

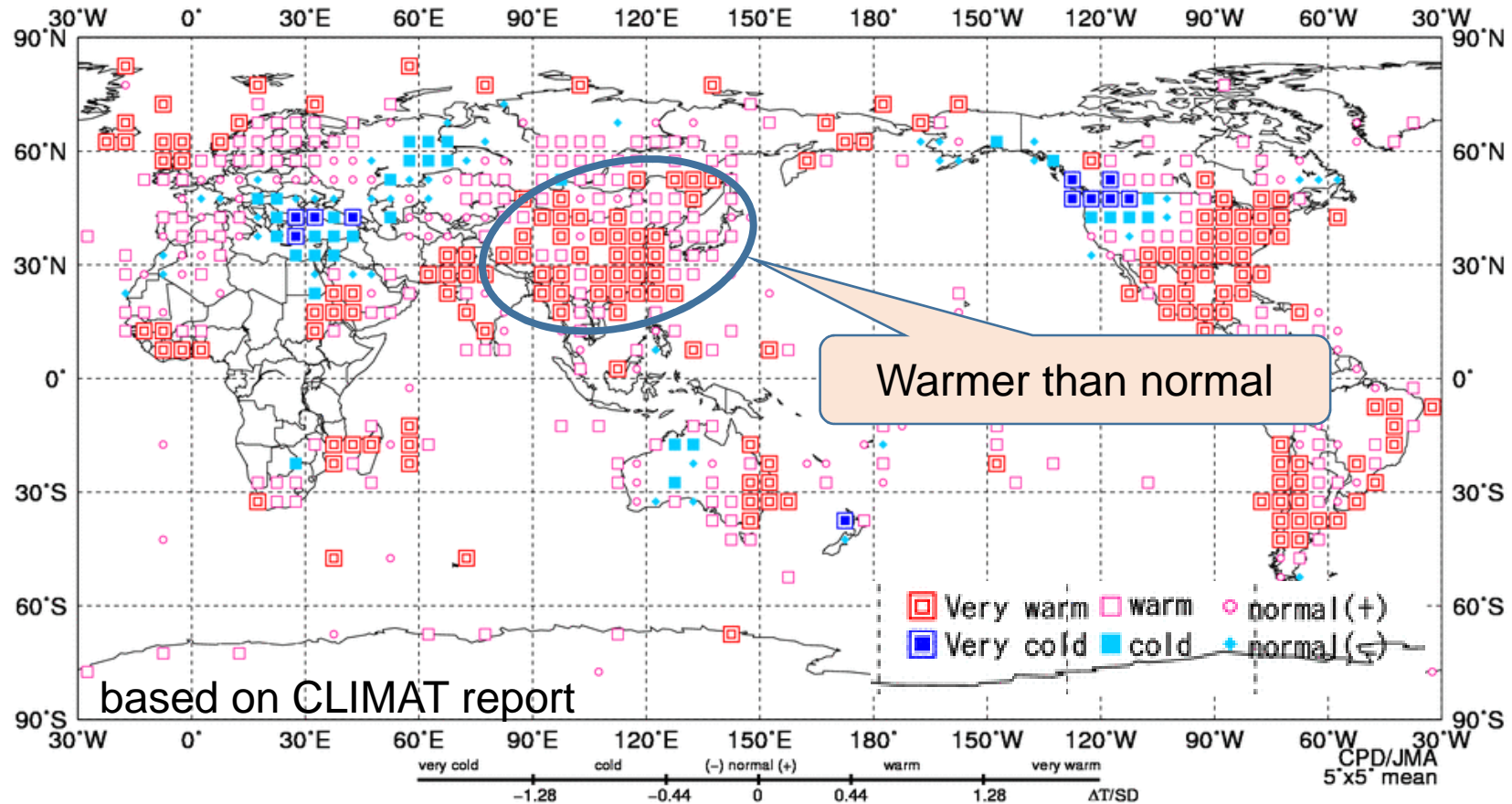
2016/17 Winter Monsoon in East Asia

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Outline

1. Overview of temperature anomalies in 2016/17 winter
2. Seasonal mean circulation characteristics
3. A cold surge in middle January and early February 2017

Overview of Temperature Anomalies in 2016/17 Winter



Normalized mean temperature anomalies averaged in 5° × 5° grid boxes for 2016/17 winter (DJF).

- In most of East Asia, warmer or very warmer winter than normal.

