



Seasonal Climate Outlook for Winter 2021/2022 over China

Zhi Rong , Zheng Zhihai

Beijing Climate Center, China Meteorological Administration

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Outline

1. EAWM System

2. Outlook for EAWM

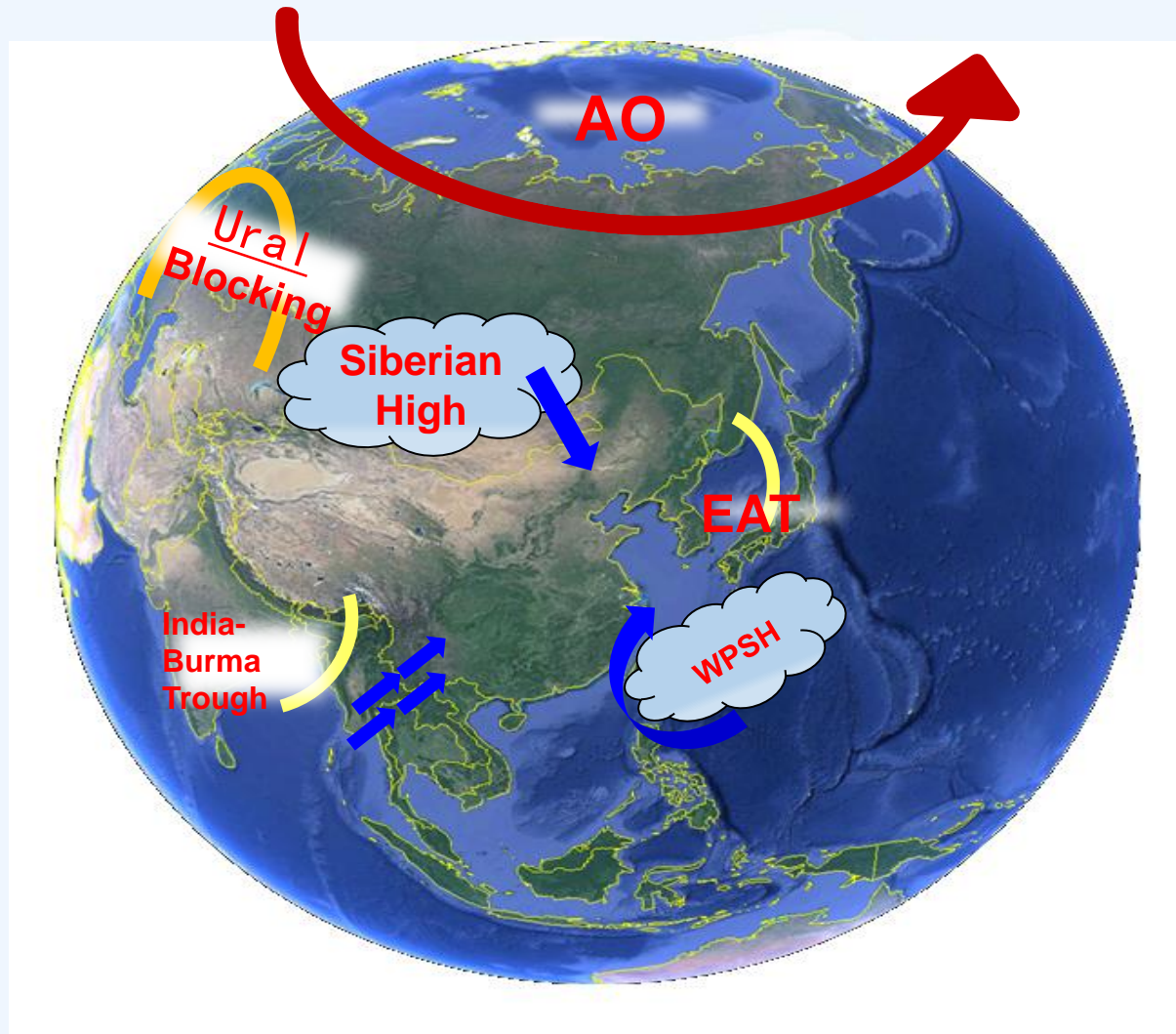
2.1 Prediction by BCC_CSM 1.1m, BCC/CMA

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

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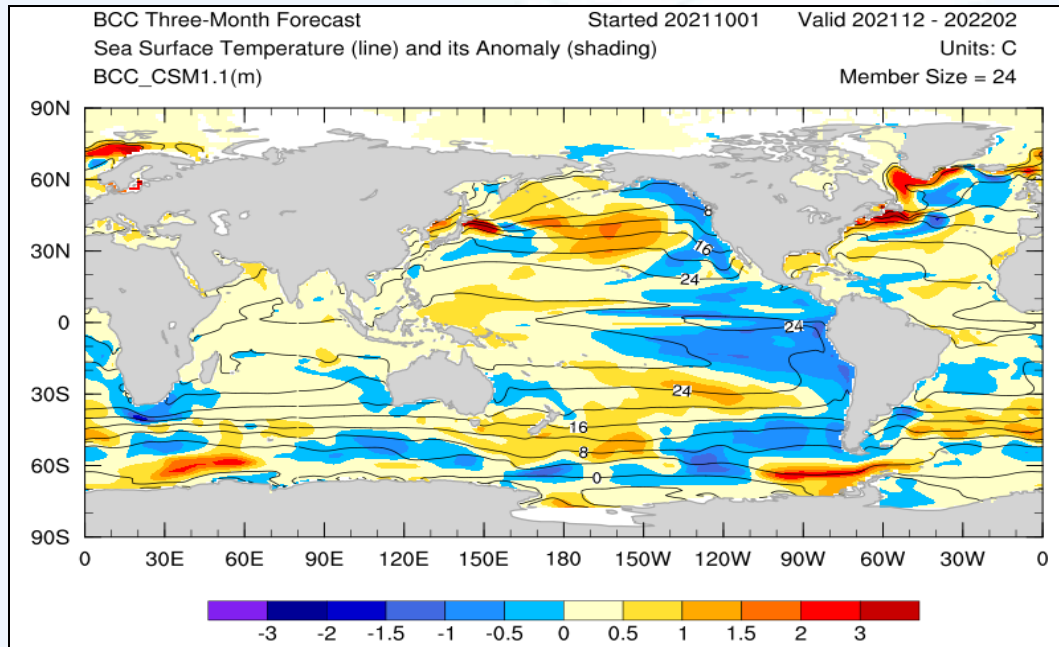
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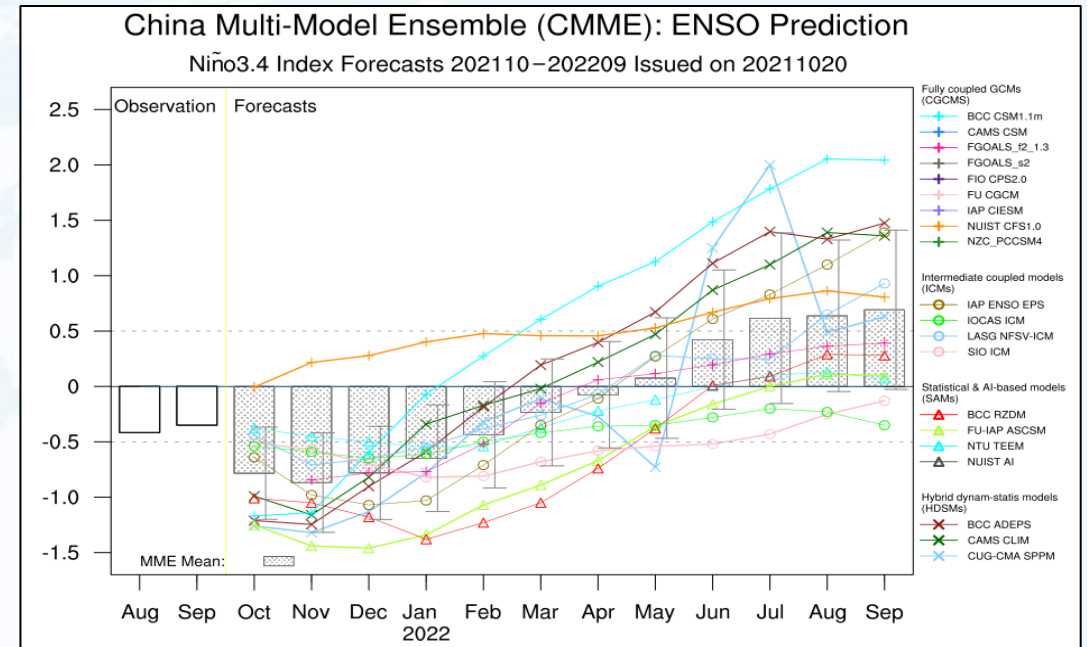
ENSO



BCC_CSM1.1(m)



