



Seasonal Climate Outlook of East Asia in Summer 2022

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Beijing Climate Center, May 9, 2022

Outline



- 1. BCC Climate Prediction System and Products**
- 2. Statistical Analysis**
- 3. Conclusions**



CMA Climate Prediction Models

Phase III
2016-2022

CMA-CPSv3

S2S, seasonal prediction,
annual outlook
Integrated prediction

Based on climate system model **BCC-CSM2-HR**

BCC-AGCM3-HR(T266L56,Top:0.1hPa)
BCC_AVIM2(T266)
MOM4-L40v3(1/4°)
SIS

CMIP6

Phase II
2005-2015

CMA-CPSv2

S2S

Seasonal prediction

Extended range forecast
DERF2.0

Based on climate system model **BCC_CSM1.2**

BCC_AGCM2.3(T106L40)
BCC_AVIM1(T106)
MOM4-L40(1/3°~30km)
SIS(1/3°~30km)

CMIP5 S2S
Climate
prediction

Based on climate system model **BCC_CSM1.1m**

BCC_AGCM2.2(T106L26)
BCC_AVIM1(T106)
MOM4-L40(1/3°~30km)
SIS(1/3°~30km)

CMIP5

Based on atmospheric model
BCC_AGCM2 (T106L26)

Phase I
1995-2004

BCC-CPSv1

Seasonal prediction

Extended range forecast
DERF1.0

Base on air-sea coupled model
BCC_CM1

Based on atmospheric model
BCC_AGCM1 (T63L16)

CMIP3
1st Operational
climate prediction
system

CMA Climate Prediction Models in operation

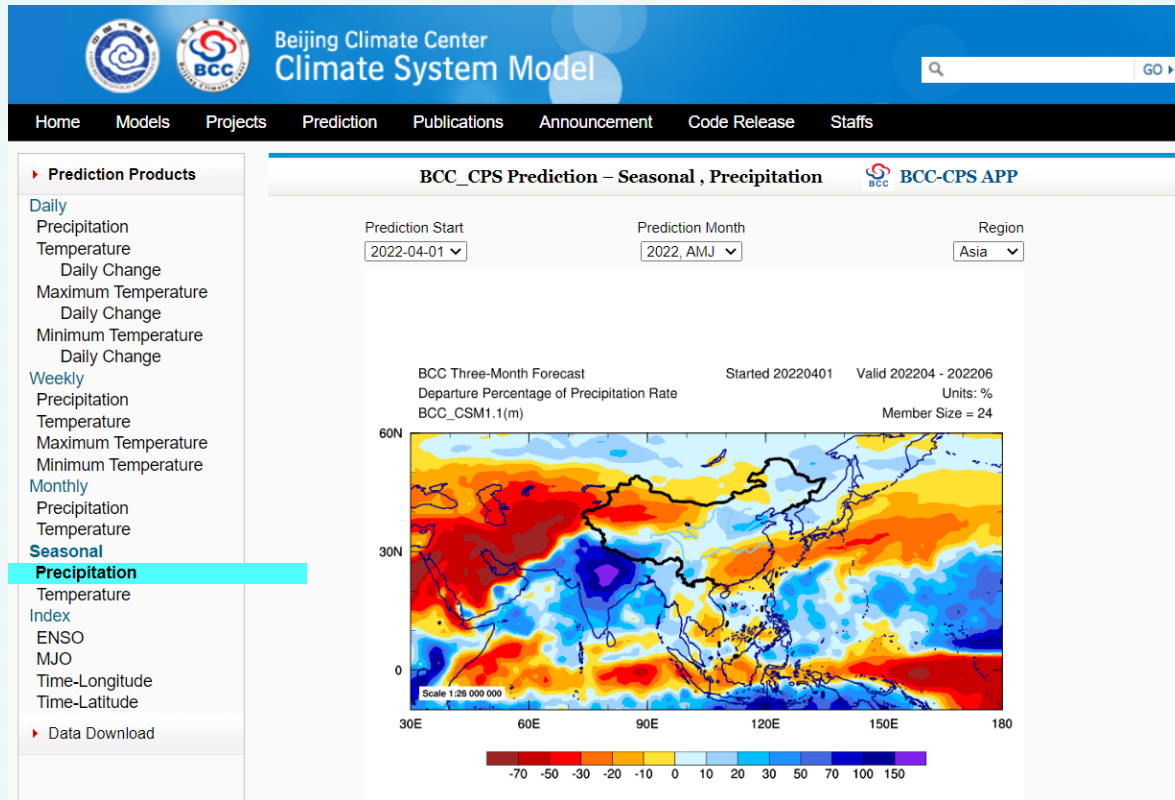


| | CMA-CPSv2 | CMA-CPSv3 |
|---------------------|--|---|
| operational time | 2015-now | 2021 |
| Model versions | BCC-CSM1.1m BCC-AGCM2.2(T106L26) BCC-AVIM1.0(T106) MOM4-L40(1/3° ~30km) SISv2(1/4° ~30km) | BCC-CSM2-HR BCC-AGCM3-HR(T266L56) BCC-AVIM2.0(T266) MOM5-L50(1/4°) SISv2(1/4°) |
| Operating frequency | initialized on 1 st of each month, run for 13-month | run for 7-month |
| Initial data | Atmosphere: NCEP reanalysis for hindcast, and NMC/CMA T639 assimilation for real-time; Ocean: NCEP-GODAS oceanic data | Multilayer coupling assimilation system |
| | 24 samples (15LAF+9SV) | 21 samples (SPPT+LAF) |
| Hindcast period | 1991-2020 | 2001-2020 |

