

The Anomalies of Polar Vortex before the Serious Snow Storm and Freeze Calamity in China 2008

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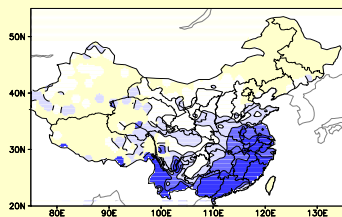


Fig.1 The precipitation from Jan.13 to Feb.2, 2008 (in mm)

A serious snow storm and freeze calamity occurred in south part of China in Jan. 2008, which was seldom seen in the history with its extension, strength and long duration. The snow storm and freeze calamity affected 19 provinces and cities as shown in Fig.1. It is the heaviest snow and freeze in a century in Hunan and Hubei province, which caused the ice cover on the electronic wire as thick as 30~50mm in south of Hunan province; The history record of the days with sustained sleet has broken in the 49 county in Guizhou province; The thickness of the accumulated snow in the area between Yangtze and Huai River reached 30~54cm.

In order to investigate the relationship between the anomaly of the stratospheric polar vortex and the serious snow storm and freeze calamity, the day by day variation of the stratospheric polar vortex from December 2007 to February 2008 has been analyzed using NCEP data.

Results:

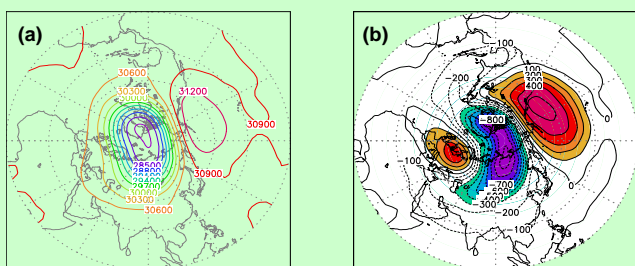


Fig.2 The geopotential height at 10hPa (a) and its departure (b) for Jan. 1, 2008

1. The stratospheric north polar vortex strengthened and deformed before the occurrence of the snow storm and freeze calamity (Fig.2).

The polar vortex expanded to Asia and North America; the stratosphere over north part of Asia was dominated by a strong low trough one month before the serious snow storm and freeze calamity.

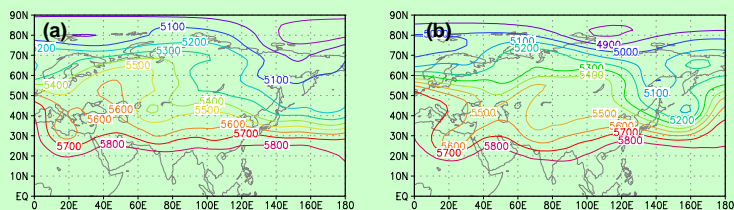


Fig.5 Geopotential height at 500hPa over Eurasia (a) for Jan. 18, 2008 (b) for Jan. 25, 2008

3. The Changes of geopotential height at 500hPa over Eurasia (Fig.5)

The East Asian Trough in 500hPa was shift to the east of Siberia and the pressure in most part of Eurasia raised, a strong blocking high was developed in the region from Mediterranean Sea to the Ural Mountains since the middle of January, which moved slowly to the east and dominated Eurasia. The north-westerly flow in the front of the blocking high leded the cold air from north area entered into China, which met the warm and wet air from Bay of Bengal and South China Sea in south part of China, then caused the serious snow storm and freeze calamity.

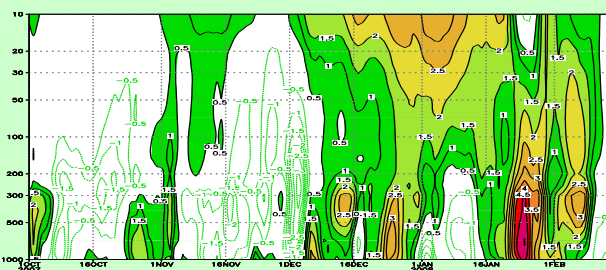


Fig.3 Time-height section of NAM indices from October 2007 to February 2008 (values larger than 0.5 are shaded)

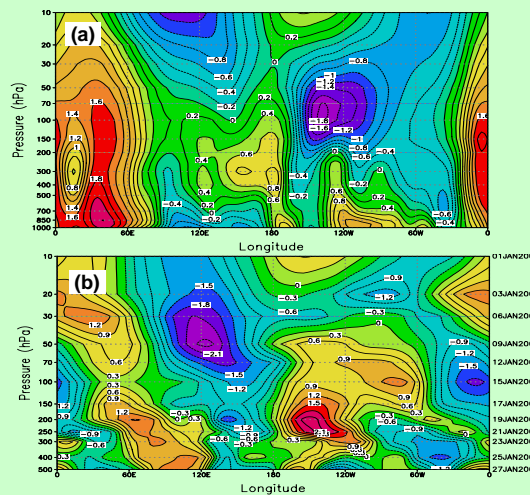


Fig.4 Height-longitude section of the standardized departure of geopotential height along 60°N. (a) for Jan. 1, 2008 (b) from 1st Jan. 2008 to Jan. 27, 2008

2. Downward propagation of the anomalies in the stratosphere and affected the troposphere.

The Northern Annular Mode (NAM) indices as lager as +3.0 in the first ten days of January 2008 (Fig.3); It propagated downward to the troposphere and enhanced significantly from Jan, 16, 2008 to the beginning of February, when the snow storm was heaviest. And as the stronger low trough extended downward, it moved to the east (Fig.4b).

Conclusion:

The exceptionally serious snow storm and freeze calamity in south part of China in January 2008 was connected not only with the changes of the tropospheric circulation, but also with the changes of the stratospheric circulation. Meaningfully, the changes of the stratospheric circulation were more than one month ahead of the snow storm and freeze calamity. Therefore it is helpful to improve the middle and long term weather forecast, if we use the information of the stratospheric circulation to the weather prediction.