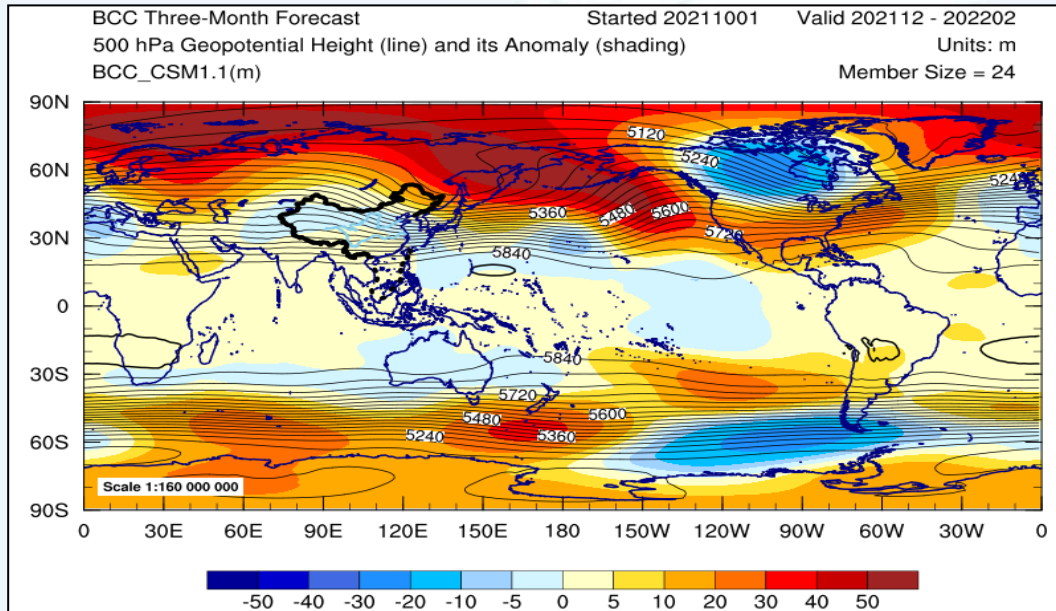
China Multi-Model Ensemble



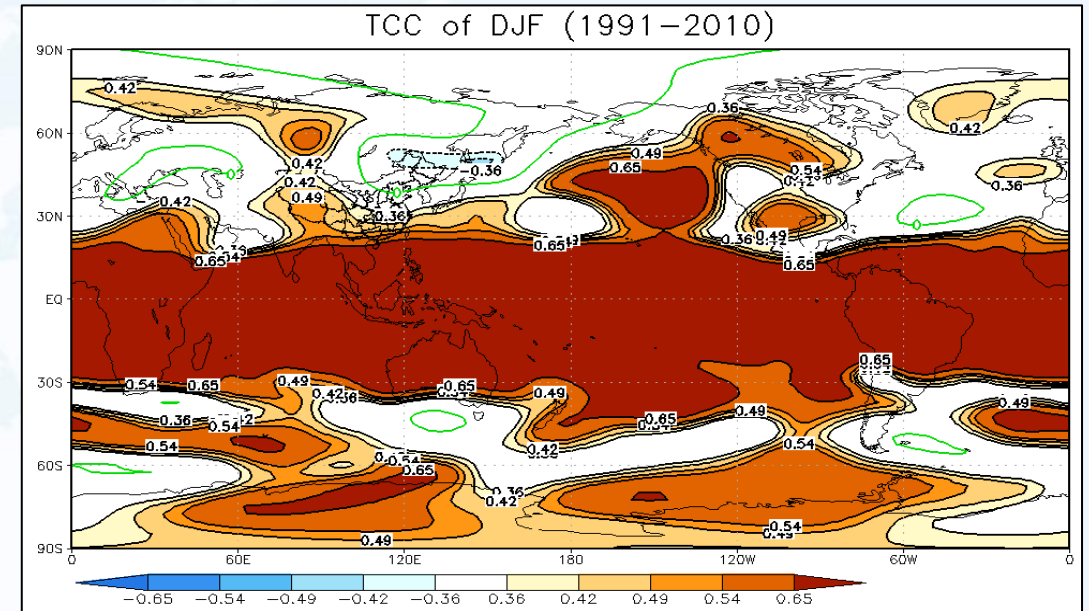
- In September 2021, the Niño3.4 index was **-0.35°C**.
- The latest model prediction indicate that negative SSTA is expected to develop in the central and eastern equatorial Pacific, and **possibly reach weak-moderate La Niña level during the coming winter.**

500 hPa GH

Prediction



Hindcast skill

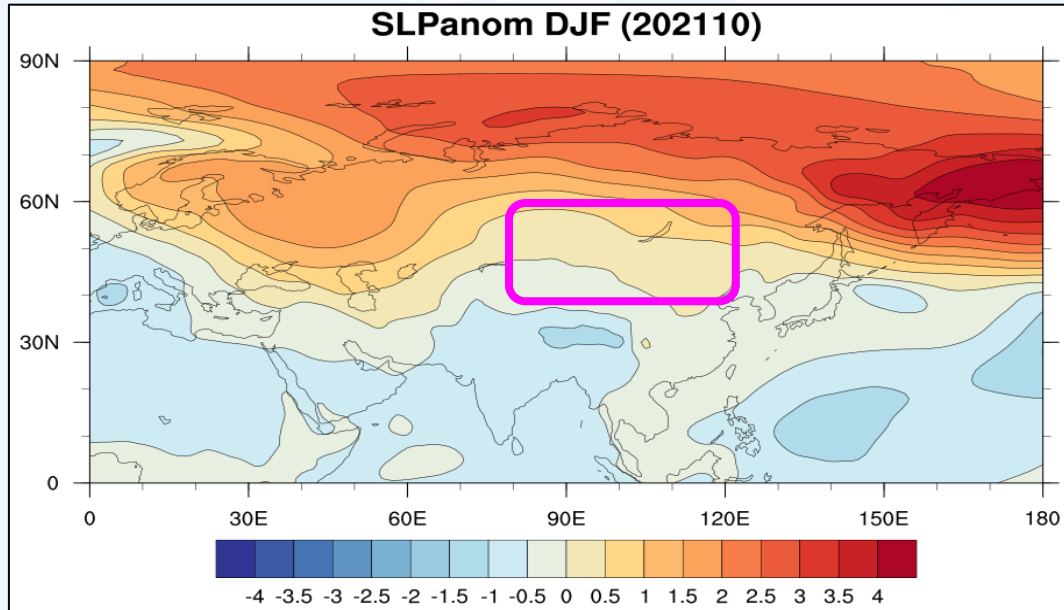


- Meridinal circulation over East Asia
- Negative AO
- Normal-weak East Asia trough
- Positive Tibetan Plateau height anomaly
- Weak west pacific subtropical high
- Weak India-Burma trough

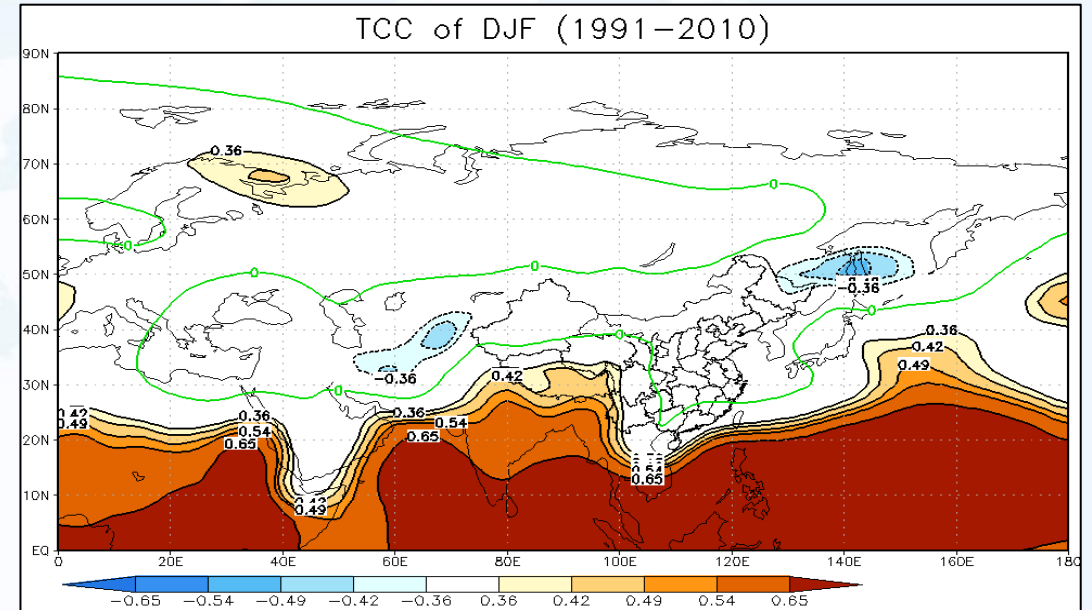
SLP



Prediction



Hindcast skill



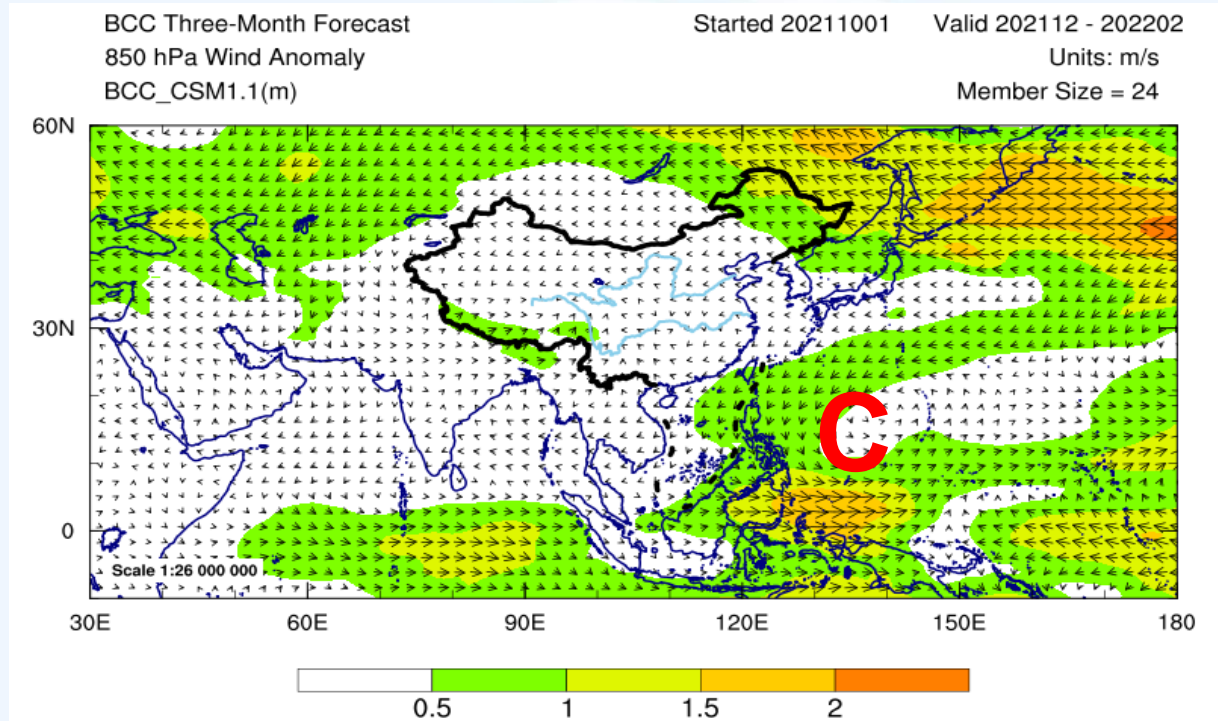
Strong Siberian High

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

850hPa wind

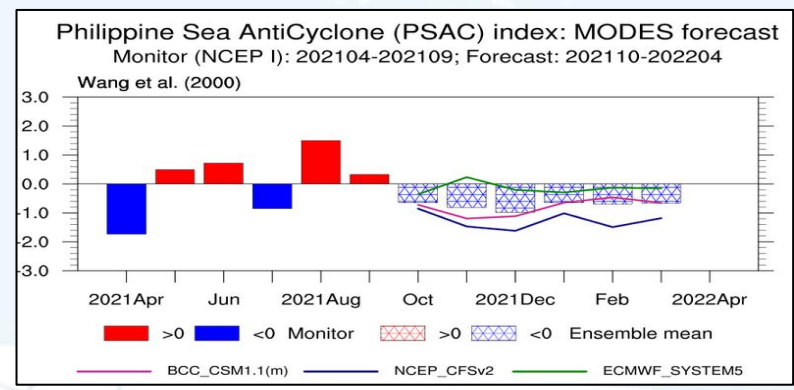
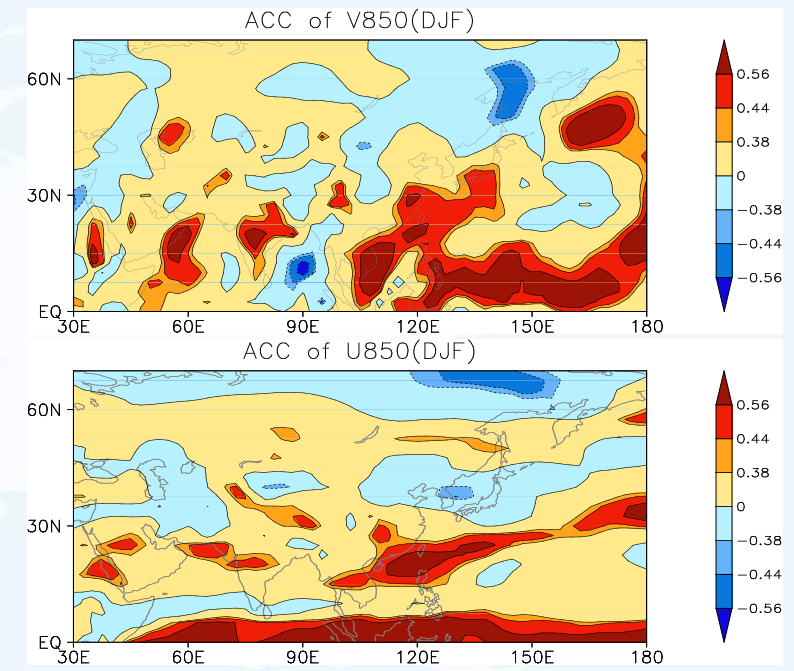


Prediction



- Weak northerly wind anomaly will dominate East Asia in middle latitude.
- Cyclone anomaly around the Philippines.
- Normal-weak India-Burma trough.

