Extreme low Temp and Icy Weather in South China in Jan 2008

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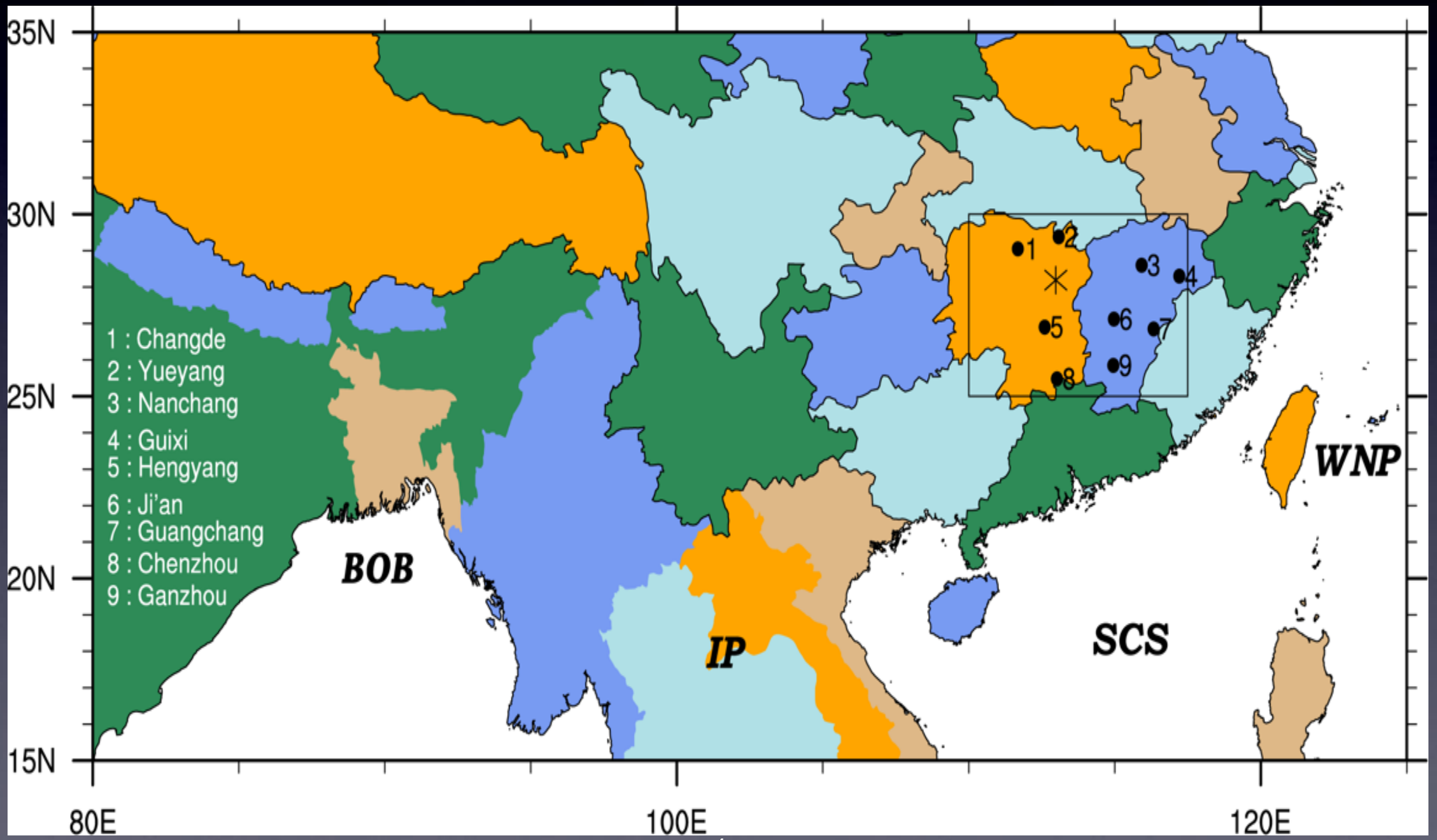
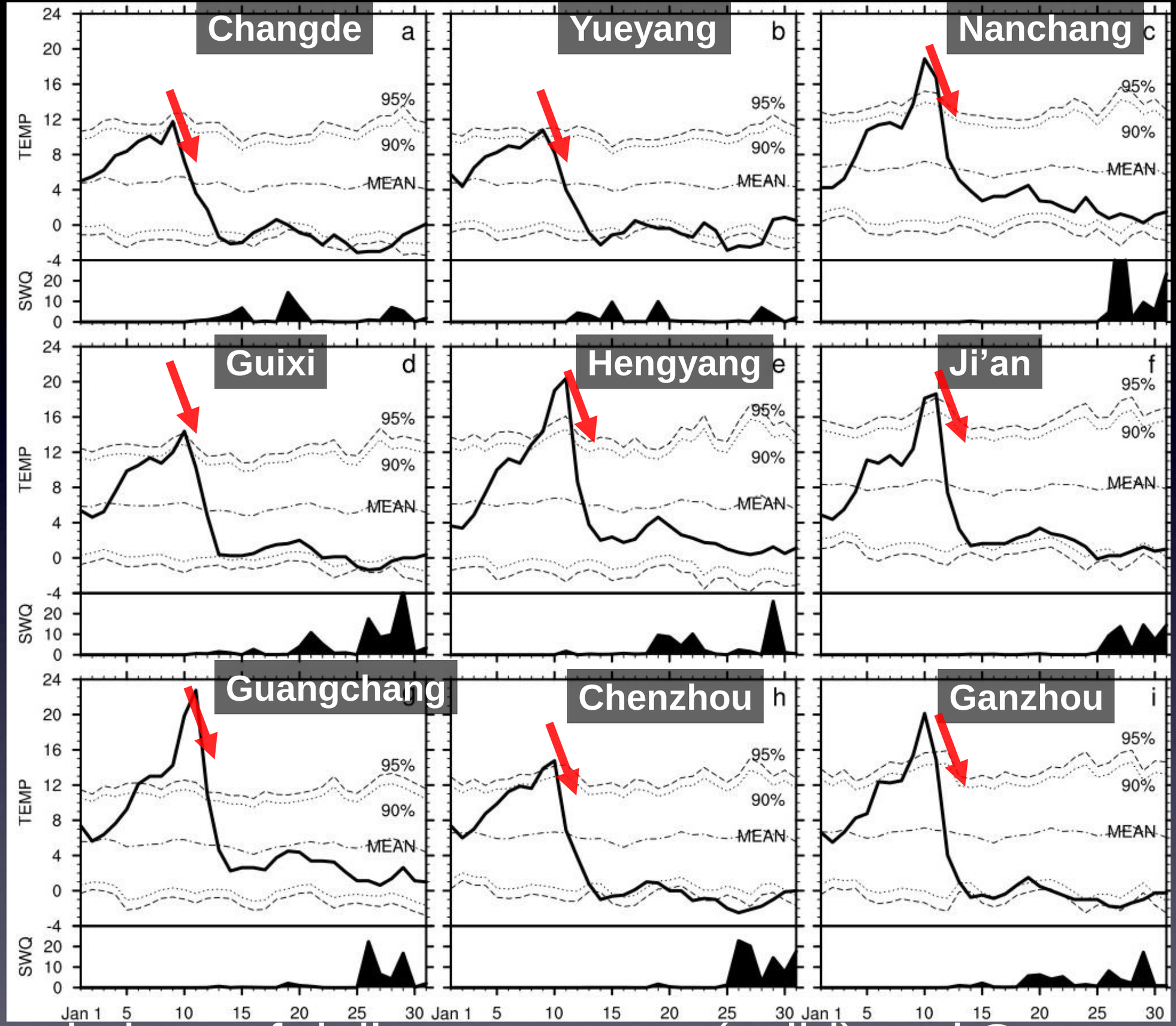
2008 snowstorm