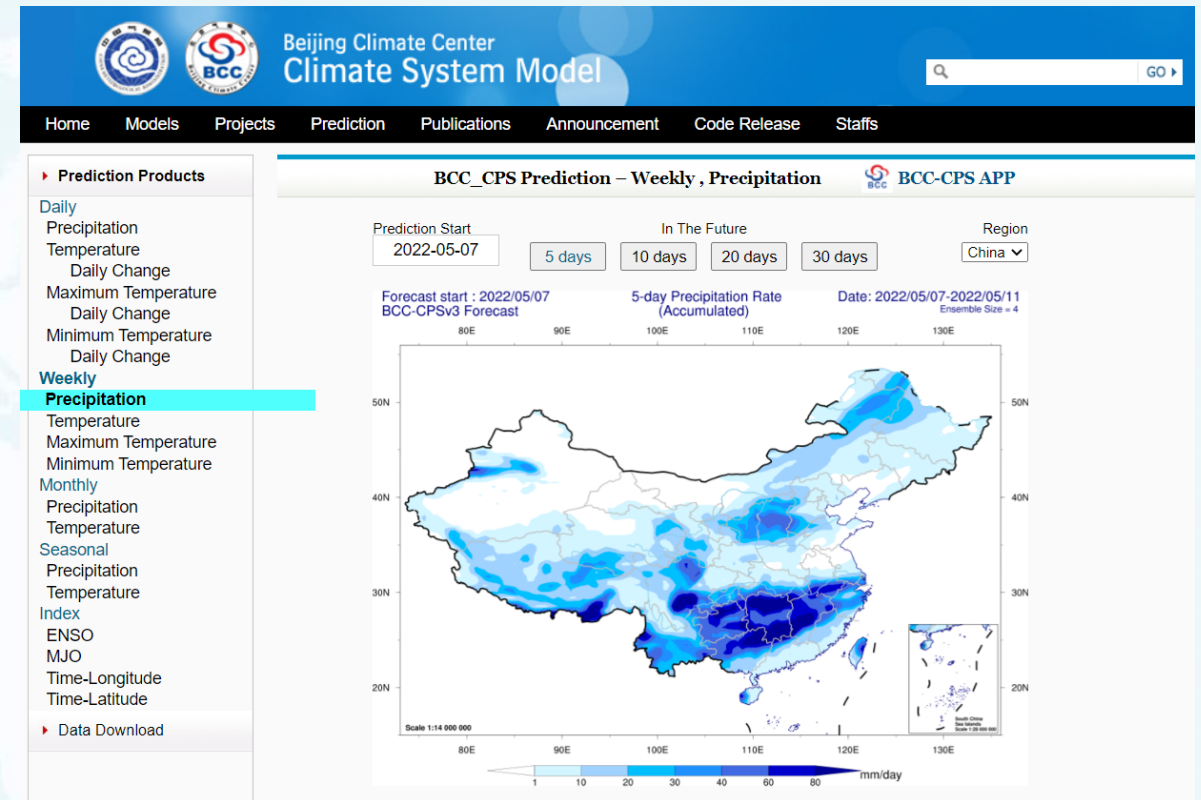
CMA Climate Prediction products



Seasonal prediction products of CMA-CPSv2

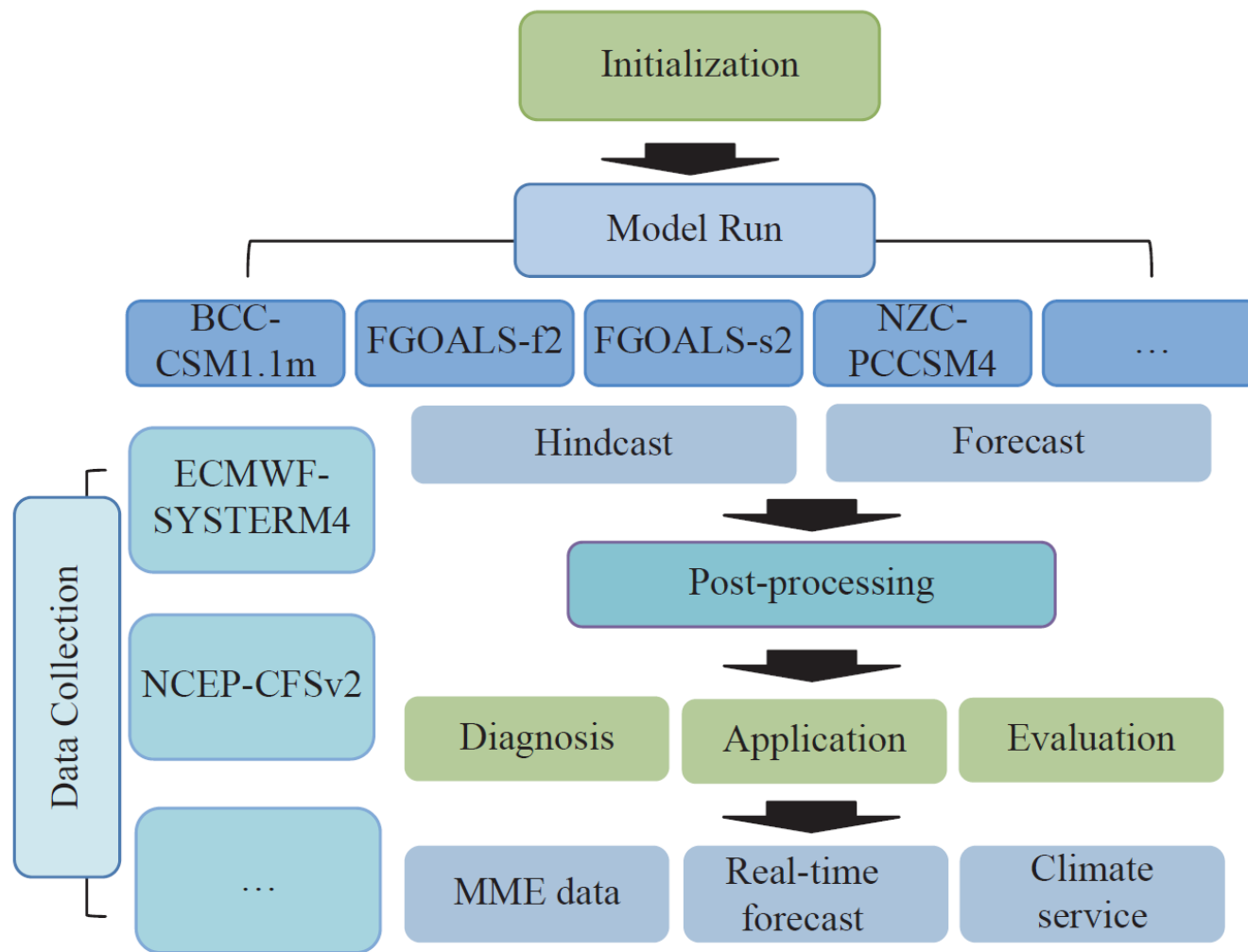


Weekly forecast products of CMA-CPSv3



<http://forecast.bcccsn.ncc-cma.net/web/channel-95.htm>

China MME system-CMME



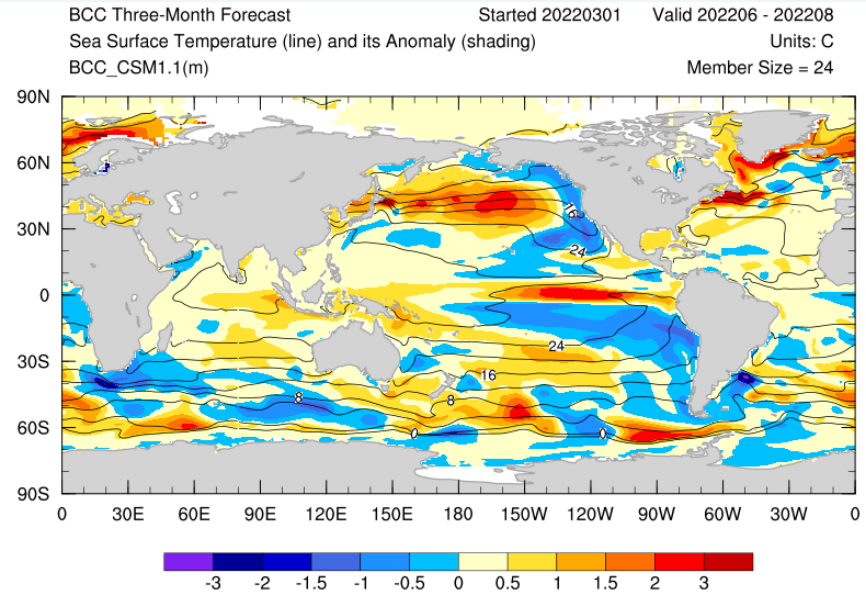
Framework of the China multi-model ensemble prediction system (CMME)



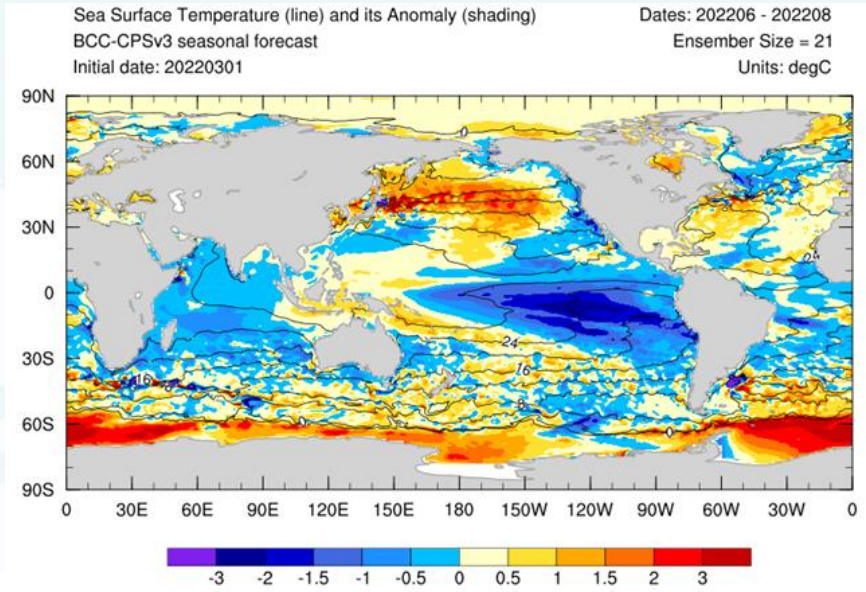
SSTA prediction for summer 2022 by CMA models

Prediction

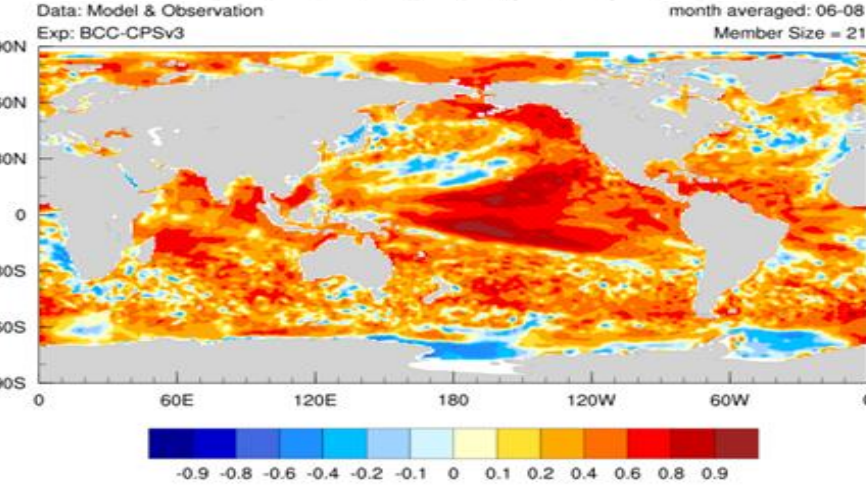
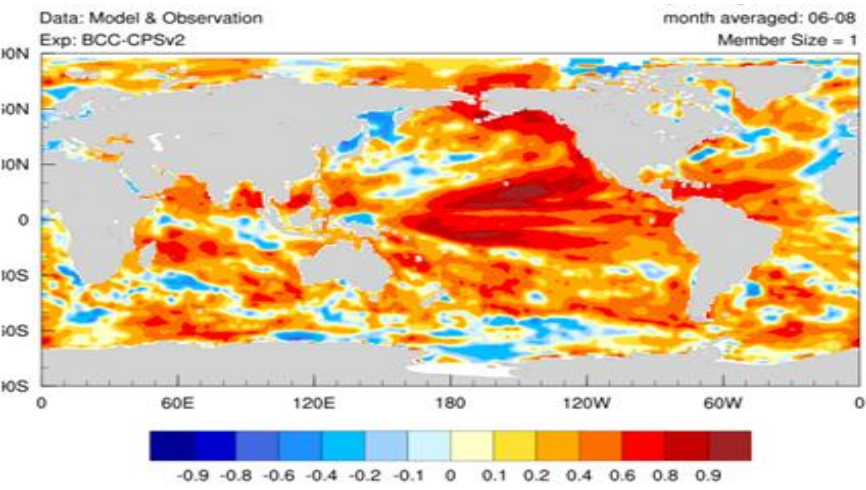
BCC-CPSv2



