Primary factors of cold winter 2012/2013 in East Asia

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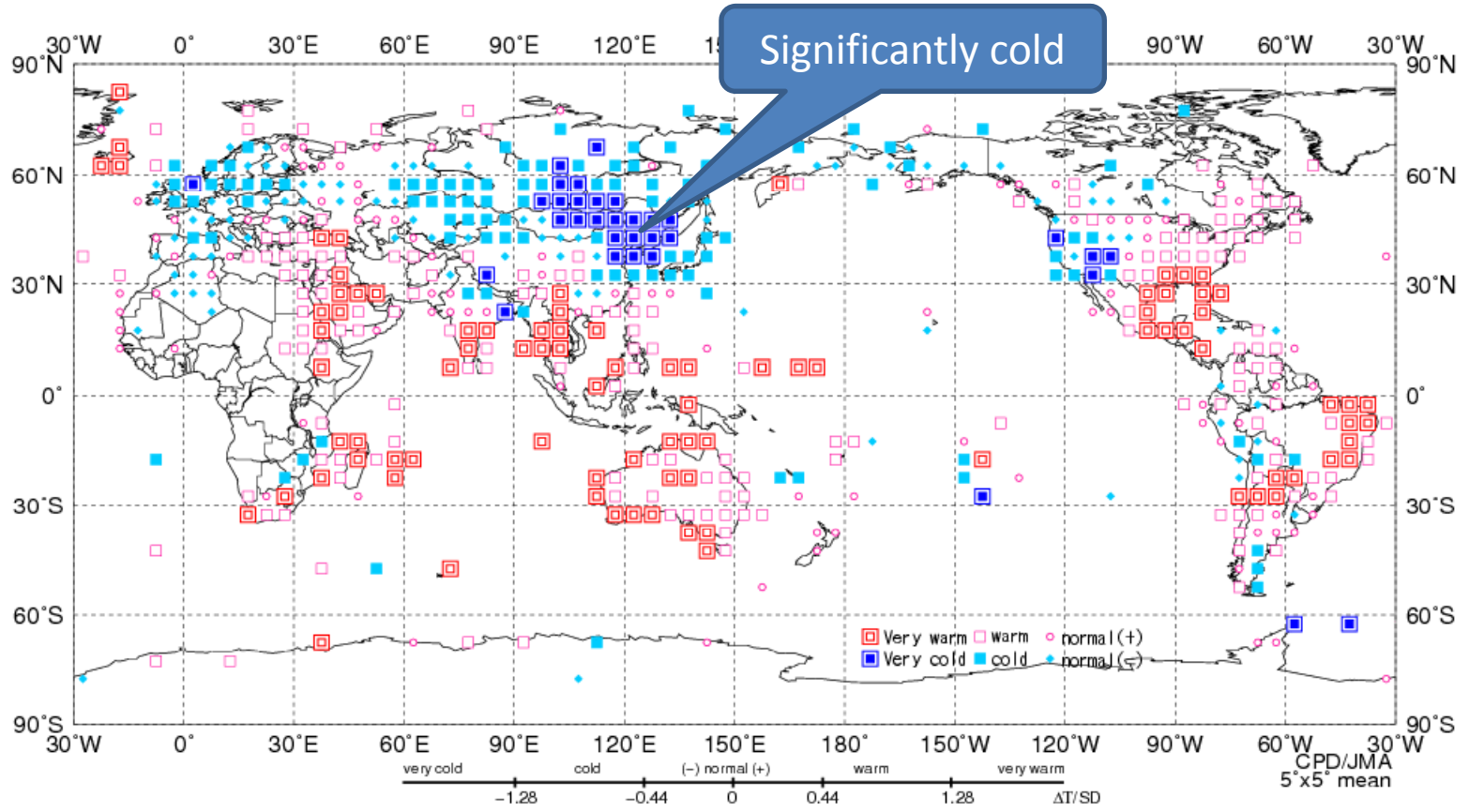
Surface temperature anomalies (winter 2012/2013)

- East Asia experienced significantly cold winter.
- Eurasian mid-latitudes experienced cold winter.