- What is the return period of this extreme event?
- What caused this extreme cold weather in South China?
- What forcing mechanisms may have played a role in the event?

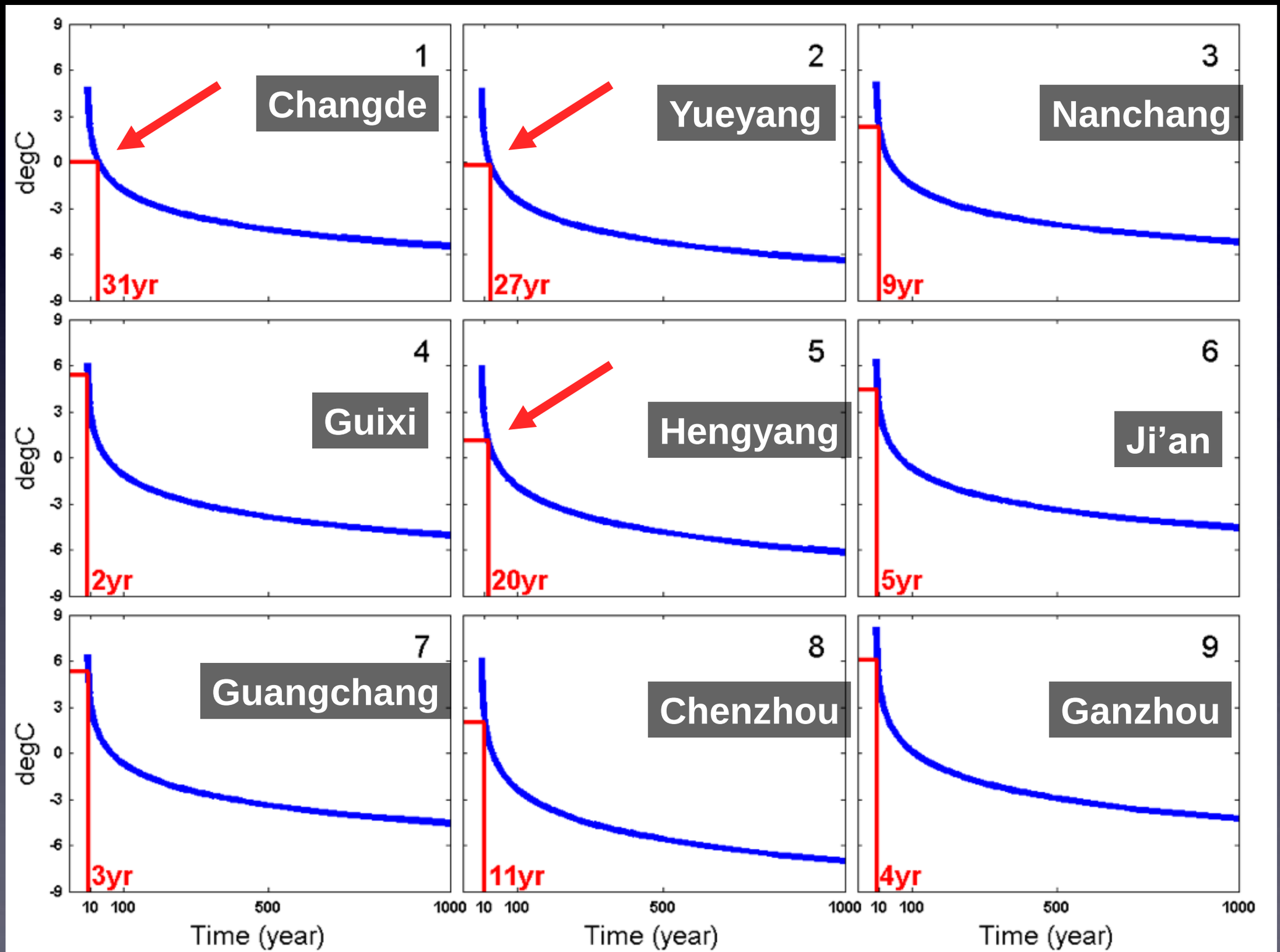
Southern China hit by Snowstorm



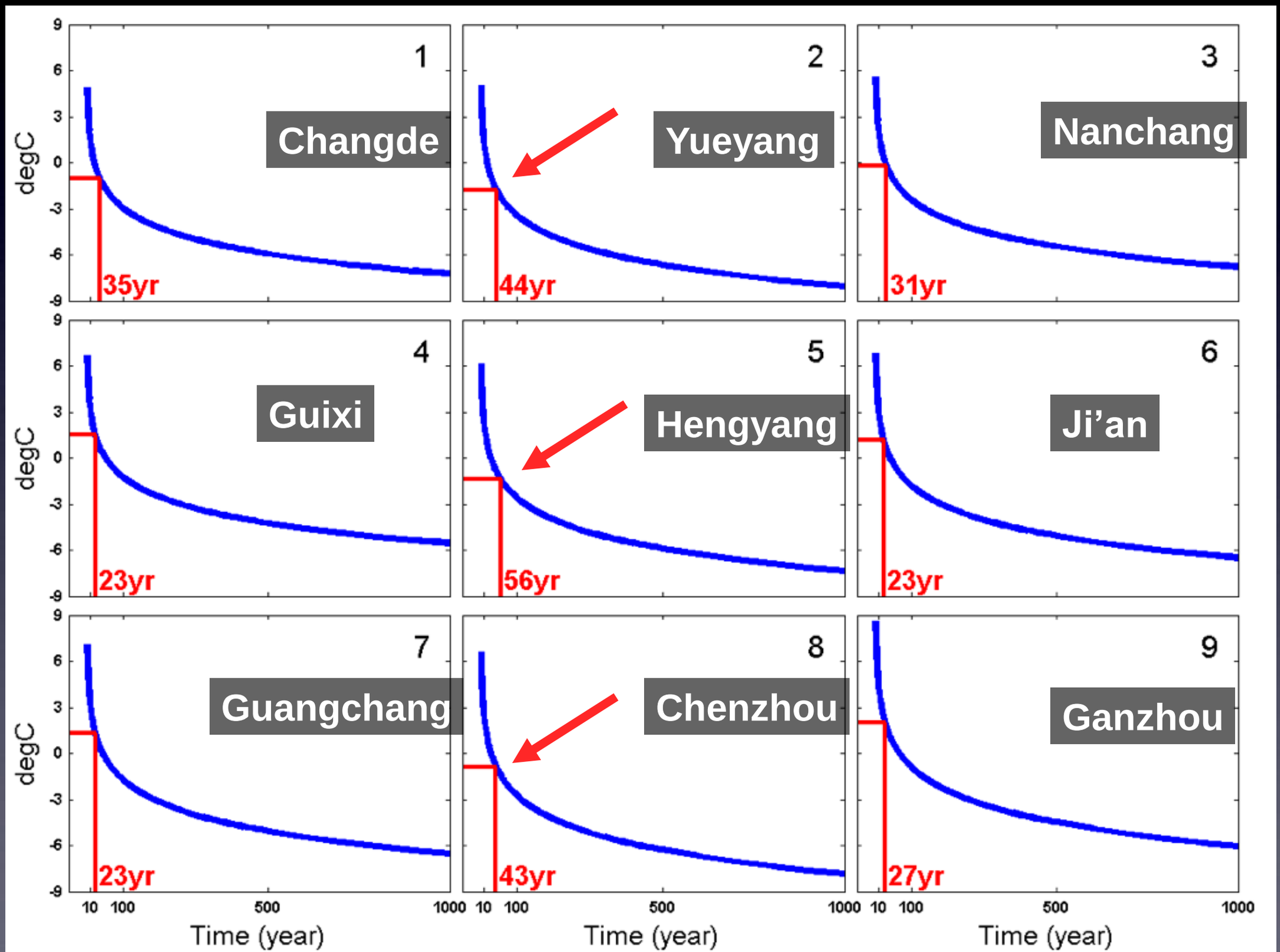