BCC-CPSv3



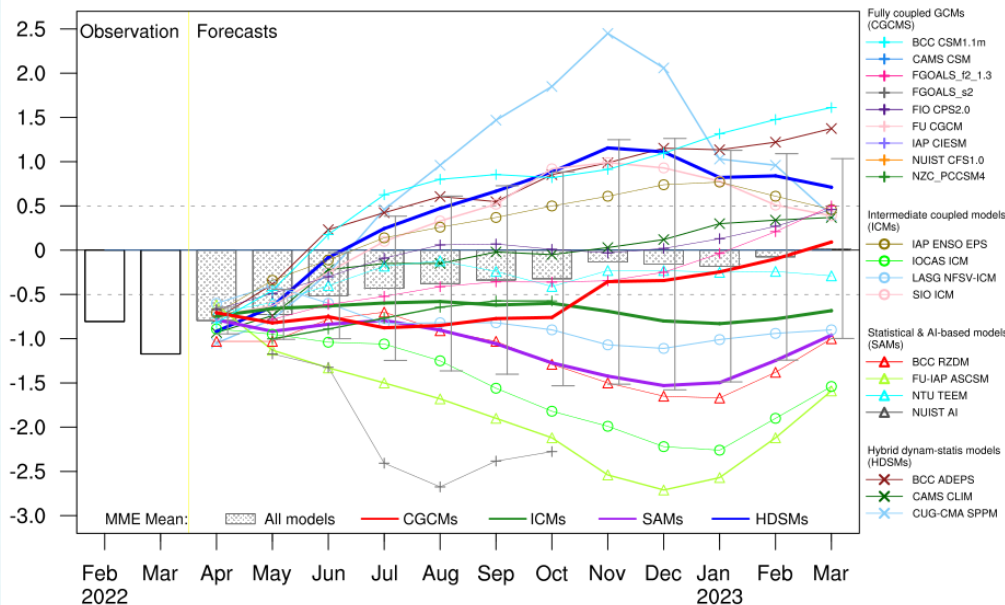
TCC Skill



ENSO outlook by CMME : from La Nina to ENSO-neutral

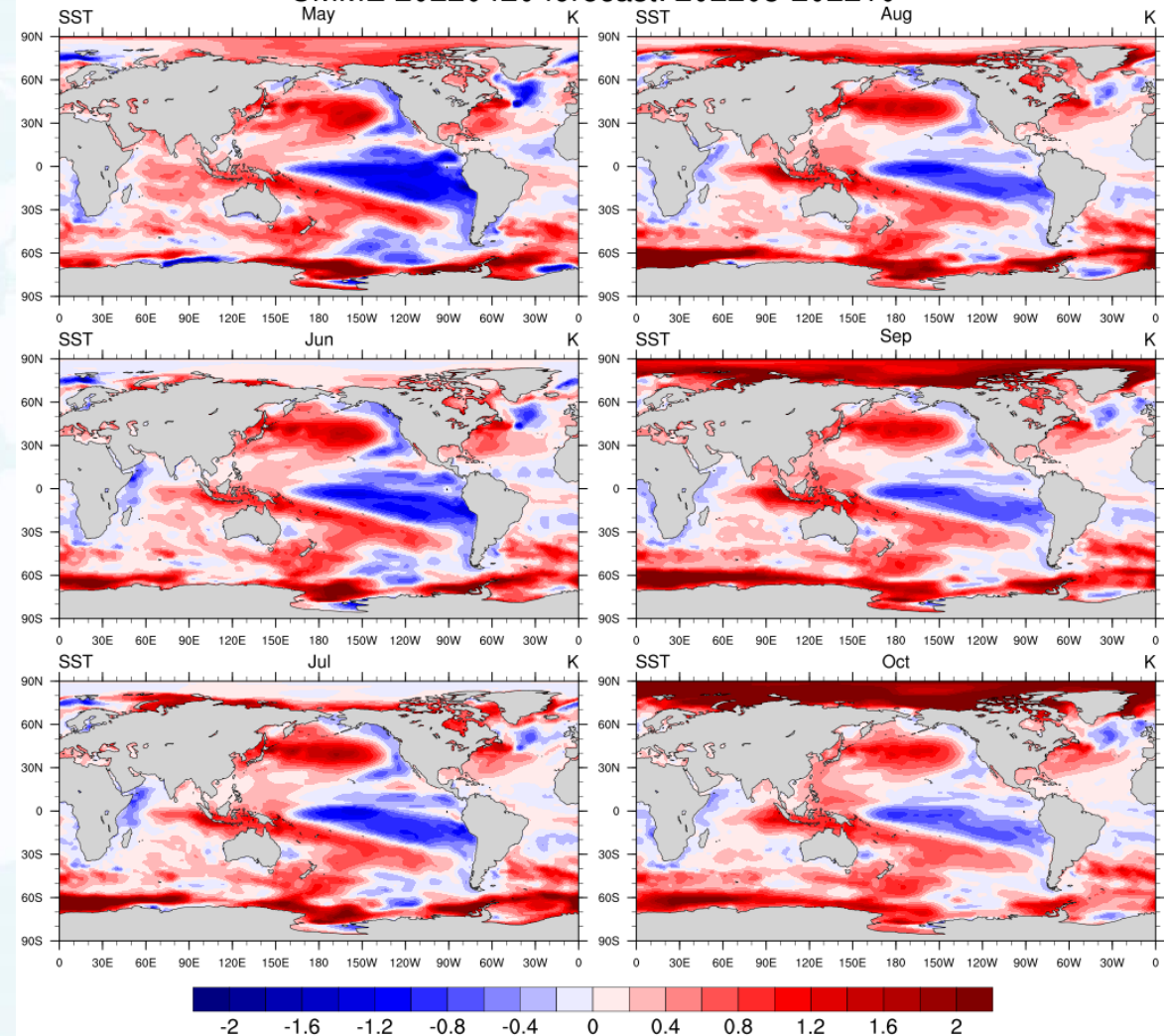


China Multi-Model Ensemble (CMME): ENSO Prediction
Niño3.4 Index Forecasts 202204–202303 Issued on 20220425



- Dynamical model output shows the La Niña event might be ends in late spring and early summer, and enters into ENSO-neutral state in summer.
- It should be noted that the possibility of another La Niña events in next winter can not be ruled out so far.

