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Impact of the asymmetric dynamical processes of the structure and intensity change of two-dimensional hurricane-like vortices KONSTANTINOS MENELAOU, M.K. YAU, McGill University, YOSVANY MARTINEZ, Researcher — In this study, a simple two-dimensional (2D) unforced barotropic model is used to study the asymmetric dynamics of the hurricane-inner core region and assess their impact on the structure and intensity change. Two sets of experiments are conducted starting with a ring of enhanced vorticity to mimic intense mature hurricane-like vortices, that is perturbed by an external impulse. The theory of empirical normal modes (ENM), and the Eliassen-Palm (EP) flux theorem is then applied to extract the dominant wave modes from the dataset and diagnose their kinematics, structure, and impact on the hurricane-like vortex. From the first experiment, it is found that the evolution and the lifetime of an elliptical eyewall may be controlled by the inviscid damping of sheared vortex Rossby waves (VRWs) or quasimodes. The critical radius and the structure of the quasimode obtained by the ENM analysis is shown to be consistent with the predictions of a linear eigenmode analysis of small perturbations. From the second experiment, it is found that the outward propagating VRWs that arise due to barotropic instability and the inward mixing of high vorticity, organizes into secondary ring of enhance vorticity that contains a secondary wind maximum. Sensitivity tests performed on the spatial extent of the initial external impulse verifies the robustness of the results. The fact that the secondary eyewall occurs close to the critical radius of some of the dominant modes emphasize the important role played by the VRWs.

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