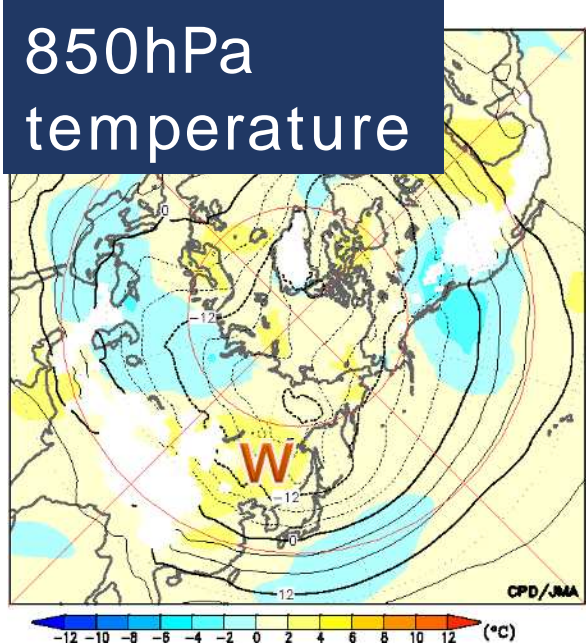
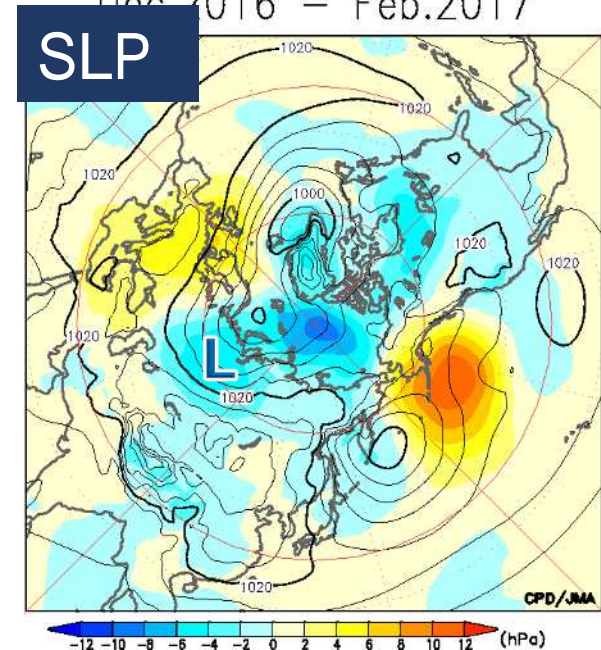
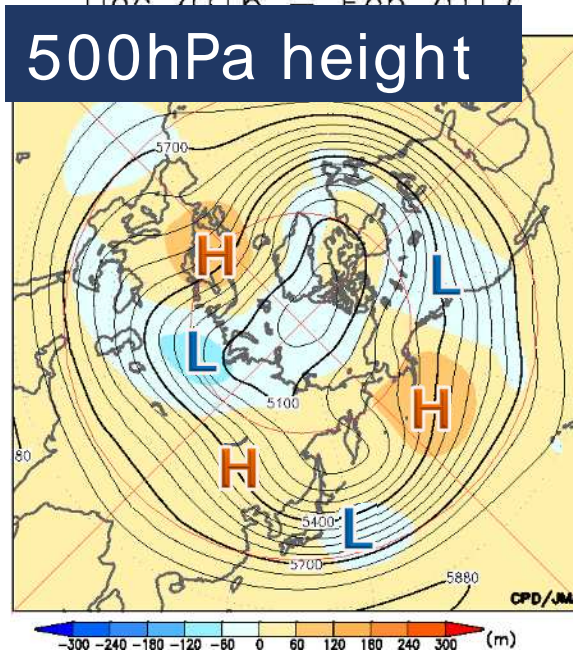
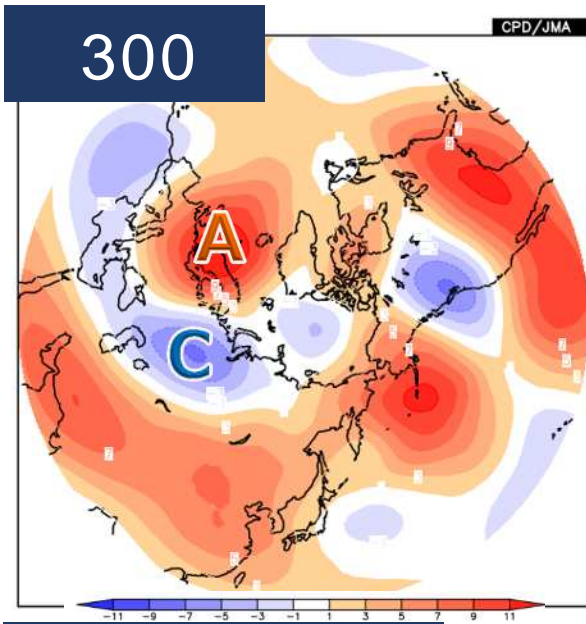
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Characteristic Atmospheric Circulation (Dec. – Feb. 2016/17)