Global SST Anomaly
CMME 20220420 forecast: 202205-202210

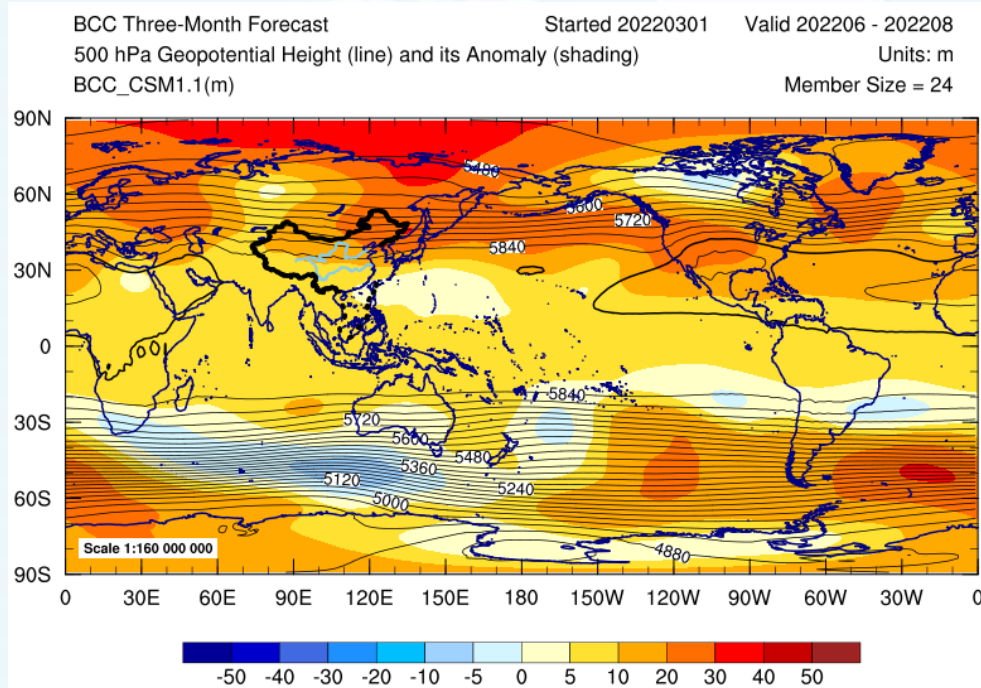


CMA-CPSv2 and CPSv3 forecasts: H500

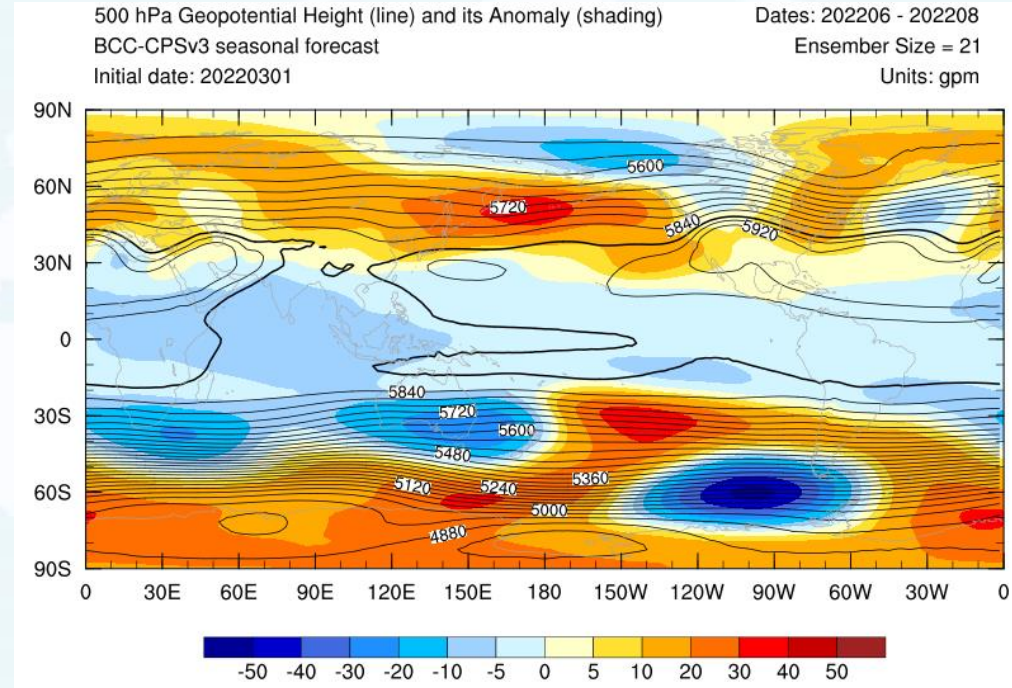


Prediction of 500hPa _started from 1st April/March

CPSv2



CPSv3

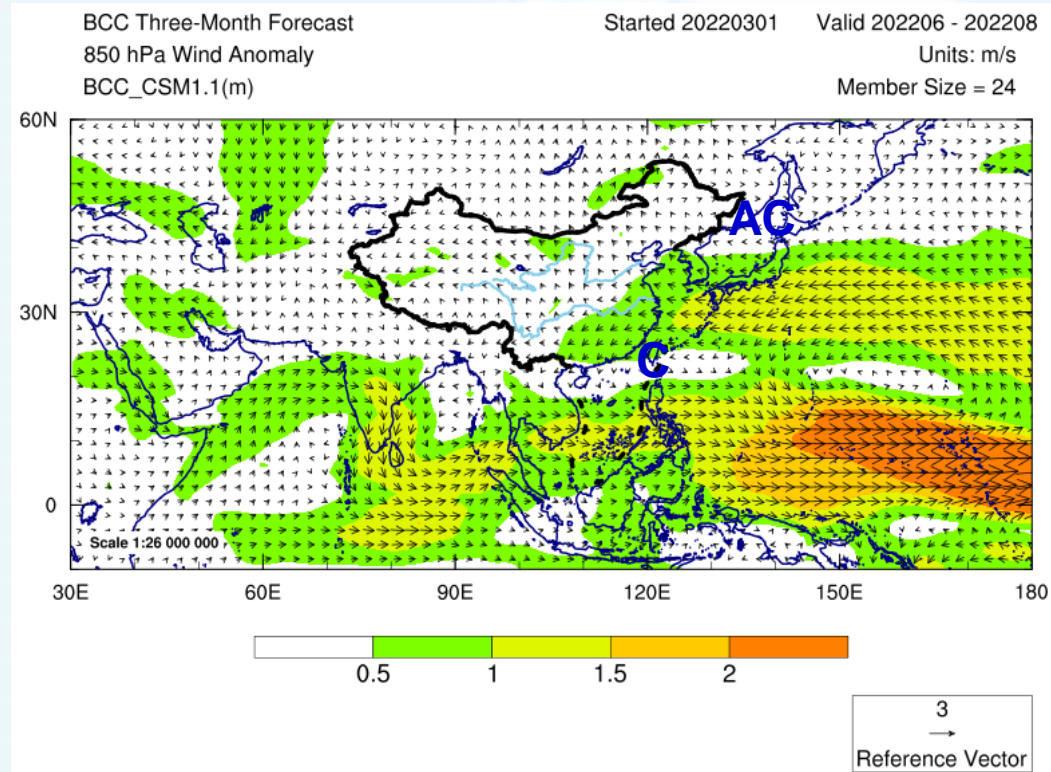


- BCC-CPS forecast for JJA 2022 shows a northward displaced western North Pacific Subtropical High and a positive anomalous height center in the mid-high latitude areas of Northeast Asia, indicating a strong East Asia Summer Monsoon.