Hindcast skill





From BCC_CSM1.1(m)

- Weak-moderate La Niña
- Strong EAWM/Siberian High
- Meridional circulation over East Asia
- Negative AO
- Normal-weak East Asia Trough
- Positive Tibetan Plateau height anomaly
- Weak West Pacific Subtropical High
- Normal-weak India-Burma trough
- Weak northerly wind anomaly over East Asia
- Cyclone anomaly around the Philippines

Outline

1. EAWM System

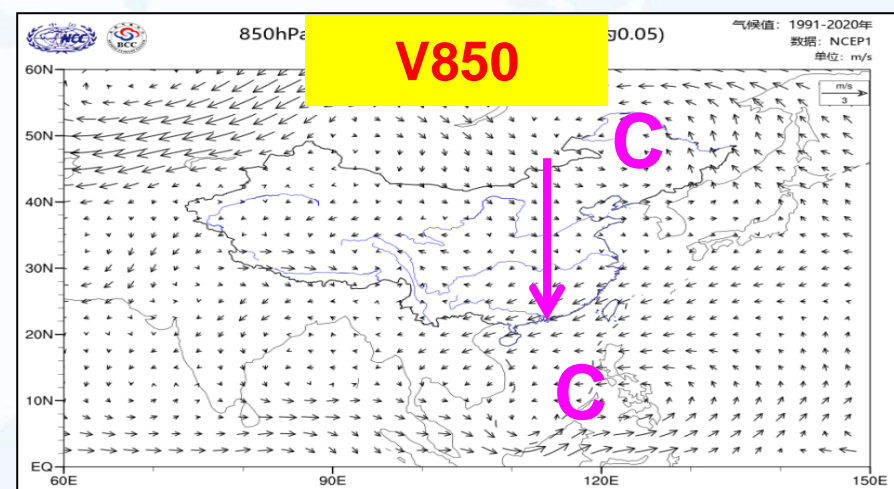
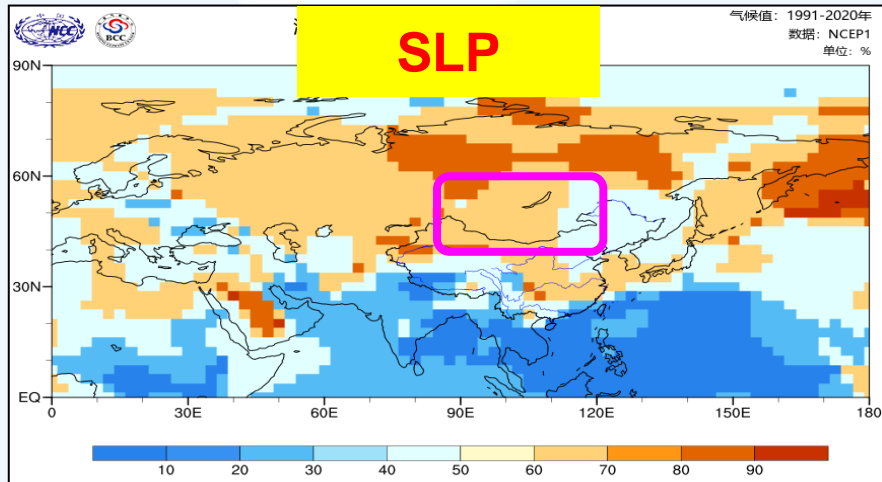
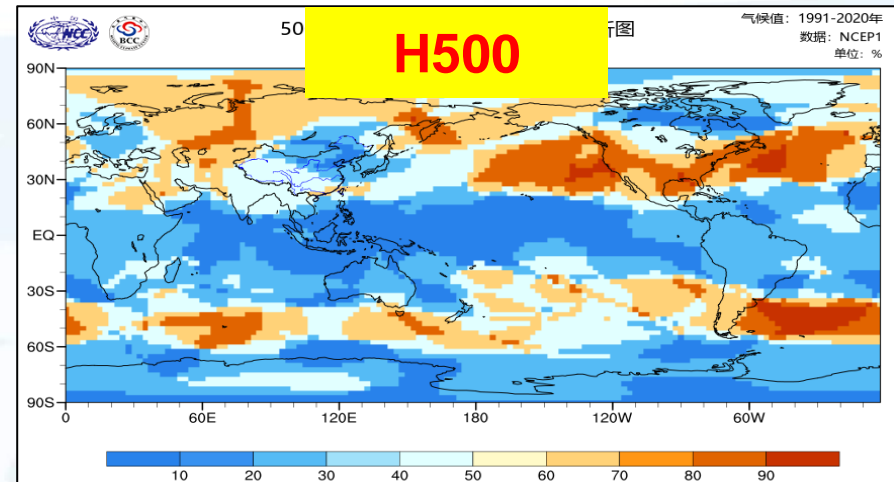
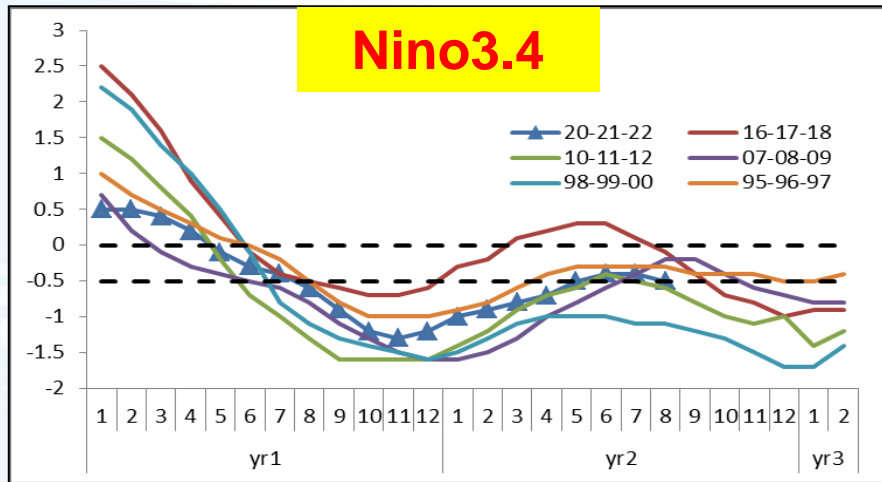
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2.2 **Statistic Analysis**

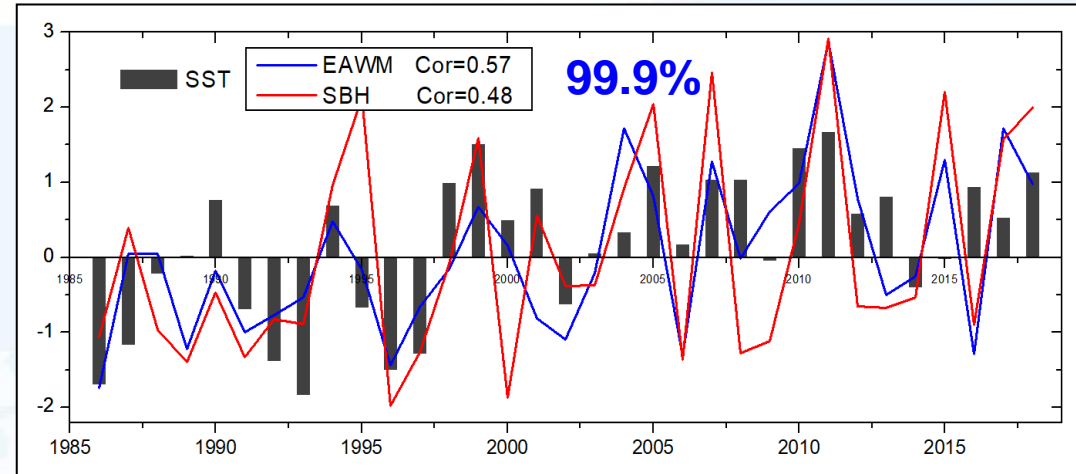
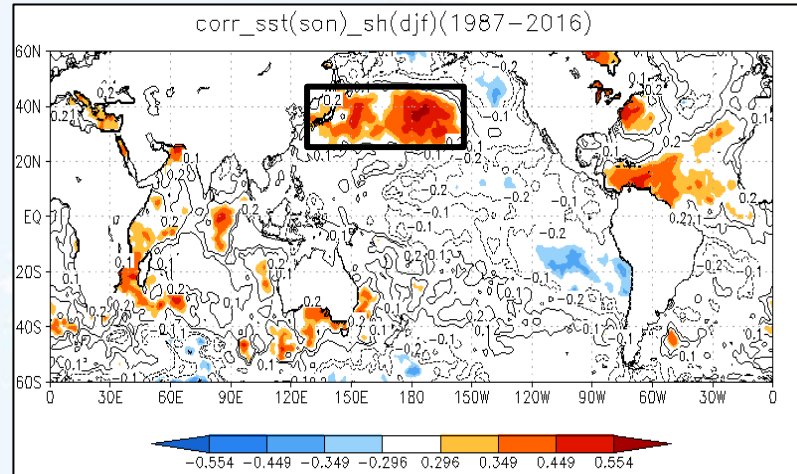
3. Outlook for temperature and precipitation over China

Impact of double-dip La Niña

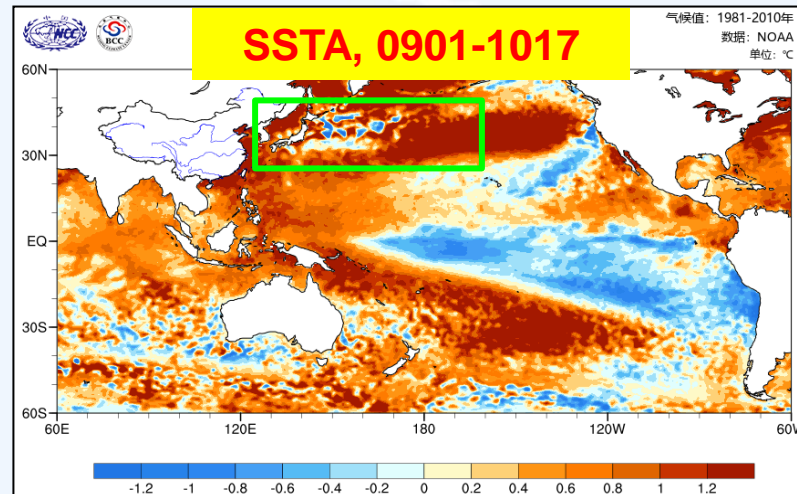


Weak Siberian High. Strong East Asian trough. Low-level anomalous northerlies over East Asia. WPSH extending more westward and southward. Anomalous anticyclone around the Philippines.