Dec 2016 – Feb 2017

Dec 2016 – Feb.2017



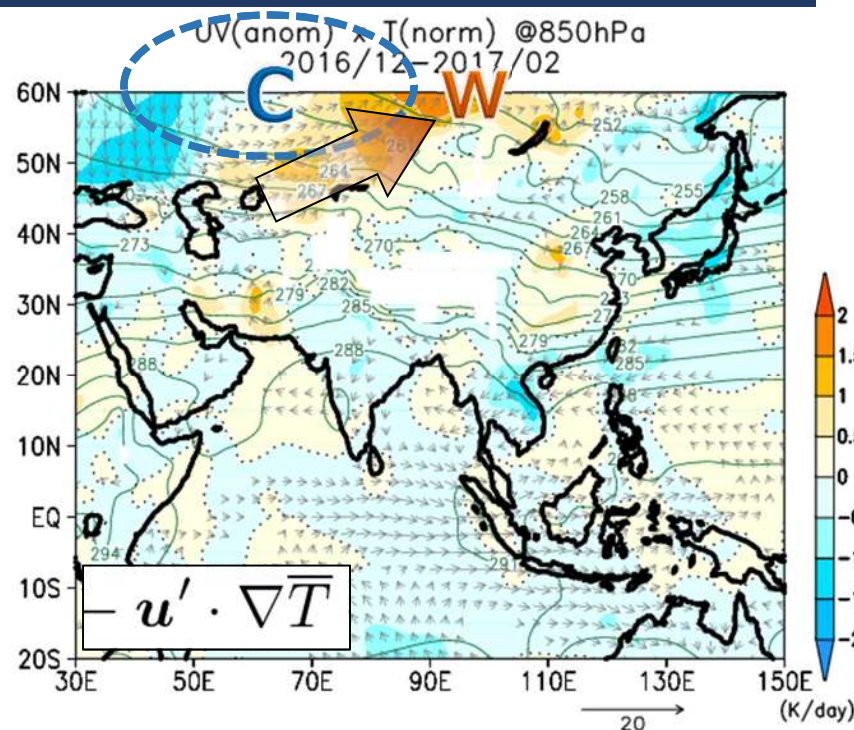
contour : values

shading : anomaly

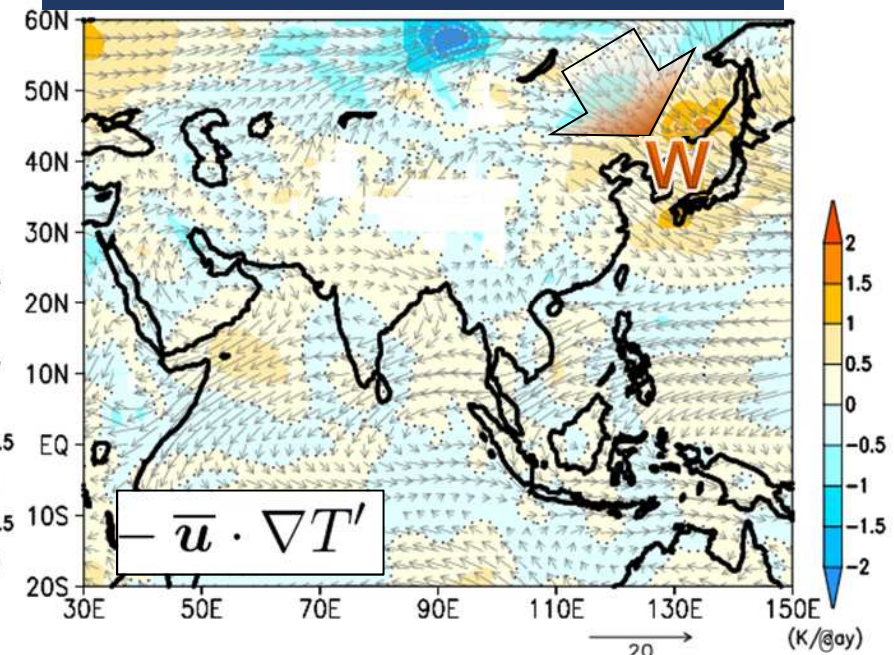
- Wave pattern frequency observed along polar front jet.
- Barotropic cyclonic circulation anomalies in Western Siberia.
- Warmer than normal conditions led weaker Siberian High.

Contribution of 850hPa Temperature Advection

Effect of Wind anomaly



Effect of Temperature anomaly

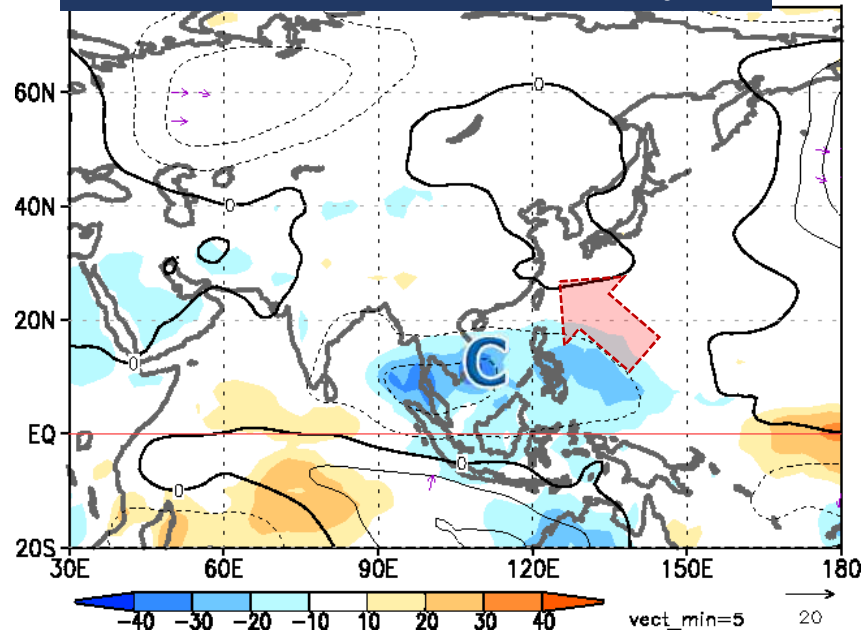


contour : temperature, shading : temperature advection, vector : wind

- Cyclonic circulation anomalies induced the warm air advection into Central to Eastern Siberia.
- Influence of cold air was weaker than normal.