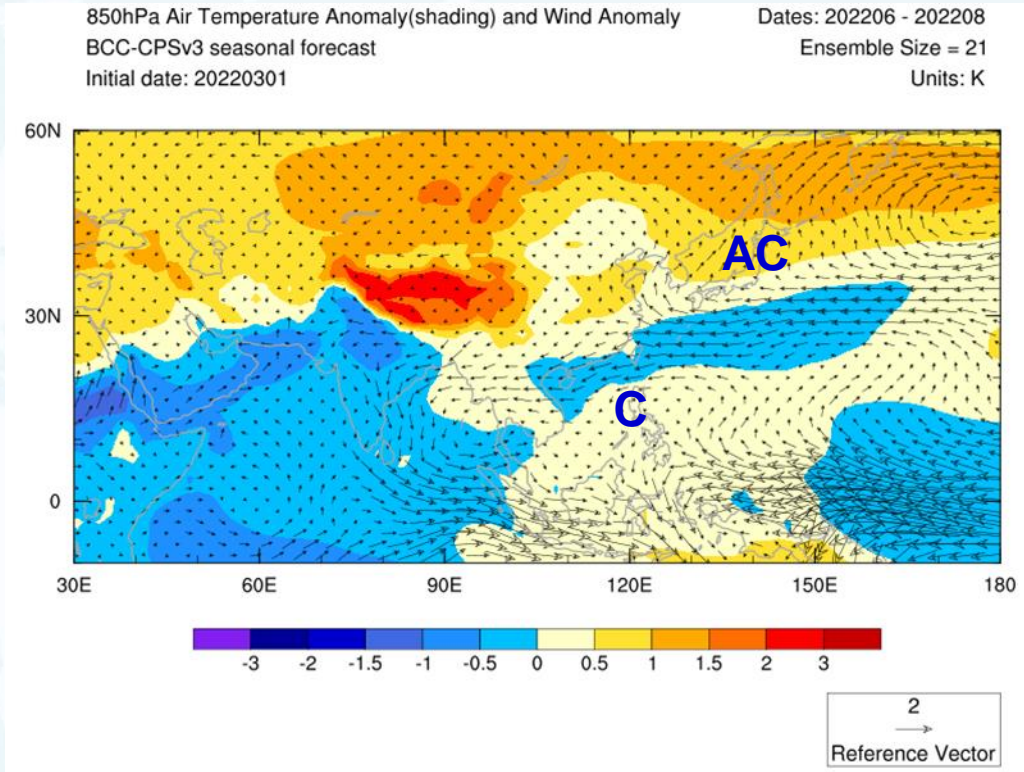
CMA-CPSv2 and CPSv3 forecasts: UV850



CPSv2



CPSv3

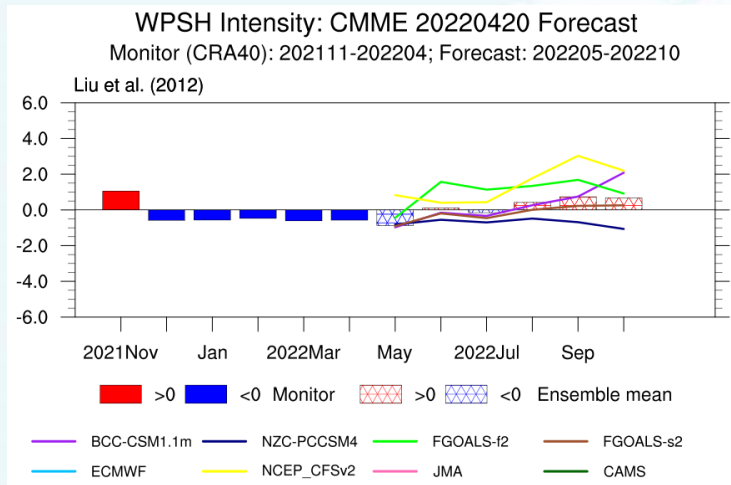


BCC-CPSv3 forecast for JJA 2022 shows:
Anomalous low-level cyclone over western North Pacific and southerly anomalies wind over North China in summer.

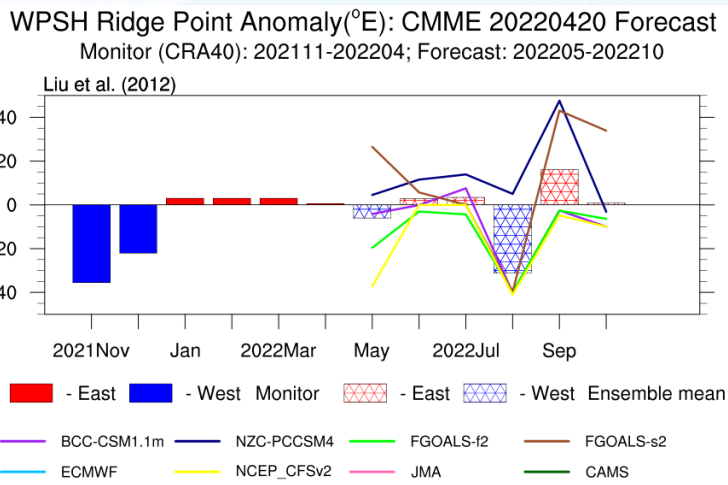
CMME forecast: WPSH



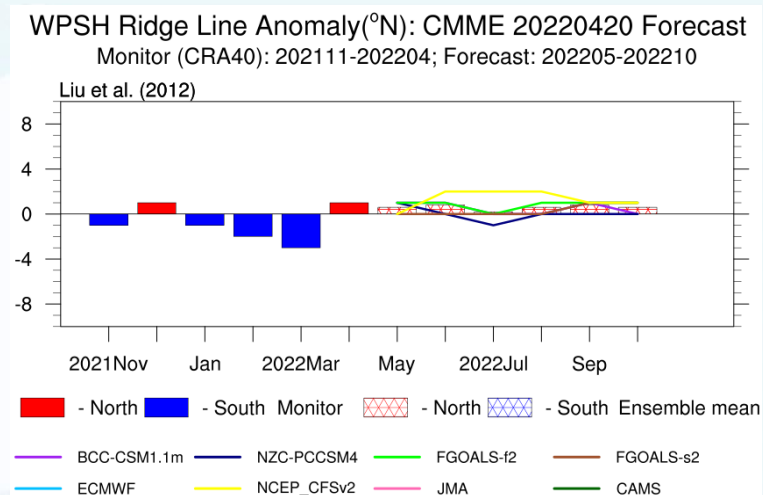
WPSH intensity index



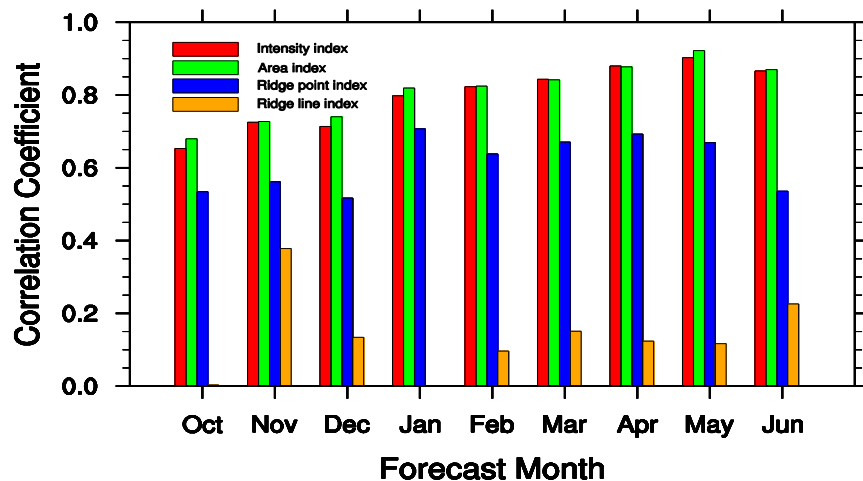
WPSH ridge point index



WPSH ridgeline index



Forecasting Skill of WPSH: BCC_CSM1.1m

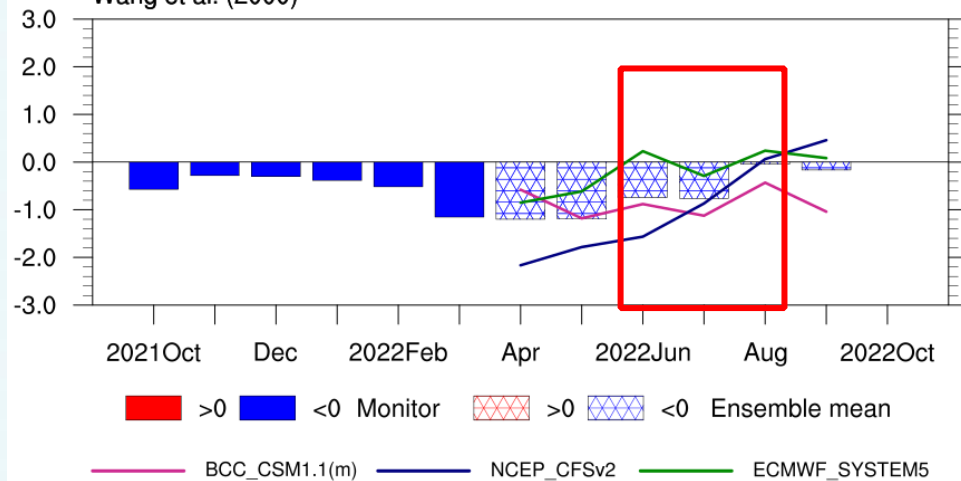


Intensity: near normal
Position: westward displaced, northward

CMME forecast: PSAC and EASM

Philippine Sea anticyclone index

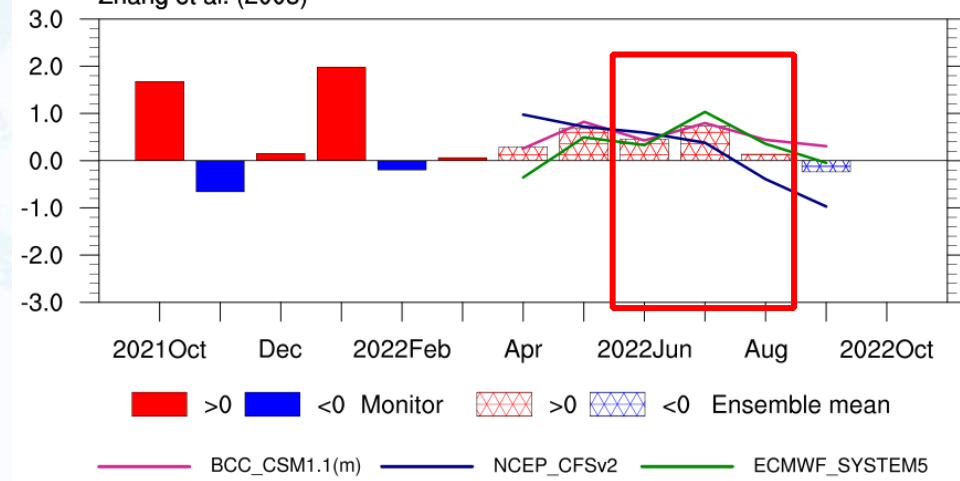
Philippine Sea AntiCyclone (PSAC) index: MODES forecast
Monitor (NCEP I): 202110-202203; Forecast: 202204-202210
Wang et al. (2000)



