Nishimoto, S., and H. Kanehisa, 2018: Analytical solutions of vortex Rossby waves associated with vortex resiliency of tropical cyclones. *J. Meteor. Soc. Japan*, **96**, 5-24.
https://doi.org/10.2151/jmsj.2018-003

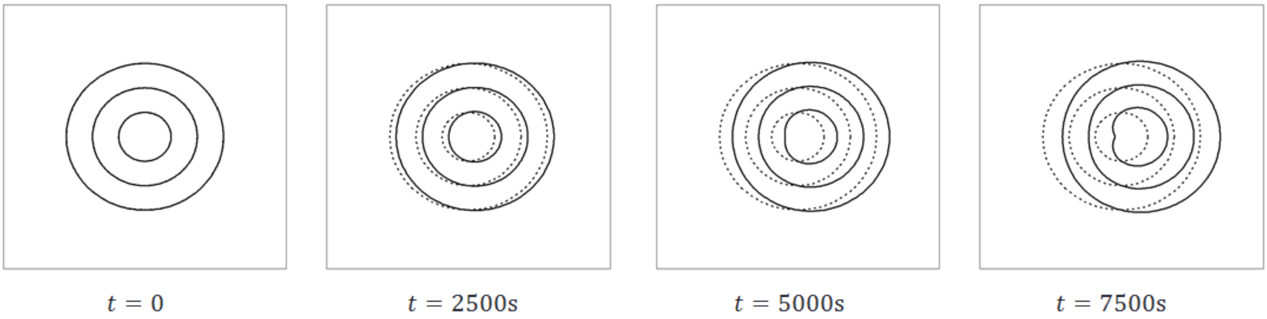

Figure 1. The case of weak vertical interaction between VRWs. The dotted and solid lines are, respectively, the basic and perturbed Iso-PV lines on the upper level. The lower level perturbations are equal in magnitude and opposite in sign to the upper level perturbations.

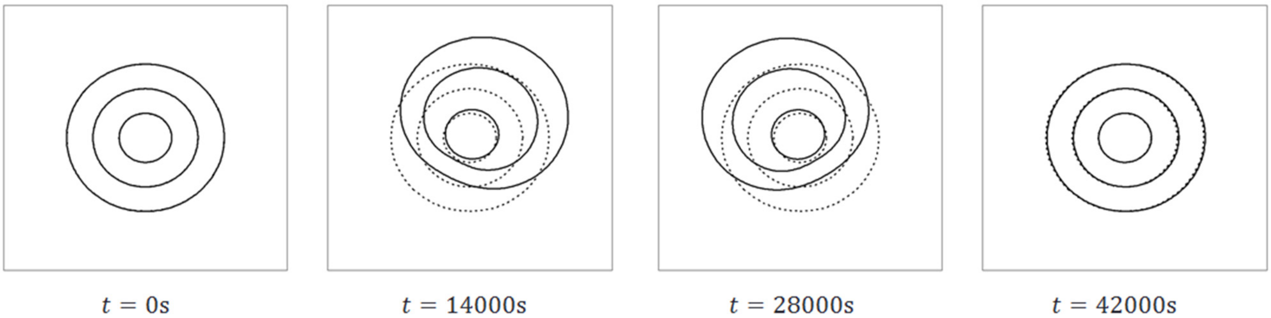

Figure 2. As in Fig. 1 but for strong vertical interaction between VRWs in the central region.

- As is well known, tropical cyclones (TCs) are resilient against destructive environmental vertical shear of moderate strength. In order to analytically investigate the resilience mechanism, we analytically examine the behaviour of vortex Rossby waves (VRWs) generated on TC-like vortices. Specifically, we consider a barotropic axisymmetric vortex in the quasigeostrophic system, whose potential vorticity (PV) is piecewise uniform in the radial direction. VRWs are excited on the basic vortex by an environmental flow which is unidirectionally (to the right in Figs. 1 and 2) vertically sheared. We obtain analytical solutions of the VRWs. The main results are shown in Fig. 1 and Fig. 2.
- Figure 1 shows the case of weak vertical interaction between VRWs. VRWs which are stationary in the azimuthal direction and linearly grow in time are selectively excited. The linear growth implies that the vortex is eventually destroyed by the environmental vertical shear.
- Figure 2 shows the case of strong and weak vertical interactions between VRWs in the central and outer regions, respectively. Because of the strong vertical interaction in the central region, the VRWs precess instead of linearly growing. The precession implies that the vortex maintains vertical coherence in spite of the environmental vertical shear.