Another Cause of Warm Winter

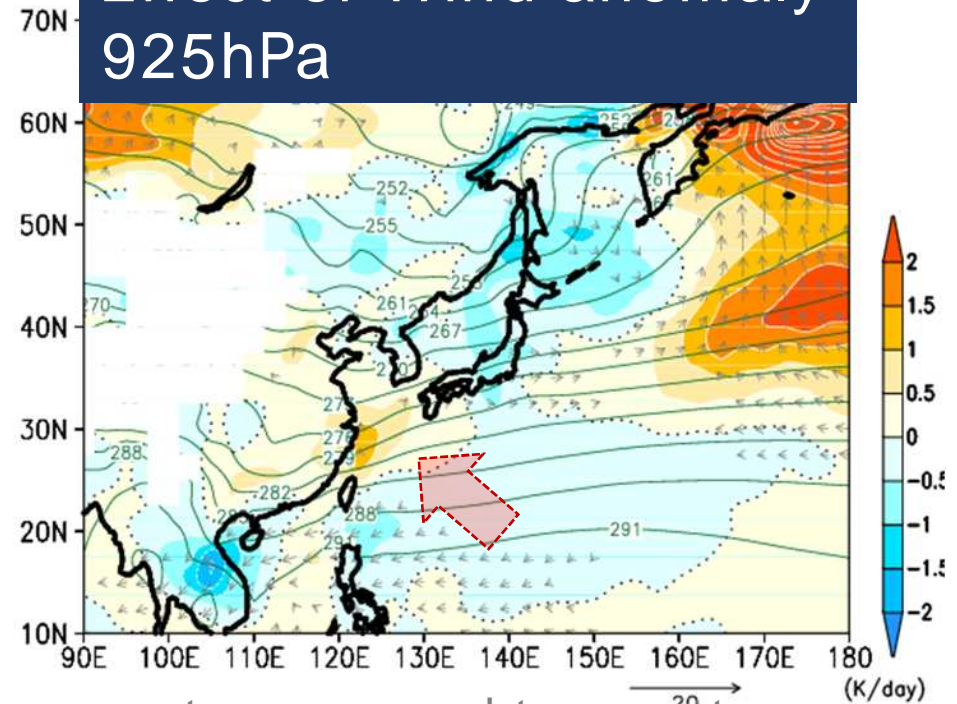
850/OLR anomaly



contour : stream function anomalies
 shading : Outgoing Longwave
 Radiation(OLR) anomalies

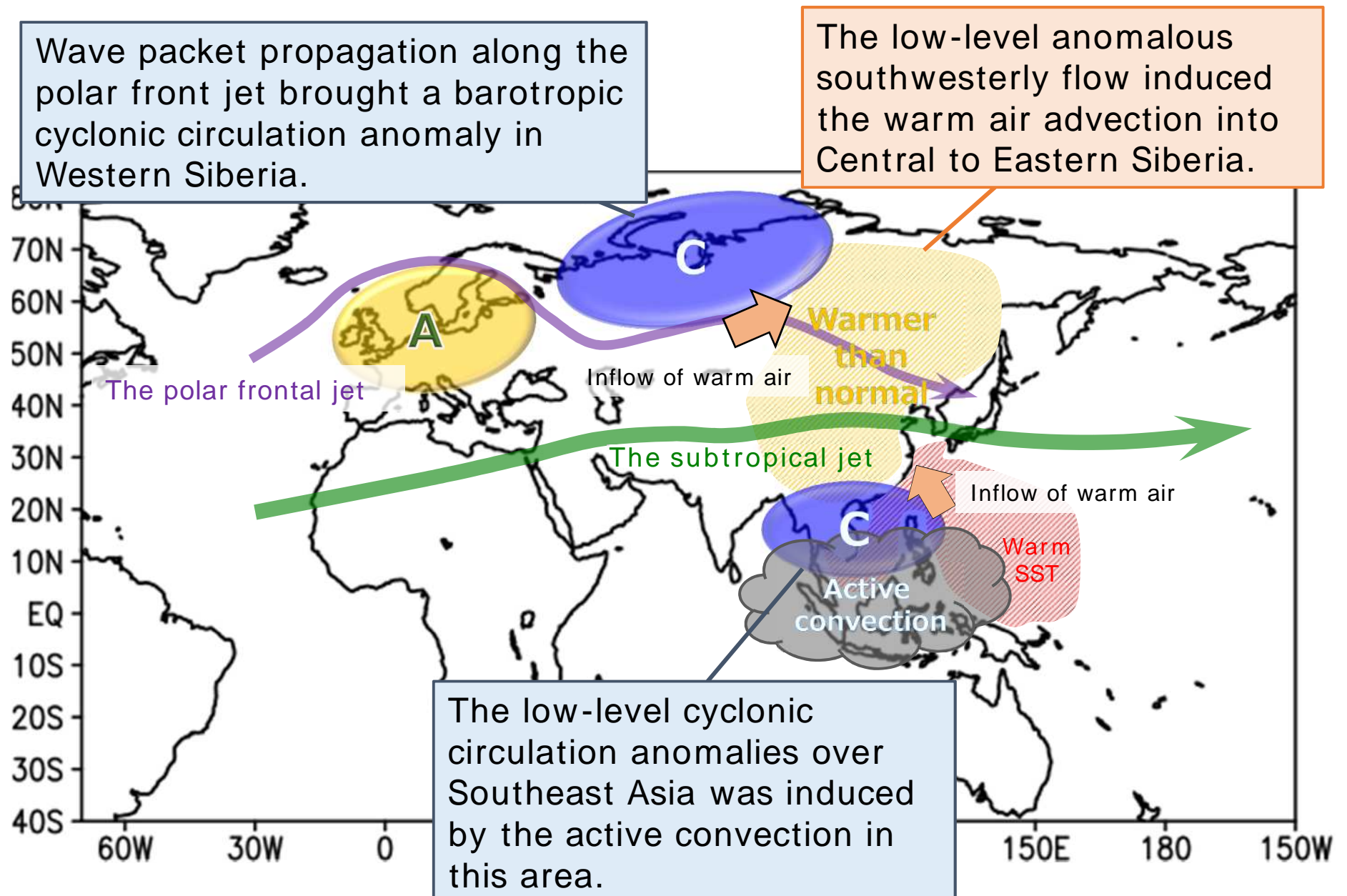
- Active convection in Southeast Asia.
- Induced cyclonic circulation anomalies led to warm southeasterly flow anomalies.
- Okinawa/Amami is the warmest December since 1946

