Dramatic changes in the inner-core structure of Typhoon Jebi (2018) at landfall and relationship between a mesovortex and strong wind gusts

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Landfalling tropical cyclones experience dramatic structural changes due to increased friction, topography, reduced surface heat fluxes, and reduced moisture supply. Typhoon Jebi (2018) made landfall in Shikoku Island on September 4, 2018, and then it caused record-breaking gust wind speeds greater than 40 m s^{-1} and heavy rainfall greater than 50 mm h^{-1} along its track. Dramatic changes in the inner-core structure of Jebi at landfall and the relationship between heavy rainfall and strong wind gusts, and structural features were examined by using observations. The azimuthal-mean structure of Jebi after landfall shows that while the tangential wind at 1-km altitude decreased from 45 m s^{-1} to 30 m s^{-1}, the structure became more compact, with the radius of maximum wind (RMW) at ~50 km and radar reflectivity increasing inside the RMW at altitudes from 1 to 5 km. Because of increasing forward speed and active convection inside the RMW, maximum wind speed below 6-km altitude did not decrease significantly even after landfall. Inside the RMW, a mesovortex with a scale of 50 km formed in the downshear-left quadrant. The formation of the mesovortex was likely attributed to dynamically forced updraft associated with the storm vortex tilted by vertical wind shear and attributed to tilting of horizontal vorticity associated with the convergence of enhanced frictional inflow. The mesovortex contributed to the strong wind gusts and heavy rainfall. Also, the fast forward speed of more than 15 m s^{-1} increased wind gusts on the right-hand side of Jebi’ s track.

Keywords: landfalling tropical cyclones, radar analysis, mesovortices

