Geophysical Research Abstracts,
Vol. 11, EGU2009-1230, 2009
EGU General Assembly 2009

Numerical studies of large-amplitude mountain waves

K. Moiseenko

Obukhov Institute of Atmospheric Physics, Atmospheric Composition Division, Moscow, Russian Federation
(konst.dvina@mail.ru)

Some non-linear aspects of interactions between adjacent layers of stratified inviscid stationary airflows are examined basing on numerical experiments with two-dimensional analytical and three-dimensional numerical models. The first approach is based upon consideration of two- and three-layer airflow in a half space over a mountain of arbitrary shape on the assumptions that upstream wind velocity and static stability within each layer are constant (Long's model). The general solution is given in terms of distributions of a source function along the bottom flat boundary as well as discontinuities along the undisturbed separation surface level. Invoking kinematic and dynamic conditions on the separation surface and free-slip condition on the lower boundary then yields a system of linear integral equations for the densities of these distributions, which are solved by perturbation technique. Application of the model to simple troposphere – stratosphere system is considered. It is shown that the non-linearity of the boundary conditions on the separation surface has a second-order effect (in asymptotic sense) on the resulting flow contrary to the obstacle shape having first-order influence.

Quasi-resonant regimes in three-dimensional flows have been studied basing on numerical solution of unelastic, non-hydrostatic system of equations with use of forward-in time weakly dissipative scheme derived within a general Lax-Wendroff concept. The combined effects of partial up-stream near-surface blocking and wave energy redistribution due to lapse rate and wind velocity variations are studied. Application of the results to phenomena of Novorossiisk bora and large-amplitude waves in the free troposphere observed earlier at Crimean Mountains is discussed.