- variations of daily mean temp (solid) and Snow water equivalent (shaded area) at 9 stations, mean(1955-2007)

Return Period (Jan 11-20)



Return Period (Jan 21-30)



T-logP diagram

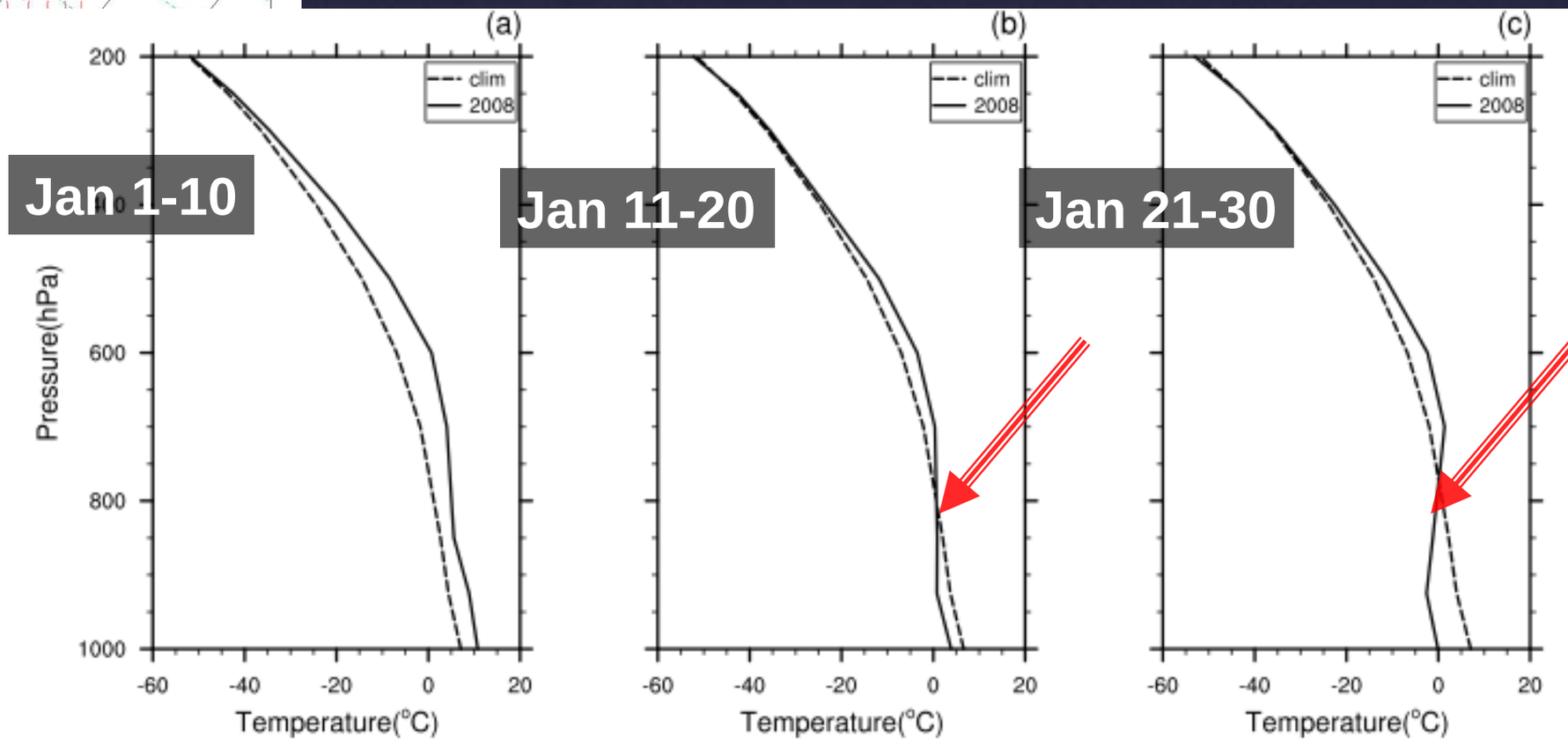
- **Black line: Jan 8; Blue line: Jan 25; Green line: Jan 28; Solid: air temperature;**

