JIN, H., J. R. MOSKAITIS, Y. JIN, and J. D. DOYLE, 2022: Resolution Impact on Rapid Intensification and Structure Change of Super Typhoon Hagibis (2019). *J. Meteor. Soc. Japan*, **100,** 943-964.
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**Plain Language Summary:** Typhoon Hagibis (2019) had significant societal impacts in Japan and went through a period of explosive rapid intensification (RI), followed by a secondary eyewall formation (SEF) and an eyewall replacement cycle (ERC). Operational forecasts from Coupled Ocean/Atmosphere Mesoscale Prediction System – Tropical Cyclone (COAMPS-TC), with the finest grid spacing at 4-km, failed to capture Hagibis' explosive RI, peak intensity, and the associated inner-core structural evolution. Four COAMPS-TC sensitivity experiments, initialized at 1200 UTC 5 Oct. 2019, were conducted to study the impact of horizontal resolution on prediction of Typhoon Hagibis' RI and structure. Results indicate that rapid intensification of the storm to Category 4 intensity can be simulated with the finest grid spacing at 4-km, but use of 1.33-km for the finest grid spacing facilitates more realistic prediction of the explosive intensification rate, Category 5 peak intensity, and small inner core accompanying the RI.

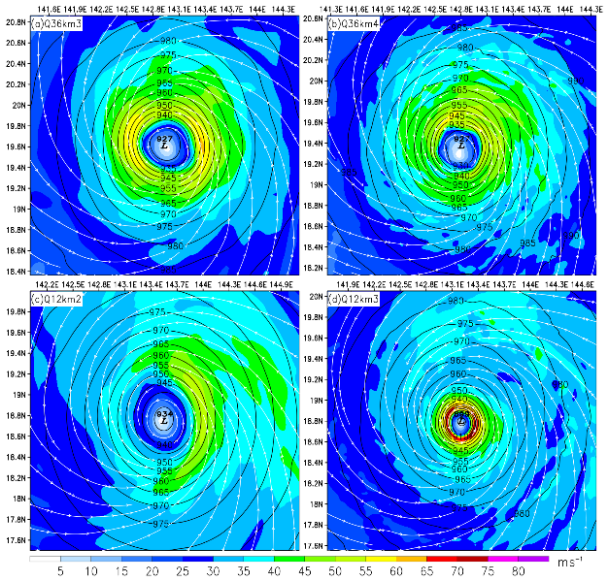


Fig. 1. The 10-m winds (m $s^{-1}$, shaded and streamlines), and sea-level pressure (hPa, black contours) at 72-h for four experiments (a) Q36km3, (b) Q36km4, (c) Q12km2, (d) Q12km3, from the forecasts starting at 1200 UTC 5 Oct. 2019. The experiment (such as Q36km3) names indicate the grid spacing of the fixed outermost grid (36 km) and the total number of grids (3). The vortex in Q12km3 is very small and intense with a radius of maximum wind of 12 km.

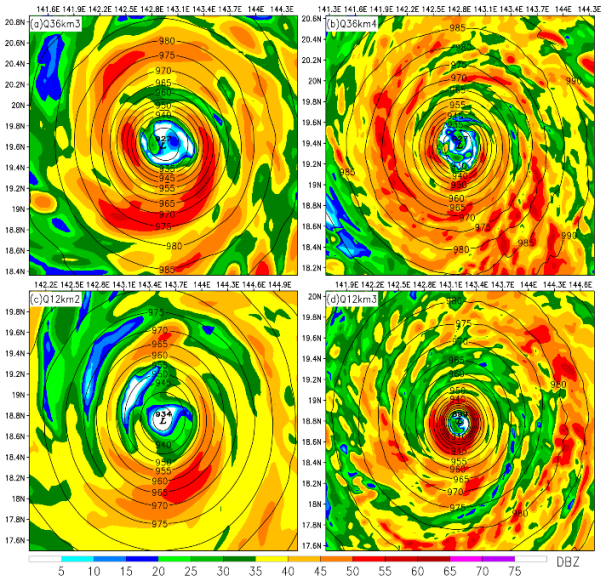


Fig. 2. The simulated composite radar reflectivity (DBZ, shaded) and sea-level pressure (hPa, contours) at 72 h for four experiments (a) Q36km3, (b) Q36km4, (c) Q12km2, and (d) Q12km3, from the forecasts starting at 1200 UTC 5 October 2019. The reflectivity for Q12km3 appears to have a secondary maximum at larger radius separated from the strong convective eyewall by a low-reflectivity "moat", a scenario of SEF/ERC.

## Highlights:

- Our sensitivity experiments indicate that realistic simulation of Hagibis' SEF/ERC requires simulation of a very intense storm with a small inner core as a prerequisite; therefore the finest grid spacing at 1.33-km is a necessary but not sufficient condition to capture the SEF/ERC.
- The simulation of the RI and SEF/ERC is also sensitive to the resolution of the outermost grid, which has impacts on the storm's moisture distribution by modulating the flow of moist air from the deep tropics into the TC.
- While these results have implications for the grid configuration of TC prediction models similar to COAMPS-TC, it is also important to gain systematic understanding of the physical processes associated with simulation of explosive RI and SEF/ERC, and the interactions between fine-scale aspects of the TC vortex evolution and that of the large-scale environment.