Impact of Kuroshio -- SH

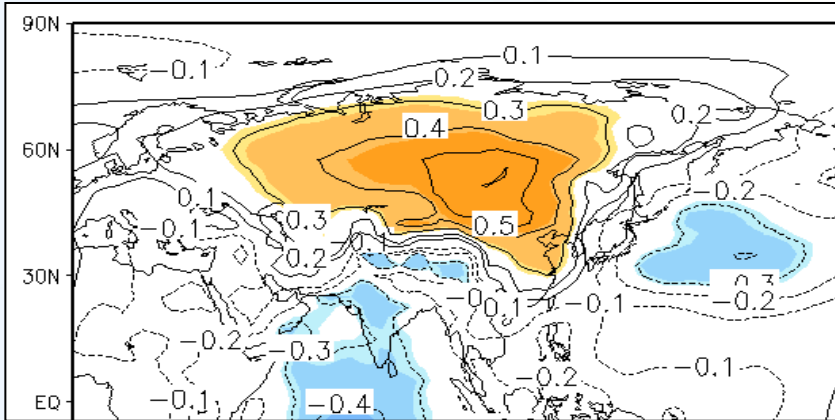


Correlation coefficients between the SH index and SST in the preceding autumn.

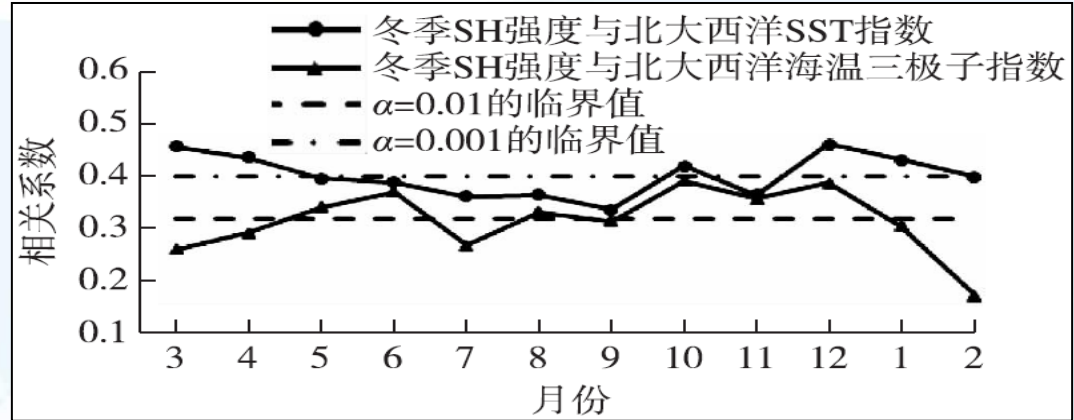


- In autumn, the significant response of EAWM to SSTA occurs in the **mid-latitude Pacific**.
- The **warmer** (cooler) autumn SST in the mid-latitude Pacific is favorable to the occurrence of a **stronger** (weaker) EAWM.
(Chen Haishan et.al, 2002; Liu Shi et. al,2010)

Impact of North Atlantic-- SH

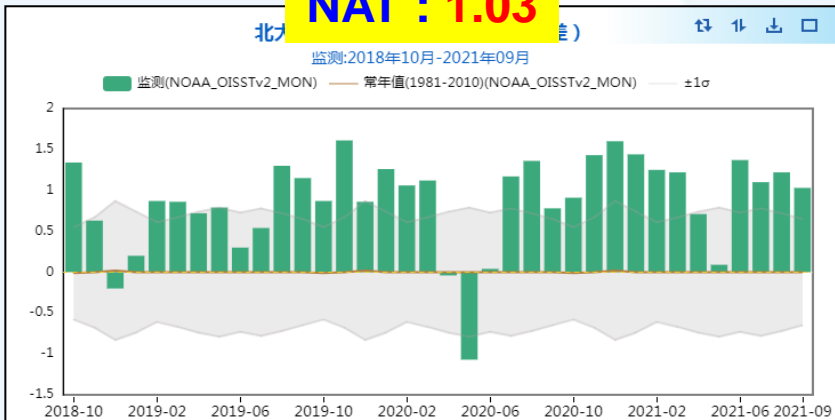


Regression map of SLP in the corresponding winter against the winter NAT index.



Monthly correlations of the NAT index from March in the current year to February in the next year with the winter SH index

NAT : 1.03

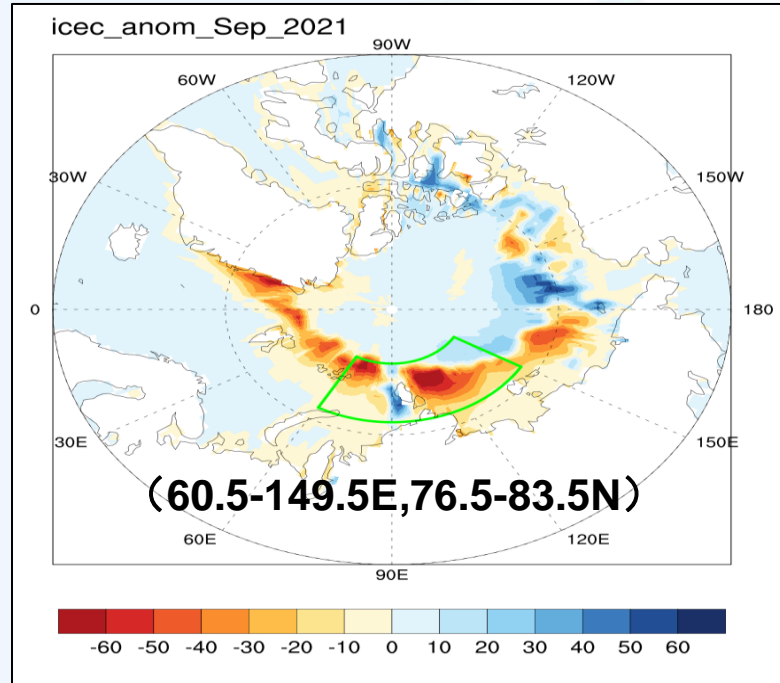


➤ An anomalously high (low) NAT index in all seasons can together make the winter SH stronger (weaker).

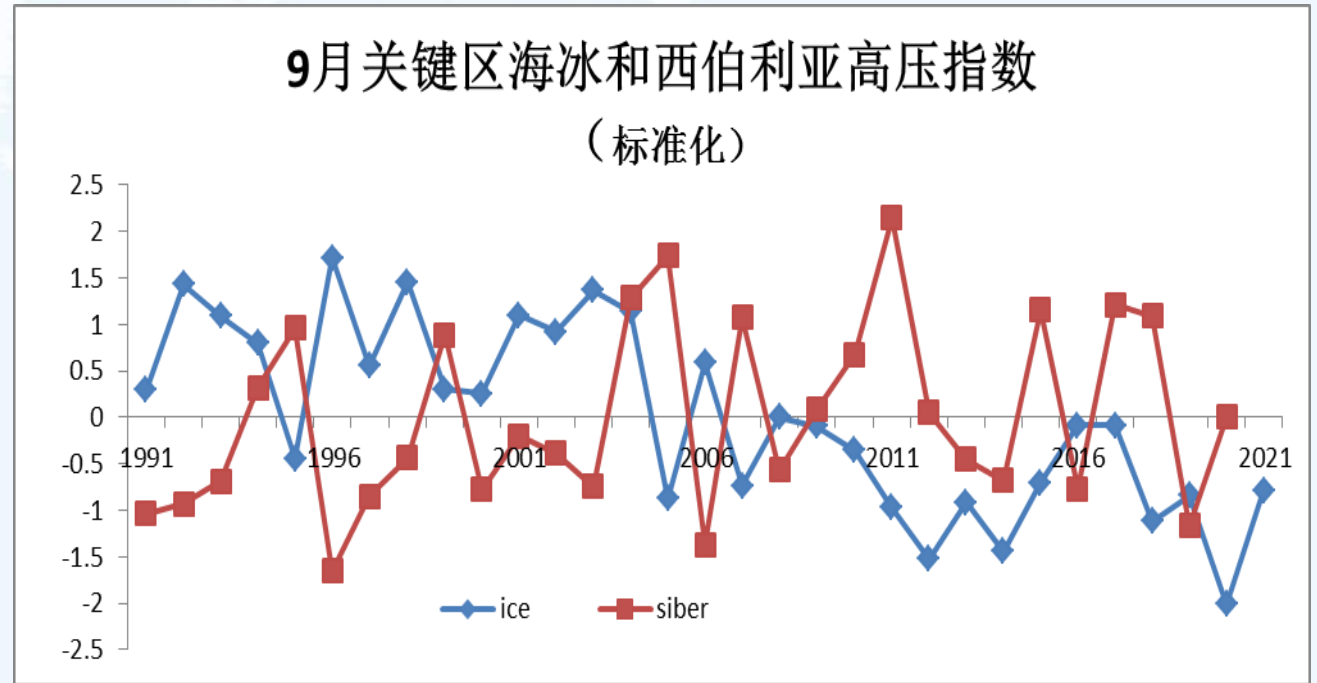
(Li Dongliang and Lan Liuru, 2017)

Possible impact of SIC in Arctic

SIC anomaly in Sep 2021

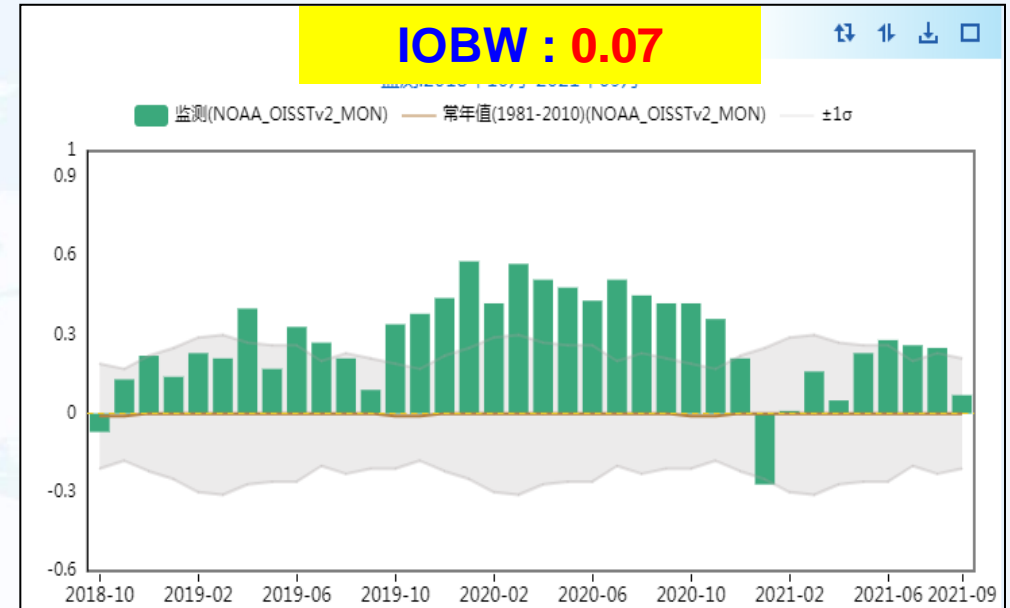
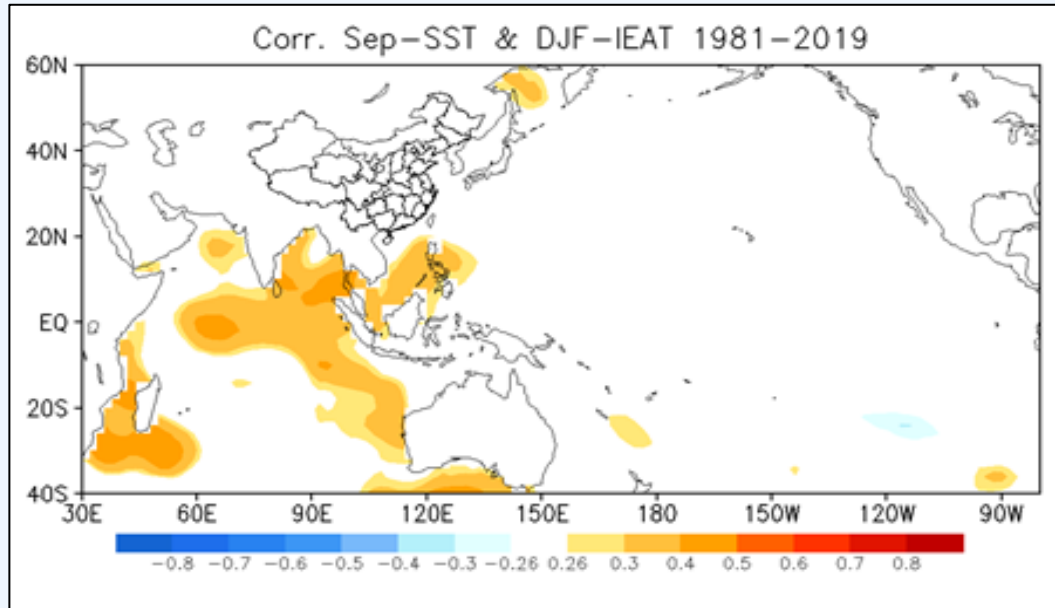