  Dashed: dewpoint

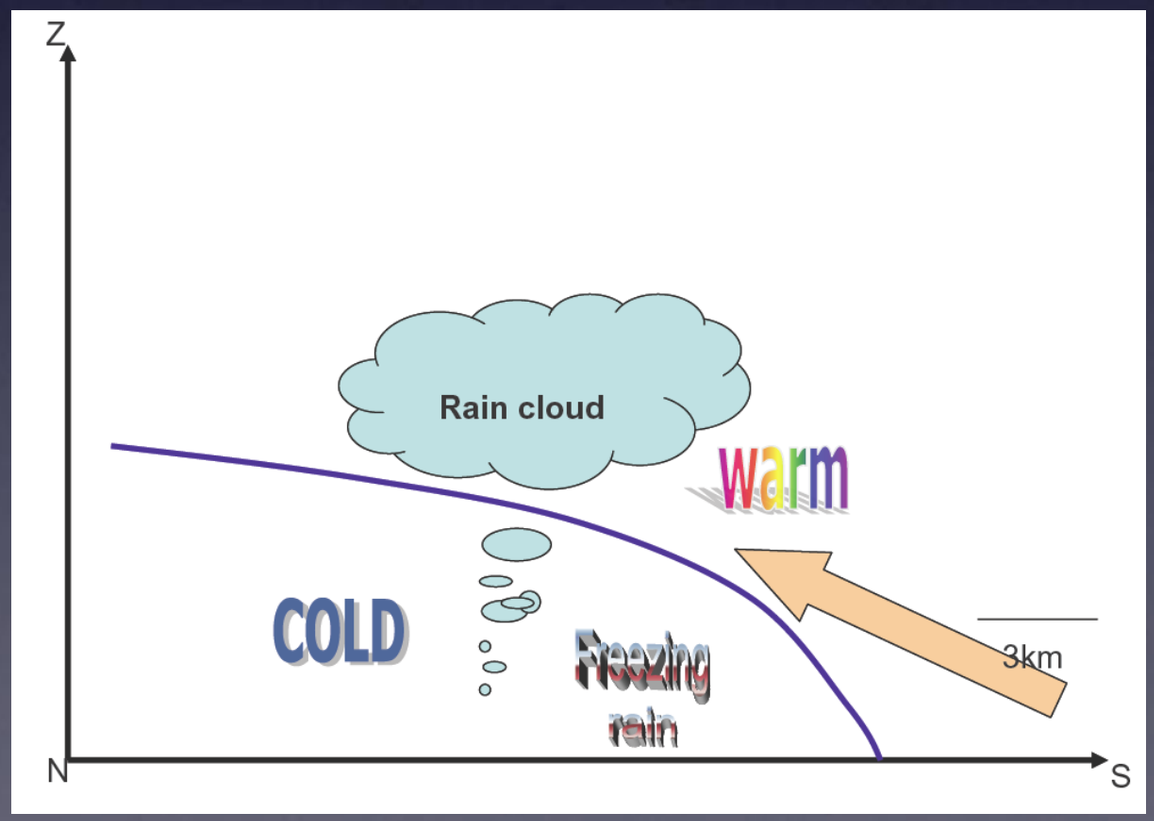
- **Warm/moist air around 700-800 hPa**

- **Dry air above 675 hPa (blue), moist air above 600 hPa (green)**

Inversion layer

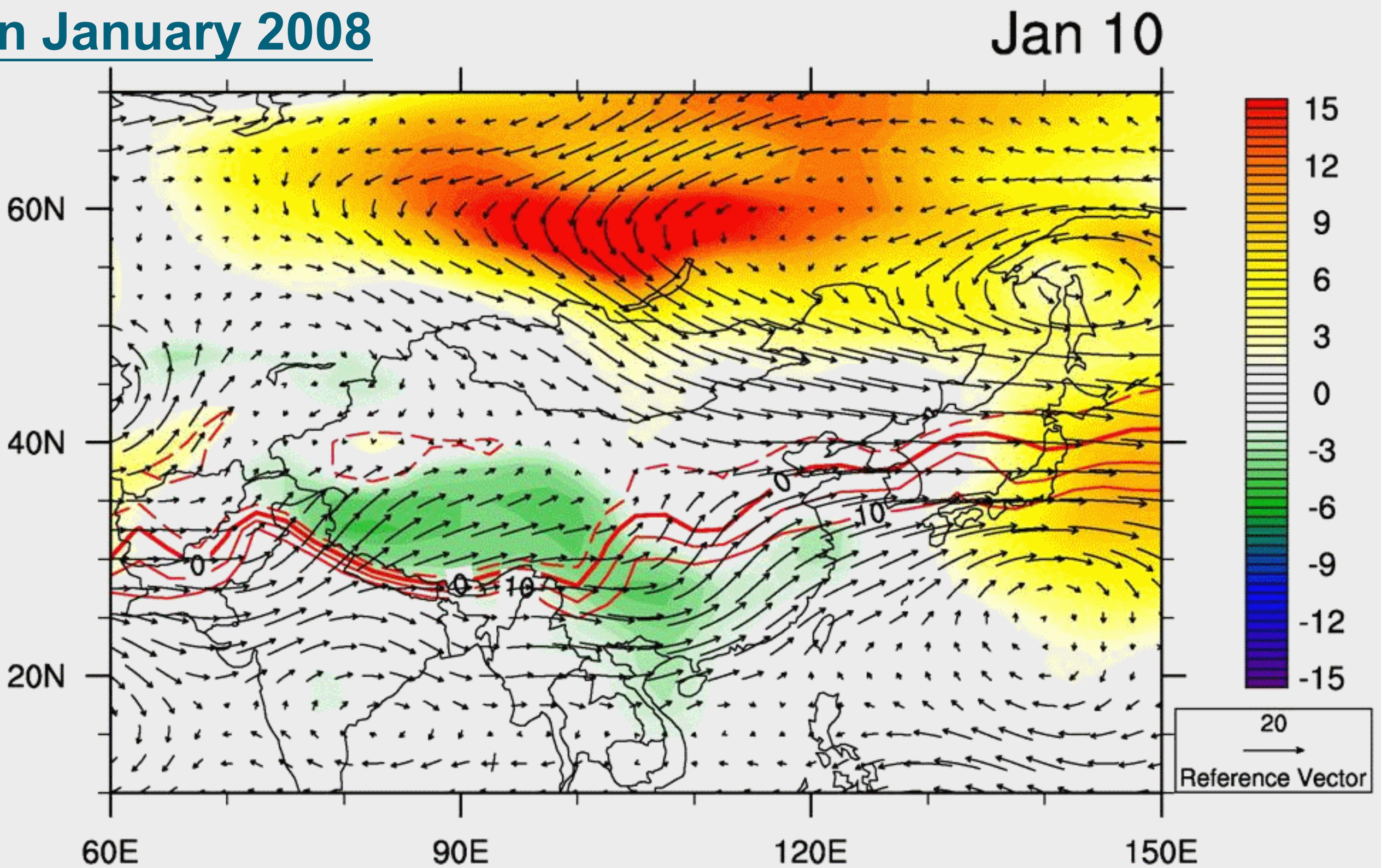


Freezing rain

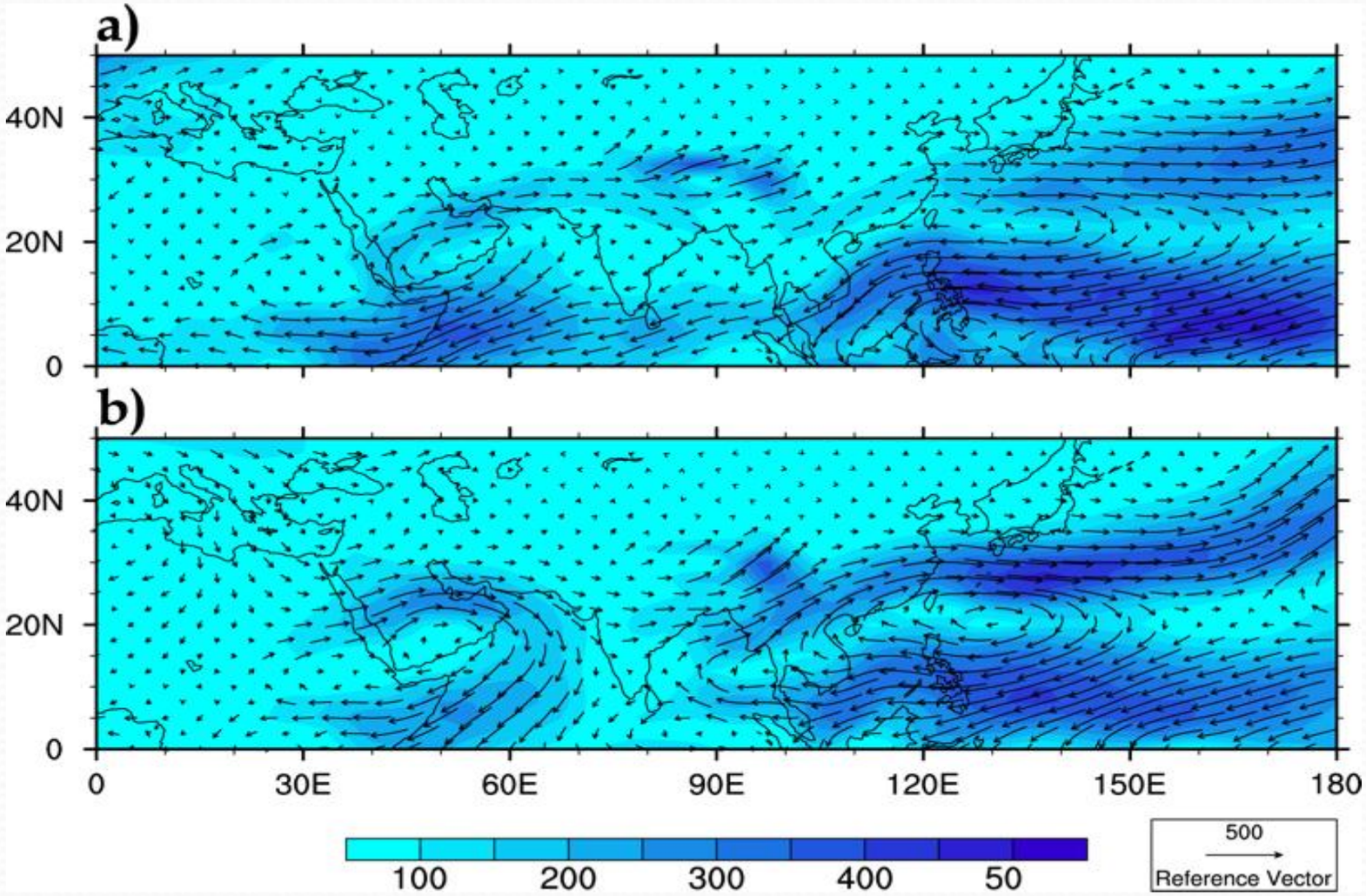


- **Warm moist air (south) met cold air (north)→ being forced to rise→ Moisture condensed at a higher altitude→ clouds →rain / snow.**
