EGU21-8560
https://doi.org/10.5194/egusphere-egu21-8560
EGU General Assembly 2021

Spontaneous inertia-gravity wave generation from mesoscale eddies

Bo Zhao[1,3,4], Zhenhua Xu[1,3,2], Qun Li[5], Yang Wang[1,3,2], and Baoshu Yin
[1]Institute of Oceanology Chinese Academy of Sciences, CAS Key Laboratory of Ocean Circulation and Waves,, China (815160999@qq.com)
[2]Pilot National Laboratory for Marine Science and Technology
[3]Center for Ocean Mega-Science, Chinese Academy of Sciences
[4]College of Earth and Planetary Sciences, University of Chinese Academy of Sciences
[5]Polar Research Institute of China, Shanghai

An exact geostrophic vortex generate spontaneously inertia-gravity waves (IGWs) with spiral patterns via singularity instability mechanism. In the vertical direction, the energy of the IGWs is dominated by mode-1 in the generation and propagation processes, leading to weak dissipation and long-distance propagation. The amplitude of the IGWs increases linearly with the Rossby number in the range 0.04–0.1. Additionally, the IGWs emitted from an anticyclonic vortex are stronger than those radiated from the cyclonic vortex. Anticyclonic and cyclonic geostrophic vortices transfer roughly 0.54% and 0.41% of their kinetic energy to IGWs in this transient generation process, respectively. However, quasi-geostrophic mesoscale eddies are decomposed to balanced geostrophic component and unbalanced near-inertial oscillations with different timescales. Near-inertial waves (NIWs) also can be generated as a forced response to the nonlinear coupling of the geostrophic component and high-frequency oscillations of the quasi-geostrophic eddies. Afterwards, the NIWs resonate with the near-inertial oscillations and share the same horizontal wavenumbers with the eddy. Generally, an anticyclonic mesoscale eddy can emit much stronger NIWs than does a cyclonic eddy. The NIW intensity strengthens exponentially with the Rossby number. The spontaneous generated NIWs represent an effective pathway for mesoscale eddy energy skin and non-negligible contribution to the global NIW energy.