specification. CNNs are designed and trained to predict synthetic signals that are provided by the FLOWS platform and real-world signals are used to determine the parameters of the GW model. The performance of the method is demonstrated using seismo-acoustic signals that were recorded at Norwegian stations in August-September, over the last couple of years. It is shown that the resulting CNNs, together with the updated GW model, possess a good generalization ability in predicting new seismo-acoustic signals.

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