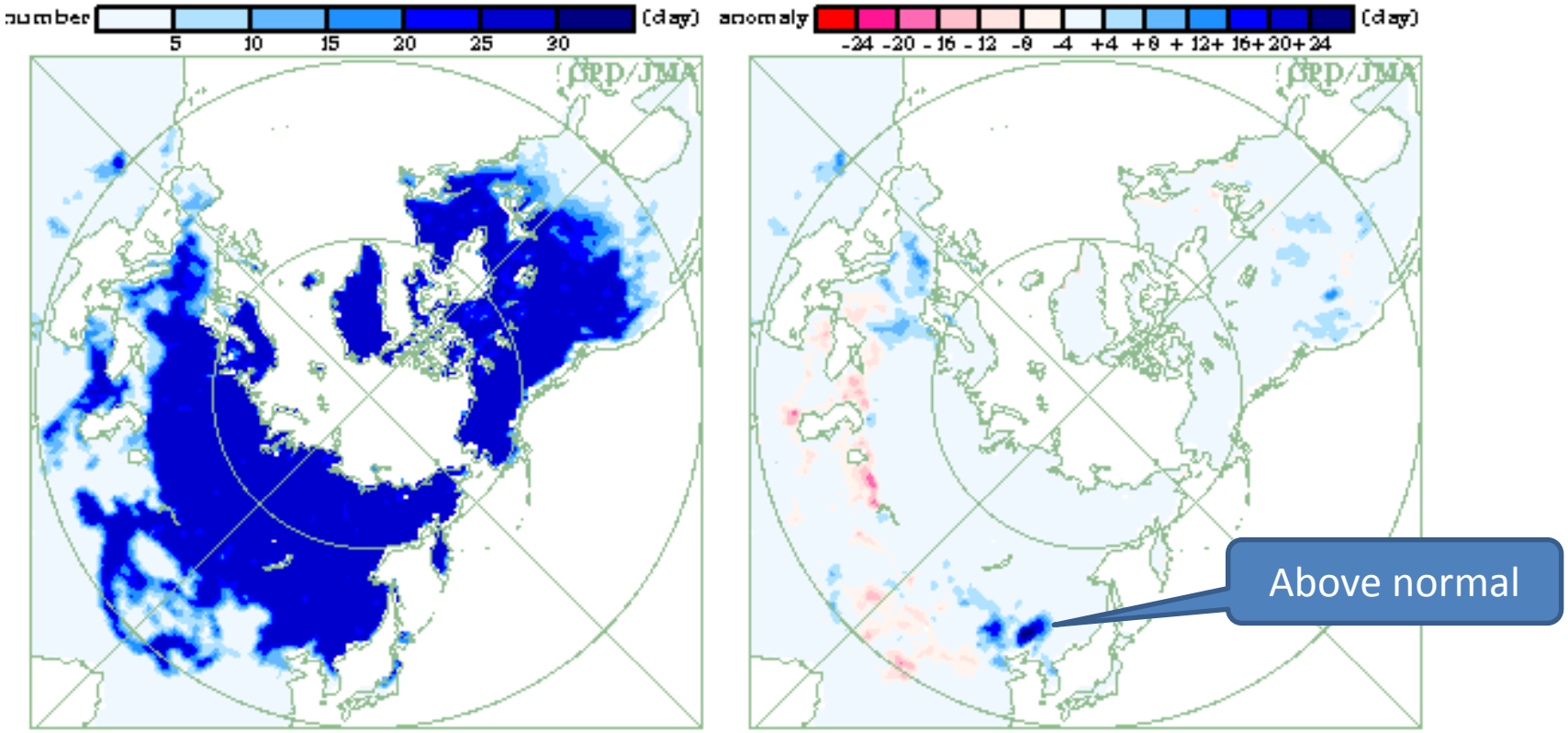


Normalized anomalies of three-month mean temperatures for Dec. 2012 – Feb. 2013

The base period for the statistics is 1981 – 2010.

Snow cover days (Feb. 2013)

