



Seasonal Climate Outlook for Winter 2022/2023 over China

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Outline

1. EAWM System

2. Outlook for EAWM

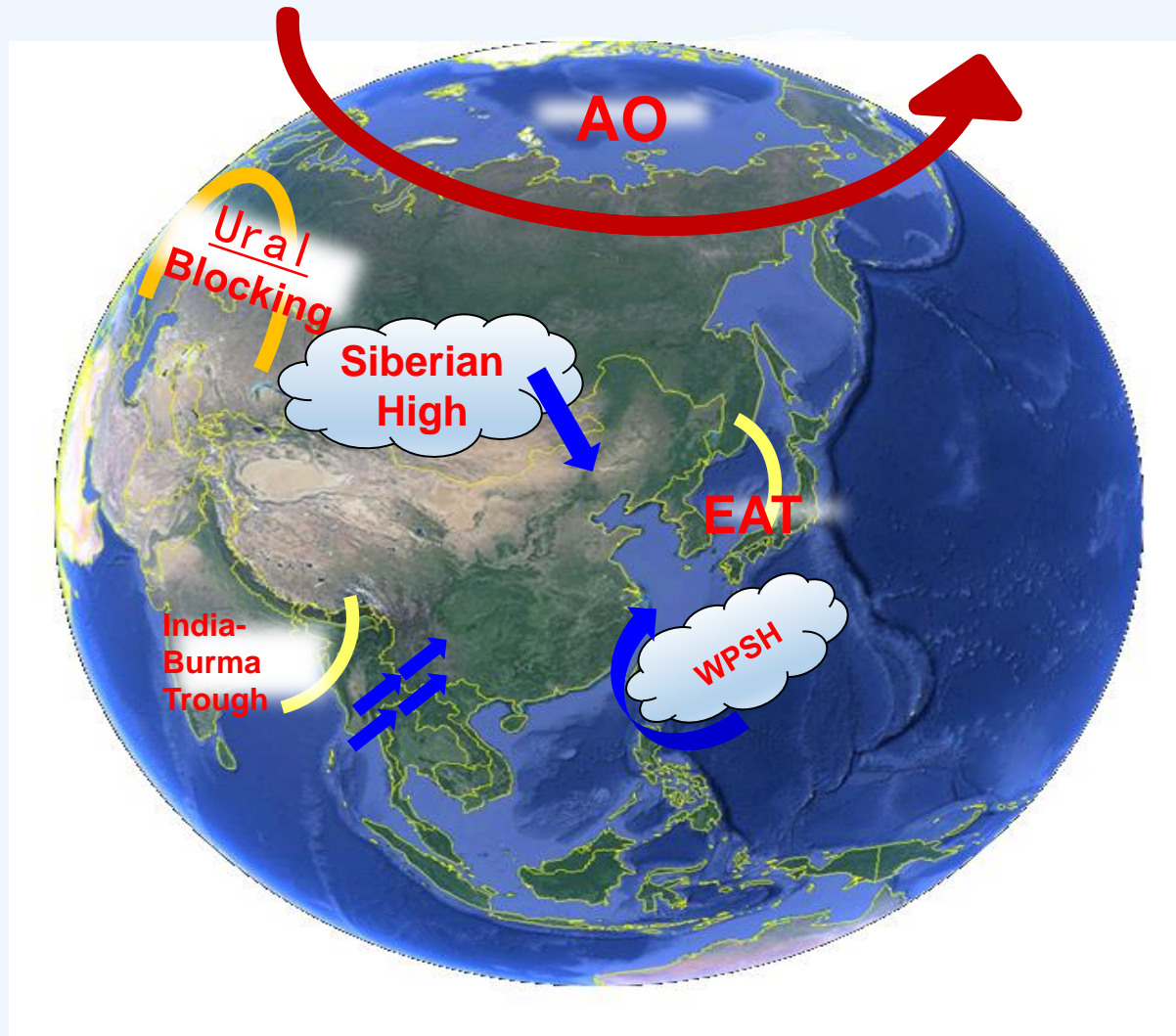
2.1 Prediction by BCC_CSM 1.1m, BCC/CMA

2.2 Statistic Analysis

3. Outlook for temperature and precipitation over China

EAWM system and potential boundary forcing

Major circulation systems affecting winter climate in China



- East Asia Winter Monsoon (EAWM), including :
 - Arctic Oscillation (AO)
 - Ural blocking (UB)
 - Siberian high (SH)
 - East Asian trough (EAT)
 - Western Pacific subtropical high (WPSH)
 - India-Burma trough (IBT)
- Potential Boundary Forcing:
 - SSTA
 - Arctic Sea Ice

Outline

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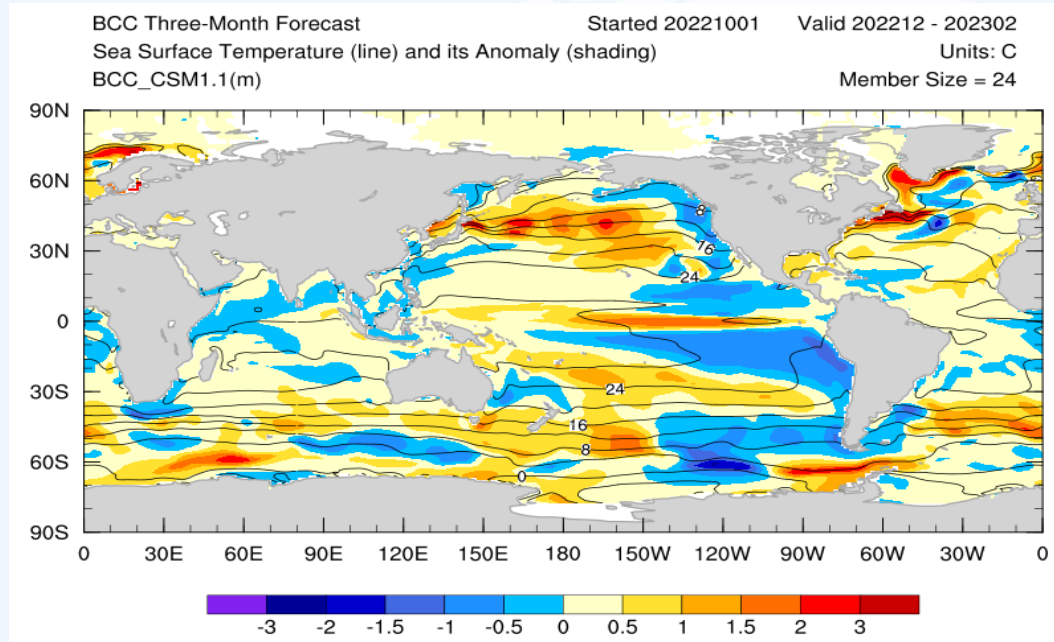
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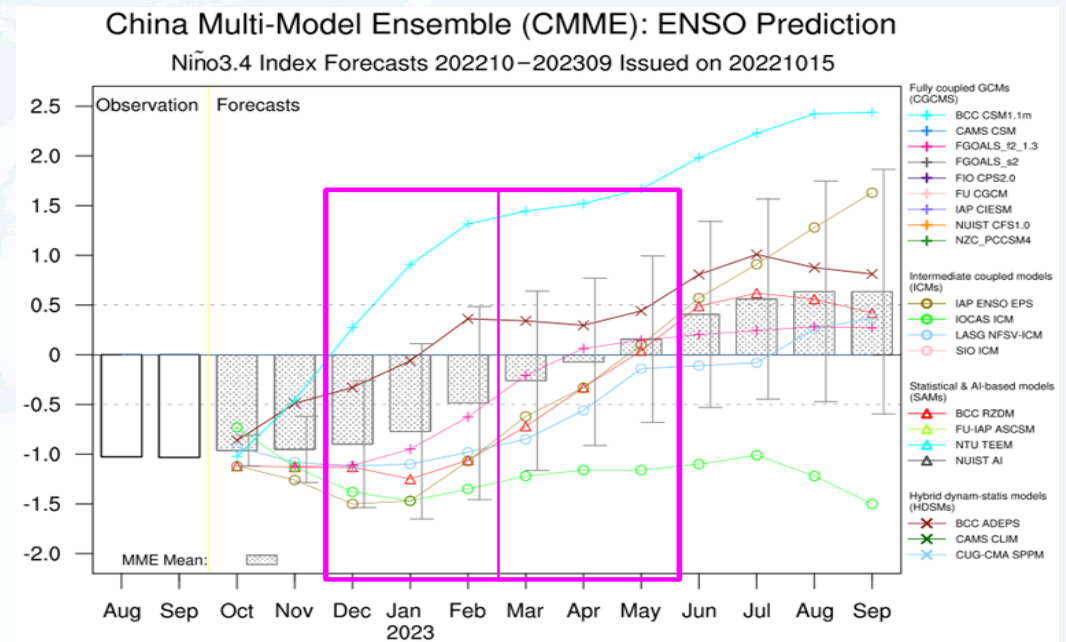
3. Outlook for temperature and precipitation over China

ENSO

BCC_CSM1.1(m)



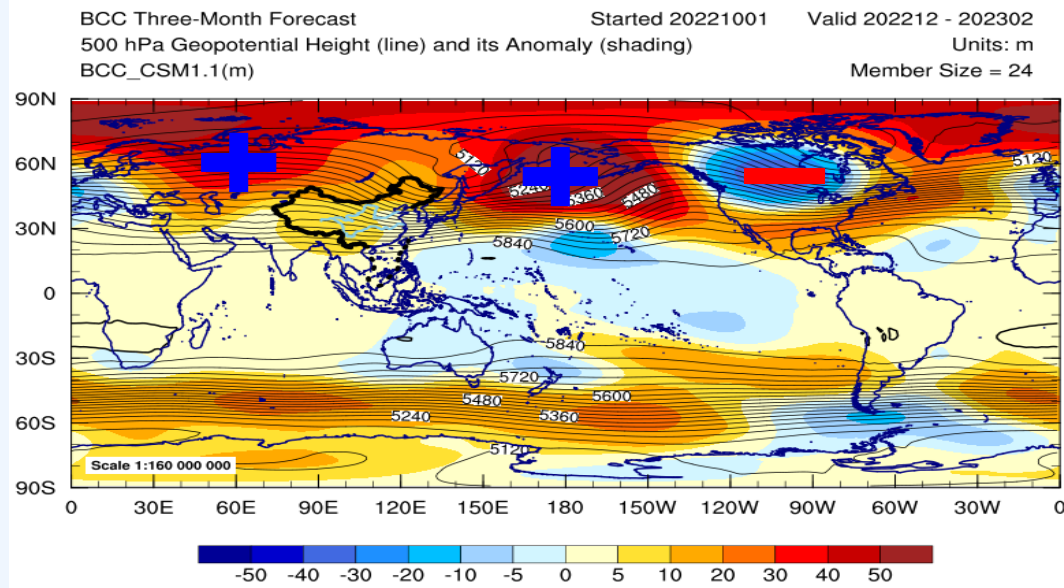
China Multi-Model Ensemble



- In September 2022, the Nino3.4 index was **-1.03°C**.
- The latest model prediction indicate that the La Nina event will last until the winter of 2022/2023. In the spring of 2023, it will become ENSO neutral.

