



## **Numerical investigation on spontaneous gravity wave radiation from an unsteady jet in a rotating spherical shallow water**

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We perform nonlinear numerical simulations on spontaneous gravity wave radiation from an unsteady jet flow in a rotating spherical shallow water system. Gravity waves play an important role on the middle atmosphere to drive a global circulation. Since global material circulation in the middle atmosphere greatly affect long term climate change, it is one of the most important topics to understand the process of gravity wave radiation. Recent observational studies suggested that gravity waves are radiated from strong rotational flows, such as polar night jet, sub-tropical jet, and typhoon. Although there are several studies about these gravity wave radiation, the radiation process is not fully understood. In the present study, we focus on one possible radiation mechanism, which is spontaneous gravity wave radiation from initially balanced rotational flows. Since the energy of gravity waves are far smaller than those of jet flows, it is difficult to study spontaneous gravity wave radiation numerically. Recently, we have developed the spectral-like three point combined compact difference (sp-CCD) scheme, which has high accuracy as well as the spherical harmonics model. Using this model, we could estimate gravity wave amplitude with high accuracy. In addition, we use a numerical experimental setting of shallow water system, which is the most simplified system that both gravity waves and rotational flows can exist. We make an unsteady jet flow with zonal relaxation forcing. Then spontaneous gravity wave radiation is generated continuously. In the present study, we focus on the dependencies of the jet latitude on spontaneous gravity wave radiation. Using the analogy with the theory of the aero-acoustic sound wave radiation (Lighthill theory), we discuss on the conditions of gravity wave radiation and propagation. We also discuss results with the basis of f-plane shallow water system which we studied previously. At present, we are

studying spontaneous gravity wave radiation in two layer shallow water system, and will show recent results in the presentation.