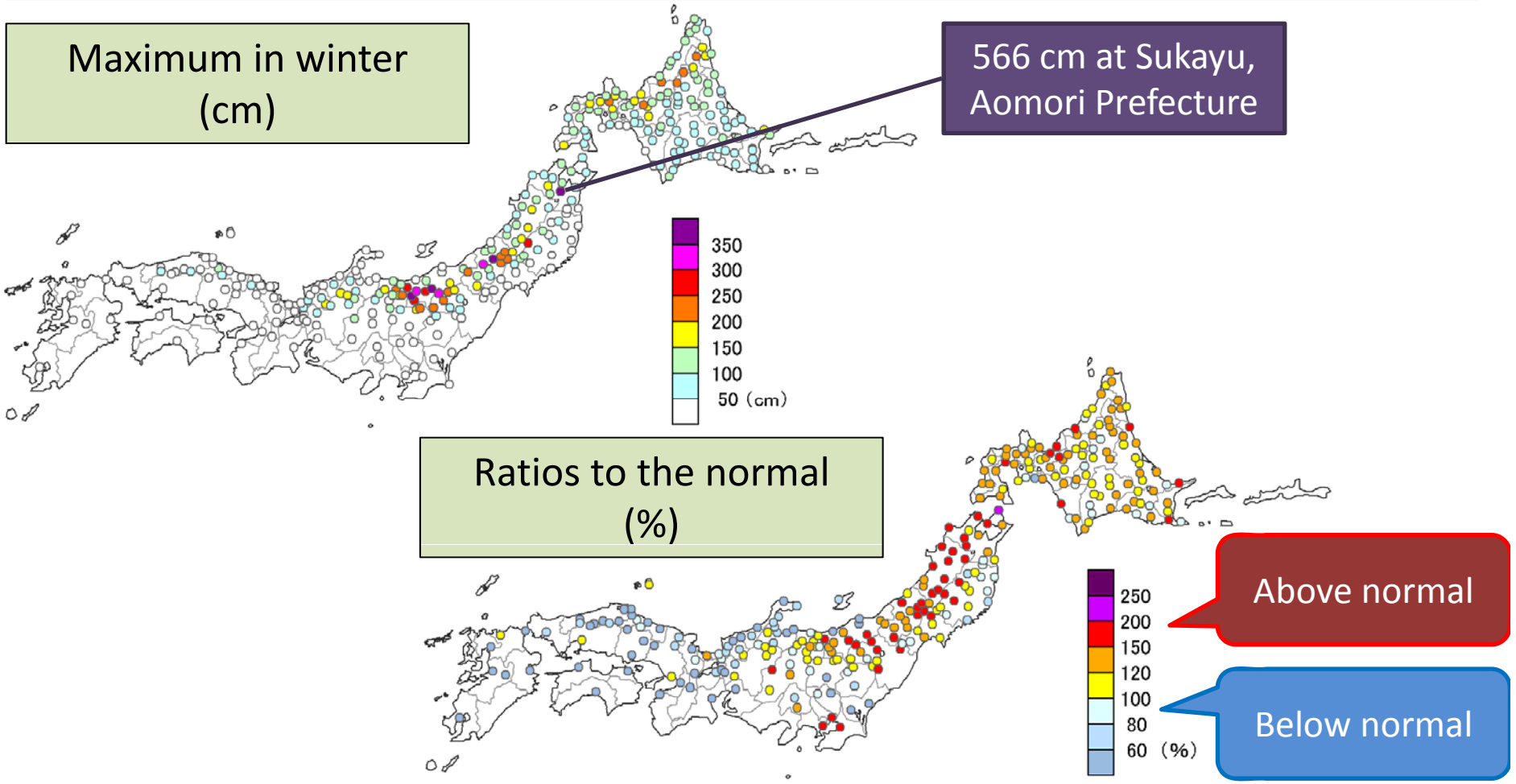
- The numbers of days of snow cover were above normal in northern East Asia.



NUMBER OF DAYS OF SNOW COVER AND ANOMALY BY SSM/I IN THE NORTHERN HEMISPHERE (Feb. 2013)
The left and right panels show the number of days of snow cover and anomalies, respectively. Analysis performed by JMA using its own algorithm based on observations carried out with SSM/I and SSMIS provided by NCDC. The base period for the normal is 1989-2010.

Maximum snow depth in Japan (winter 2012/2013)

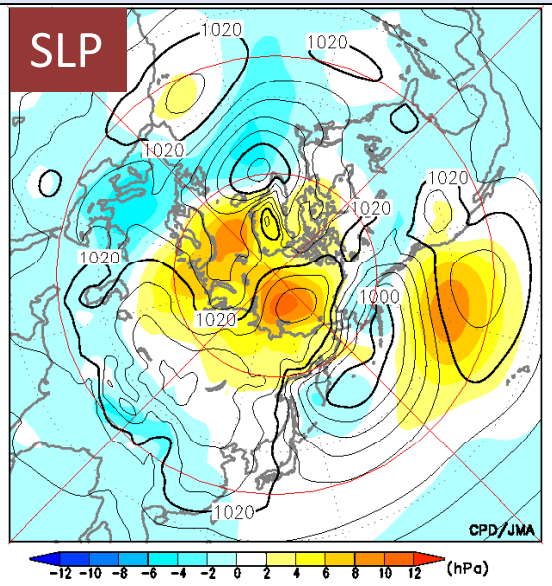
- Northern Japan experienced above-normal snowfall, and 12 observation stations set record-breaking snow depth (There are 330 stations of snow observation all over Japan).



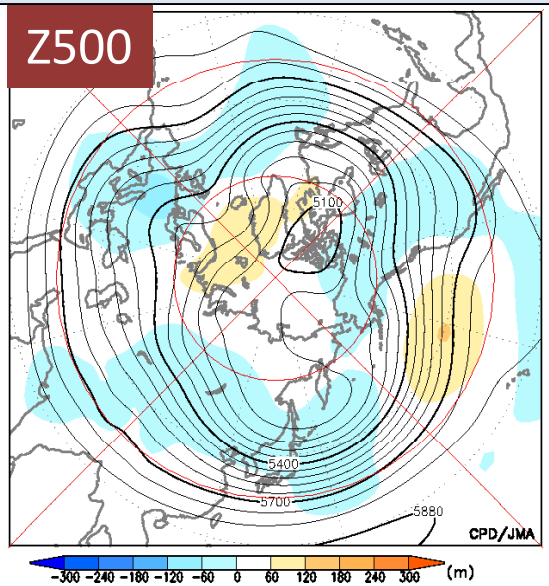
Northern Hemispheric circulation (winter 2012/2013)

- Annular patterns like negative AO were observed in the troposphere and stratosphere.