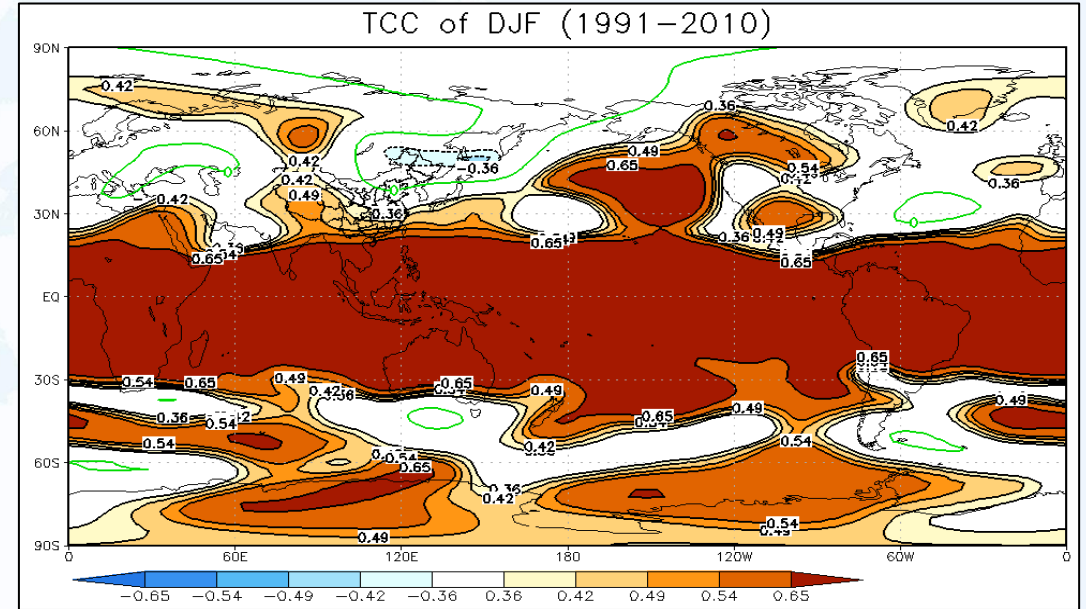
500 hPa GH

Prediction



- Zonal circulation over East Asia
- Positive Ural blocking
- Normal-weak East Asia trough
- Positive height anomaly over China

Hindcast skill



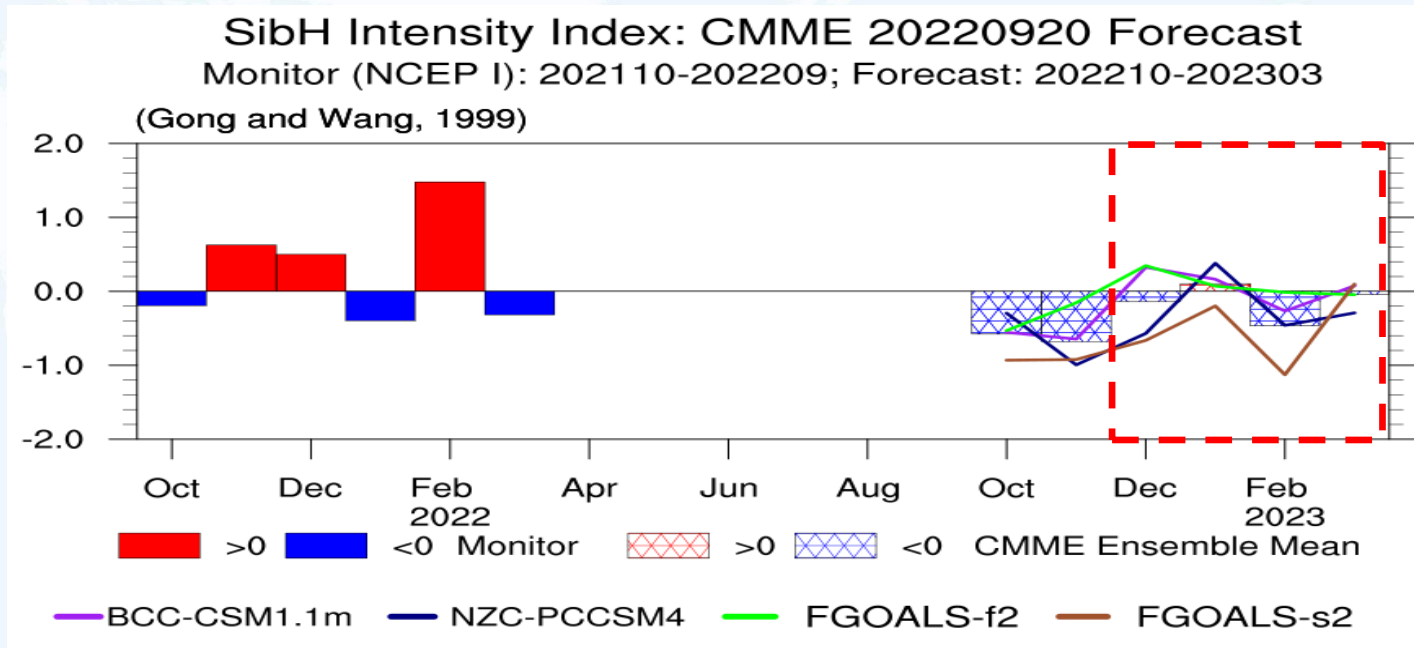
- Weak west pacific subtropical high
- Weak India-Burma trough



SLP



China Multi-Model Ensemble



Weak Siberian High

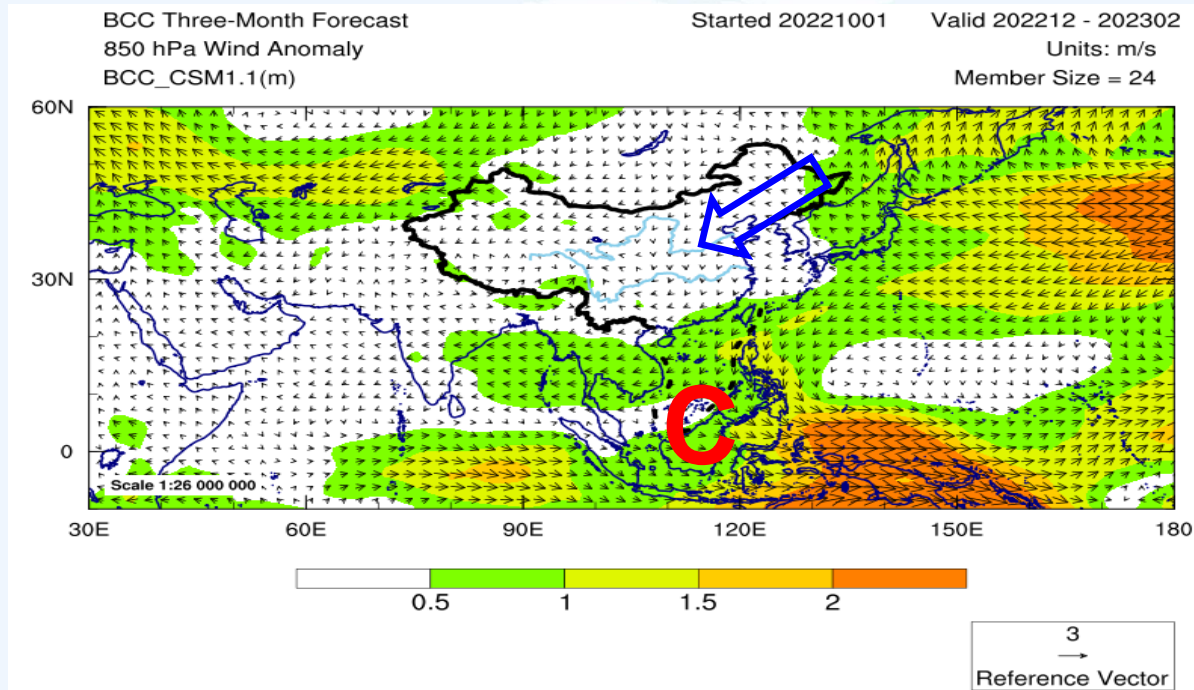
SH is defined by standardized SLP averaged from 40-60N, 80-120E.



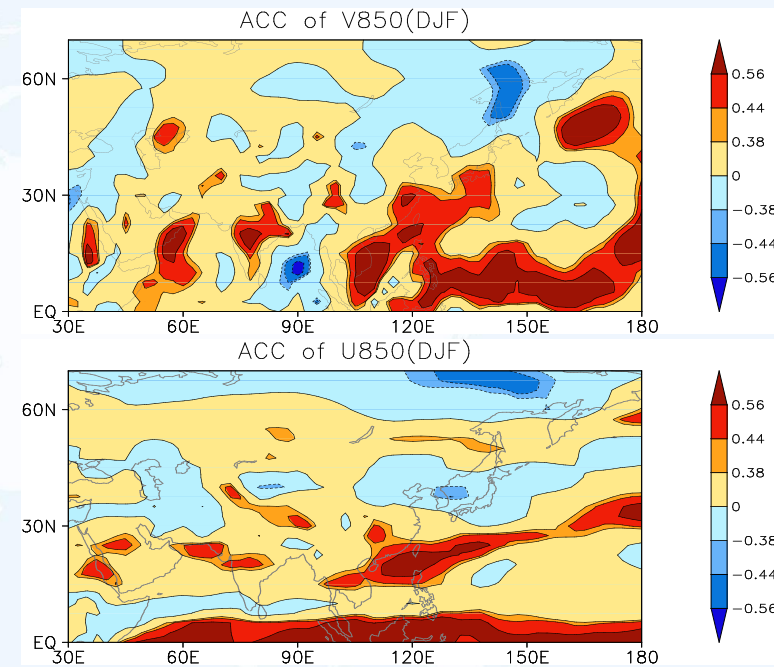
850hPa wind



Prediction

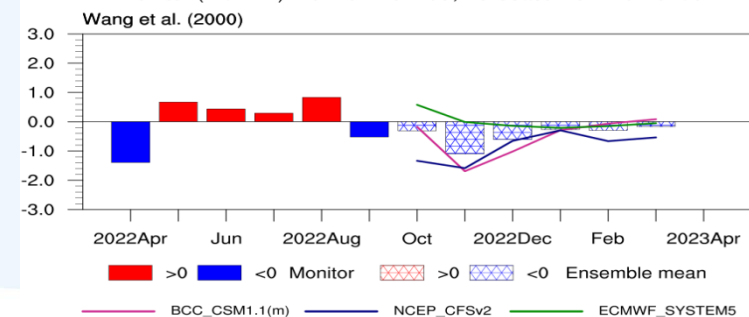


Hindcast skill



- Weak north wind anomaly will dominate East Asia in middle latitude.
- Cyclone anomaly around the Philippines.

