Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09411, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09411
EGU General Assembly 2008

Resonance states in the stationary buoyancy wave spectrum

M. Zirk and R. Rõõm

50090 Tartu, Ülikooli 18, University of Tartu, Estonia (Marko.Zirk@ut.ee)

In the course of numerical stationary orographic buoyancy (SOB) wave modelling in a stratified atmosphere, specific resonance states with narrow sharp peaks were discovered in the wave spectrum. Locations, relative intensities, and the half-widths of the resonances are independent of orographic details but depend strongly on the stratification and atmospheric flow particularities. The resonances appear also in the wave drag, causing essential modulation of the spectral wave-drag coefficient.

To find out the resonance origin, analytical modelling of SOB wave spectral amplitudes with the simplified two-layer continuous model was carried out. The lower layer with constant scale height H and buoyancy N, and with constantly sheared wind $U(z)$ presents troposphere, while the upper layer, starting at z_0 = 12 km, with the scale height $H_0 < H$, buoyancy $N_0 > N$, and constant wind $U_0 = U(z_0)$, does model the stratosphere. As it turns out, the SOB wave resonances are a rather common phenomenon in the real stratified atmosphere. They represent the bound stationary precursors of baroclinic instability, which will arrive in the form of a transient baroclinic wave, if some critical value of the wind shear dU/dz is exceeded.

Three main parameters tuning the location, the height, and the half-width of resonances, are the positive buoyancy jump $\Delta N = N_0 - N$ at the tropopause, the tropospheric mean wind $\bar{U}$, and the tropospheric mean wind shear $\overline{dU/dz}$. Using the known dependencies of resonances on these three parameters in the case of simplified linear model, a parameterization scheme of the spectral wave drag is developed, which aims on substantial revision of the wave-drag handling in low-resolution NWP and climate models.