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Assimilation of asymmetric dropsonde data and a bogus vortex using a 4DVar system

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Many recent studies have shown that asymmetric dropwindsonde data may have a negative effect on forecasts of typhoons or hurricanes, which may be overcome by improved data-assimilation techniques. Here, we perform several experiments to assimilate asymmetric dropwindsonde data from the DOTSTAR program using an ensemble-based 4DVar. With additional asymmetric dropwindsonde data, the experiment with a bogus vortex yields a near-perfect track forecast and improves central pressure forecast. The results also highlight the importance of the wind field from the dropwindsonde data for improved track forecast. Furthermore, the use of observations nearer the centre of the typhoon yields a smaller track-forecasting error during the first 30 hr compared with the use of data located far from the centre. The results of layered experiments reveal that low-level wind is a key factor in improving the track forecast, although the upper-level wind also makes a contribution during the first 24 hr.