Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Efficient method for the computation of wave propagation in the atmosphere: horizontal rays and vertical normal modes NOE LAHAYE, STEFAN LLEWELLYN SMITH, Department of Mechanical and Aerospace Engineering, University of California, San Diego — The development of efficient methods for computing the propagation of waves throughout the atmosphere is a longstanding issue. The widely-used WKBJ approximation is inaccurate when the typical scale of the fluid properties is of the order of the wave scale, or in particular regions such as turning points or critical levels. Homogeneity in the horizontal allows one to reduce the problem to an ODE (generally in the vertical) and solve this numerically with no further approximation. However, this may not be a valid approximation in applications; for example tsunami-generated acoustic-gravity waves have a large length scale and propagate over long distances up to the ionosphere. We propose a resolution method for 3D wave propagation that combines normal-modes and ray tracing, relying on scale separation between vertical and horizontal directions. This method has been widely used in the oceanic acoustic context and in waveguide theory, yet few applications in the atmospheric context seem to have been reported. First, we present some results in a simple framework (quiescent fluid, rigid boundary conditions), then show how the method may be adapted in the atmospheric context (including compressibility) to the propagation of waves emitted by a moving source and/or in a moving fluid.

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Date submitted: 01 Aug 2015 Electronic form version 1.4