Effect of Wind anomaly 925hPa



contour : normal temperature,
 vector : wind anomalies
 shading : temperature advection

Schematic Figure – Warm Winter -

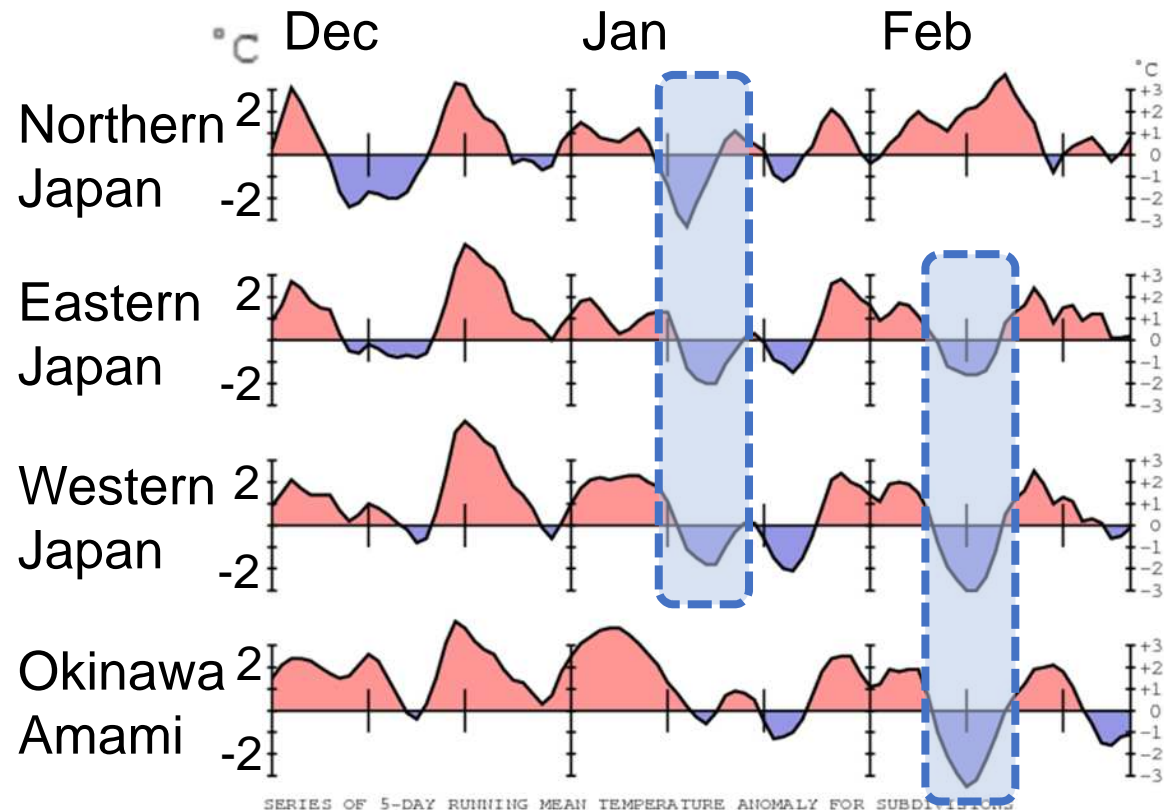


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Cold Surge Events in middle Jan. and early Feb.

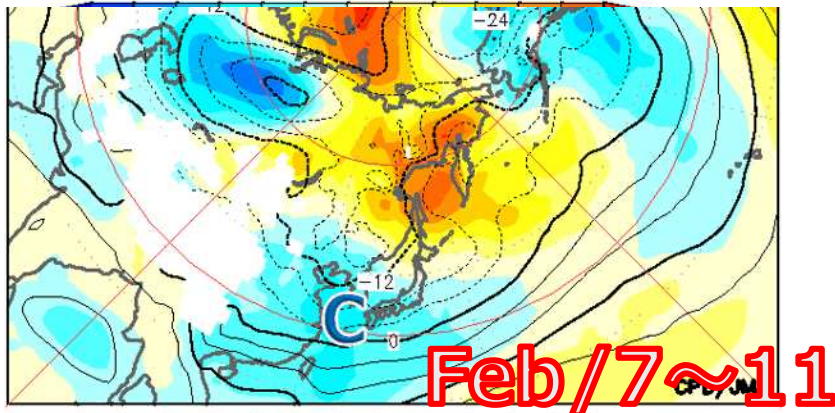
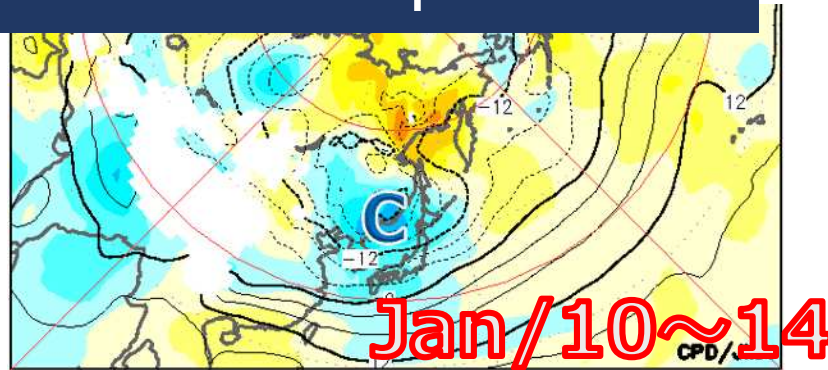
Time series of temperature anomalies in areas of Japan, respectively