Philippine Sea AntiCyclone (PSAC) index: MODES forecast
Monitor (NCEP I): 202204-202209; Forecast: 202210-202304





From BCC_CSM1.1(m)

- La Nina will last until the winter of 2022/2023
- Weak EAWM/Siberian High
- Zonal circulation over East Asia
- Normal-weak East Asia Trough
- Positive height anomaly over China
- Weak West Pacific Subtropical High
- Weak India-Burma trough
- Weak northerly wind anomaly over East Asia
- Cyclone anomaly around the Philippines



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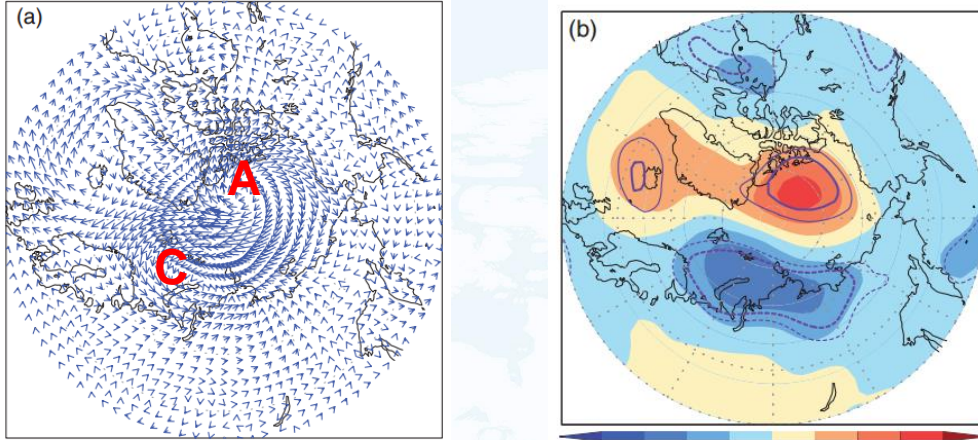
2.2 **Statistic Analysis**

3. Outlook for temperature and precipitation over China

Possible impact of SIC in Arctic

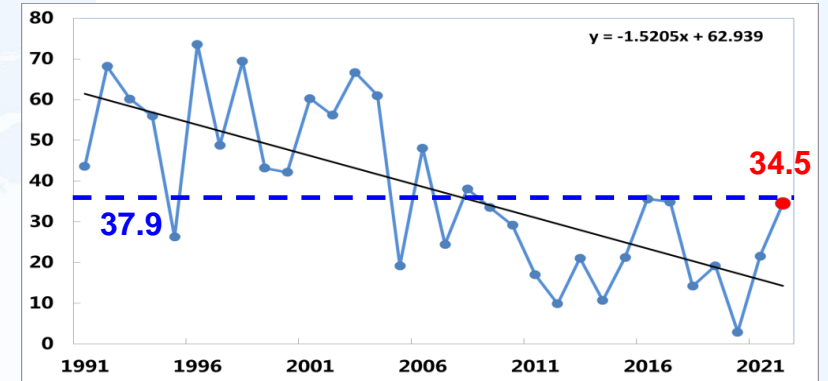


Typical AD type negative phase of summer circulation

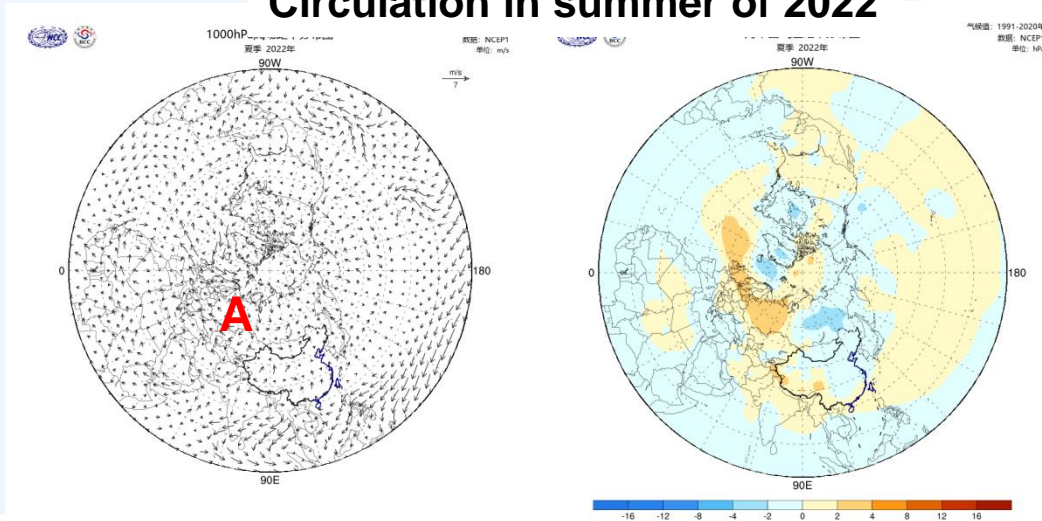


Summer mean anomalies in (a) 10-m wind (m s^{-1}), (b) SLP (hPa). Values are derived from linear regression on the normalized negative AD wind pattern using detrended data.

SCI of Key regions in September (60.5-149.5E, 76.5-83.5N)



Circulation in summer of 2022



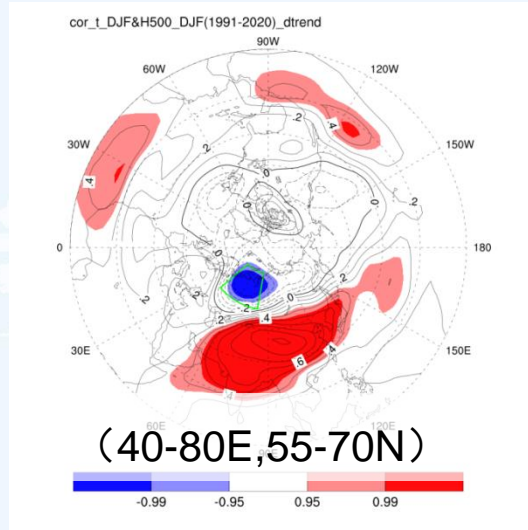
Summer Arctic dipole wind pattern affects the following winter Siberian high, *Inter. J. Climatology*, 2016

- ✓ This study investigates the relationship between the summer (JJA) Arctic dipole wind pattern and the following winter (DJF) Siberian High.
- ✓ The wind pattern is significantly correlated with the strength of the Siberian High during the following winter and with the frequency of extreme cold events over East Asia during the winters of 1979–2014.

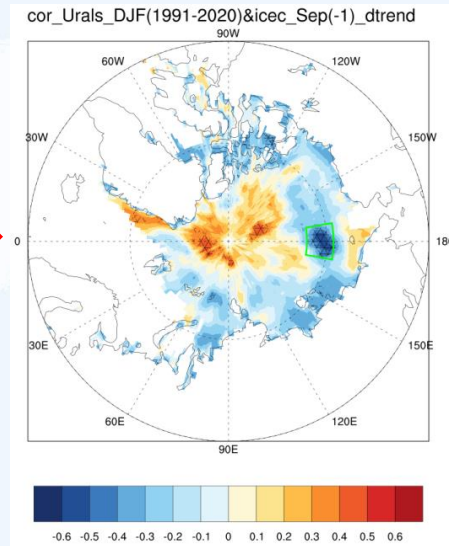
Possible impact of SIC on Ural blocking



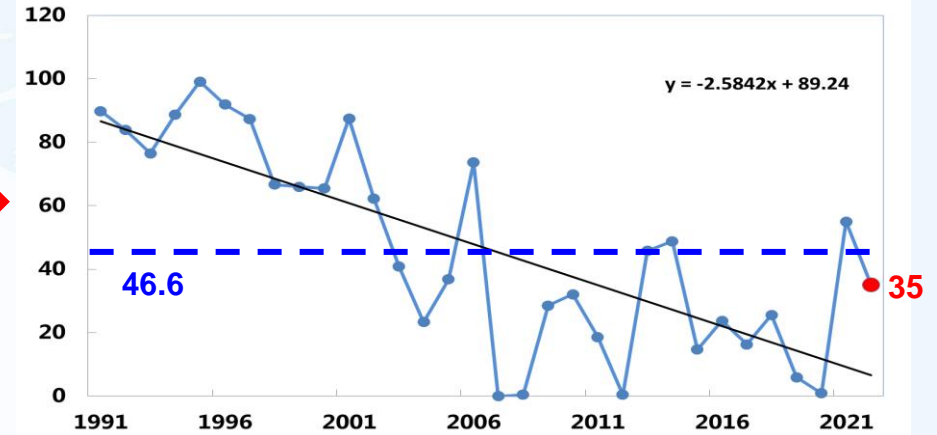
Cor_T&H500_DJF



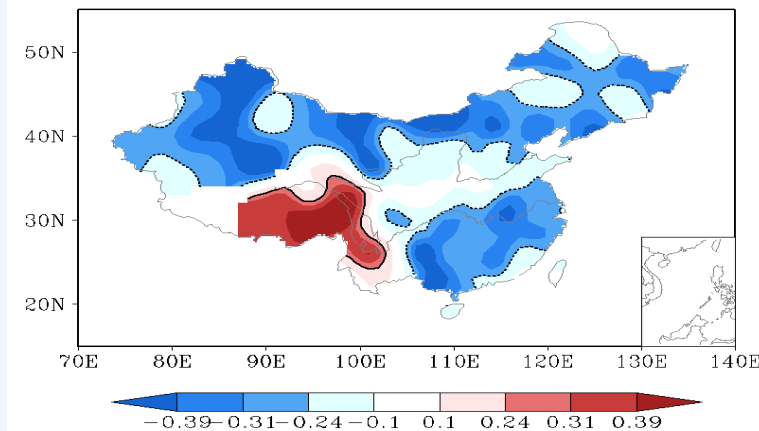
Cor_Urals_DJF&SIC_Sep



SCI of Key regions in September
(170E-170W, 74-78N)

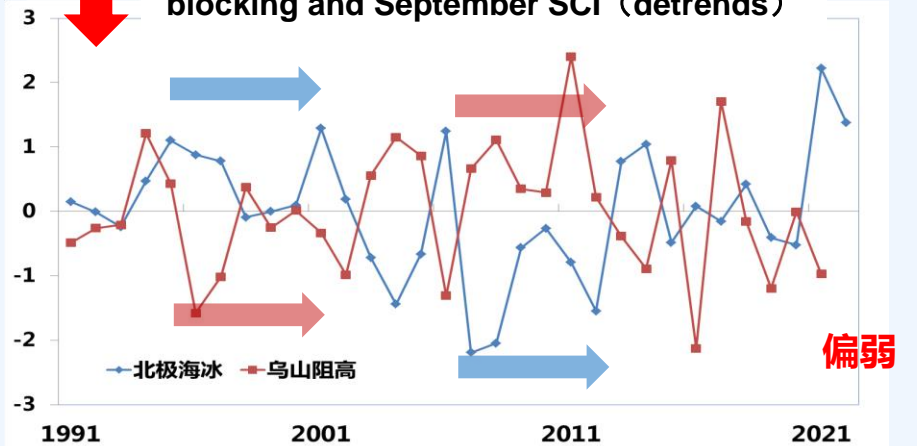


Cor_T&Urals_DJF



The SIC in the key area is more after detrended, which is not conducive to the Ural blocking activities.

