Gravity wave generation from the dipole

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The present study revisits spontaneous generation of gravity waves from jet exit region in an idealized numerical simulation of the dipole to discuss the nonlinear interactions. While the experimental setting is basically the same as in a previous study (Snyder et al., 2007), parameter sweep experiments with longer time integration are preformed to focus on the backreaction of gravity waves.

The numerical model (DCPAM5-plane) solves dry primitive equations on an *f*-plane in a sigma coordinate. The domain is 3000 km times 3000 km in horizontal and 20 km in vertical directions. The number of grid points are 128 times 128 with 80 layers, which corresponds to a resolution of ~23.4 km in the horizontal and 250 m in the vertical. The boundary conditions are doubly periodic in horizontal and rigid upper and lower boundaries. The initial condition is an exact dipole solution derived analytically in the quasi-geostrophic approximation (Muraki and Snyder, 2007). Ageostrophic winds are added as an extension of previous study (Snyder et al., 2007). Numerical simulations with several Rossby number (Ro=0.05-0.30) are performed. Time integration depends on Ro to keep the same moving distances. With this setup, if the dipoles were purely quasi-geostrophic, their trajectories would be exactly the same. Differences that arise between the different simulations come from higher-order corrections to quasi-geostrophy and from spontaneously generated gravity waves

In the results, gravity waves can be detected only larger Ro > 0.15. Further, through the wave capture mechanism the effect of the gravity waves on the vortices is revealed by the distance between the two vortices. In the presentation, we will discuss diagnostics of spontaneous emission, the implications for parameterizations of gravity waves, and their impacts on the middle atmosphere.

Key words: Gravity waves, Spontaneous emission, Wave capture, Backreaction

References

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