Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Low frequency acoustic waves from explosive sources in the atmosphere CHRISTOPHE MILLET, CEA, JEAN-CHRISTOPHE ROBINET, SINUMEF, CAMILLE ROBLIN, CEA / SINUMEF, XAVIER GLOERFELT, SINUMEF, CEA TEAM, SINUMEF TEAM — In this study, a perturbative formulation of non linear euler equations is used to compute the pressure variation for low frequency acoustic waves from explosive sources in real atmospheres. Based on a Dispersion-Relation-Preserving (DRP) finite difference scheme, the discretization provides good properties for both sound generation and long range sound propagation over a variety of spatial atmospheric scales. It also assures that there is no wave mode coupling in the numerical simulation The background flow is obtained by matching the comprehensive empirical global model of horizontal winds HWM-93 (and MSISE-90 for the temperature profile) with meteorological reanalysis of the lower atmosphere. Benchmark calculations representing cases where there is downward and upward refraction (including shadow zones), ducted propagation, and generation of acoustic waves from low speed shear layers are considered for validation. For all cases, results show a very good agreement with analytical solutions, when available, and with other standard approaches, such as the ray tracing and the normal mode technique. Comparison of calculations and experimental data from the high explosive "Misty Picture" test that provided the scaled equivalent airblast of an 8 kt nuclear device (on May 14, 1987), is also considered. It is found that instability waves develop less than one hour after the wavefront generated by the detonation passes.

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Date submitted: 05 Aug 2006 Electronic form version 1.4