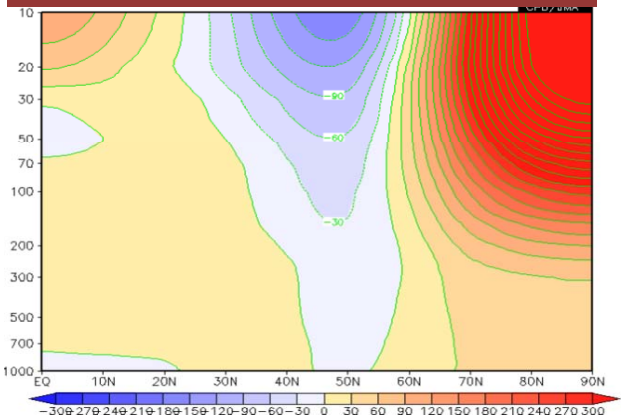
SLP



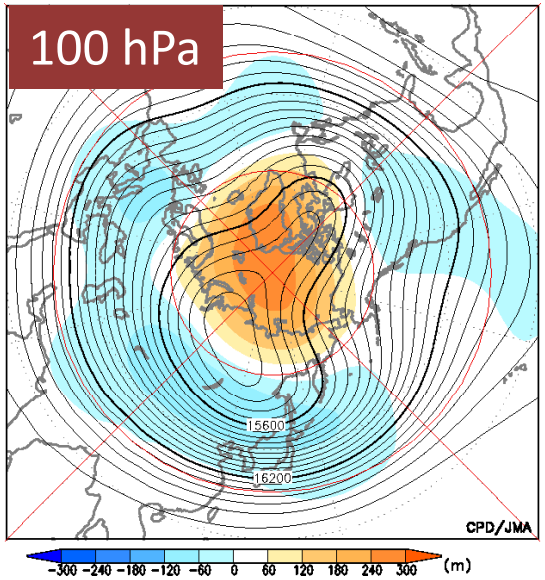
Z500



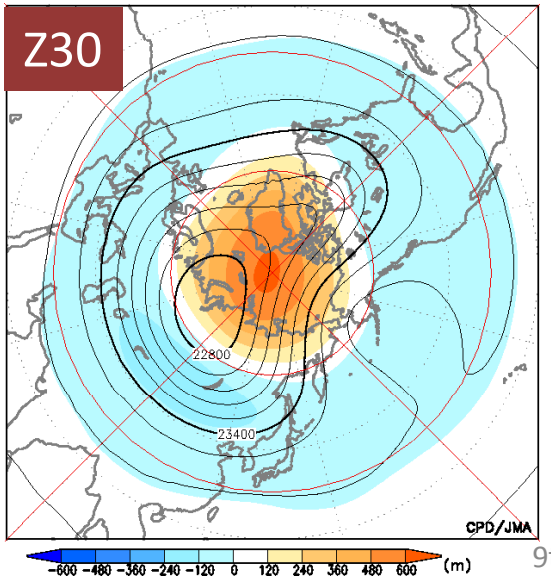
Zonal mean height anomalies (0 – 360 degrees)