- **The ground of South China remained cold (snow-covered) (blocking pattern).**
- **Freezing rain is due to the rain falling through the cold-air dome near the ground.**

Conditions leading to the event in January 2008



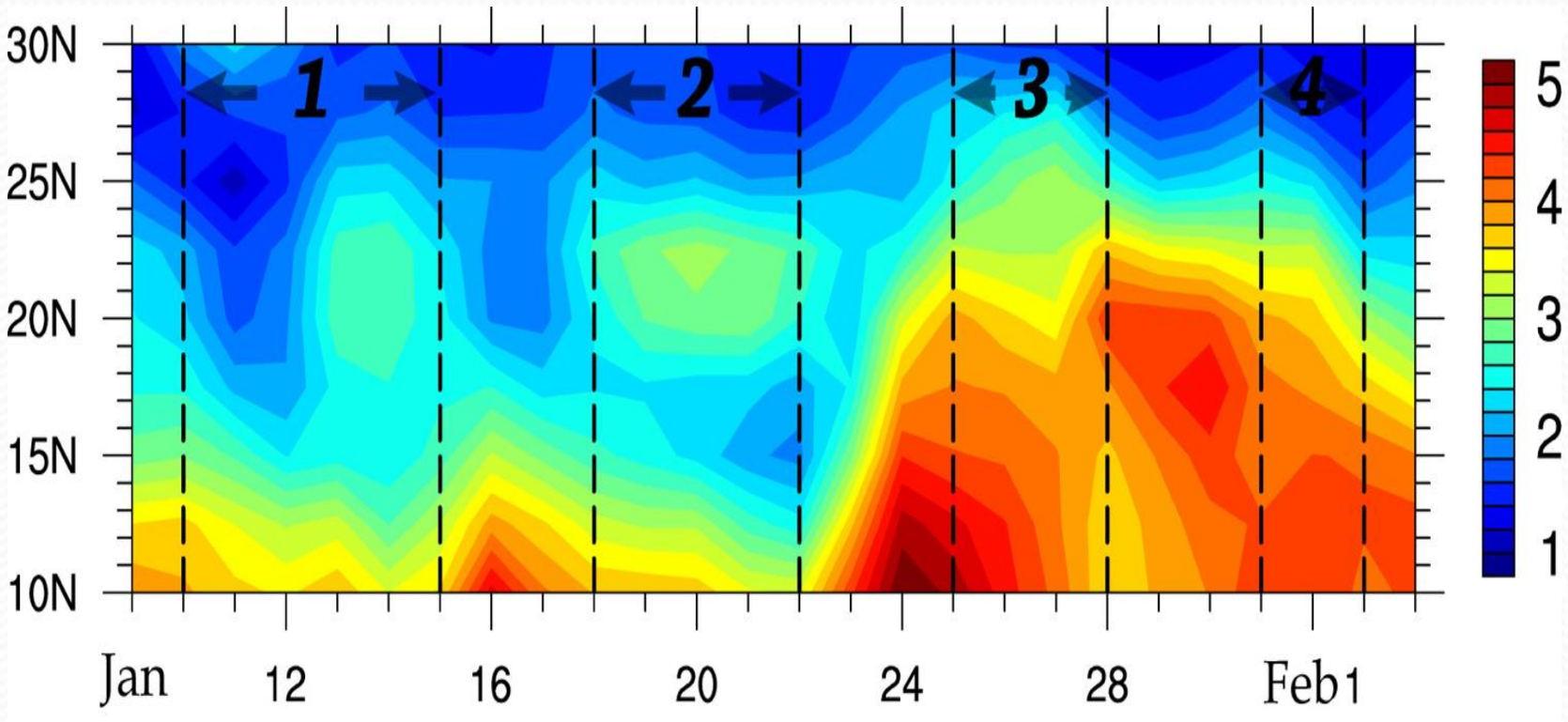
Color: 24h SLP difference, Vector: 700hPa wind
Thick Solid line: 0°C (surface temperature), Dash line: -5°C