SH in DJF and SIC in Sep (standardized)



- ❑ Studies have shown that **Arctic sea ice concentration** provides a potential signals for winter Siberian High.(Wu et al., 2011, 2012, 2016, 2021) . There is a significant **negative correlation** between sea ice anomalies over Barents-Kara Sea in Sep and the SH in winter.
- ❑ **SIC in Sep 2021 is favorable to a stronger Siberian high in the coming winter.**

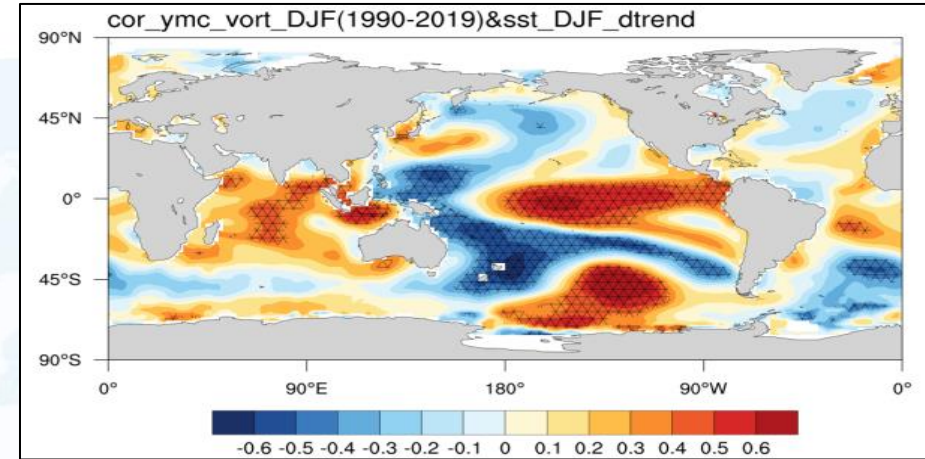
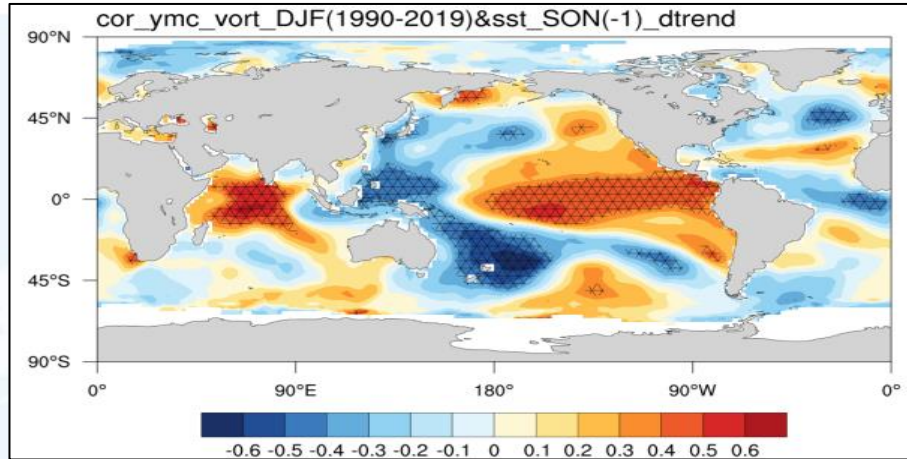
Impact of Indian Ocean-- EAT



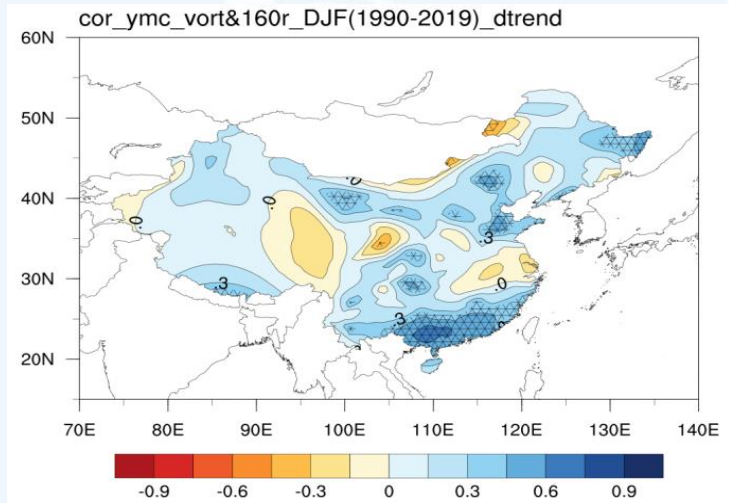
Correlation coefficients between the EAT index and SST in the preceding Sep.

- Positive SSTA over tropical Indian Ocean during the preceding September indicates weak EAT in the coming winter.
- IOBW index in Sep 2021 is near to normal, and that favorable to a **normal EAT** in the coming winter.

Impact of El nino -- IBT



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



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

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

Summary of Outlook for Winter Circulation in 2021/2022

- EAWM: **strong**
- Siberian High: **strong**
- East Asian Trough: **strong**
- AO: **negative**

Colder 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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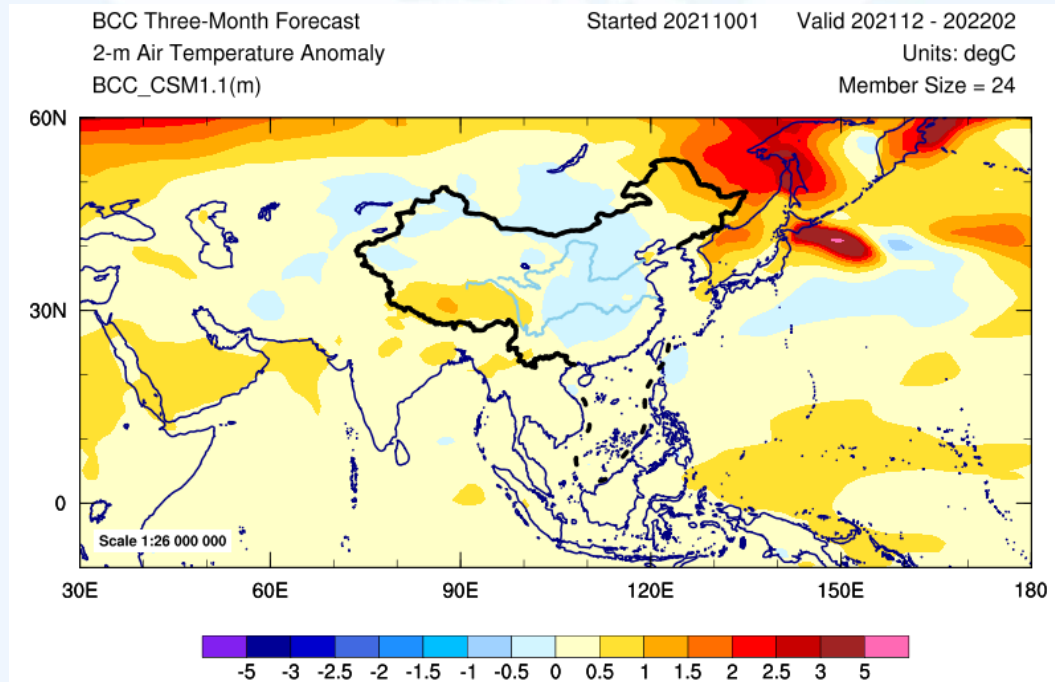
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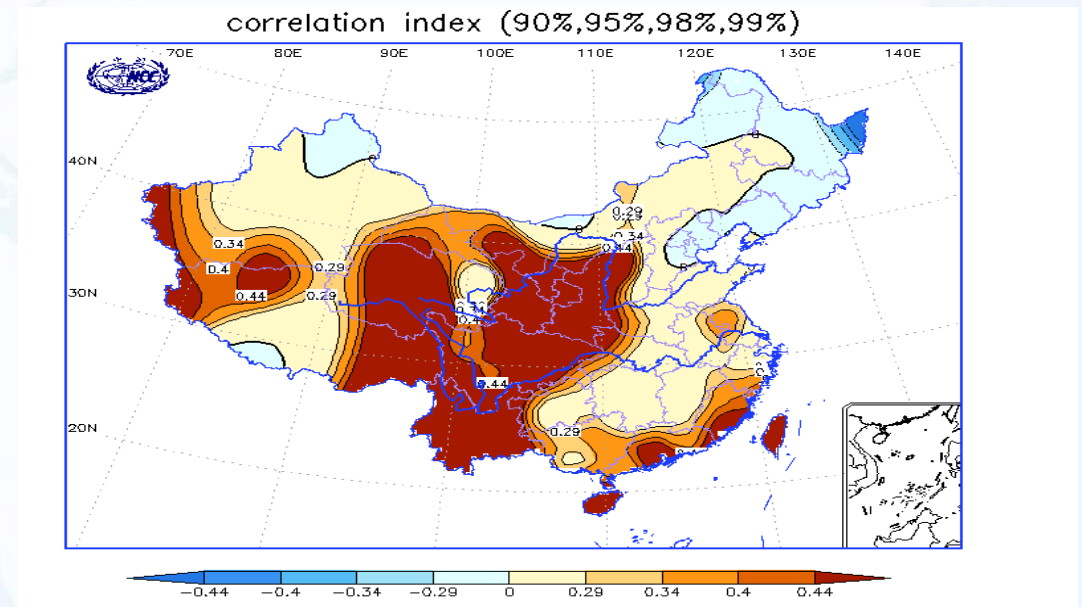
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Temperature – BCC_CSM1.1m

