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Explosively developing extratropical cyclone associated with the high wind-waves along the east coast of Korea

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An extreme extratropical cyclone struck the northern part of Korea on May 3, 2016 causing significant damage to property on the land due to extreme winds and abnormal high waves in coastal area. The meteorological composite fields for the cyclone show a strong surface wind velocity (up to 45 m s^{-1}) during its mature phase. This study investigated the development mechanisms of an explosive cyclone through numerical simulation and sensitivity experiments using the Advanced Research version of the Weather Research and Forecasting (WRF-ARW) model. The trigger mechanism for the explosive cyclogenesis is the strong baroclinic instability and temperature advection associated with upper-level cut-off low and the interaction of potential vorticity (PV) anomalies between the lower- and upper-level. The efficient placement of the high- and low-level jets forms a favorable condition for its development and transportation of water vapor and the instability energy into the cyclone. The sea-state wave simulation of large swell waves along the eastern coast of the Korean Peninsula is obtained using the wave model WAVEWATCHIII (WW3) forced by the 10-m above ground level wind field from the WRF-ARW simulations. The simulation results of WW3 for the significant wave height were compared against buoy observation data at 1-h intervals. The simulated significant wave height systematically underestimated by 0.5 m. However, strong wind field generated by the cyclone is clarified as key features determining the characteristics of the high waves in terms of the temporal growth and decay patterns.