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Inversion of infrasound signals for passive atmospheric remote sensing: Implications of various orders of approximation in the context of atmospheric uncertainty

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In order to solve the inverse infrasound acoustic tomography problem, it is important to understand how variance in the atmospheric fields maps into variances of the infrasound observables. In between are the propagation modeling codes with varying levels of approximation such as range dependence, topography, and the presence of internal gravity waves. For the inverse problem, it is also important to understand the influences of various model ansatze on the nature of wave propagation near the modal transition regions; this includes the stability of modal transitions with range and time. Most of the information about the atmosphere that can be obtained from a network of infrasound observations is weighted toward the vicinity of these transition regions. Conversely, large uncertainties in the specification of the atmosphere in the vicinity of these transition regions can result in large uncertainties in the quantities inferred from infrasound observations. Secondly for the inverse problem is the incorporation of a priori information such as from operational analyses or radiosonde profiles over parts of the inversion domain which can improve the conditioning of the problem.