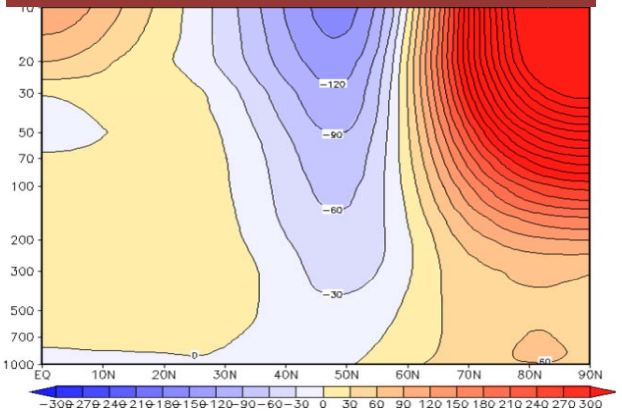
100 hPa



Z30

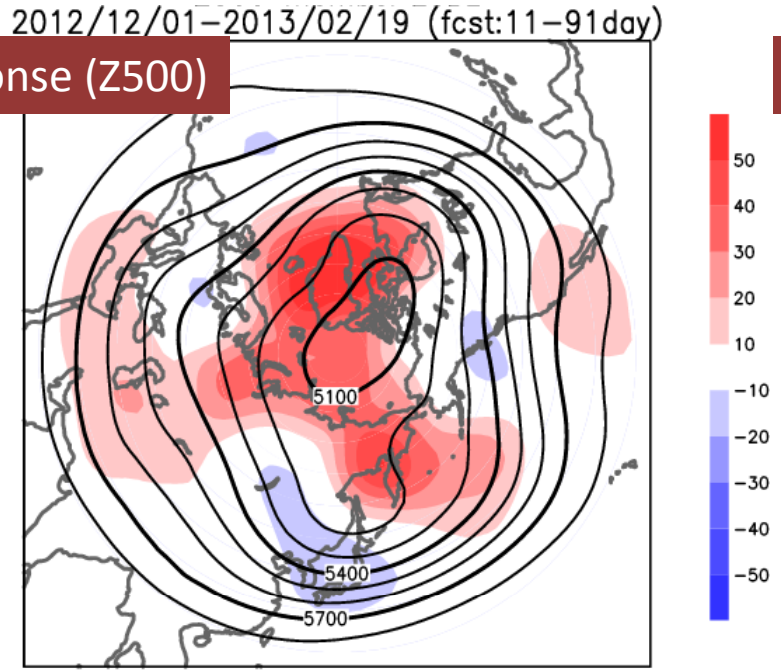


~~Zonal mean height anomalies~~ (0 – 180 degrees)

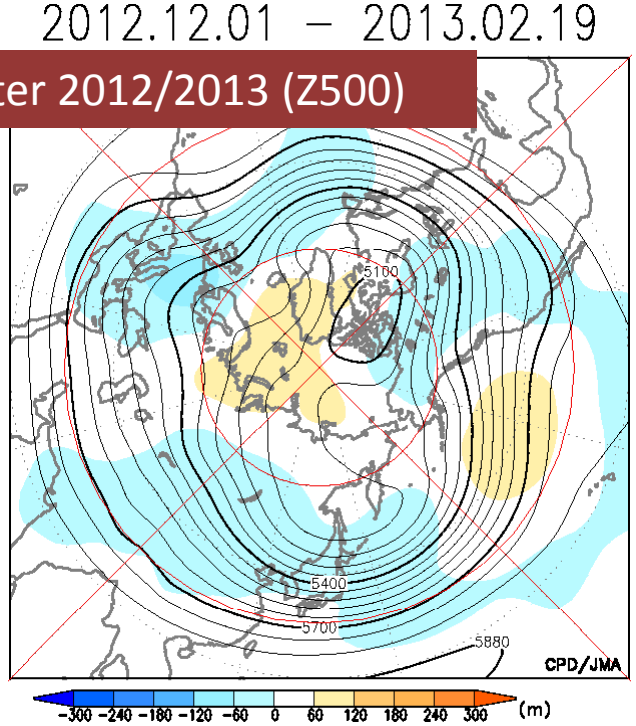


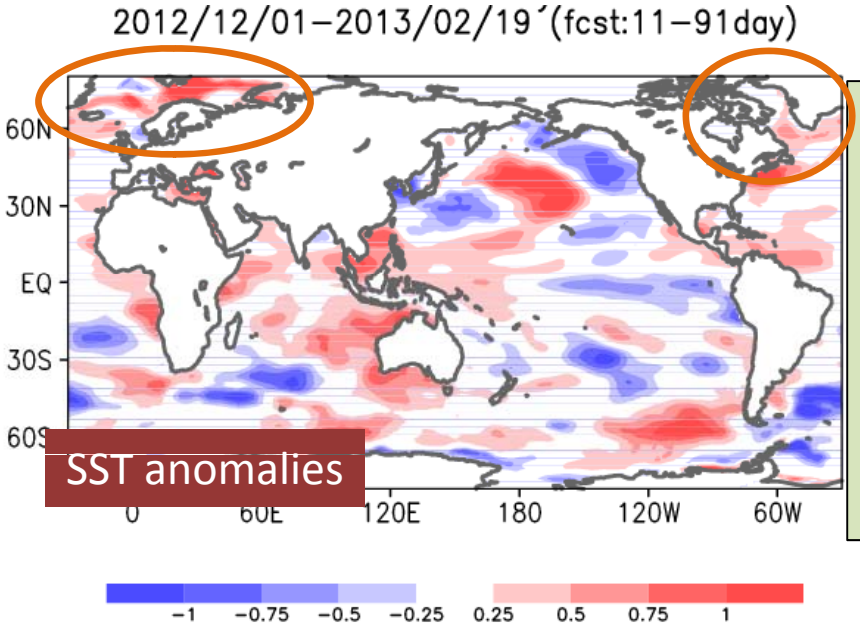
SST and sea ice impacts (AGCM experiments)

Response (Z500)



Winter 2012/2013 (Z500)





