A study on terrain-induced mesoscale circulations of landfalling typhoons with different storm characteristics

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In order to retrieve the typhoon circulation correctly from radar-observed Doppler velocity, a vortex-based Doppler velocity dealiasing (VDVD) algorithm for tropical cyclones (TCs) is developed to recover the aliased Doppler velocity due to the strong winds from typhoons. The algorithm is based on an inner-outer iterative procedure with a Rankine-combined-vortex model as a reference field for velocity dealiasing. The structure of the reference vortex is adjusted in the inner iterative procedure which applies the ground-based velocity track display (GBVTD) technique. The outer loop, based on the GBVTD-simplex, is used for correction of TC center location.

The VDVD algorithm is applied to dealias the Doppler velocity of TY Soudelor (2015), a relatively large typhoon (R17 ~3.2°), and TY Nesat (2017), a relatively small one (R17 ~1.9°), observed by the Wu Feng Shan radar in Taiwan. The retrieved symmetric tangential wind shows that the radius of maximum wind (RMW) of TY Nesat shrunk gradually when it was approaching Taiwan. In contrast, TY Soudelor only had a minor change on its RMW. Moreover, a split of the eyewall strong wind area was observed before its landfall. To diagnose the unique features of TY Soudelor, a numerical model simulation with radar data assimilation (DA) is conducted. Compared to the simulated typhoon without radar DA, the simulated one with radar DA has the kinematic feature closer to observed one. In order to reproduce a more reasonably simulated typhoon similar to TY Soudelor, different assimilation strategies will be investigated in the future. Angular momentum budget will be calculated to understand the mechanism of momentum change which is responsible for the unique features of TY Soudelor.

Key words: Typhoon, radar, Doppler velocity, dealias, size

References

Chang, P.-L., W.-T. Fang, P.-F. Lin, and M.-J. Yang, 2019: A vortex-based Doppler velocity dealiasing algorithm for tropical cyclones. *J. Atmos. Oceanic Technol.,* accepted.

Lee, W.-C., J.-D. Jou, P.-L. Chang, and S.-M. Deng, 1999: Tropical cyclone kinematic structure retrieved from single Doppler radar observations. Part I: Interpretation of Doppler velocity patterns and the GBVTD technique. *Mon. Wea. Rev.*, **127**, 2419–2439.

Lee, W.-C., and F.D. Marks, 2000: Tropical cyclone wind fields retrieved from single

ground-based Doppler radar. Part II: The GBVTD-simplex center finding algorithm. Mon. *Wea.* Rev., **128**, 1925-1936.

Yang, M. J., T. C. Chen Wang, Y. Zhang, and C. Y. Weng, 2011: Momentum budget evolution of Typhoon Nari (2001) during the landfall process. *Terr. Atmos. Ocean. Sci.*, **22**, 595-612.