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Propagation of acoustic pulses in random gravity wave fields

CHRISTOPHE MILLET, CEA, DAM, DIF, ALVARO DE LA CAMARA, CMLA, ENS Cachan, FRANOIS LOTT, LMD CNRS, ENS Paris — A linear solution modeling the interaction between an incoming acoustic wave and a randomly perturbed atmosphere is developed, using the normal mode method. The wave mode structure is determined by a sound speed profile that is confining. The environmental uncertainty is described by a stochastic field obtained with a multiwave stochastic parameterization of gravity waves (GW). Using the propagating modes of the unperturbed atmosphere, the wave propagation problem is reduced to solving a system of ordinary differential equations. We focus on the asymptotic behavior of the transmitted waves in the weakly heterogeneous regime. In this regime, the coupling between the acoustic pulse and the randomly perturbed waveguides is weak and the propagation distance must be large enough for the wave to experience significant scattering. A general expression for the pressure far-field is derived in terms of saddle-point contributions. The saddle-points are obtained from a WKB approximation of the vertical eigenvalue problem. We present preliminary results that show how statistics of the transmitted signal are related to some eigenvalues and how an "optimal" GW field can trigger large deviations in the acoustic signals. The present model is used to explain the variability of infrasound signals.

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