SST anomalies

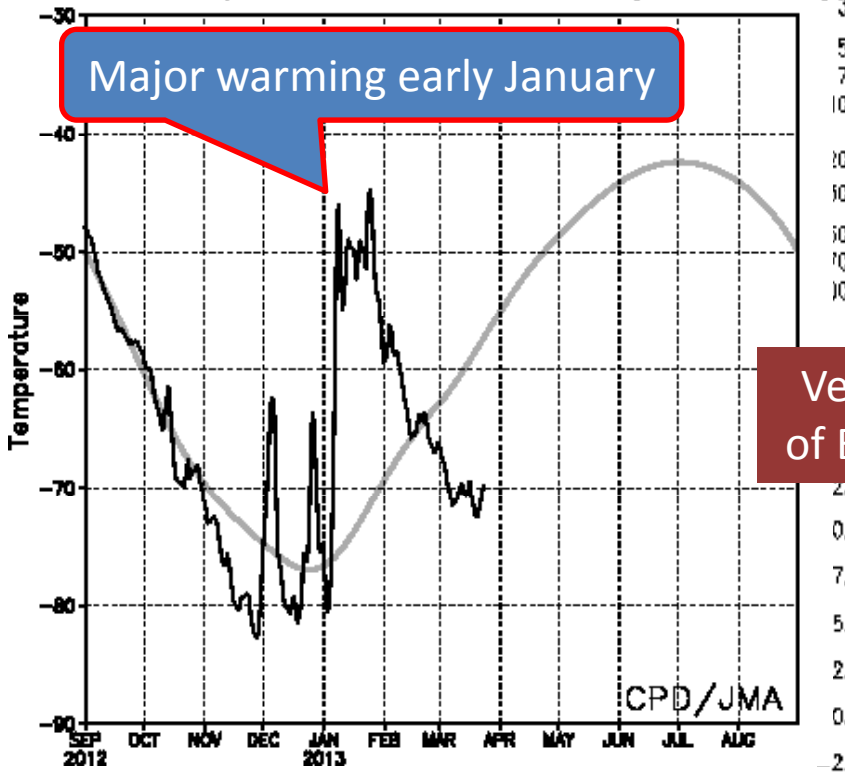
Top left: AGCM responses in the 500-hPa height field to daily SST and sea ice anomalies (deviations between ensemble-mean responses forced with real SSTs and those done with normal SSTs).

