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Low order models for uncertainty quantification in acoustic propagation problems CHRISTOPHE MILLET, CEA, DAM, DIF — Long-range sound propagation problems are characterized by both a large number of length scales and a large number of normal modes. In the atmosphere, these modes are confined within waveguides causing the sound to propagate through multiple paths to the receiver. For uncertain atmospheres, the modes are described as random variables. Concise mathematical models and analysis reveal fundamental limitations in classical projection techniques due to different manifestations of the fact that modes that carry small variance can have important effects on the large variance modes. In the present study, we propose a systematic strategy for obtaining statistically accurate low order models. The normal modes are sorted in decreasing Sobol indices using asymptotic expansions, and the relevant modes are extracted using a modified iterative Krylov-based method. The statistics of acoustic signals are computed by decomposing the original pulse into a truncated sum of modal pulses that can be described by a stationary phase method. As the low-order acoustic model preserves the overall structure of waveforms under perturbations of the atmosphere, it can be applied to uncertainty quantification. The result of this study is a new algorithm which applies on the entire phase space of acoustic fields.

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