Vertically-averaged water vapor flux (surface to 300 hPa) (vector) and the amount of water vapor transport (shading)

(a) Jan 11-20

(b) Jan 21-30



Time-latitude cross-section of the amount of water vapor transport along 105E.

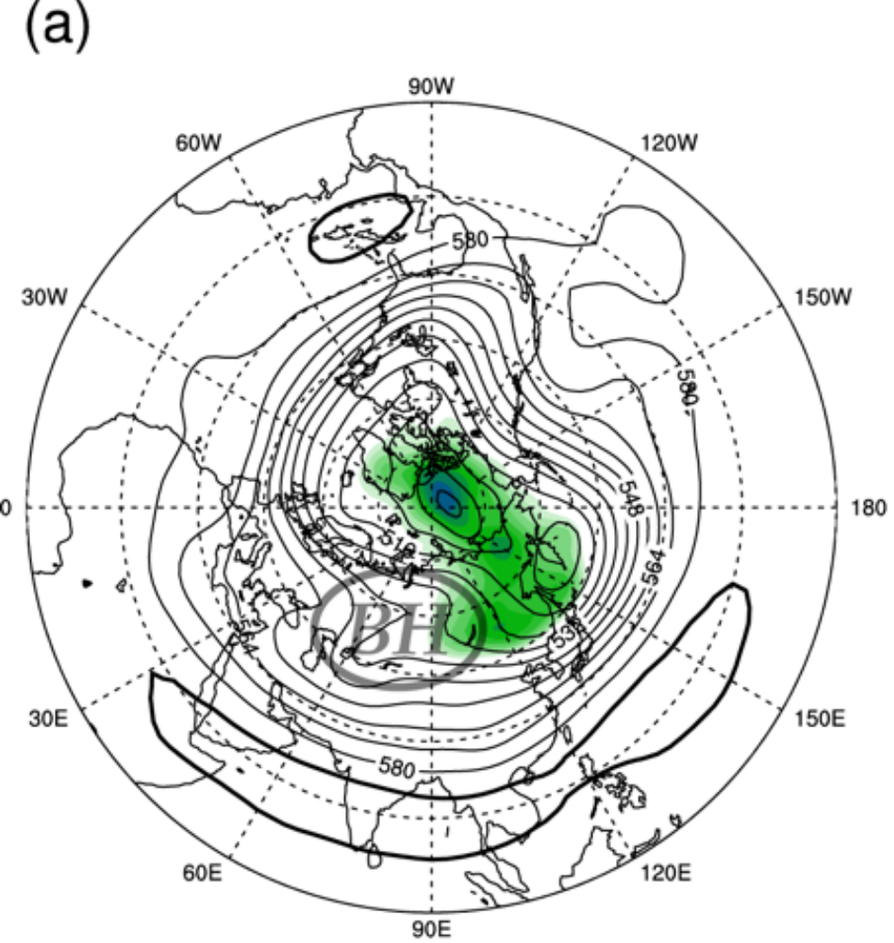