Top right: 500-hPa height and anomalies for winter 2012/2013

Bottom: SST anomalies for winter 2012/2013

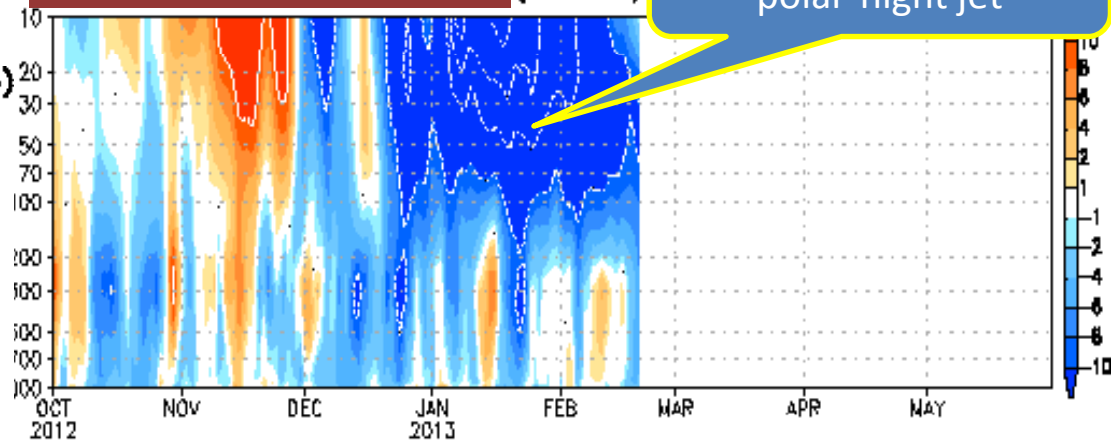
Stratospheric sudden warming

30-hPa temperatures over the North Pole

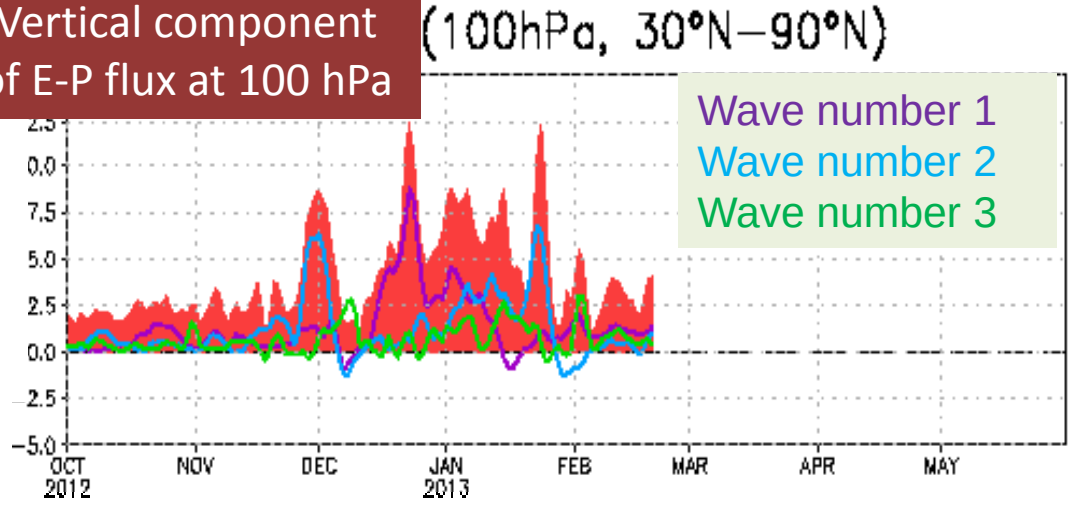


Zonal wind anomalies

Weaker-than-normal polar-night jet

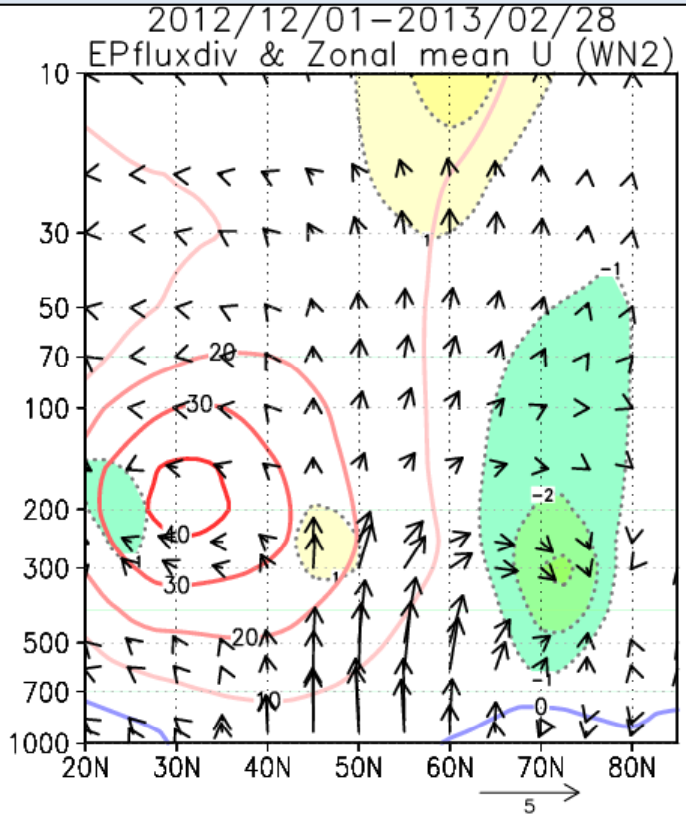


Vertical component of E-P flux at 100 hPa

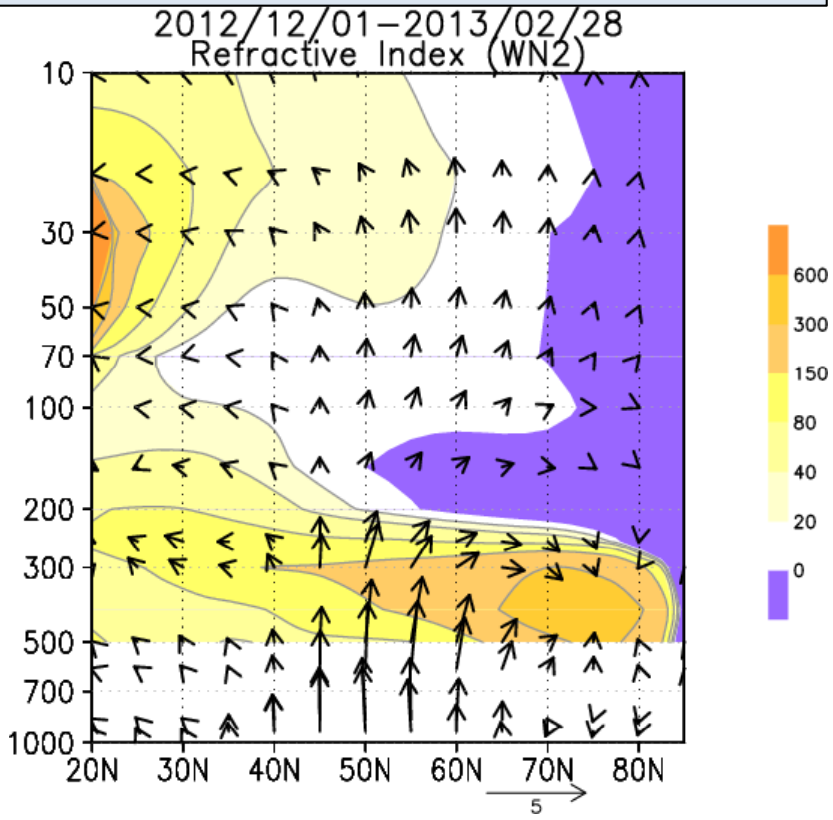


Troposphere-stratosphere interaction (winter 2012/2013)

- Planetary wave of wave-number 2 propagated poleward, refracting around the tropopause and converged over the higher latitudes.