- Seasonal mean temperature warmer than normal
- Several cold events.
- Significant cold surge events in middle Jan. , early Feb.

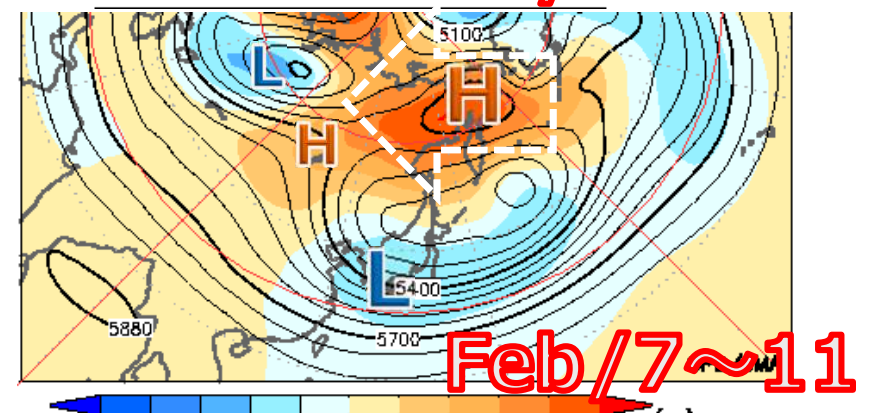
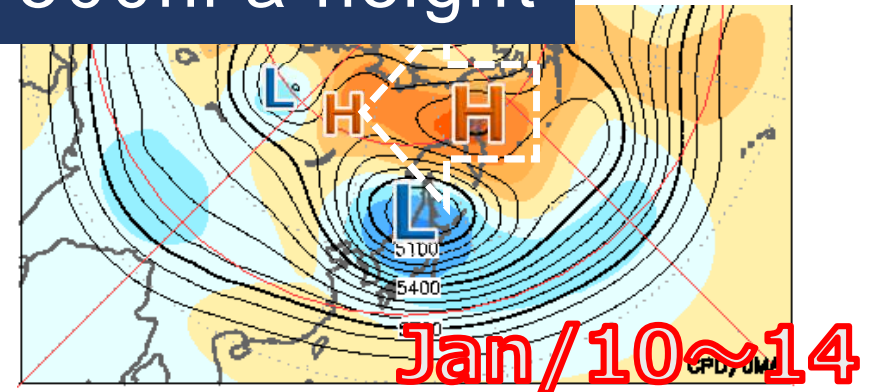
Cold Surge Events in middle Jan. and early Feb.

850hPa temperature



-12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 (°C)

500hPa height



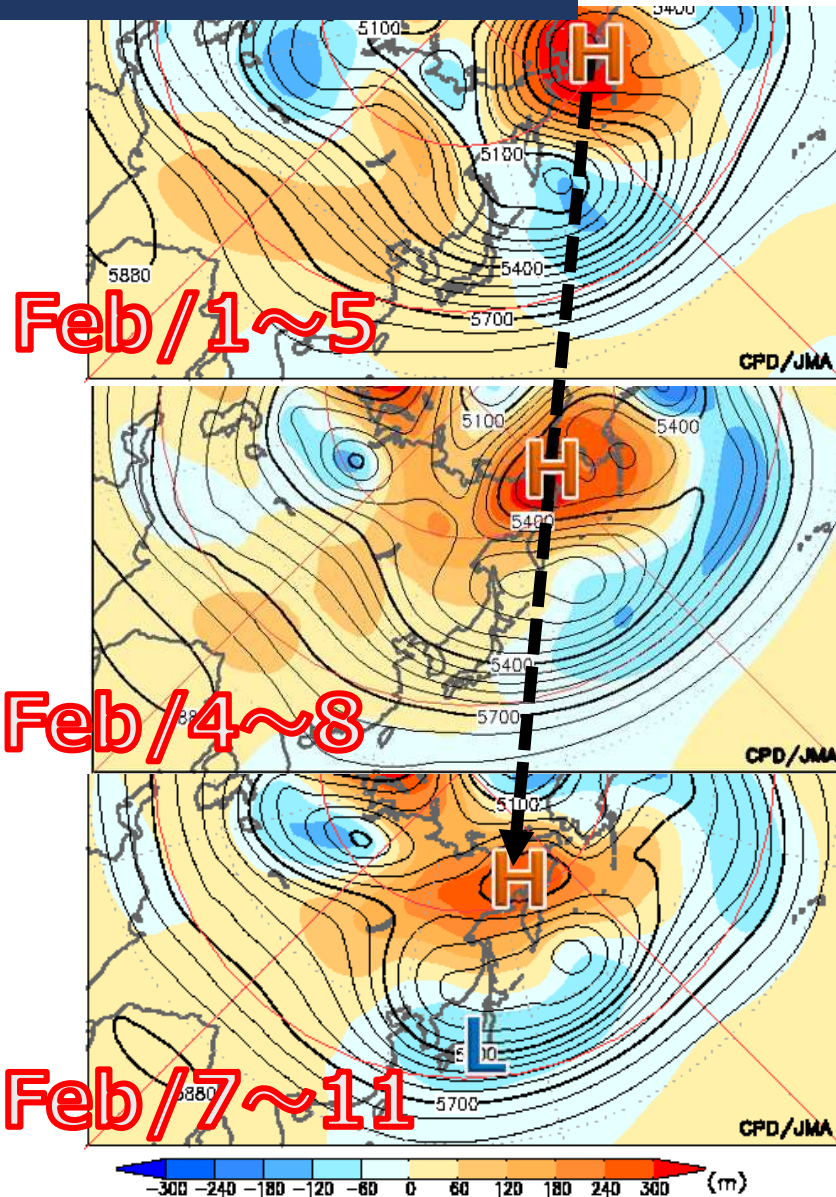
-300 -240 -180 -120 -60 0 60 120 180 240 300 (m)