Anomalous cyclone near Philippine Sea

EASM index

East Asian Summer Monsoon (EASM) index: MODES forecast
Monitor (NCEP I): 202110-202203; Forecast: 202204-202210
Zhang et al. (2003)



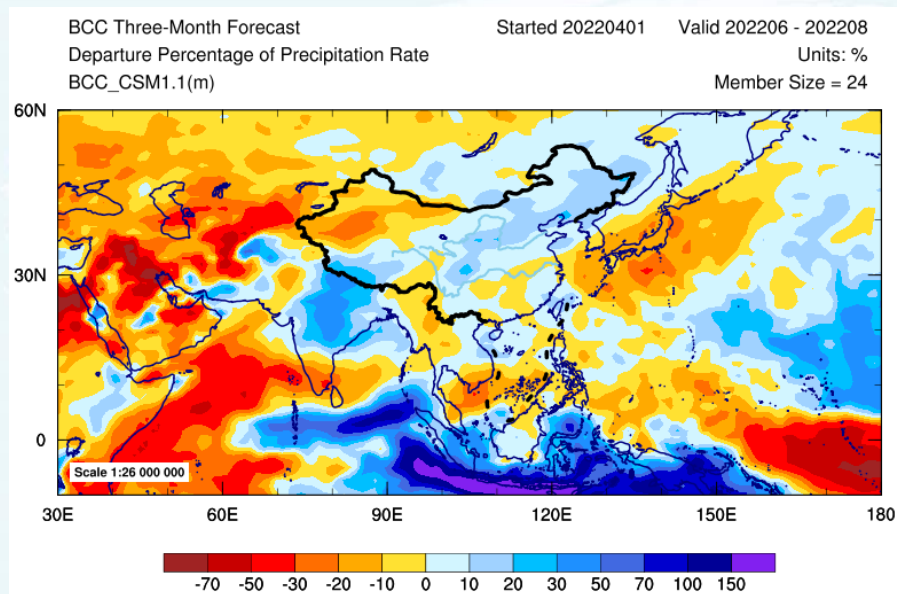
$$EASMI = U850(10-20N, 100-150E) - U850(25-35N, 100-150E)$$

EASM: Strong

Dynamical seasonal predictions of CMA_CPSv2

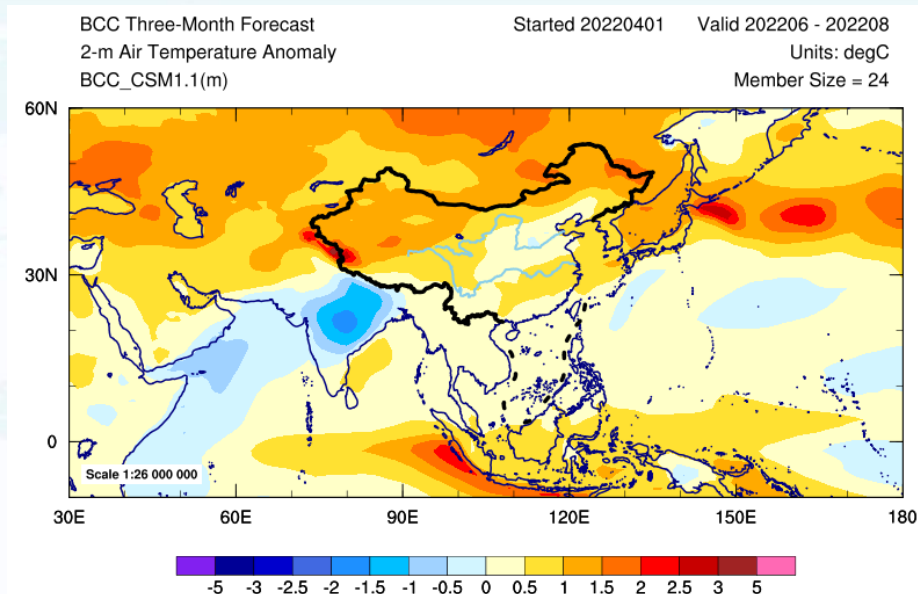


Departure percentage of precipitation rate



More precipitation over northeast Asia, India, Southern part of Southeast Asia

2-m Air temperature anomaly



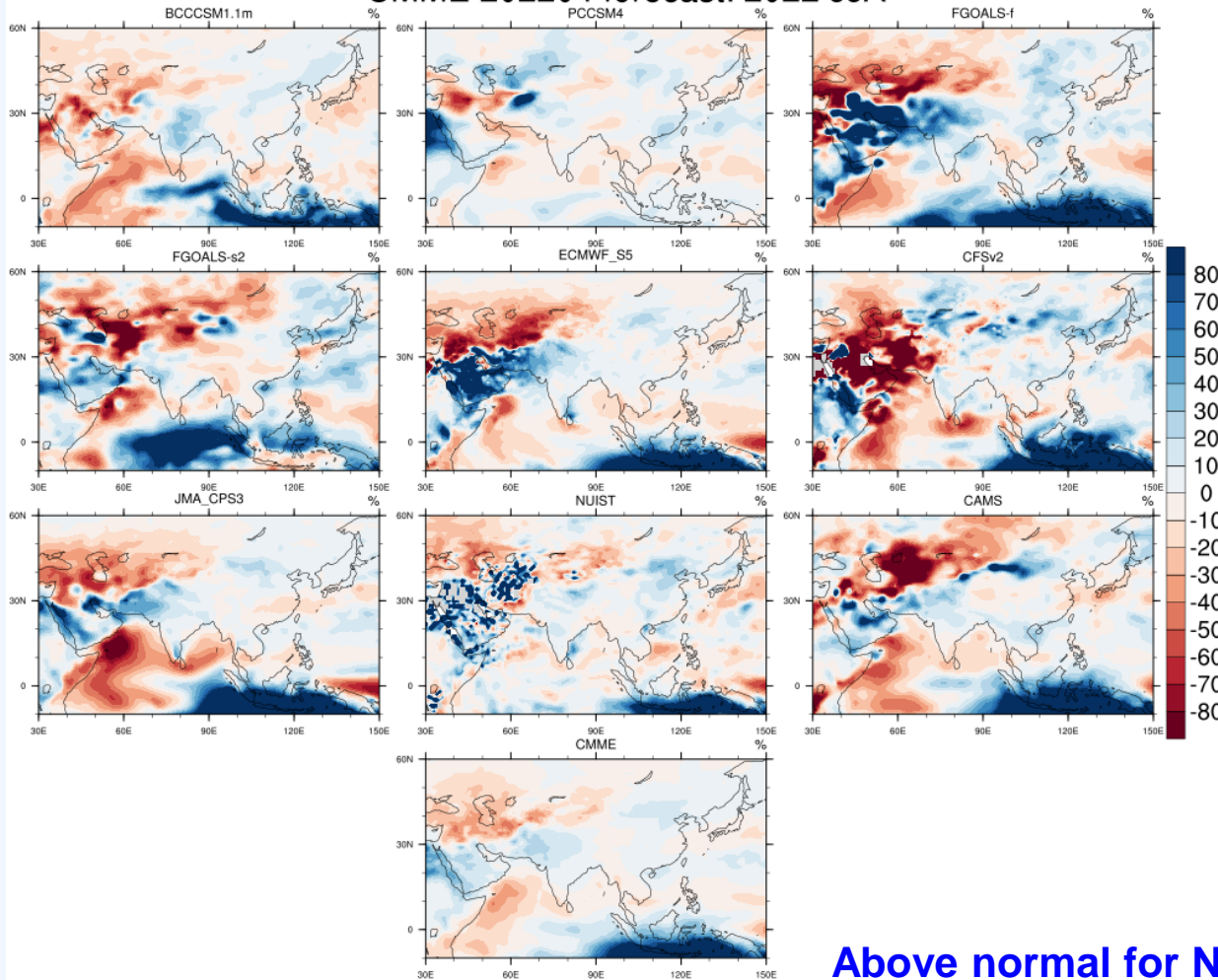
Mostly above normal except for India.