Prediction

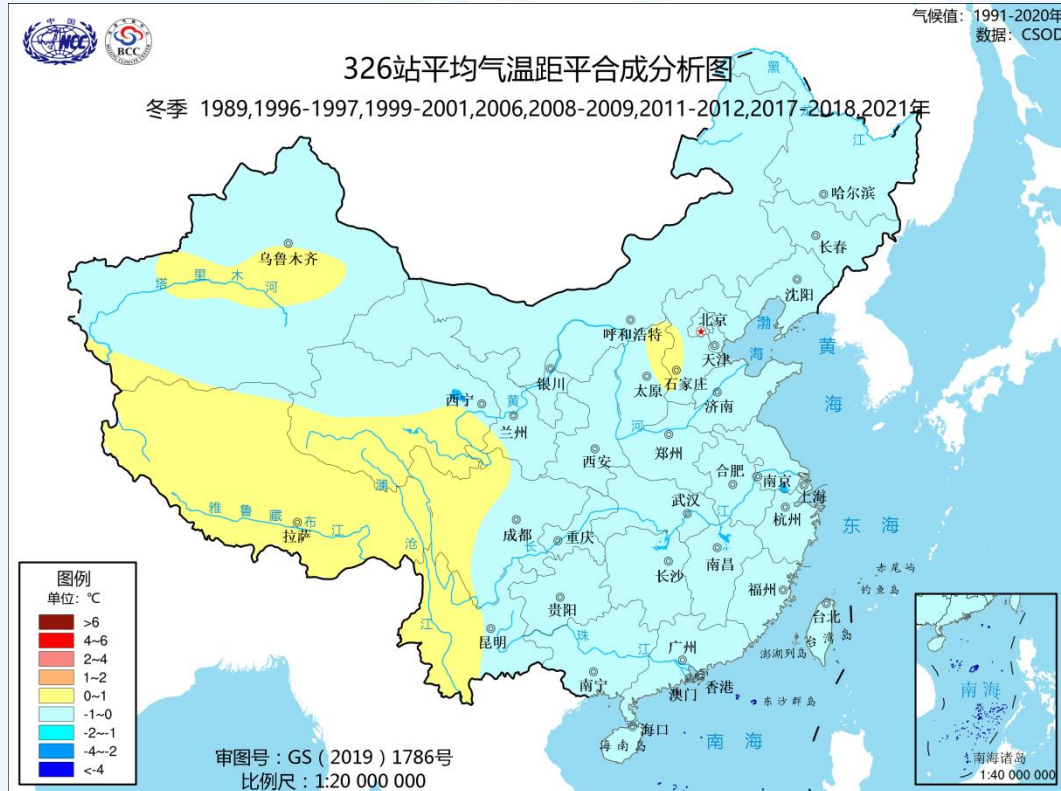


Hindcast skill



Impact of La Niña

La Niña



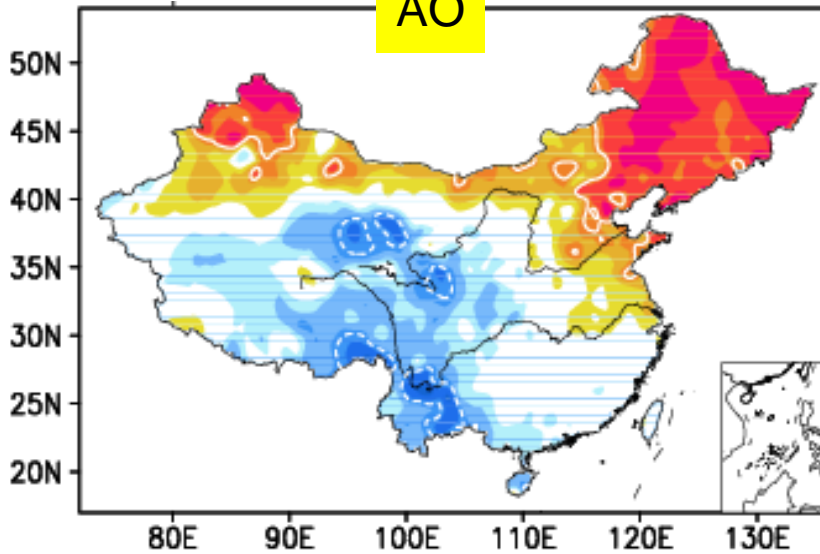
double-dip La Niña



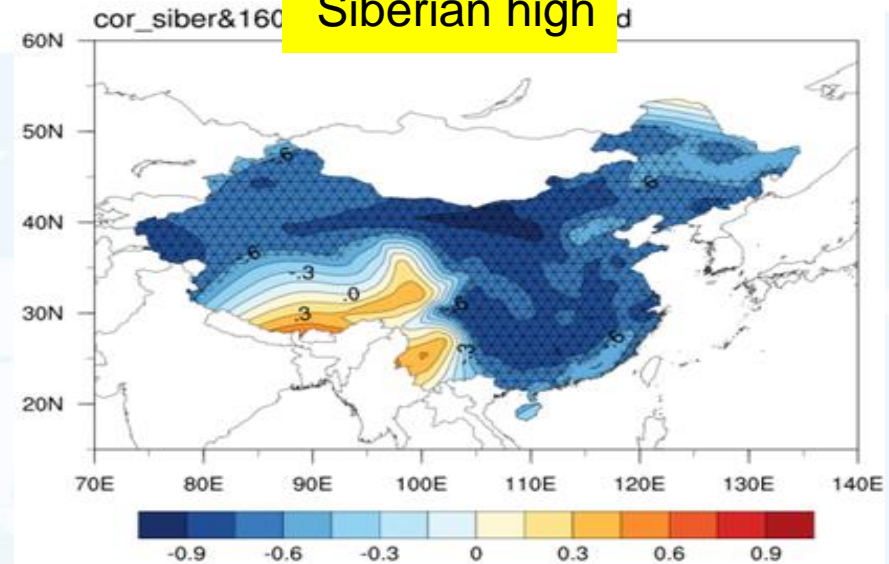
Composite of temperature

Correlation between circulation indexes and temperature

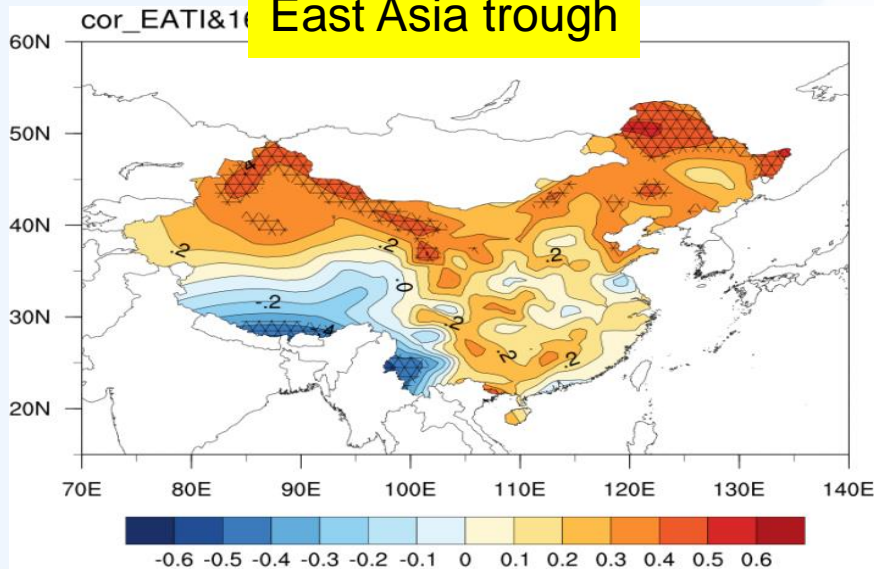
AO



Siberian high



East Asia trough

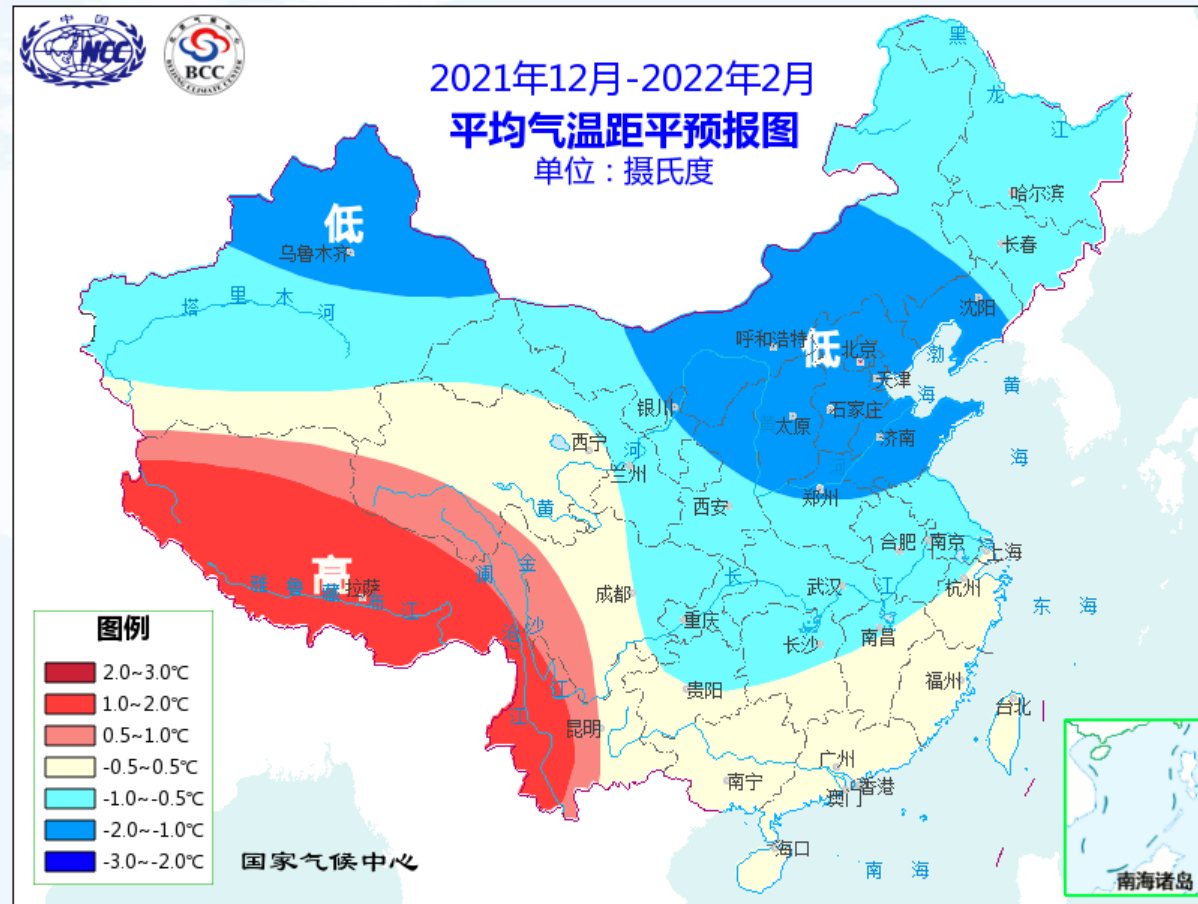


Negative AO ->