Correlation coefficients between the Ural blocking and September SCI (detrends)

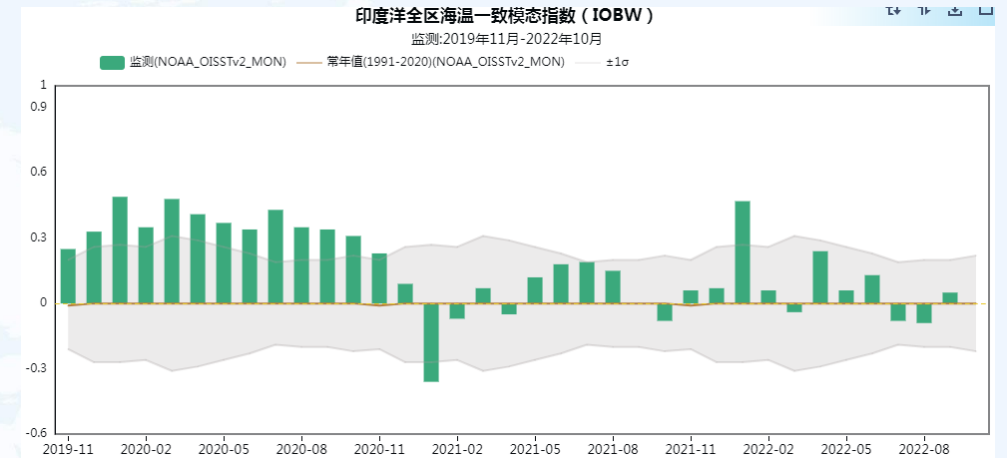
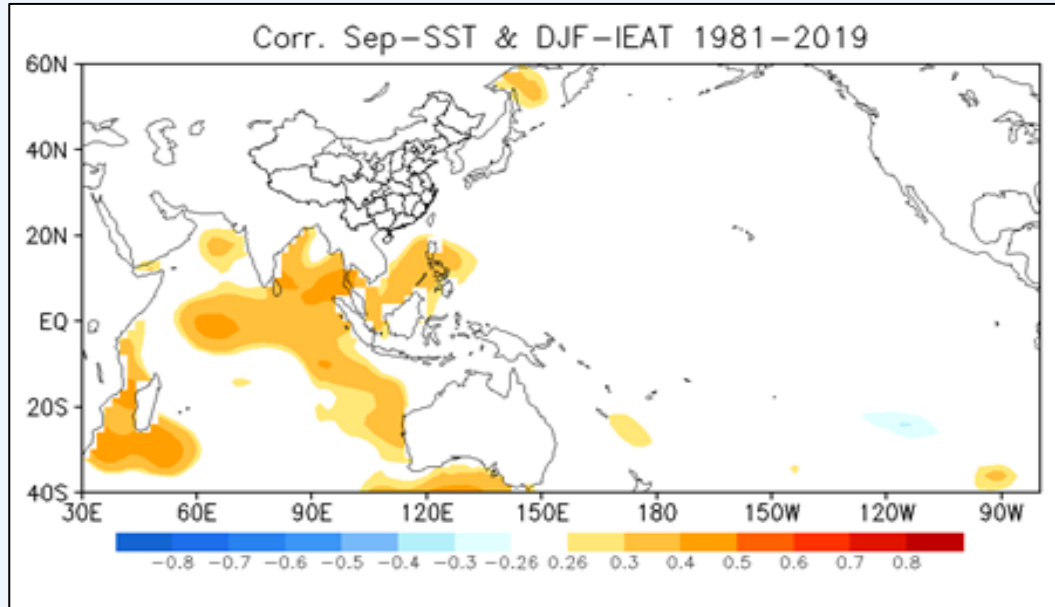


Cor = -0.55, 99%

Impact of Indian Ocean-- EAT



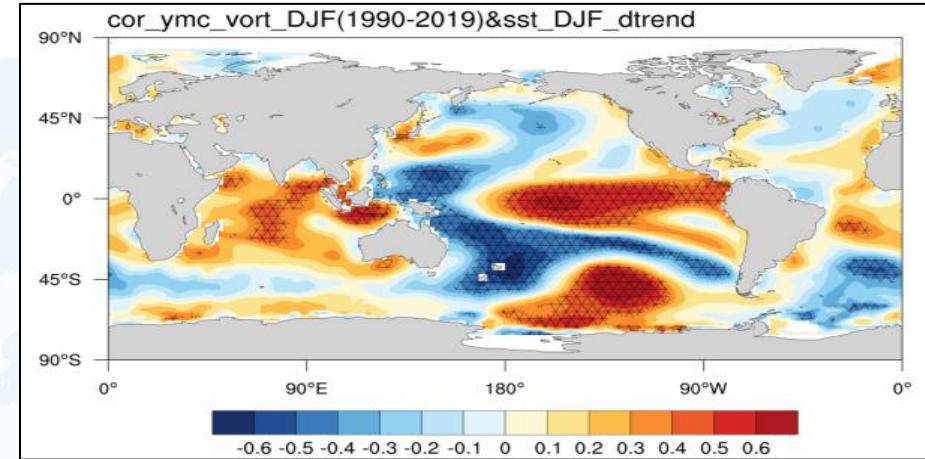
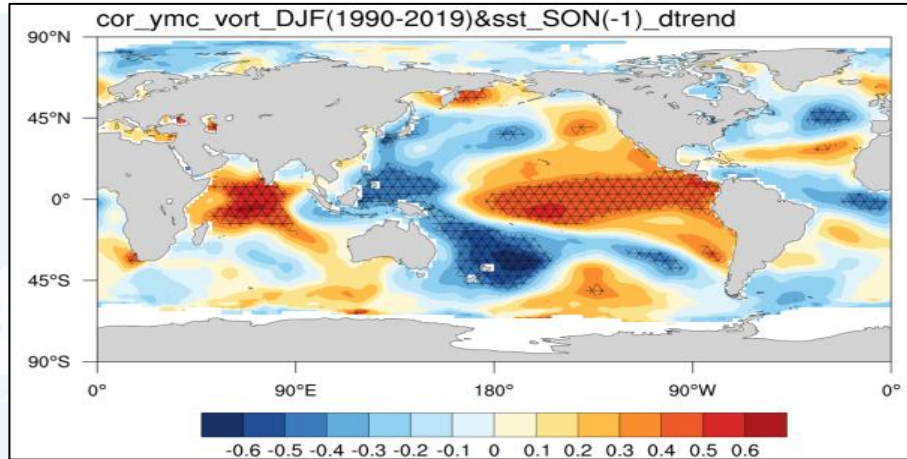
IOBW : 0.05



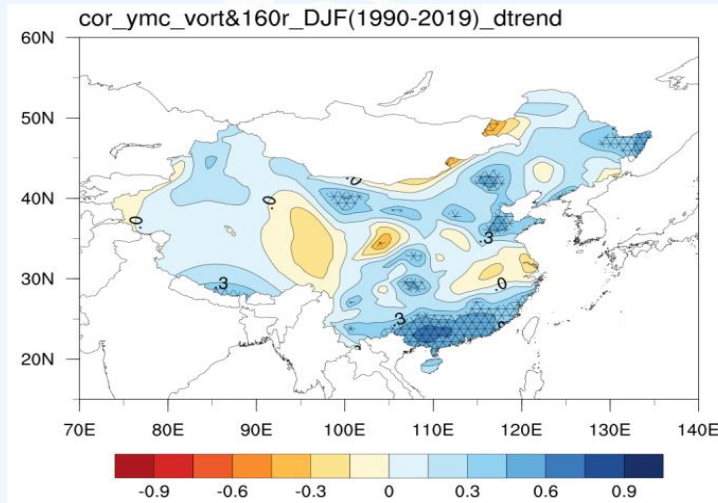
Correlation coefficients between the EAT index and SST in the preceding Sep.

- Positive SSTA over tropical Indian Ocean during the preceding September indicates weak EAT in the coming winter.
- IOBW index in Sep 2022 is near to normal, and that favorable to a **normal EAT** in the coming winter.

Impact of SST -- IBT



Correlation coefficients between the IBT index and SSTA in the preceding autumn(left) and winter(right).



vorticity of 700hPa, (80-100E,15-25N)

- IBT in winter shows positive correlation with precipitation of winter over Southern China.
- Negative SSTA over central-eastern tropical Pacific during autumn and winter indicates **weak IBT** in the coming winter.

Summary of Outlook for Winter Circulation in 2022/2023

- EAWM: **weak**
- Siberian High: **weak**
- East Asian Trough: **normal**

Warmer than normal
(clim: 1991-2020) over
most of China

- Western Pacific Subtropical High: **weak**
- India-Burma Trough: **weak**
- UV850: **cyclone** anomaly around the Philippines.

Less than normal (clim:
1991-2020) precipitation
over southern China

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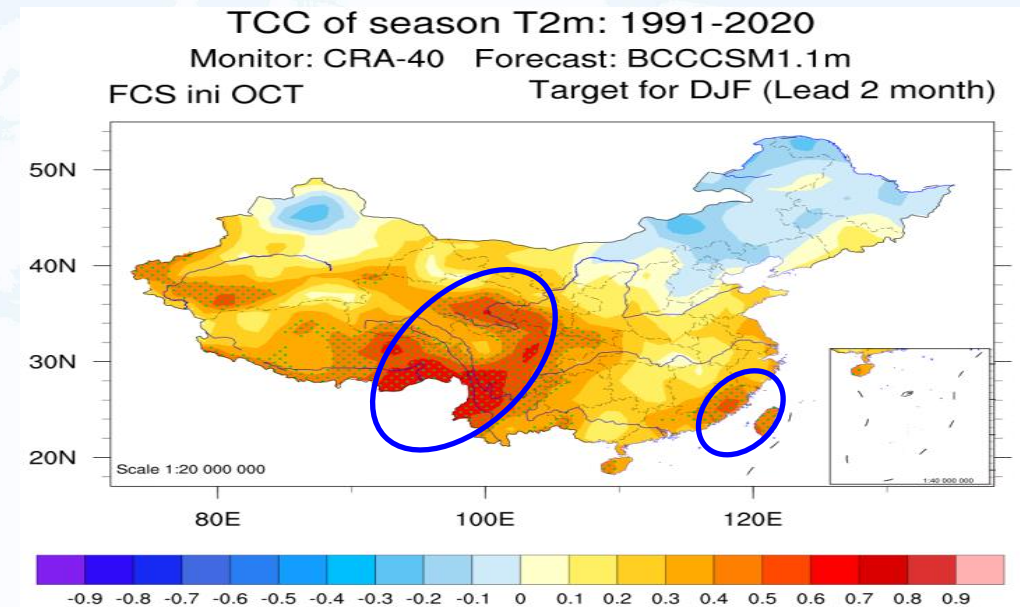
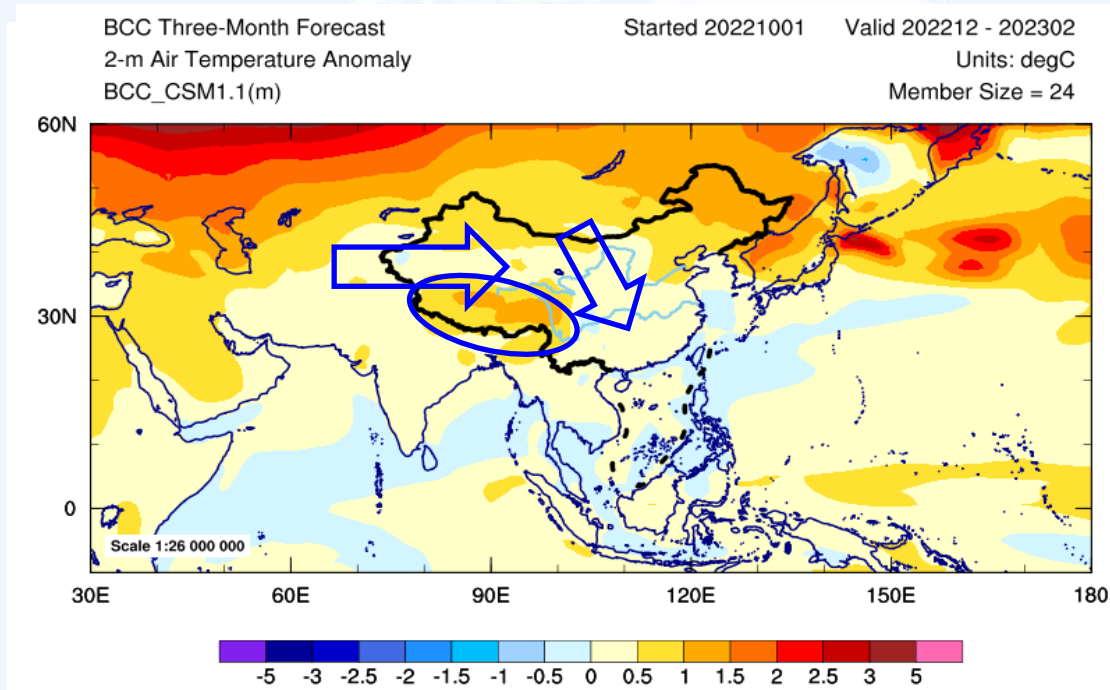
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Temperature – BCC_CSM1.1m

