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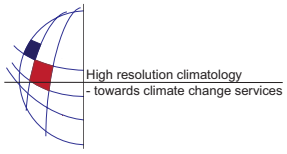

Spontaneous gravity wave radiation from vortex pair in an f-plane shallow water system

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This study investigates nonlinear interaction between rotational flows (balanced modes) and gravity waves (unbalanced modes) in geophysical fluids. Atmospheric gravity waves play very important roles on the atmosphere and ocean by driving global circulation, since they propagate far away from the source region and put significant amount of momentum and energy flux. Recent observational studies suggest gravity waves are radiated from strong rotational flows, such as polar night jet, sub-tropical jet, and typhoon. This process is considered as a "spontaneous gravity wave radiation" since gravity waves are radiated from unsteady motions of nearly balanced rotational flows, but have not been fully understood. In the present study, we focus on this new physical process of gravity wave radiation. To study fundamental physics, we use the most simplified system of shallow water that includes both gravity waves and rotational flows. In addition, we set a simple vortex pair as the basic vorticity field. First, we analytically derive far field of radiated gravity waves using the analogy with the theory of vortex sound (Lighthill theory) and Green's function. We also investigate amplitude of gravity wave flux numerically. In the numerical simulation, we use a spectral method for unbounded domains. This model allows us to estimate gravity wave amplitude with high accuracy. We will show the results for several parameter values, such as strong or weak rotation and stratification. Finally we discuss the conditions of this type of gravity wave radiation in real atmosphere.

REFERENCEs

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