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learning surrogate model for near real-time estimation of ground-level infrasound transmission losses

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Accurate modeling of infrasound transmission losses (TLs) is essential to assess the performance of the global International Monitoring System infrasound network. Among existing propagation modeling tools, parabolic equation method (PE) enables TLs to be finely modeled, but its computational cost does not allow exploration of a large parameter space for operational monitoring applications.

To reduce computation times, Brissaud et al. (2022) explored the potential of Convolutional Neural Networks (CNN) trained on a large set of regionally simulated wind fields (< 1000 km from the source) to predict TLs with negligible computation times compared to PE simulations. However, this emulator shows difficulties in upwind conditions, especially at high frequencies, and causal issues with winds at large distances from the source affecting ground TLs close to the source.

In this study, we have developed a Recurrent Convolutional Neural Network (RCNN) designed to minimize prediction errors while predicting TLs from globally (< 4000 km) simulated combined temperature and wind fields. Our approach enhances the previously proposed one by implementing key optimizations that improve the overall performances. The implemented model predicts TLs with an average error of 9 dB in the whole frequency band (0.1 – 1.6 Hz) and explored realistic range-dependent atmospheric scenarios

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