contour : value shading : anomaly

- Colder than normal in a wide range of East Asia
- Deep troughs were clearly seen associated with the blocking highs
→ These troughs are considered to bring cold surges

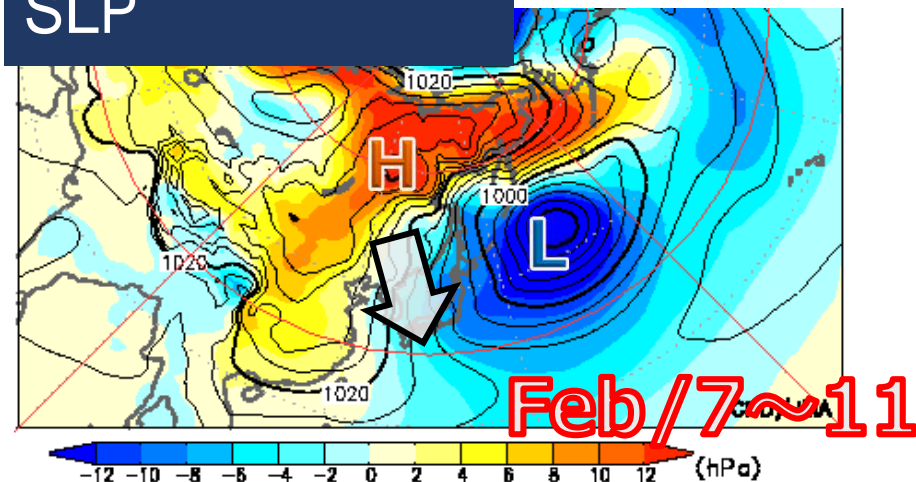
Cold Surge Event : early February

500hPa height



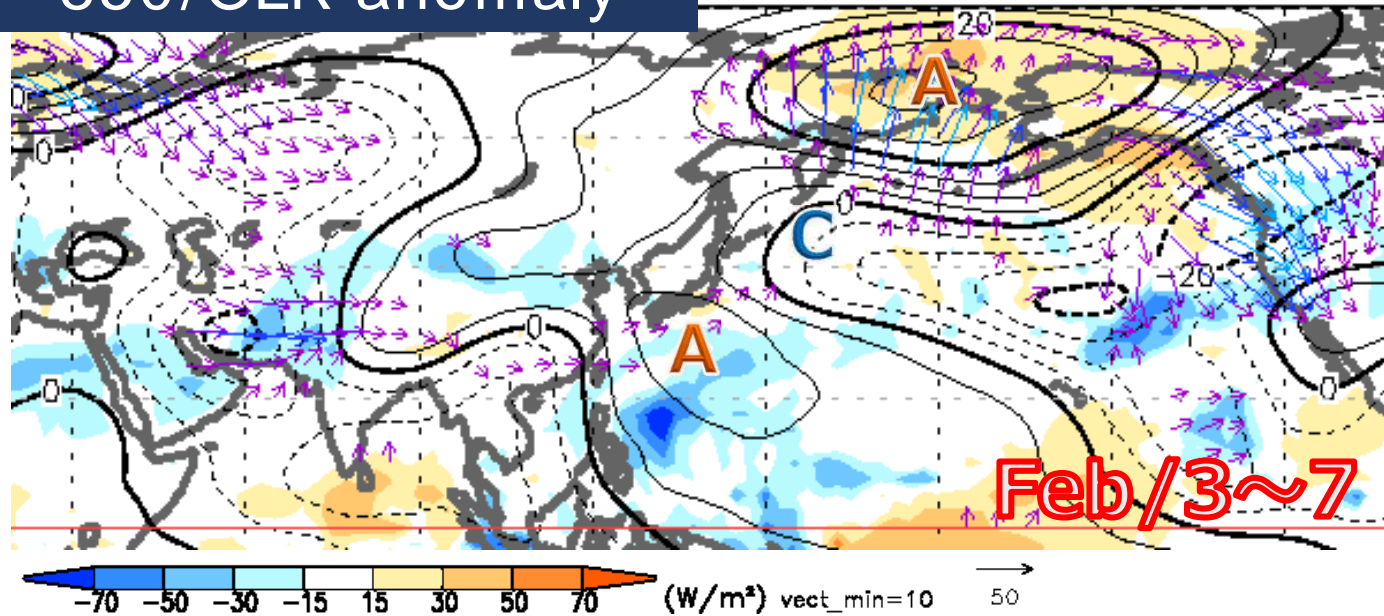
- Blocking high emerged around Bering Sea → Moved westward
- Deep trough was formed associated with blocking high.
→ Enhanced northerly flow
→ Brought significant cold surge
- Formation of blocking high was contributed by tropical convection.