Prediction of PREC in JJA 2022



Prediction

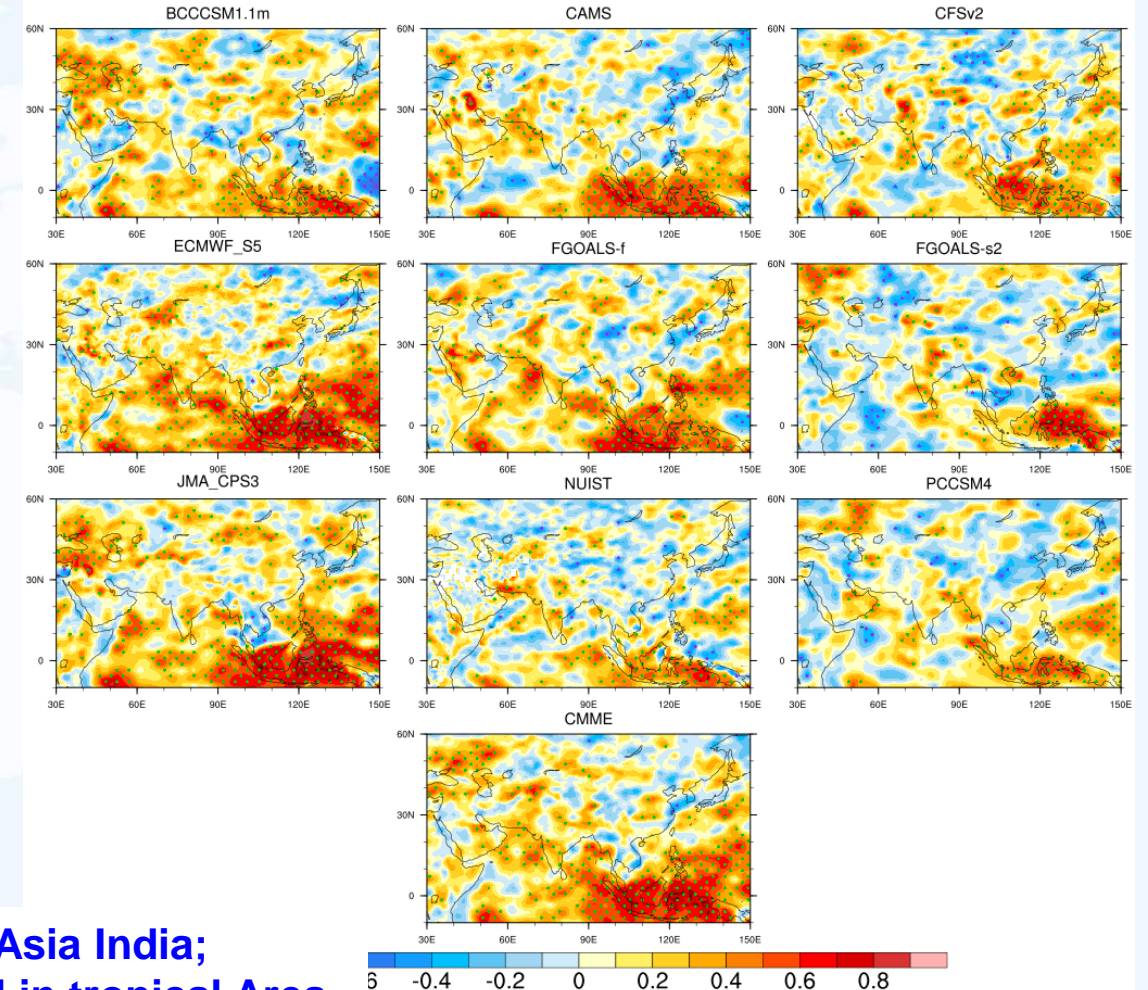
Precipitation Anomaly Percentage
CMME 202204 forecast: 2022 JJA



Above normal for NE Asia India;
Higher prediction skill in tropical Area.

Verification (TCC Skill)

TCC of season PREC: 1991-2020
FCS ini: APR Target: JJA (Lead 2 month)