Below-normal temperature over Northern China

Strong SH ->
Below-normal temperature over most of China

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

Temperature forecast

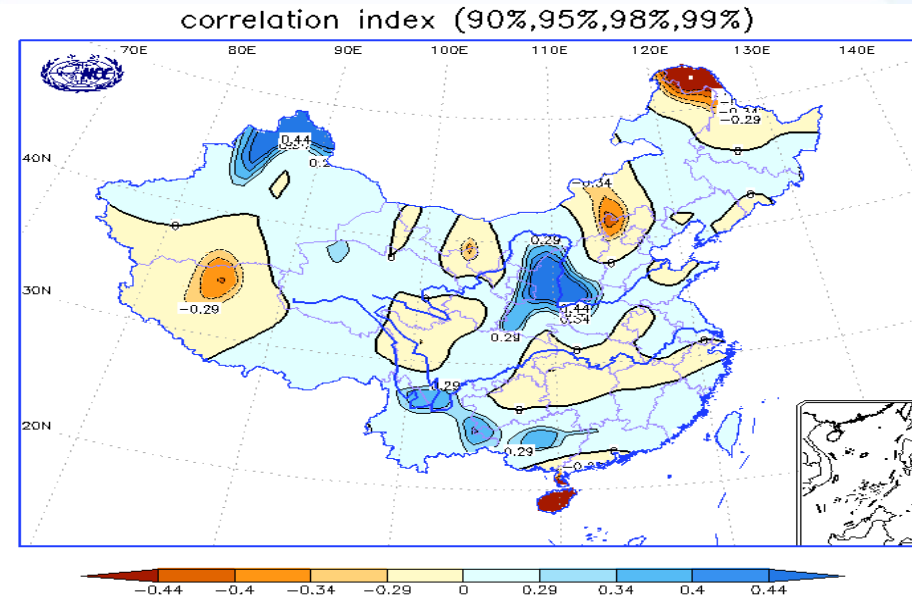
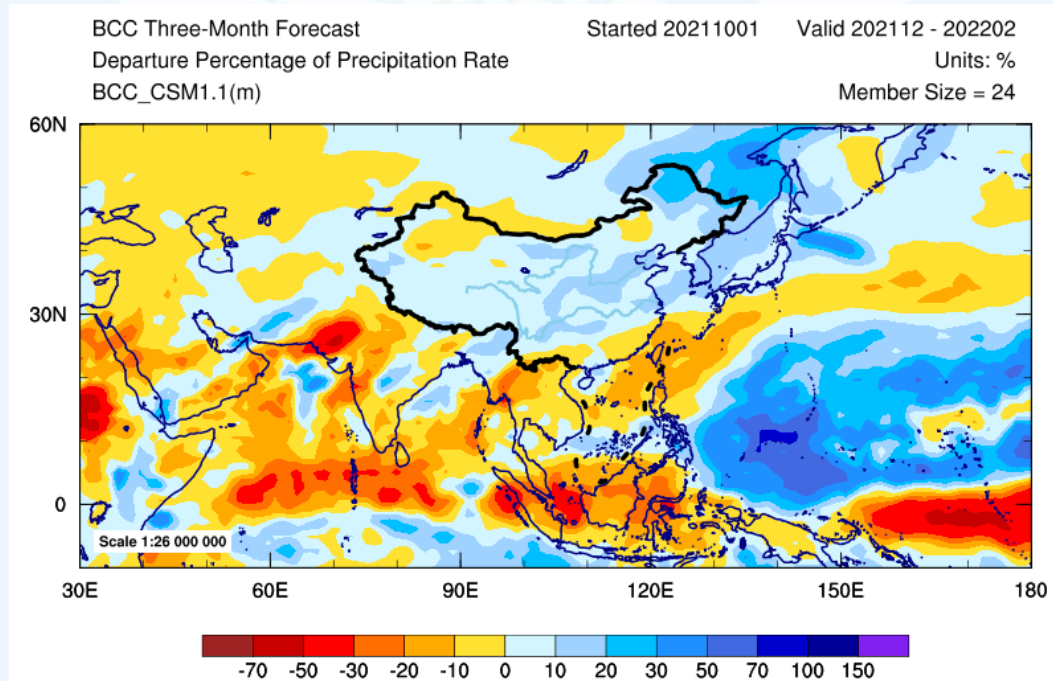


Clim: 1991-2020

Precipitation – BCC_CSM1.1m

Prediction

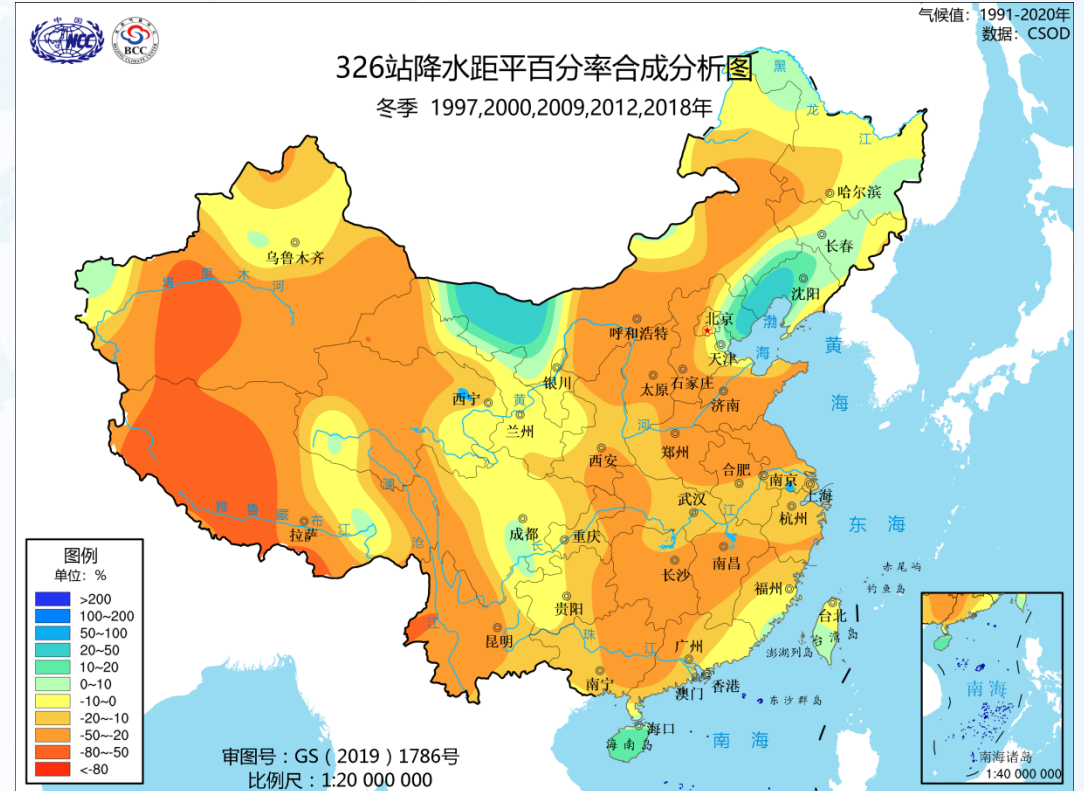
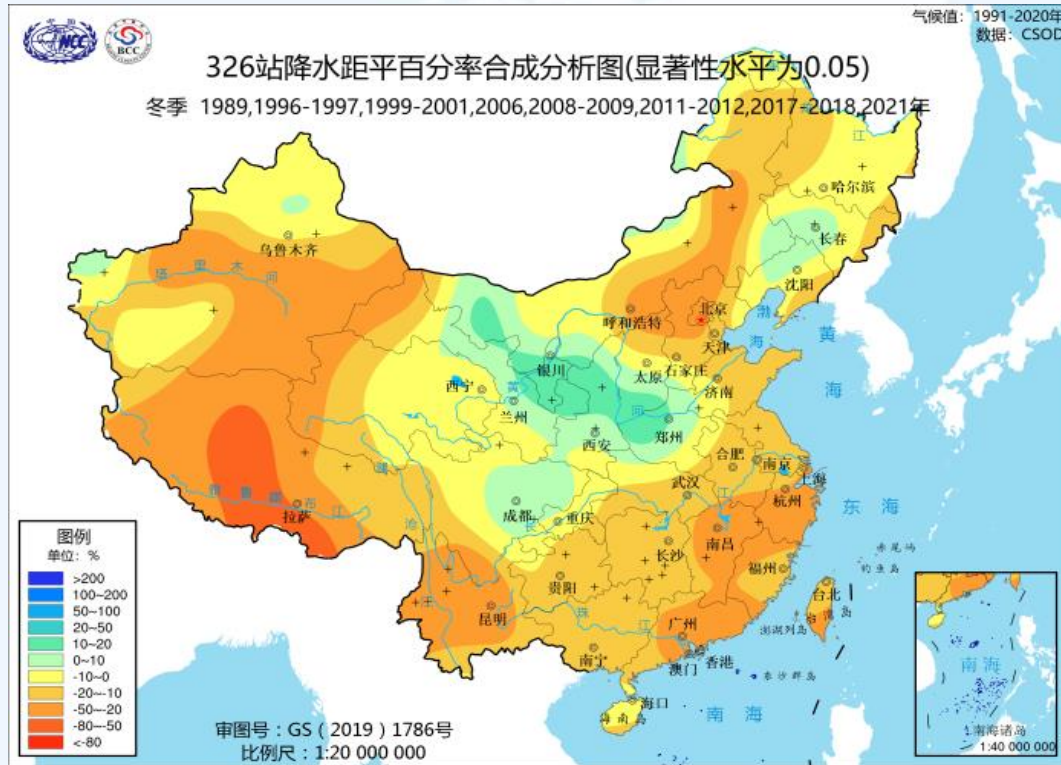
Hindcast skill