SLP



The Effect of Convection in the Equatorial Western Pacific

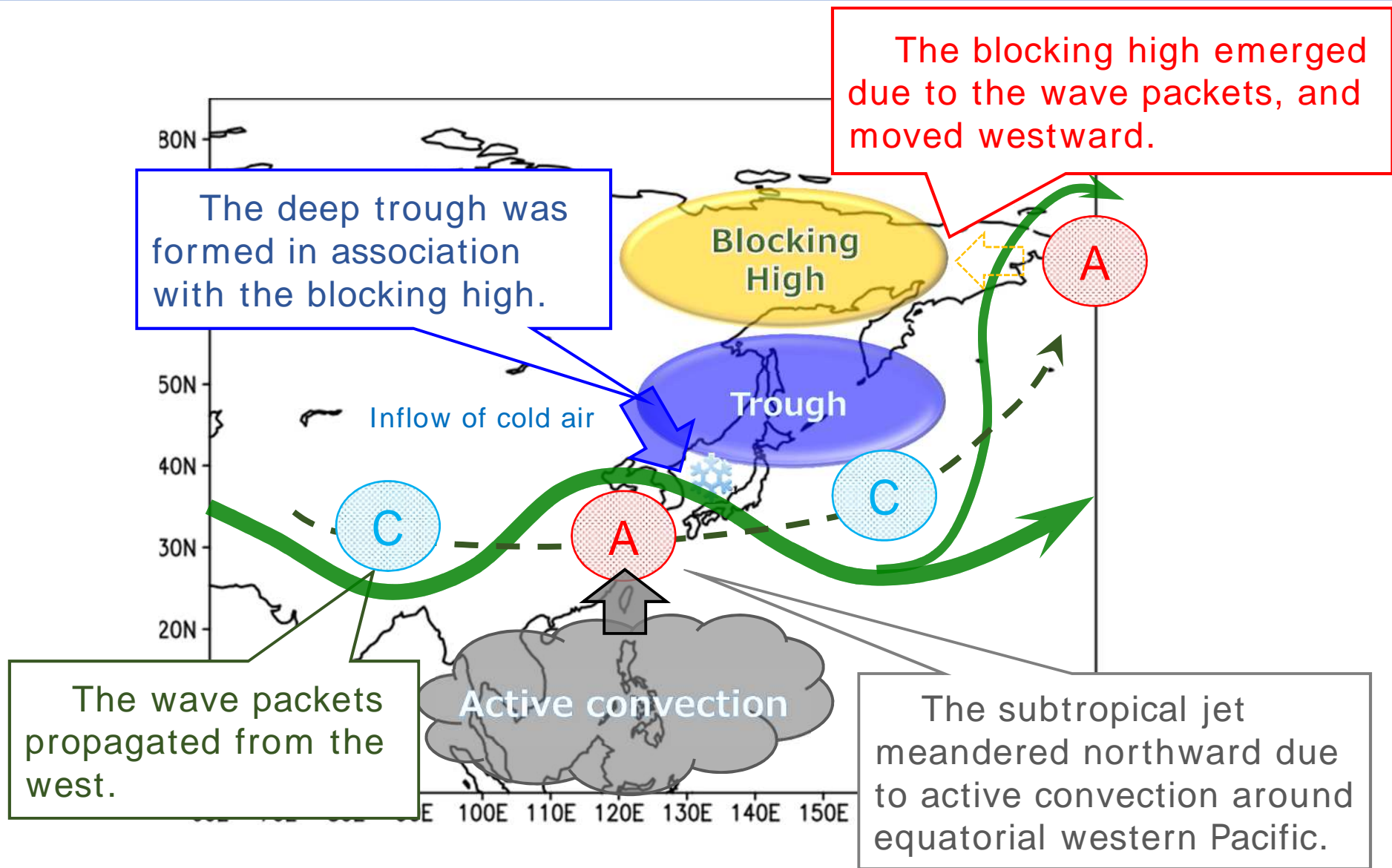
850/OLR anomaly



contour : stream function anomalies at 850hPa
shading : Outgoing Longwave Radiation(OLR) anomalies
vector : wave activity flux

- Active convection induced upper-level acticyclonic circulation.
- Wave packet propagation from Western Pacific to Bering Sea.
- The blocking high was formed and sustained likely in association with enhanced convective activity over equatorial western Pacific.

Schematic Figure – Cold surge of Western Japan –



Thank you for your attention !