Prediction

Hindcast skill



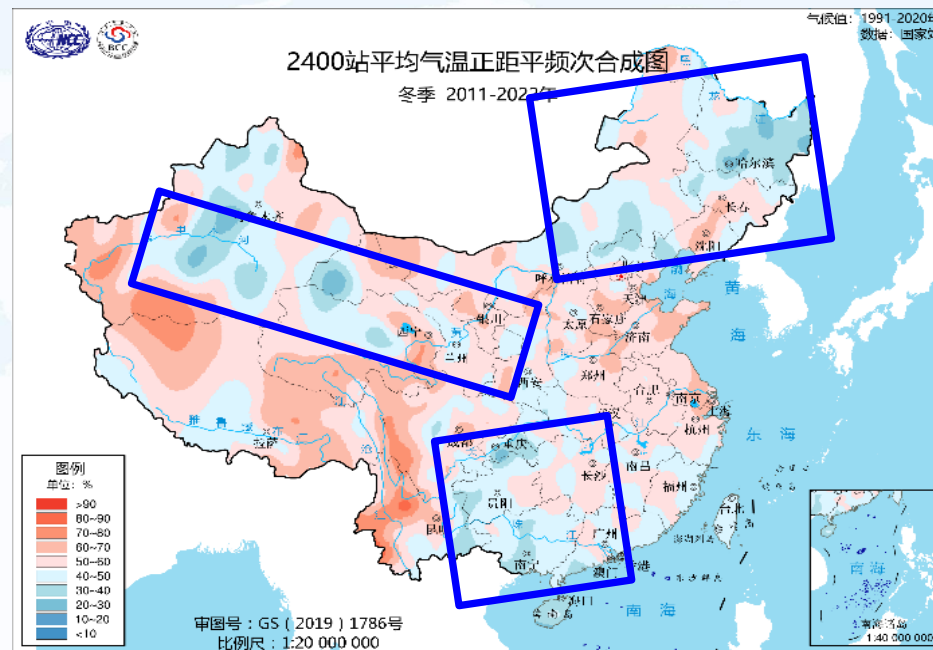
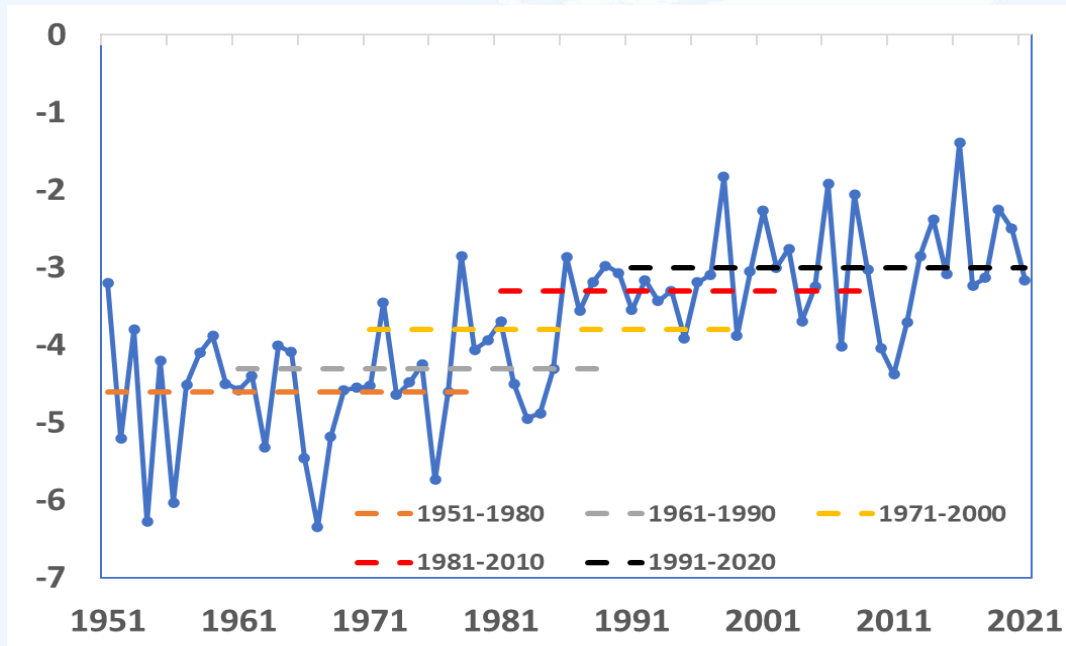
- ✓ Model prediction is skillful in most parts of China;
- ✓ The winter temperature in most parts of China will be above normal;
- ✓ Affected by the cold air of West Road, the temperature in central and western China is likely to be low.

Interdecadal signals of winter temperature in china



Chinese average temperature in winter from 1951 to 2021

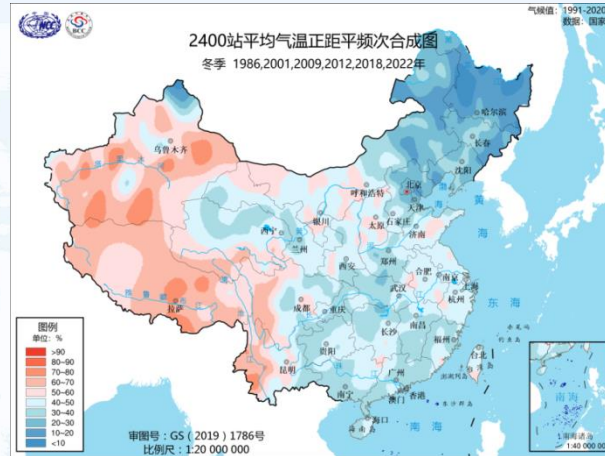
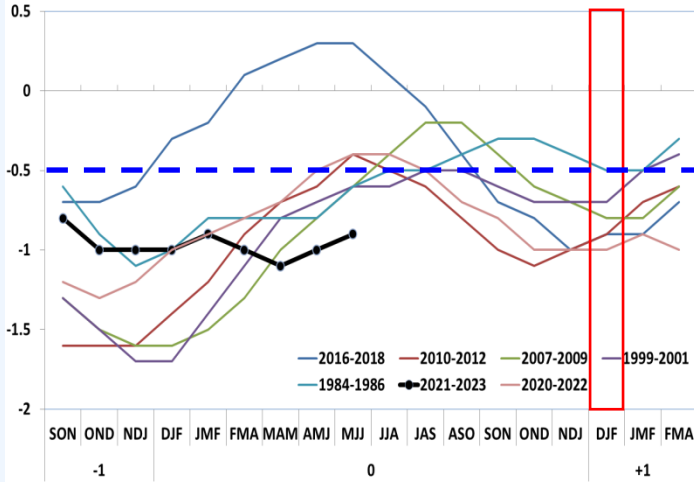
composite of positive anomaly frequency of winter temperature from 2011 to 2022



➤ The winter temperature in China is under the interdecadal background of warming.

Impact of La Niña

Composite of temperature



2021/2022

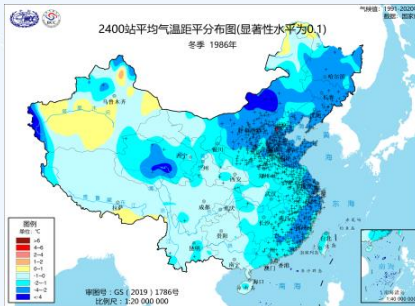
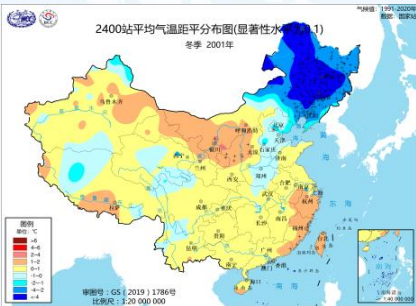
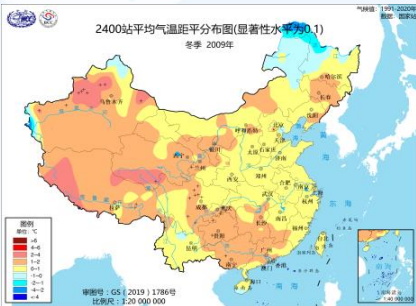
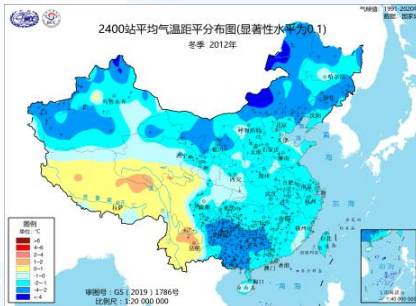
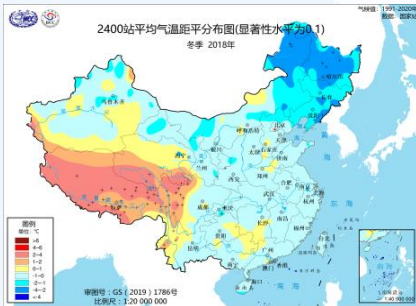
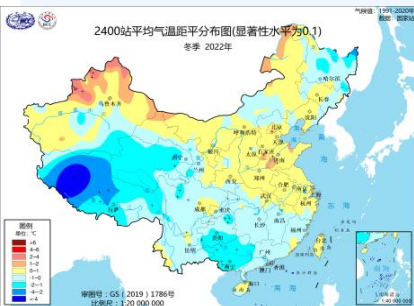
2017/2018

