Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A low-order model for wave propagation in random waveguides

CHRISTOPHE MILLET, MICHAEL BERTIN, DANIEL BOUCHE, CEA, DAM, DIF — In numerical modeling of infrasound propagation in the atmosphere, the wind and temperature profiles are usually obtained as a result of matching atmospheric models to empirical data and thus inevitably involve some random errors. In the present approach, the sound speed profiles are considered as random functions and the wave equation is solved using a reduced-order model, starting from the classical normal mode technique. We focus on the asymptotic behavior of the transmitted waves in the weakly heterogeneous regime (the coupling between the wave and the medium is weak), with a fixed number of propagating modes that can be obtained by rearranging the eigenvalues by decreasing Sobol indices. The most important feature of the stochastic approach lies in the fact that the model order can be computed to satisfy a given statistical accuracy whatever the frequency. The statistics of a transmitted broadband pulse are computed by decomposing the original pulse into a sum of modal pulses that can be described by a front pulse stabilization theory. The method is illustrated on two large-scale infrasound calibration experiments, that were conducted at the Sayarim Military Range, Israel, in 2009 and 2011.

Christophe Millet
CEA, DAM, DIF

Date submitted: 31 Jul 2014 Electronic form version 1.4