Four snowstorm events

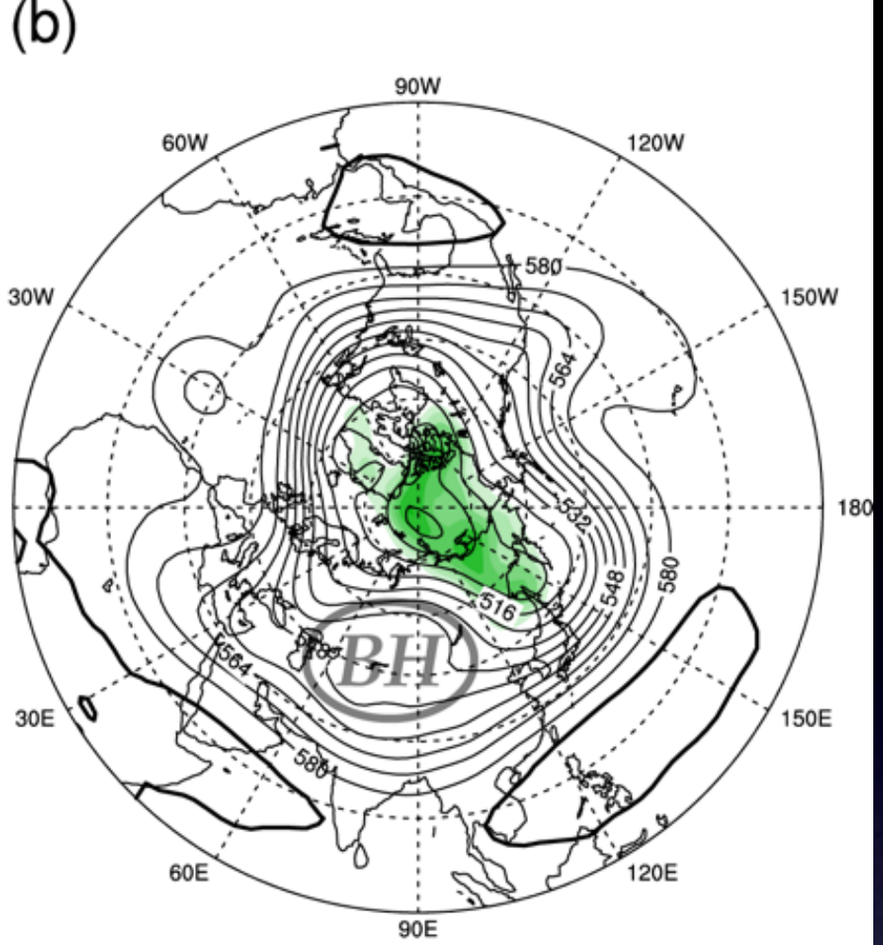
1: Jan 10-15

2: Jan 18-22

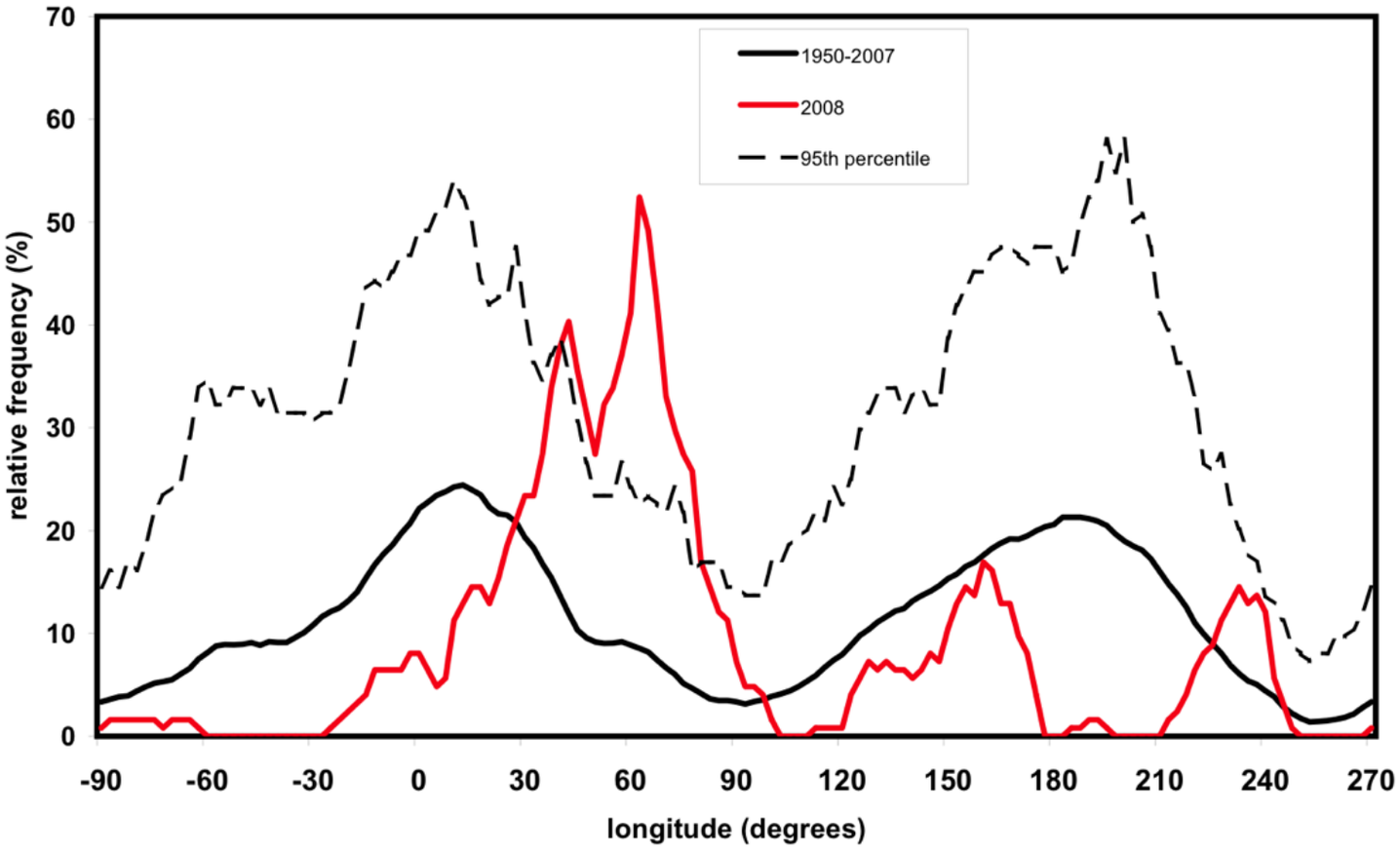
3: Jan 25-28

4: Jan 31- Feb 2





Geopotential height (contour) and Air temp (shaded) at 500 hPa
(a) Jan 11-20
(b) Jan 21-30