2011/2012

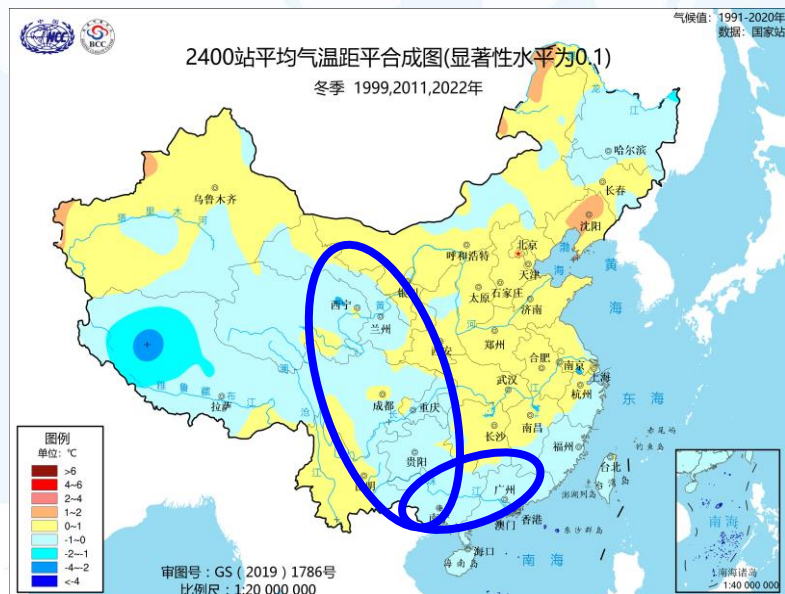
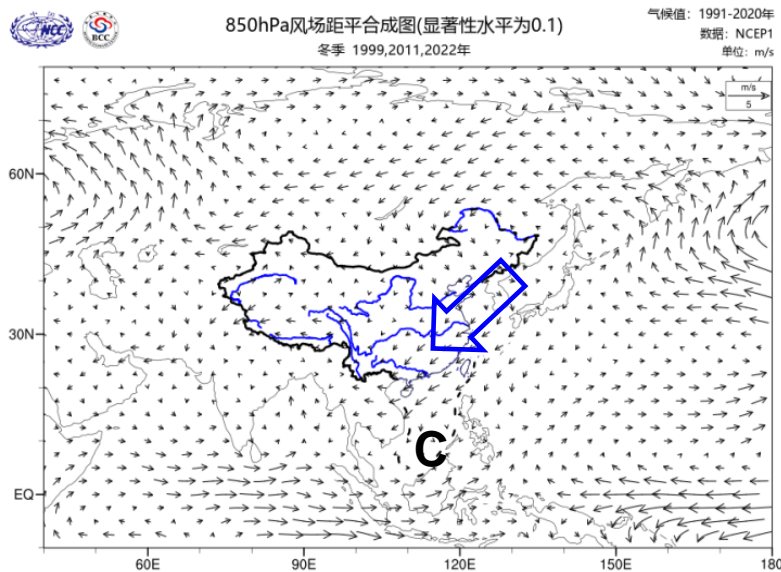
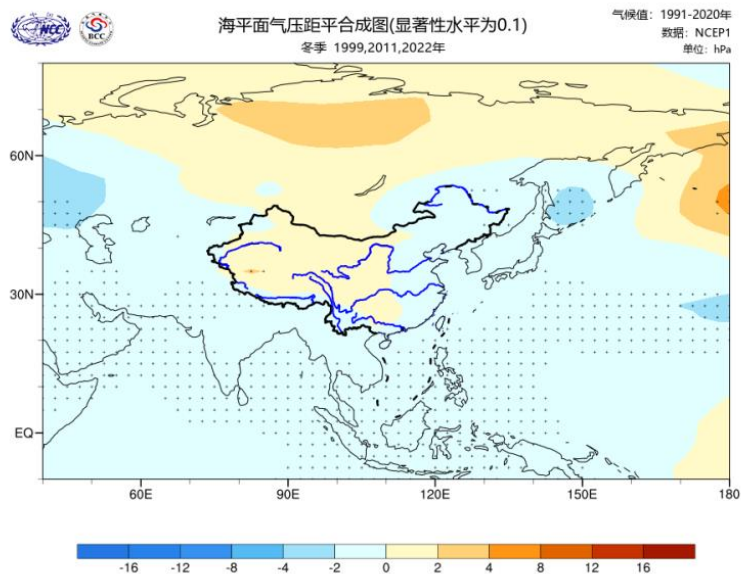
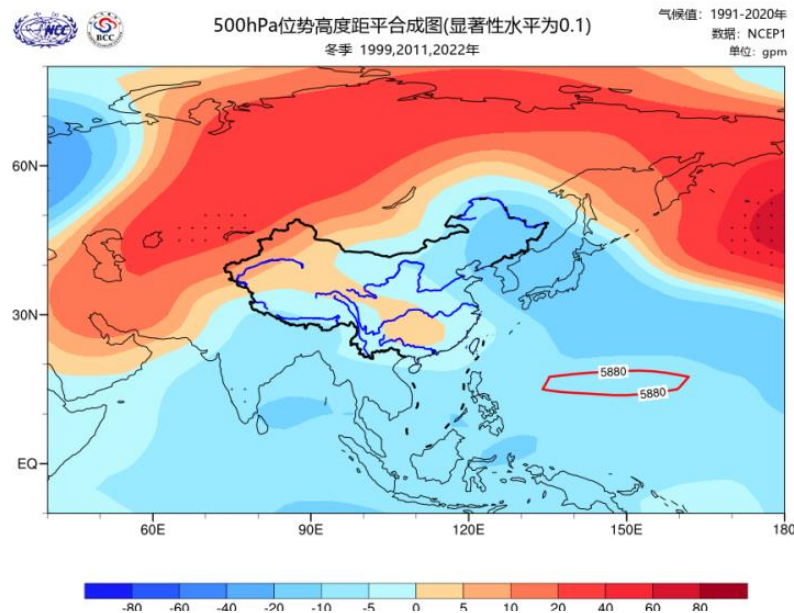
2008/2009

2000/2001

1985/1986



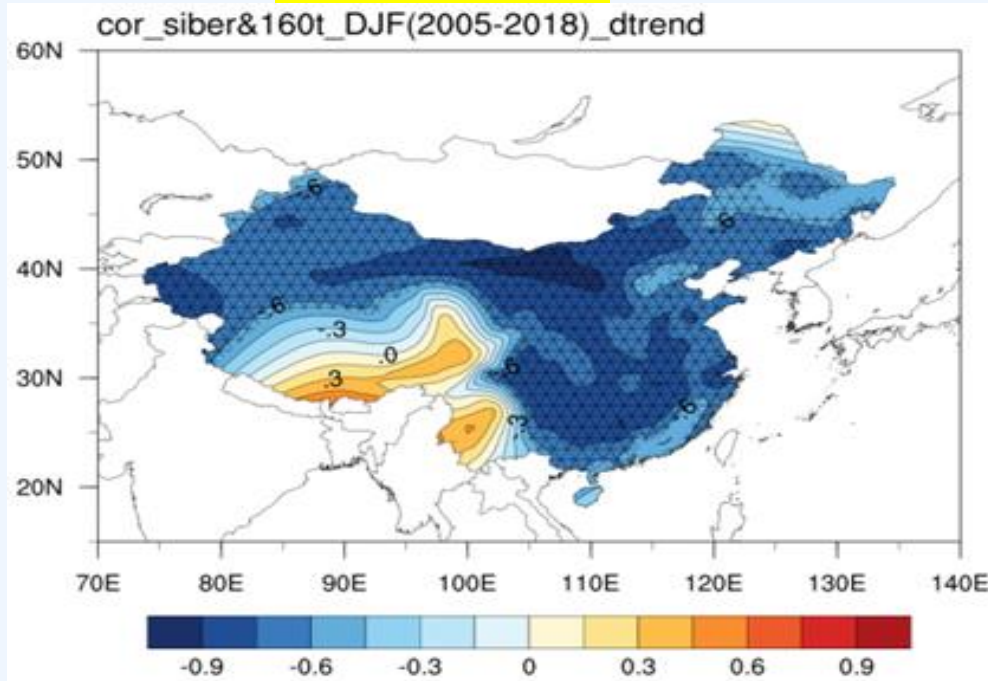
La Niña & Negative TIOD



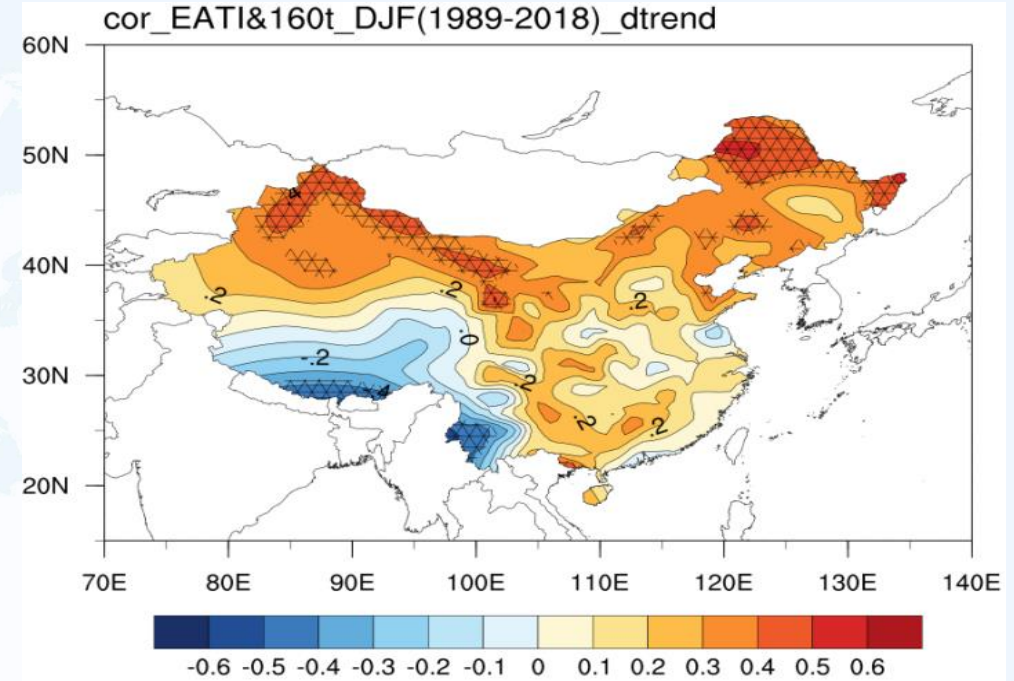
➤ La Nina winter and negative TIOD, the temperature in most parts of central and western China is likely low.

