



Ensemble Experiments on a Maritime Meso- β -scale Vortex that Spawned Tornado-like Vortices causing shipwrecks

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Ensemble forecasts with 100 members using ensemble Kalman filter analyses are performed to understand favorable atmospheric conditions for the development of a meso-beta-scale vortex (MBV) that caused shipwrecks in the southwestern part of the Sea of Japan due to a sudden gusty wind on 1 September 2015.

A composite analysis, which is performed to clarify the differences in structure and environment of the MBV between strongest 8 members (STRG) and weakest 10 members (WEAK), shows that large cyclonic horizontal shear and strong convection are crucial to the development of the MBV. The near-surface cyclonic horizontal shear between southerly and southeasterly winds in the south region of the MBV, and northeasterly and easterly winds in the north region of the MBV for STRG are stronger than those for WEAK. In addition, low-level water vapor and its horizontal flux for STRG is larger than those for WEAK. The differences of near-surface horizontal shear are closely related to the structure of an extratropical cyclone in which the MBV was embedded. For STRG, cyclonic horizontal shear of winds in the northeast quadrant of the extratropical cyclone is larger than that for WEAK, although the strength of the extratropical cyclone is comparable to that for WEAK. An ensemble-based sensitivity analysis also shows that strength of the MBV is sensitive to cyclone-scale cyclonic horizontal shear of winds, low-level water vapor, and its horizontal flux around the MBV.