

Wang, C.-C., K.-Y. Lin, C. A. Davis, S.-Y. Huang, S. C.-S. Liu, K. Tsuboki, and B. J.-D. Jou, 2020: A modeling study on the impacts of Typhoon Morakot's (2009) vortex structure on rainfall in Taiwan using piecewise potential vorticity inversion. *J. Meteor. Soc. Japan*, **98**, 707-733.

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Plain Language Summary: In this study, the impacts of Typhoon Morakot's (2009) vortex structure on the extreme rainfall in Taiwan are investigated through modeling with an application of piecewise potential vorticity (PV) inversion. The control experiment (C0), starting at 0000 UTC 7 August or 15 h before landfall, reproduces the event realistically and is validated against the observations. By altering the PV perturbation inside 750 km from its center, we conduct sensitivity experiments in which the size and/or circulation strength of Morakot is reduced/weakened in the initial field in several different ways.

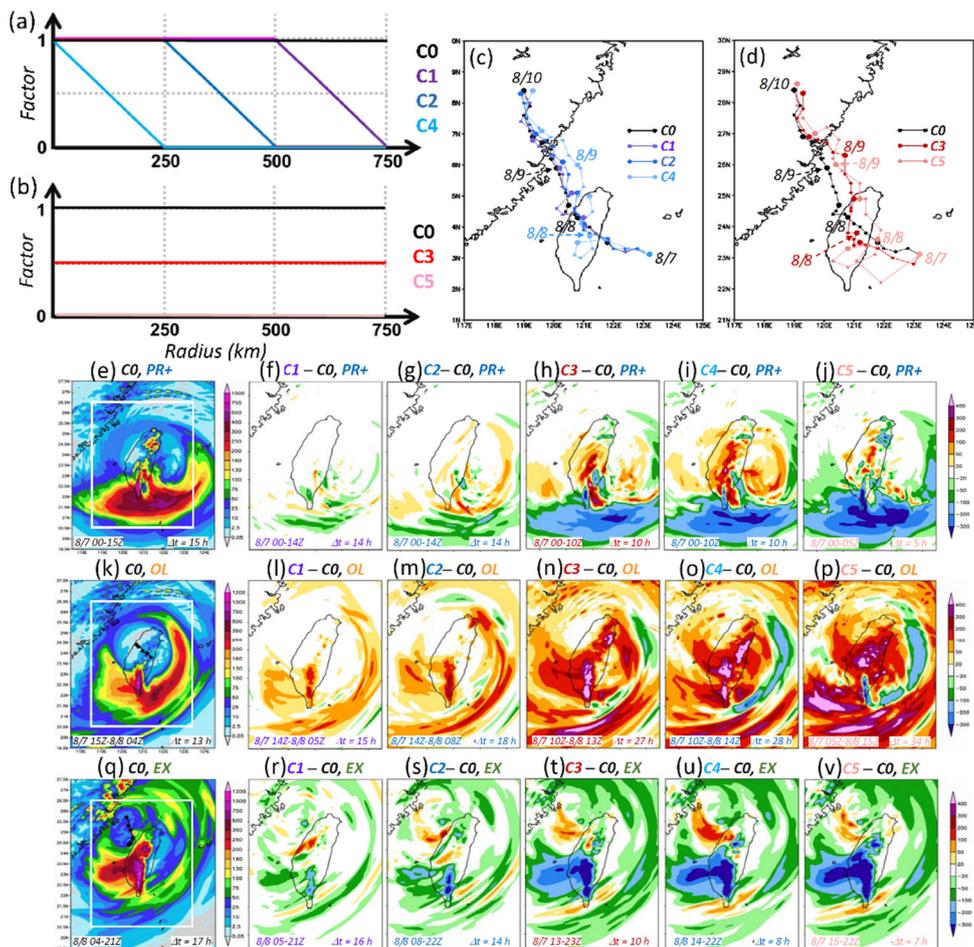


Figure 1. (a),(b) Schematics to change the PV perturbation (fraction, 0 to 1) with respect to radius (km), from the center of Morakot to 750 km, in the initial fields of the control simulation (C0) and sensitivity tests (C1-C5). (c),(d) Comparison of simulated tracks of TY Morakot in C0 with those in sensitivity tests of C1-C5 over the period of 0000 UTC 7-10 Aug 2009. (e)-(v) Total rainfall (mm) surrounding Taiwan in C0 and their difference from C0 in C1-C5, respectively, over three different periods of: (e)-(j) pre-landfall (PR+, from initial time to landfall), (k)-(p) overland (OL), and (q)-(v) exit (EX, post-landfall) phase in each experiment. Note the lengths of each phase are different among experiments (labelled inside panels as Δt).

- Taiwan receives an overall rainfall amount either comparable to, or even more than (up to +12%), C0 in all tests. This result shows the strong southwesterly flow and its moisture supply were bigger factors than the vortex structure.
- In the southern Central Mountain Range on 8 August, the rainfall tended to decrease by up to 40% with the contraction and a weaker outer circulation, indicating that the vortex structure plays an important role in the rainfall of this region.