

## Climatological Monthly Frequency of the Explosive Cyclones in the Northwestern Parts of the Pacific and the Atlantic

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This study examines the climatological monthly frequency distribution of the explosive cyclones over northwestern parts of the Pacific (NWP) and the Atlantic (NWA) in the boreal cold season (October to April) from 1979/80 to 2012/13, using the long-term reanalysis data. The distributions show the different patterns between the NWP and the NWA, i.e., trapezoid in the NWP and triangle in the NWA. The difference is particularly large in March. This study reveals the physical mechanisms that yield the difference in the monthly frequency distributions, especially around March. The low-level meridional temperature gradient well explains the monthly frequencies in the two regions. The large frequencies in the NWP are maintained from February to March, and this feature can be explained by the gradient. The gradient to the east of Japan is maintained until March, because the cold air advection with the northwesterly winter monsoon is largely decreased in March, and the warmed area largely spreads from north to south of the gradient. However, in the NWA, the northerly winds are relatively weak in winter, and the cold air advection to the south of the gradient is weak. As a result, the monthly changes of the gradient fit the triangle following the simple temperature change to the north. The large-scale land-sea distribution and mountains control the strength of winter northerly winds in the NWP and the NWA, and the difference in cold air advection yields the different temperature change to the east of the two continents. This difference further forms the specific monthly changes in the low-level meridional temperature gradient, which results in the difference of the climatological monthly frequency distributions of the explosive cyclones between the NWP and the NWA.

Keywords: explosive cyclone, meridional temperature gradient, winter monsoon