Correlation between circulation indexes and temperature

Siberian high



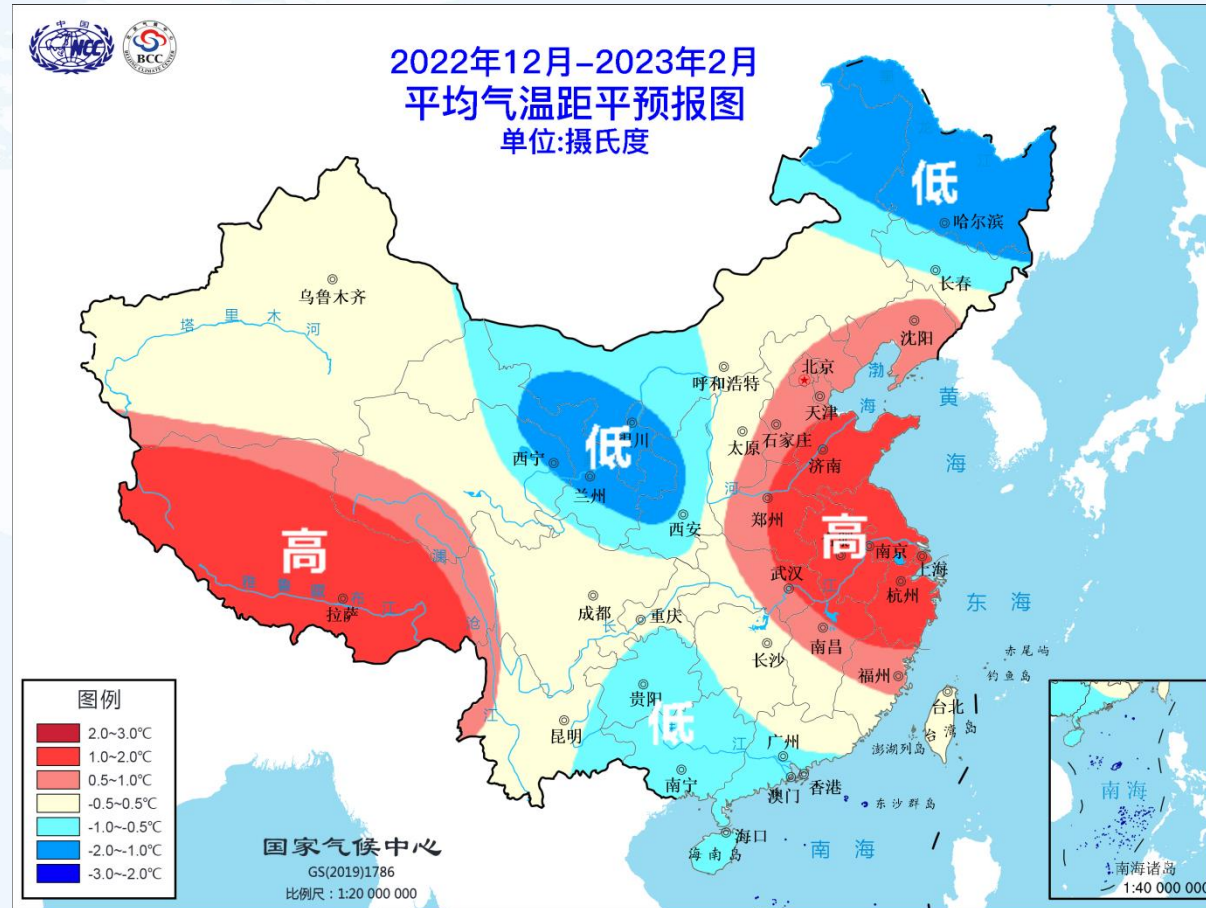
East Asia trough



Strong EAT (negative index) ->
Below-normal temperature over Northern China

Strong SH (positive index) ->
Below-normal temperature over most of China

Temperature forecast

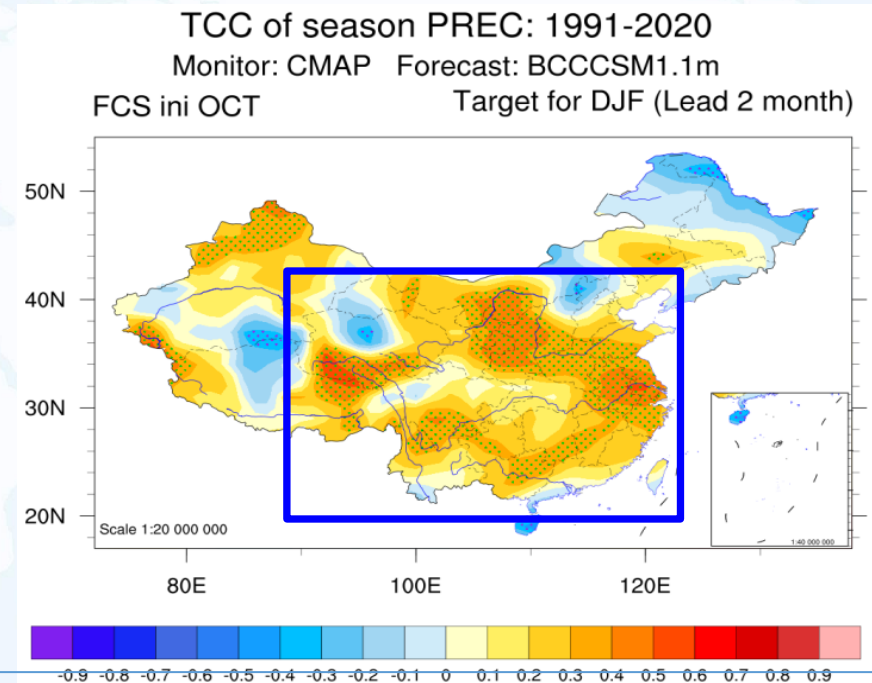
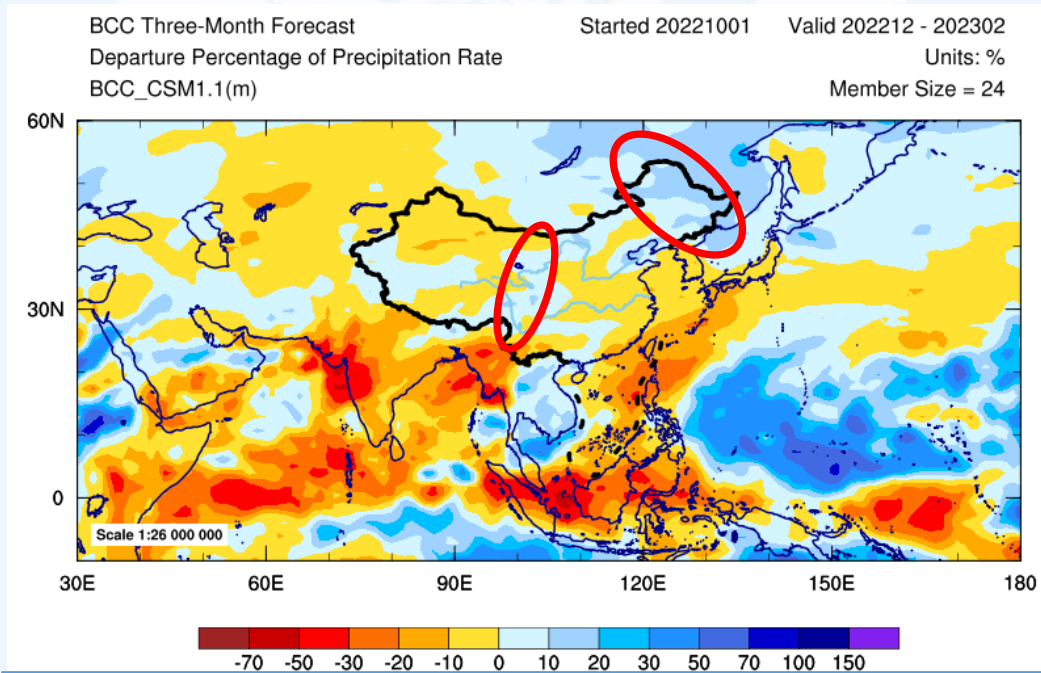


Clim: 1991-2020

Precipitation – BCC_CSM1.1m

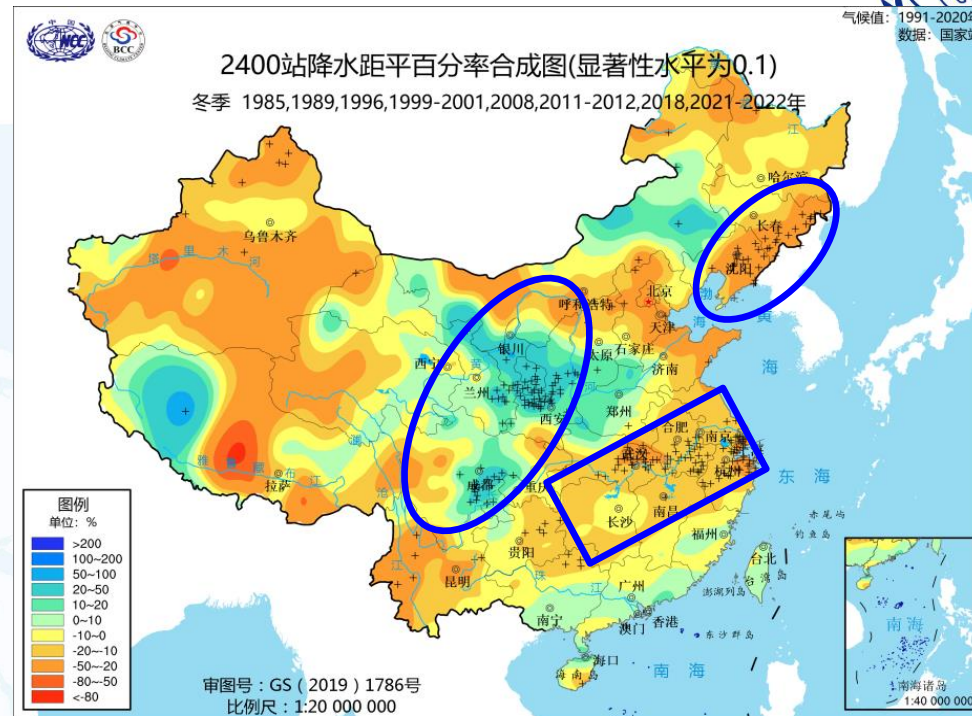
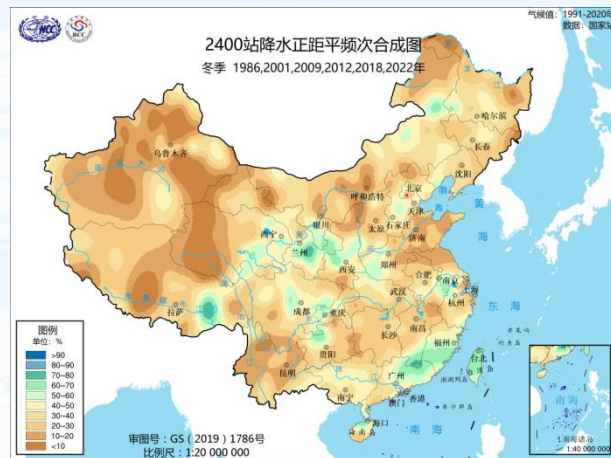
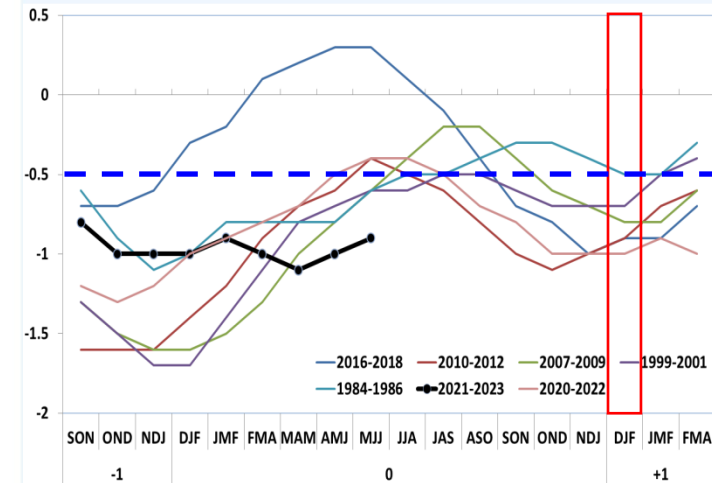
Prediction

Hindcast skill



- ✓ Model prediction is skillful in most parts of China;
- ✓ The precipitation in most regions of China will be less than normal in winter;
- ✓ more precipitation tends to occur over northern parts of China.

