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Energetics characteristics accounting for the explosive development of a twin extratropical cyclone over the Northwest Pacific Ocean

Shenming Fu

Institute of Atmospheric Physics, Chinese Academy of Sciences, International Center for Climate and Environment Sciences, Beijing, China (fusm@mail.iap.ac.cn)

A twin extratropical cyclone that appeared over the Northwest Pacific Ocean during the winter of 2011 is reproduced reasonably well by the fifth-generation PSU-NCAR Mesoscale Model (MM5). One cyclone in this event has developed into an extreme explosive extratropical cyclone (EEC), with a maximum deepening rate up to ∼2.7 Bergeron, a minimum SLP of ∼933 hPa, and a maximum surface wind of ∼33 m s-1, which means its intensity is comparable with the intensity of a typhoon. The rotational and divergent wind kinetic energy (KE) budget equations are applied to this twin cyclone event so as to understand the rapid enhancement of the wind speed in this case. Preliminary results indicate that, overall, the rotational wind KE is much larger than the divergent wind KE, however, the latter can be of comparable intensity with the rotational wind KE around the regions where the wind speed strengthened most rapidly. Different quadrants of the twin cyclone show significant unevenness, overall, the southeastern quadrant of the EEC features the rapidest enhancement of wind speed, whereas the northwestern quadrant shows the slowest wind-speed acceleration. The vertical stretching of the EEC show consistent variation features with the rotational wind KE. The transport of KE by rotational wind, the conversion from divergent wind KE to rotational wind KE, and the work done by pressure gradient force all contributed to the enhancement of rotational wind KE. In contrast, the divergent wind KE is mainly produced by the baroclinic energy conversion.