Geophysical Research Abstracts
Vol. 17, EGU2015-487, 2015
EGU General Assembly 2015

The Role of Scale Interaction on the Asymmetric Rapid Intensification of Typhoon Vicente (2012)

xiaomin chen (1,2) and Yuqing Wang (2)

(1) Key Laboratory for Mesoscale Severe Weather/MOE and School of Atmospheric Science, Nanjing University, Nanjing, China, (2) International Pacific Research Center, and Department of Meteorology, School of Ocean and Earth Science and Technology, University of Hawaii at Manoa, Honolulu, USA

Typhoon Vicente (2012) underwent an extreme rapid intensification (RI) with the maximum sustained 10-m wind speed increased by 65 knots within 15 hours just before making landfall in the northern South China Sea according to the best track data of the Joint Typhoon Warning Center (JTWC). In this study, this extreme RI process was successfully reproduced in a cloud-resolving simulation using the Advanced Weather Research and Forecasting Model (ARW-WRF). The RI of Vicente consisted of two modes: (i) an asymmetric mode (i.e. RI onset), represented by relatively slow intensification associated with a distinct eyewall contraction; (ii) an axisymmetric mode with little eyewall contraction. Special attention is paid to the first RI mode in the following analysis. Results from a system-scale tangential momentum budget during the first RI mode indicate that the spin-up of the vortex-scale circulation around the eyewall is mainly attributed to strong convergence/stretching and vertical advection of absolute angular momentum in convective updraft regions while radial eddy flux is responsible for the spin-up of vortex circulation in the eyewall throughout the troposphere. Similarly, the warming within the eye during the RI onset primarily comes from the contribution of radial eddy flux as shown in the potential temperature budget.

The two-dimensional spectral decomposition was used to separate the large-scale monsoon trough (with wavelength L > 1000 km) where Vicente was embedded from the TC vortex circulation. This allows quantifying the scale interaction between the monsoon trough and the TC. The results show that the vortex asymmetric vorticity, generated by the strong downshear convective bursts, is advected radially inward by the asymmetric tangential wind projected from the monsoon flow. This process dominates the role of radial eddy flux in spinning up the vortex-scale circulation within the eye and further benefits the eyewall contraction during the first RI mode.