Impact of La Niña



2021/2022

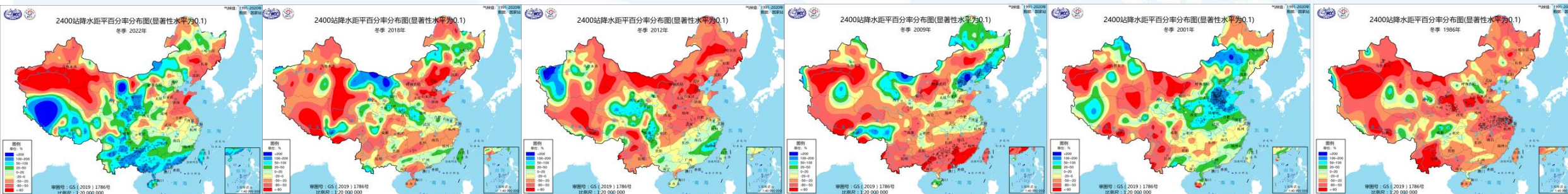
2017/2018

2011/2012

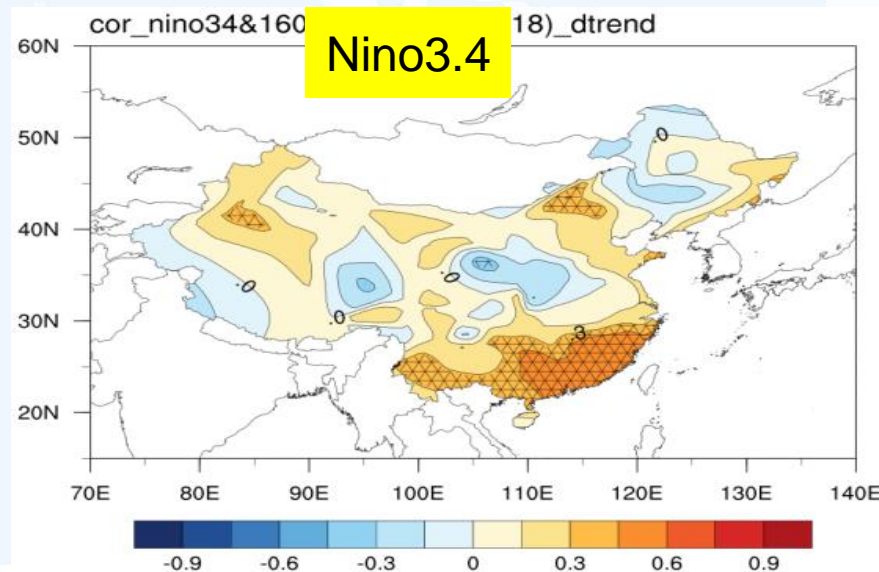
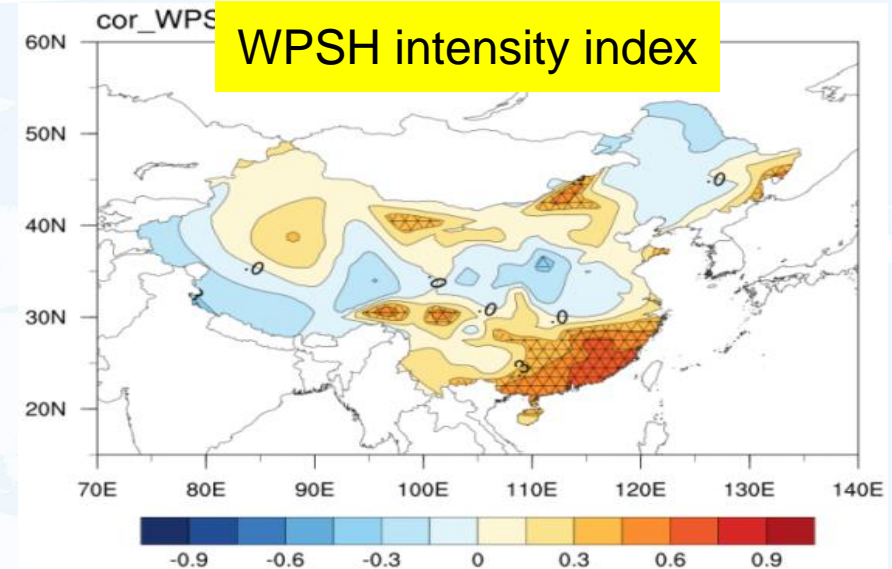
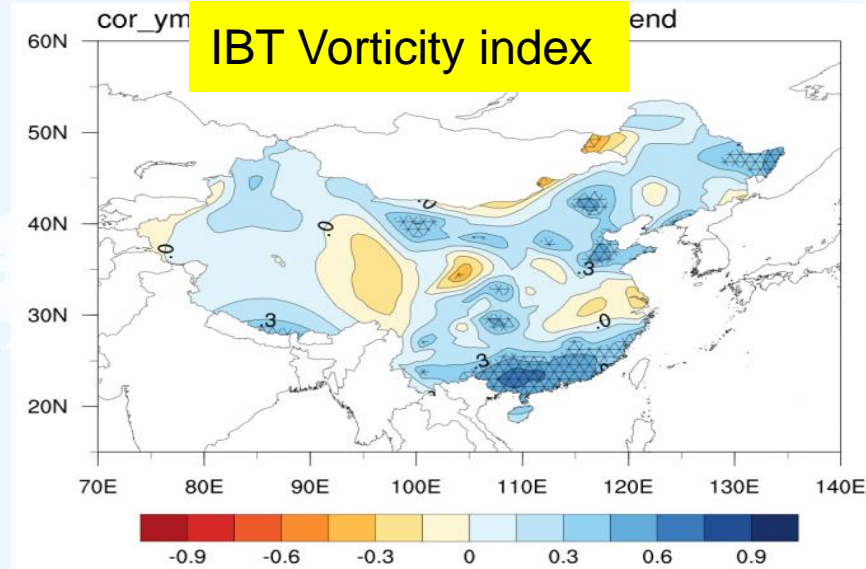
2008/2009

2000/2001

1985/1986



Correlation between circulation/sst indexes and precipitation

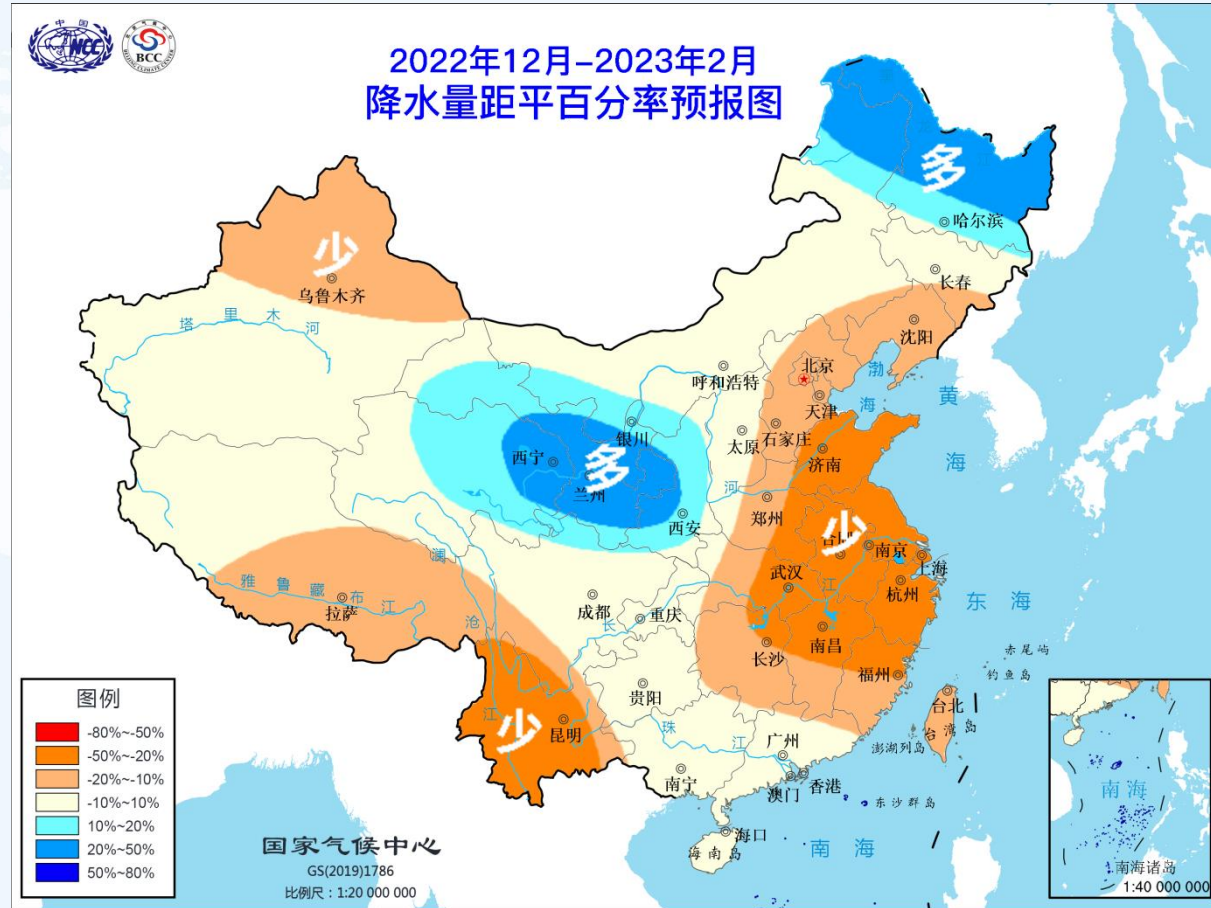


Weak IBT (negative index) ->
Below-normal precipitation over Southern China

Weak WPSH (negative index) ->
Below-normal precipitation over Southern China

Negative Nino3.4 index ->
Below-normal precipitation over Southern China

Precipitation forecast



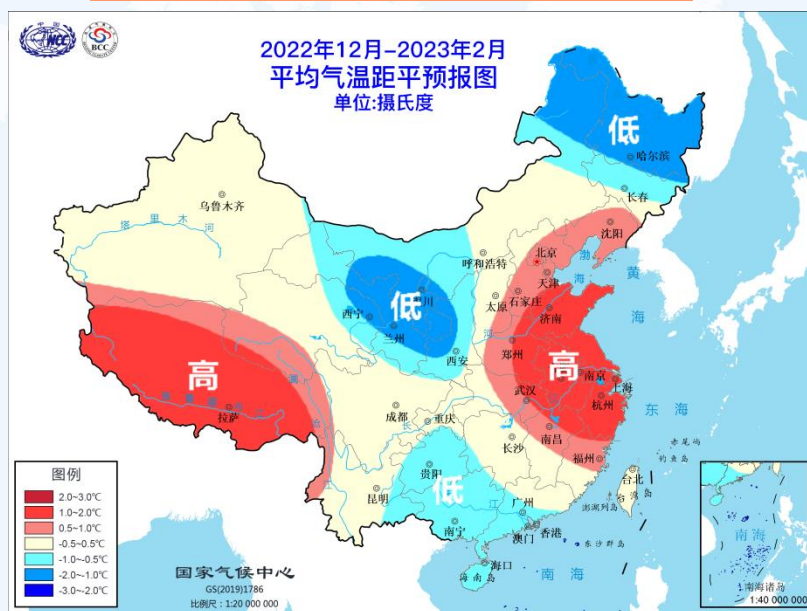
Clim: 1991-2020

Outlook for 2021/2022 winter

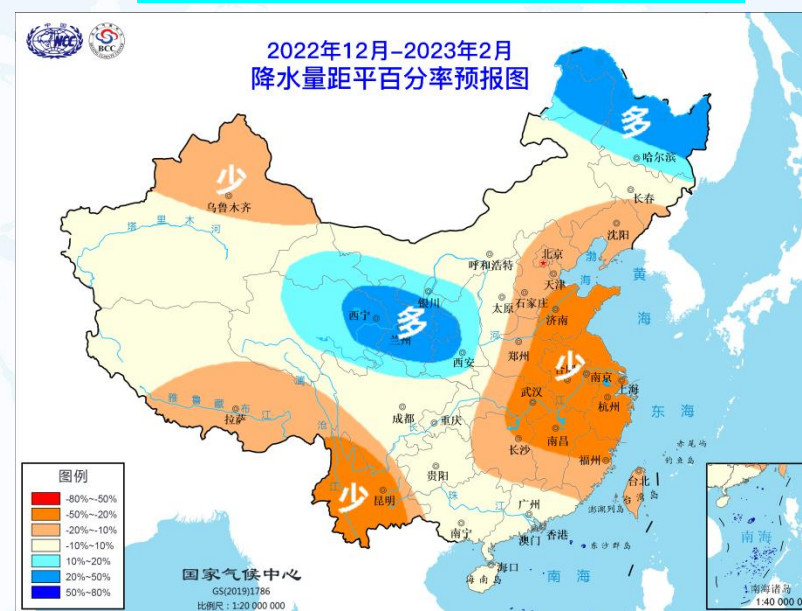


EAWM : strong

Temperature



Precipitation



- The **temperature** of most area of China will be normal to warmer.
- The **precipitation** will be above normal over Northeast China and Northwest China, but near or below normal over southern China.



THANK YOU!





Figure 1 Deterministic forecast of **Temperature**



Figure 2 Deterministic forecast of **Precipitation**