Numerical study for the explosively deepening extratropical cyclones in the northwestern Pacific Region

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- Data: JMA GANAL
OJ type

TOTAL: 224
OJ: 42
PO-L type

TOTAL: 224
OJ: 42
PO-L: 50
PO-O type

TOTAL: 224
OJ: 42
PO-L: 50
PO-O: 110
Seasonal variation of cyclone track reflects seasonal change of atmospheric environment. Cyclone’s meso-scale structure and physical processes (latent heat release), which is influenced by larger-scale atmospheric environment, causes difference of maximum deepening rate between three types.
Objectives

- To analyze time evolution extreme cases, which were most rapidly developing cyclones for each type.
- To clarify relation between latent heat release and explosive cyclogenesis using numerical simulations.
Model description

- PSU-NCAR MM5 ver. 3.6.1
  - Horizontal resolution:
    - Domain 1: 45 km (200 x 160)
    - Domain 2: 15 km (301 x 271)
  - Vertical resolution
    - 23 sigma level from surface to 100 hPa
  - Initial and boundary condition
    - GANAL, Reynolds SST
  - Integration
    - 48 hours (starting 24 hours before maximum deepening rate)
  - Sensitivity experiment
    - Control and no latent heat release by condensation runs
OJ case: 12 h before max
OJ case: Maximum deepening rate
OJ case: 12 h after max
OJ case: Backward trajectory from 850 hPa near cyclone center

CNTL

DRY

1.55 Bergeron
0.97 Bergeron
PO-L case: 12 h before max
PO-L case:
Maximum deepening rate
PO-L case: 12 h after max
PO-L case backward trajectory

CNTL

DRY

1.24 Bergeron

0.72 Bergeron
PO-O case: 12 h before max
PO-O case: Max
PO-O case: 12 h after max
PO-O case backward trajectory

CNTL

DRY

2.38 Bergeron
0.71 Bergeron
Conclusions

• For OJ and PO-L cases, latent heat release was not effective on development, while PO-O case was very sensitive to latent heat release.
• Water vapor distribution and upper jet characterized different cyclone structures and evolutions between three types.