Quantifying the development processes of explosive cyclones over the Northwest Pacific in potential vorticity perspective

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Key Points

- A new method to perform prognostic analysis in PV perspective is proposed.
- The method is applied to explosive cyclones (ECs) over the Northwest Pacific in the cold season.

Data and Methods

- ERA-Interim Reanalysis: 1.5° × 1.5°, 6 hrs, (1979–2018)
- Cyclone tracking using SLP
- PV tendency equation (isobaric coordinates)

\[
\frac{\partial q}{\partial t} = -u \frac{\partial q}{\partial x} - v \frac{\partial q}{\partial y} - \frac{\partial \tilde{q}}{\partial y} - \omega \frac{\partial \tilde{q}}{\partial p} + Q_{LH} + F_{RES}
\]

- Geopotential tendency \( \chi \) induced from each term in the PV tendency equation is calculated through inversion.
- 299 ECs are investigated.

Results

- \( \xi_{850} \equiv \frac{\partial \xi}{\partial t} = \frac{1}{f_0} \nabla^2 \chi \) at 850 hPa
- The explosive development of ECs is contributed 75.6% by zonal PV advection by the mean flow \(-u \frac{\partial q}{\partial x}\), 65.7% by latent heating, and 9.7% by warming of the surface \((\frac{\partial T}{\partial t})_{sfc}\), with other negative contributors.

References