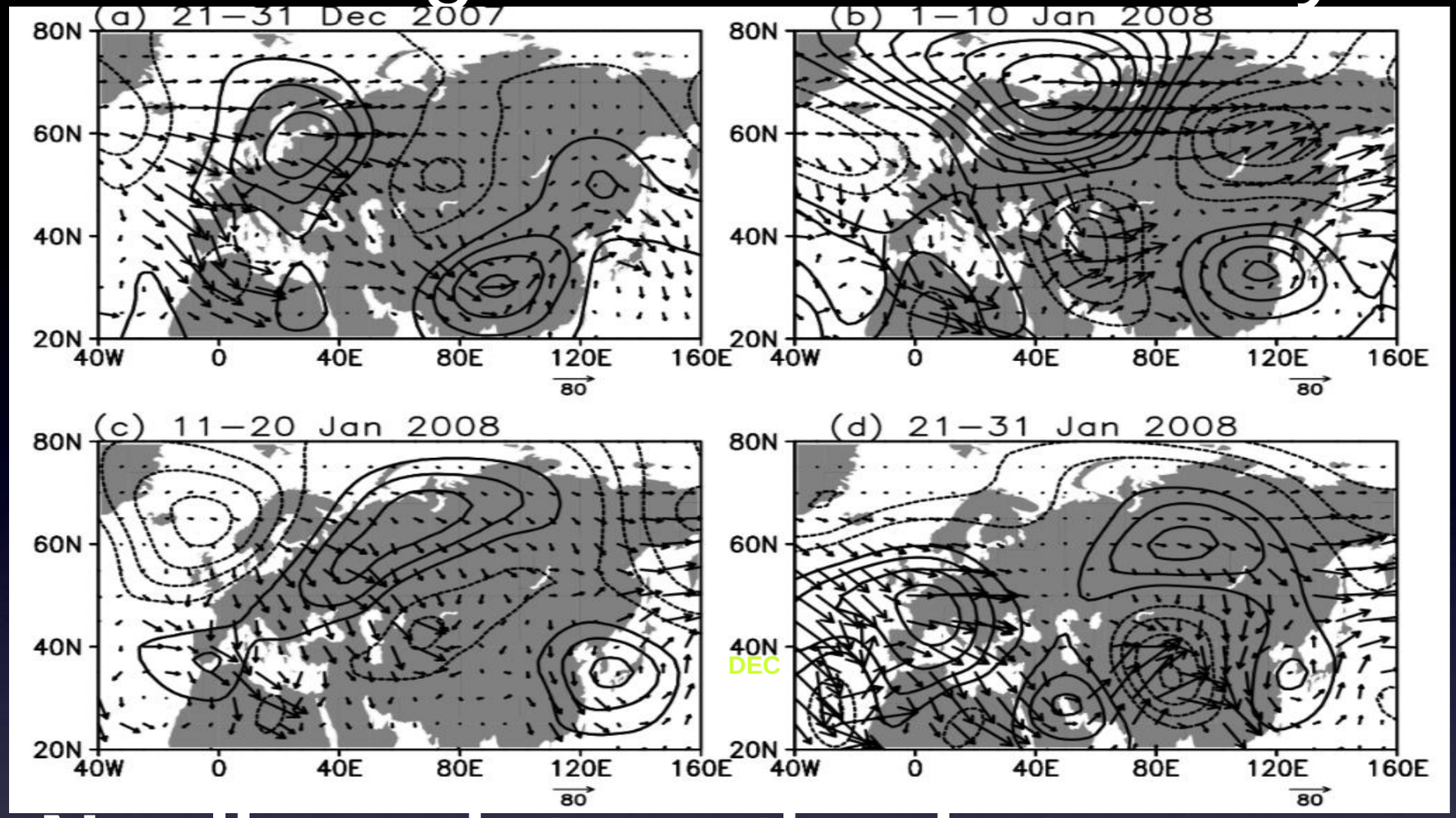


- **Blocking for the NH mid-latitudes. (Tibaldi and Molteni 1980)**
- **High percentage of block days per month: Two regions (North Atlantic, North Pacific) (1955-2007); Ural-Siberia region (2008)**

Geopotential height and wave activity at 200 hPa

Dec 21-31

Jan 1-10



Jan 11-20

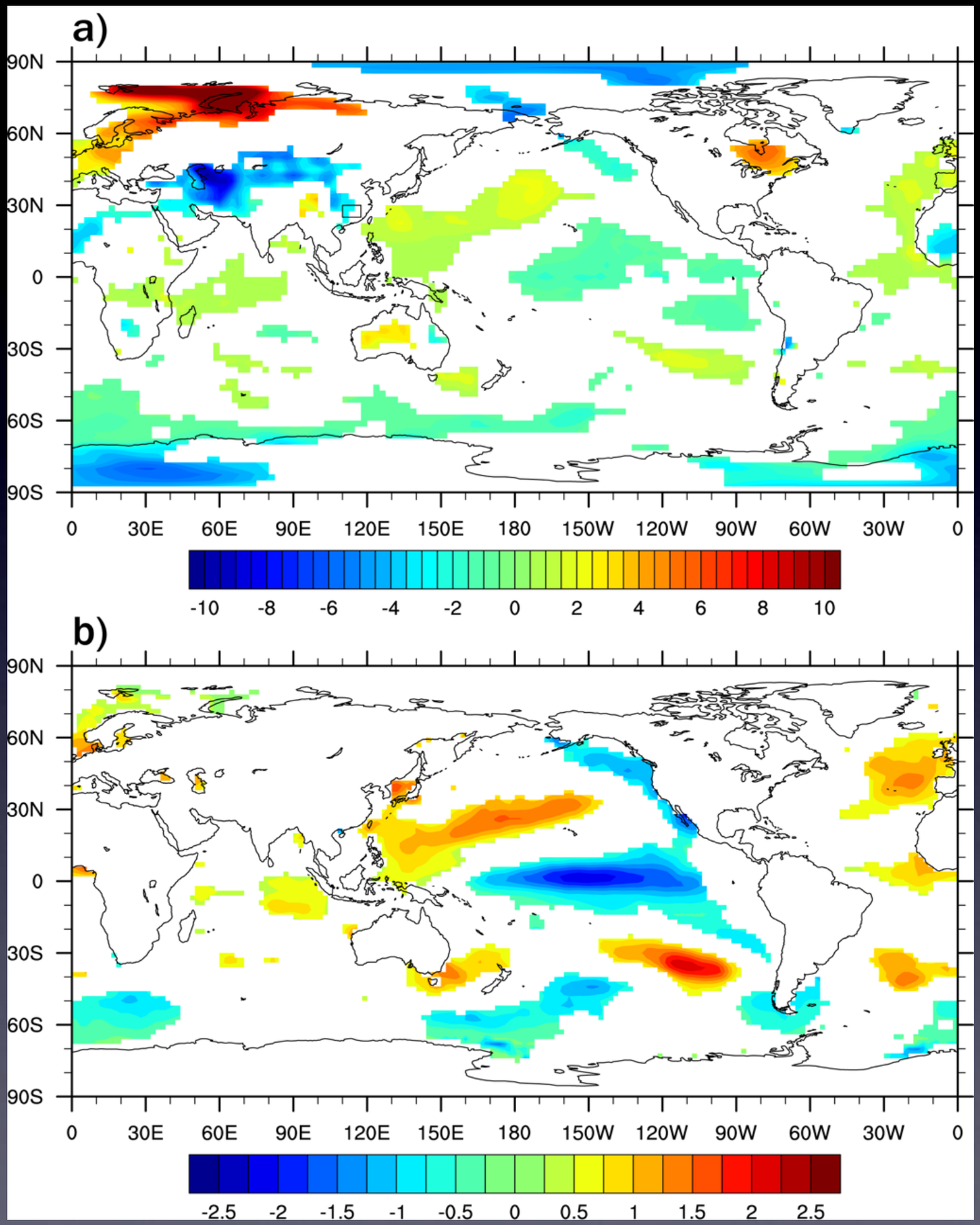
Jan 21-31

- Nonlinear interaction between waves and mean flow
- Quasi-stationary wave train (Atlantic-European) amplify UB (a, b)
- Quasi-stationary wave train move eastward from Ural to Siberia (c, d)

Summary

- Blocking pattern in the middle latitudes
- Persisting southwesterly flow over Southern China
- Deep inversion layer in the lower troposphere

END



- (a) Surface Temp
- Land-sea thermal contrast? warm in Atlantic Ocean, cold in Eurasia continent?
- (b) SST
- La Nina?

Locations and scale Parameters for Gumbel distribution

- Location parameters :
- 5.467~8.926 (Jan11-Jan20);
- 5.601~9.422 (Jan21-Jan31)
- Scale parameters:
- -0.631~-0.494 (Jan11-Jan20)
- -0.538~-0.446 (Jan21-Jan31)

probability density function~maximum likelihood approach