

Oda, M., and H. Kanehisa, 2019: A simple model of the resonant interaction between vortex Rossby and gravity waves. *J. Meteor. Soc. Japan*, **97**, <https://doi.org/10.2151/jmsj.2019-006>.

**Plain Language Summary:** We show a simple conceptual model of the resonant interaction in a typhoon-like vortex between vortex Rossby waves (VRWs) and gravity waves (GWs), which are caused by the VRWs. The proposed conceptual model is based on the buoyancy-vorticity formulation (BV-thinking), and is different from that for the barotropic and baroclinic instabilities based on PV interactions (PV-thinking).

We consider disturbances of the first baroclinic mode on a basic barotropic vortex. The disturbance vertical vorticity  $\zeta$  of the VRW in the central region has a large amplitude on the upper and lower levels. The disturbance buoyancy  $b$  and radial vorticity  $\eta$  of the GW in the outer region have a large amplitude on the middle level.

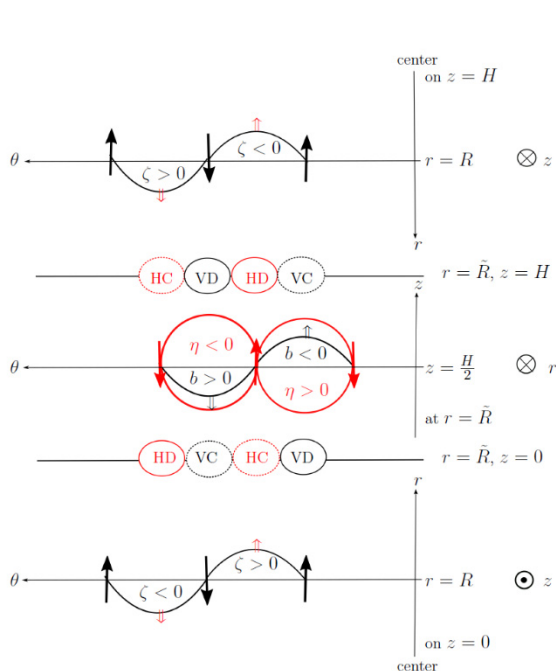


Figure.1 shows the conceptual model of the interaction between the near-central VRW and the outer GW. The circulation around  $\zeta$  of the VRW enhances  $b$  of the GW, which in turn enhances  $\eta$ . At the same time, the circulation around  $\eta$  of the GW enhances  $\zeta$  of the VRW. As a result, the VRW and GW grow simultaneously.

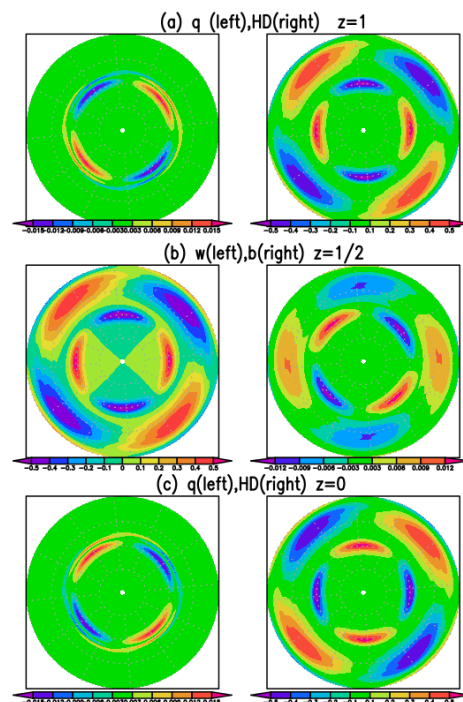


Figure.2 shows the results of the numerical calculation of the proposed model. We can see the same growing structure as shown in figure.1 .

### Highlights:

- We propose the VRW-GW resonant growth mechanism in a three dimensional model not in a two dimensional model.
- The VRW-GW resonant growth occurs in a three dimensional system. This is because the growth is caused by the interaction between the horizontal circulation of VRW and the vertical circulation of GW.
- We also show the numerical calculation of the proposed model.