Vectors: E-P flux (wave-number 2)
Shading: Convergence (green)/ divergence (yellow) of E-P flux
Contours: Zonal wind speed

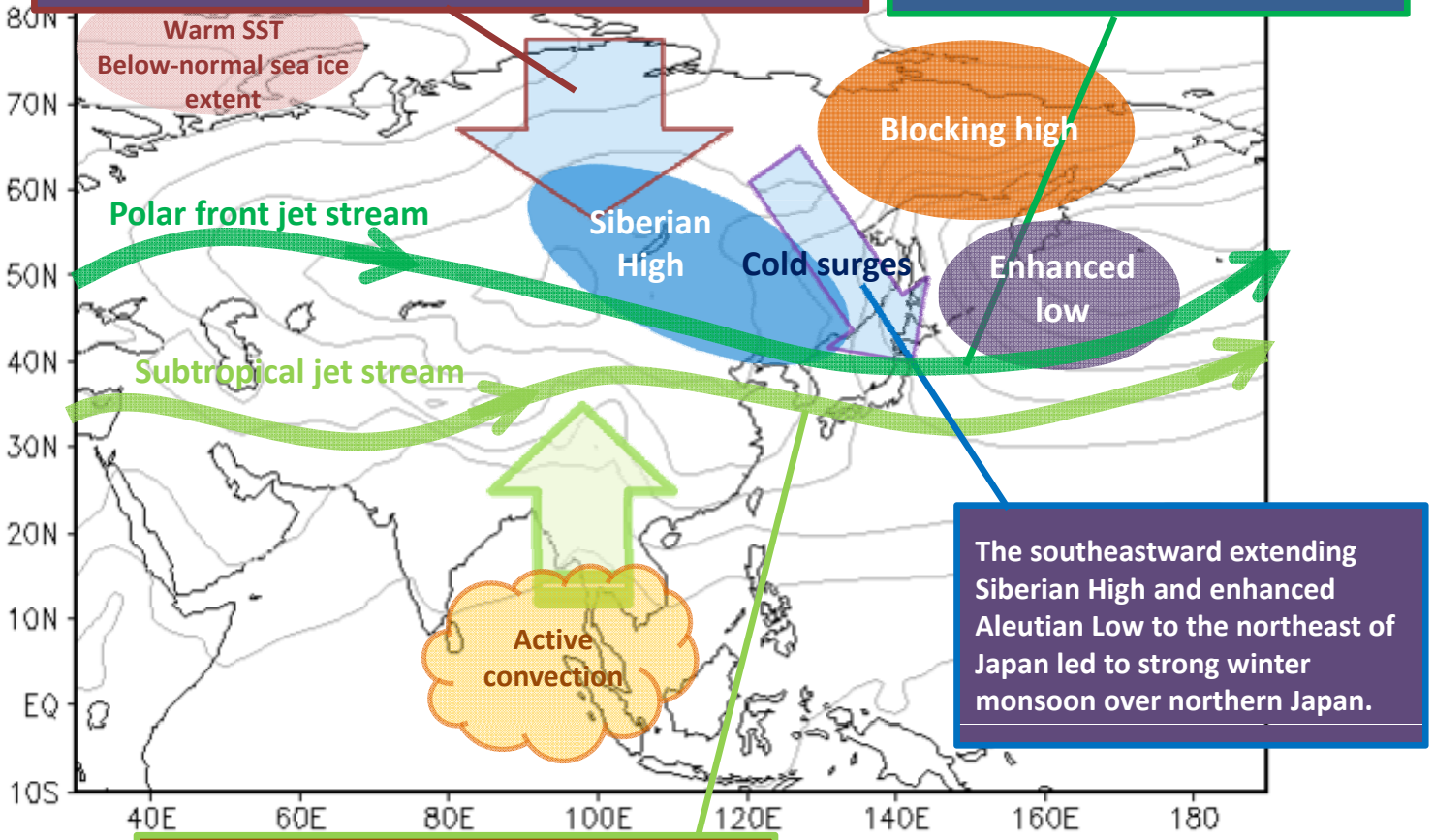


Vectors: E-P flux (wave-number 2)
Shading: Refractive index (positive: yellow, negative: purple)

Conclusion

Cold air over the Arctic region tended to move into the mid-latitudes due to negative AO-like conditions that may have been associated with warm SST and less-than-normal sea ice extent in the Arctic region and with troposphere-stratosphere interaction.

In association with blocking ridges over eastern Siberia, the polar front jet stream tended to meander southward over Japan. Upper-level cold air move into northern Japan.



The southeastward extending Siberian High and enhanced Aleutian Low to the northeast of Japan led to strong winter monsoon over northern Japan.

Enhanced convective activity over the eastern Indian Ocean contributed to the Rossby wave propagation, and the Asian jet stream meandered southward east of Japan.

Announcement about JRA-55

- **Autumn 2013**

  The Japanese 55-year Reanalysis (JRA-55) products (1958 – 2012) will be released for research use.

- **Spring 2014**

  JRA-55 real-time products will be released as JMA Climate Data Assimilation System (JCDAS) products.

Thank you for all the cooperating countries and organizations for the JRA-55 project !