Impact of La Niña

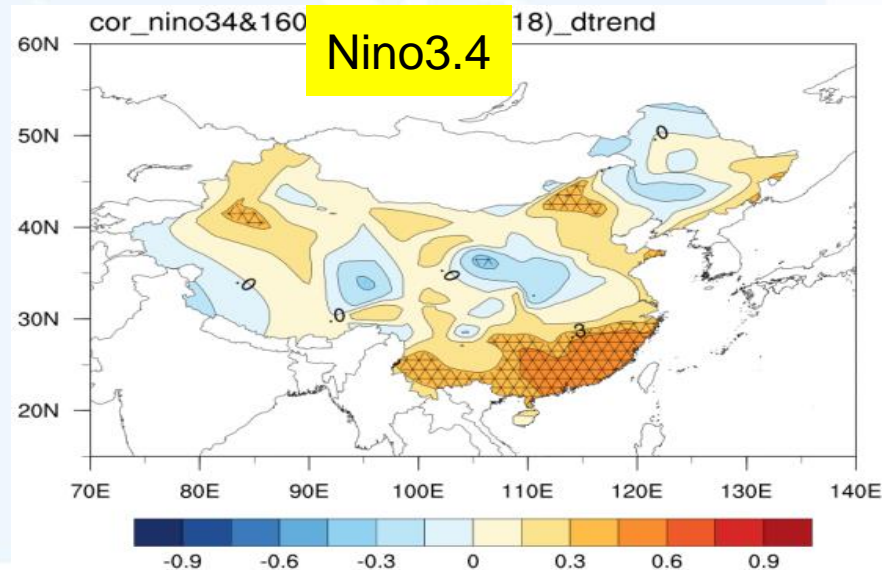
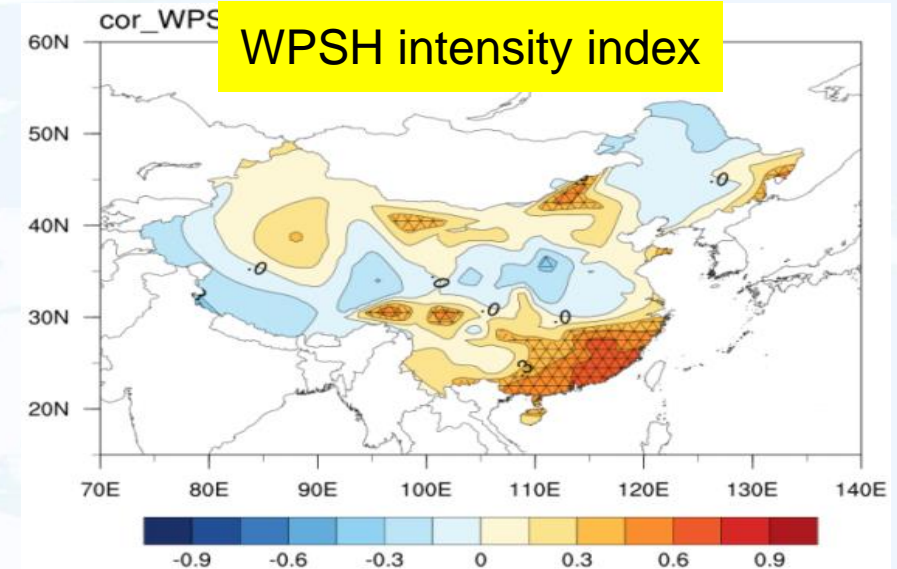
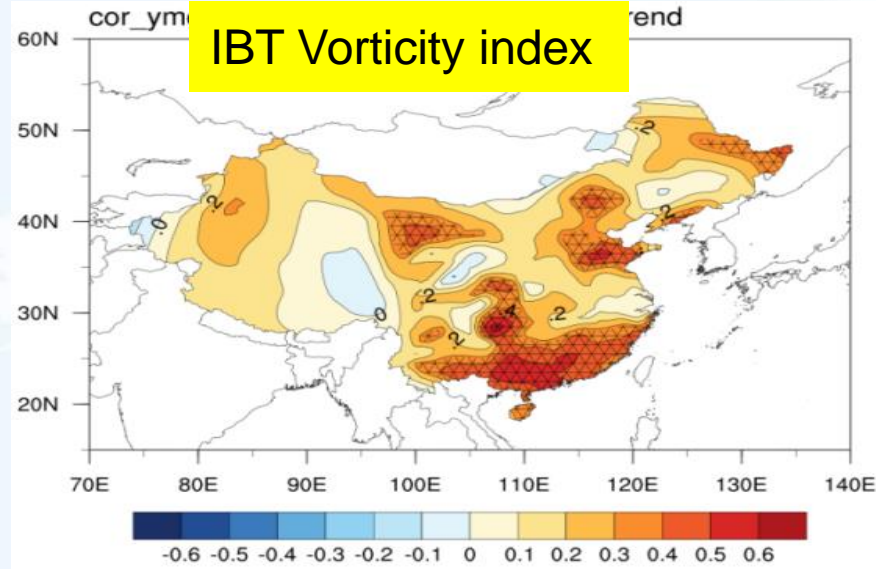
La Niña

double-dip La Niña



Composite of precipitation

Correlation between circulation/sst indexes and precipitation

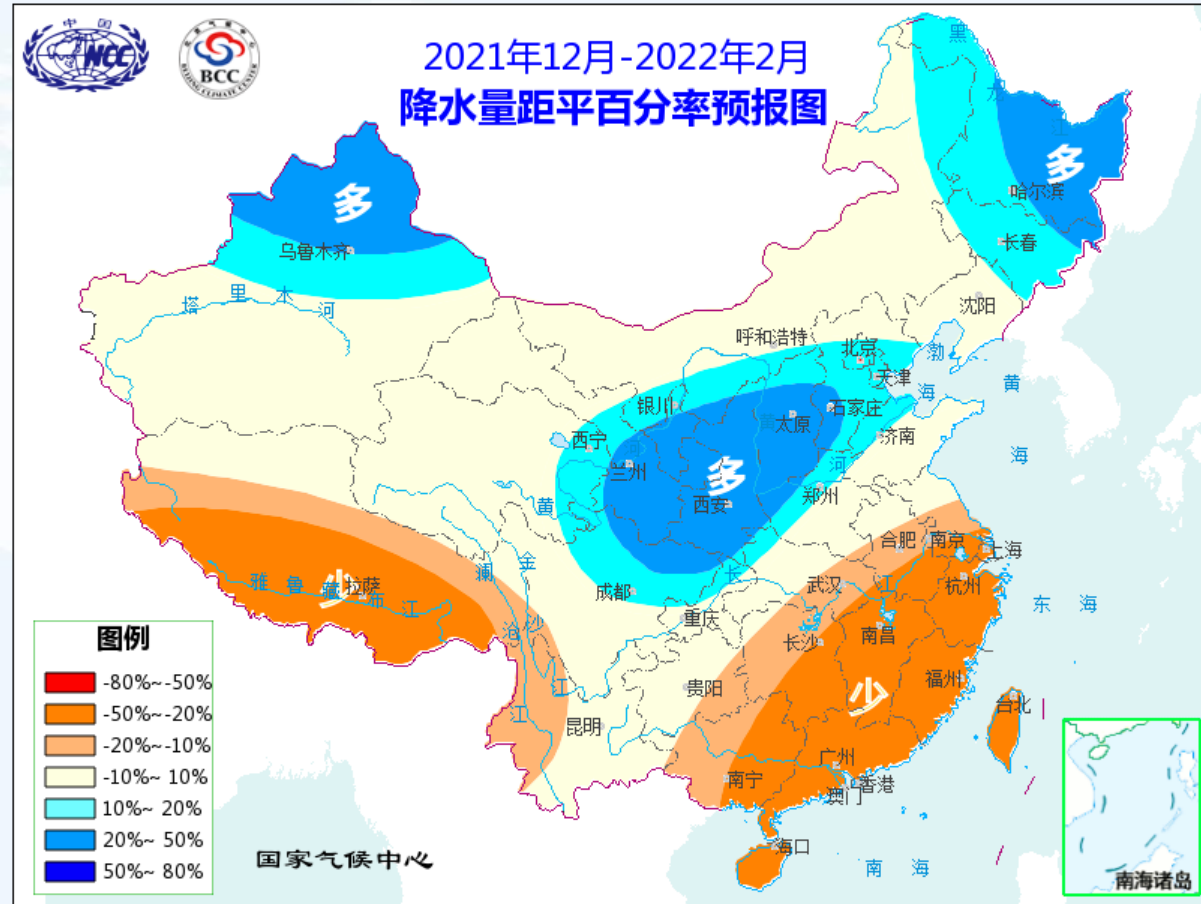


Weak IBT (negative index) ->
Above-normal precipitation over Southern China

Strong WPSH (positive index) ->
Above-normal precipitation over Southern China

Positive Nino3.4 index ->
Above-normal precipitation over Southern China

Precipitation forecast



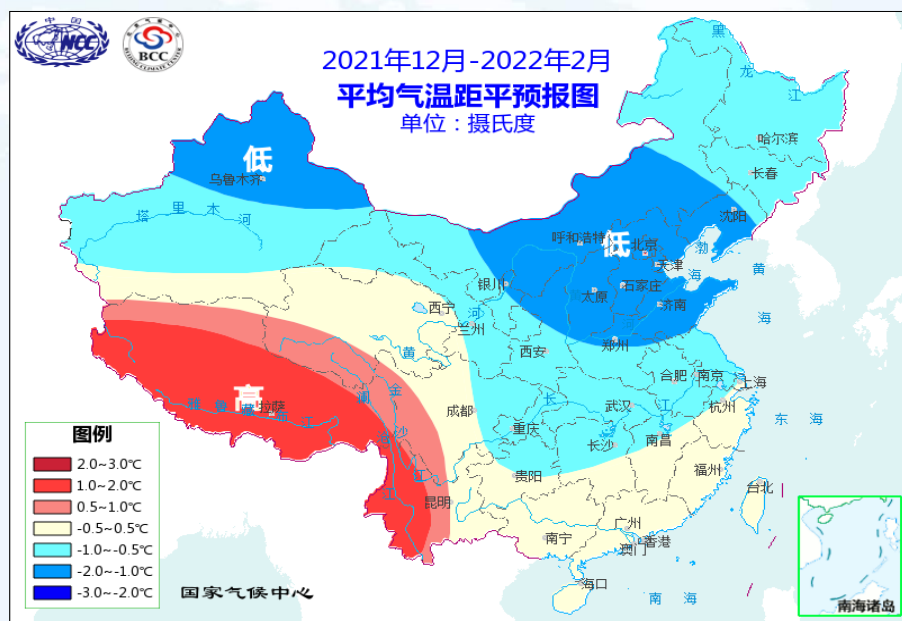
Clim: 1991-2020

Outlook for 2021/2022 winter

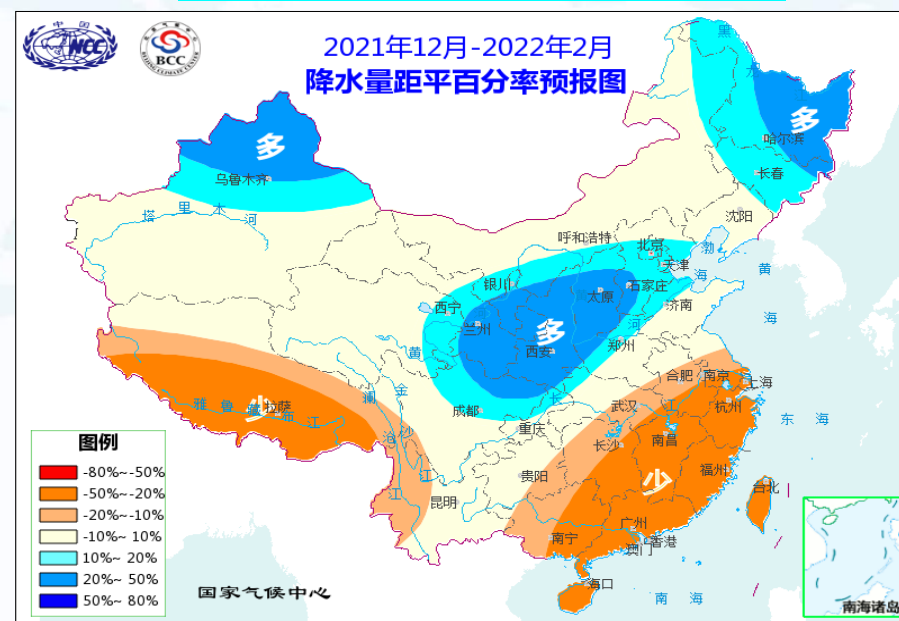


EAWM : strong

Temperature



Precipitation



- The **temperature** of most central and eastern parts of China will be colder than normal.
- The **precipitation** will be above normal over Northern China, but near or below normal over southern China.



THANK YOU!





Figure 1 Deterministic forecast of **Precipitation**



Figure 2 Deterministic forecast of **Temperature**