Vertical extent related characteristics of the explosive cyclones in the Northern Hemisphere: A 40-yr climatology study based on the ERA-I reanalysis

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The explosive cyclone (EC), which is the most destructive subcategory of the extratropical cyclone, has been a research center for decades. Many key features of this type of cyclone have been shown, however, as a three-dimensional system, their vertical extents and associated important characteristics still remain vague. This study attempts to fill this vacancy by focusing on ECs’ vertical extents related features in the Northern Hemisphere on the basis of the ERA-I reanalysis data during a 40-yr period. Some new findings are reached: (i) overall, the EC is a type of deep weather system, as more than 63% of them reach an upmost level above 300 hPa, whereas only less than 12% of them maintain below 500 hPa during their whole life spans. (ii) ECs’ vertical extents show remarkable latitude dependent features (maximum vertical extents appear in the zone of 55oN-65oN), and they also show obvious seasonal changes, with the minimum vertical extents appeared in January. (iii) ECs’ maximum vertical extents show a significant positive correlation with their minimum central pressure, whereas, their maximum vertical extents show no obvious relationship to the ECs’ maximum deepening rates and maximum 10-m winds. (iv) in general, ECs over the northern Pacific Ocean have larger intensity, longer life spans, and thicker vertical extents than those of the ECs over the northern Atlantic Ocean.