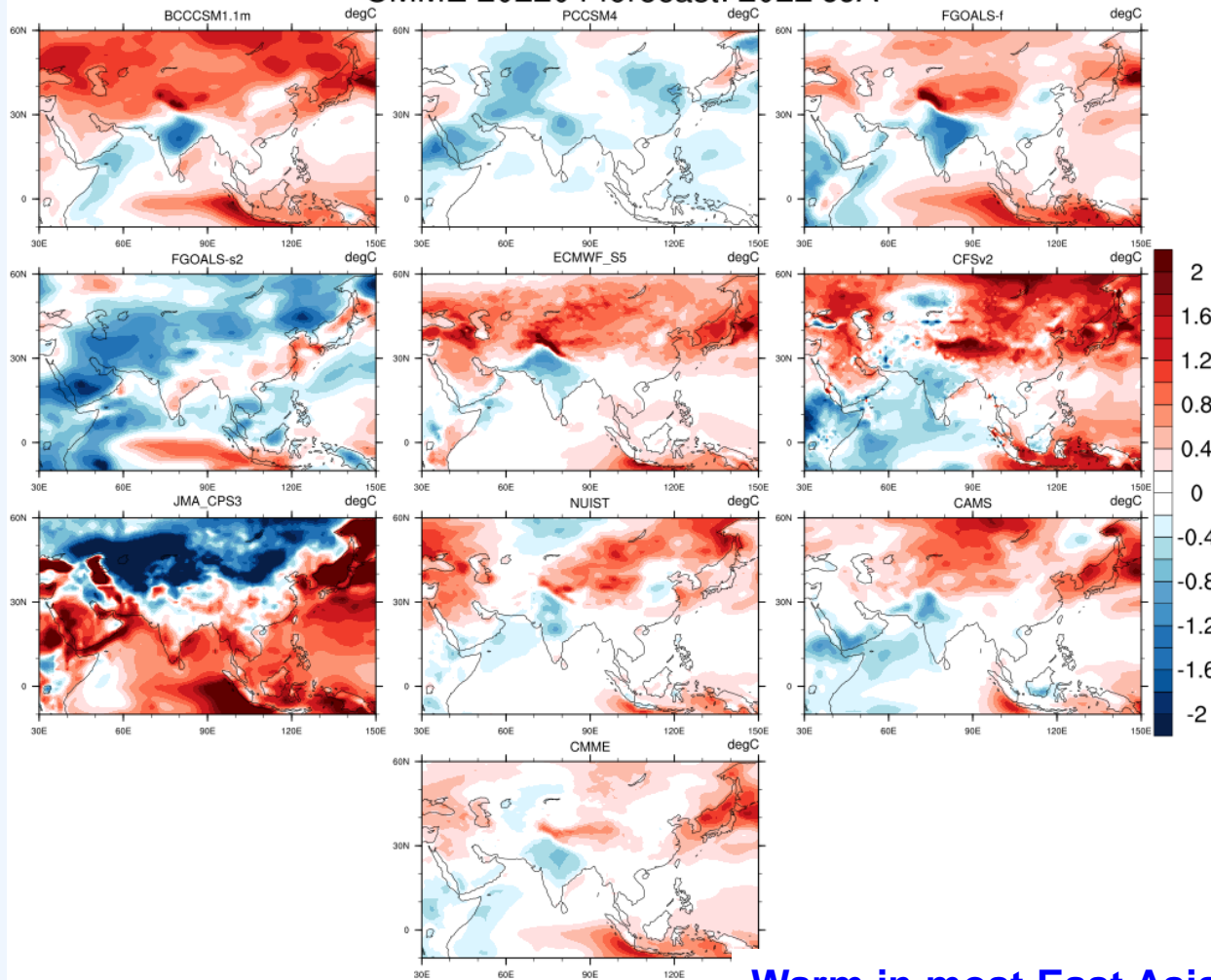


Prediction of T2m in JJA 2022



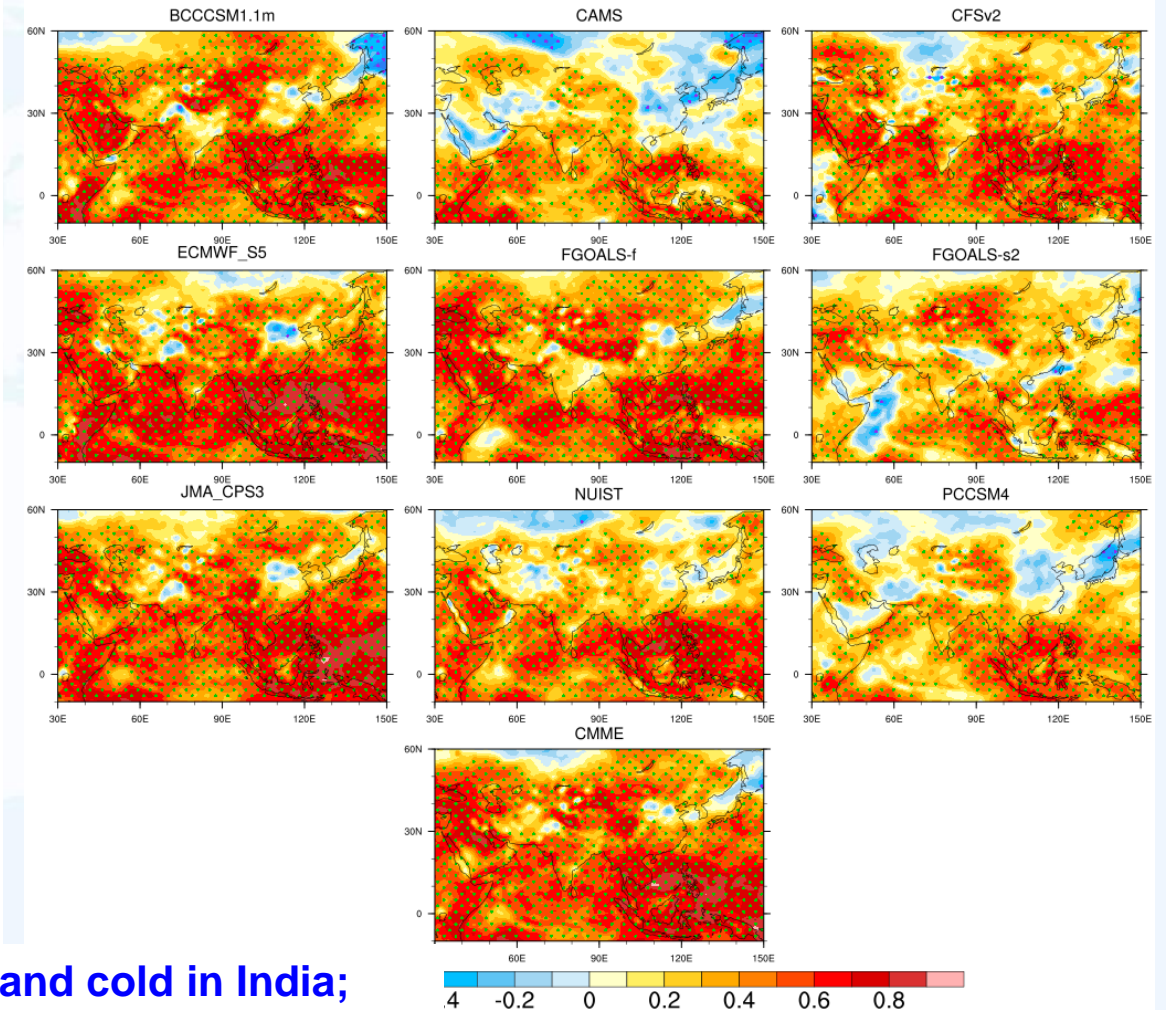
Prediction

2m Air Temperature Anomalies
CMME 202204 forecast: 2022 JJA



Verification (TCC Skill)

TCC of season T2m: 1991-2020
FCS ini: APR Target: JJA (Lead 2 month)

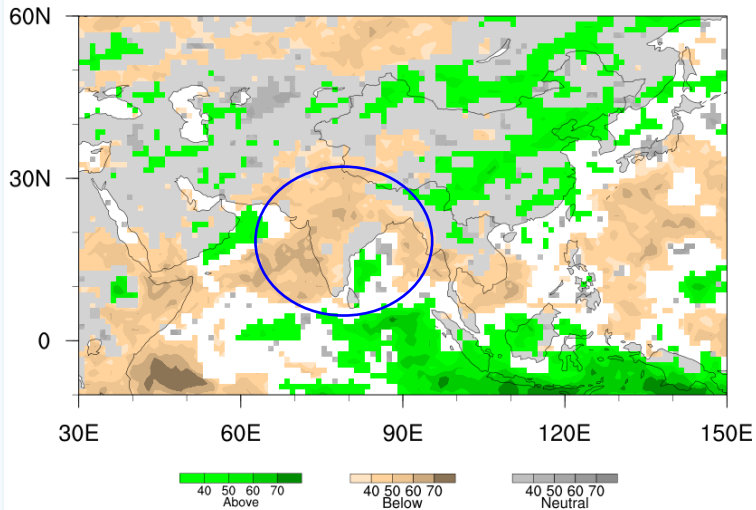


Warm in most East Asia and cold in India;
Overall good performance in T2m prediction.

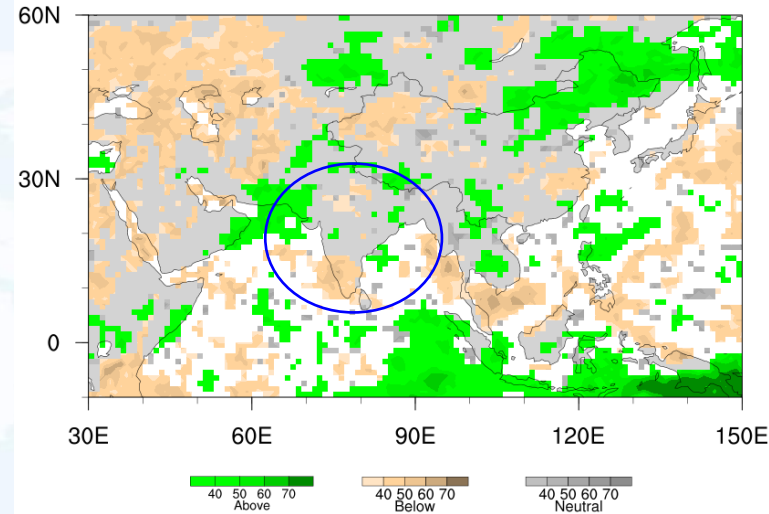
Probabilistic Prediction



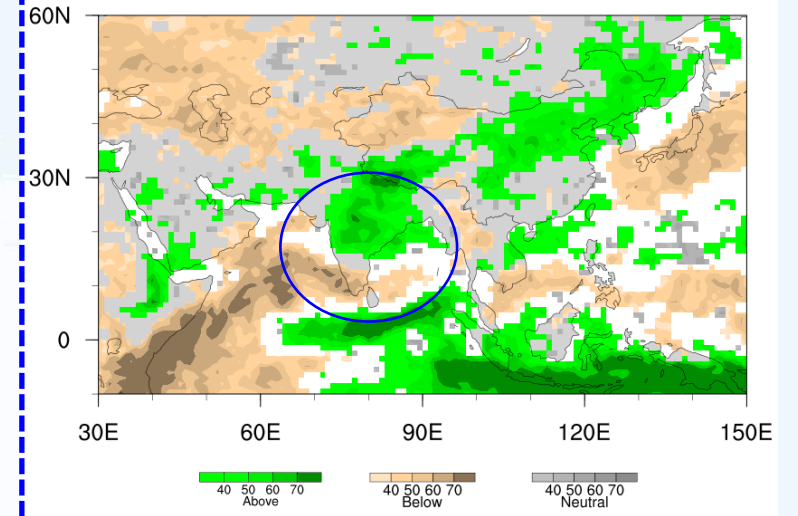
Forecast: lead 4 month (issue at 202202)



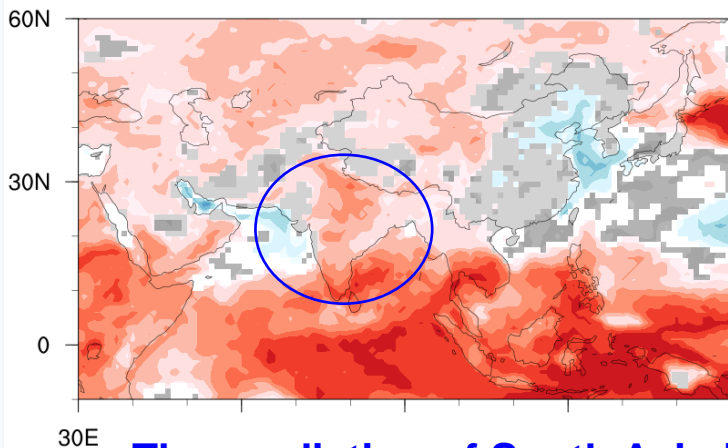
Forecast: lead 3 month (issue at 202203)



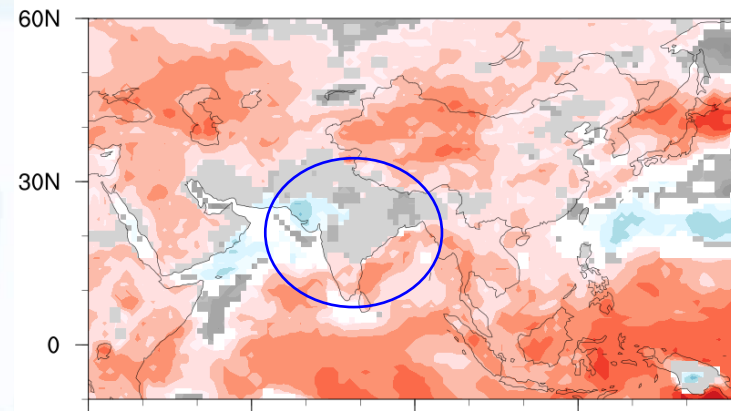
Forecast: lead 2 month (issue at 202204)



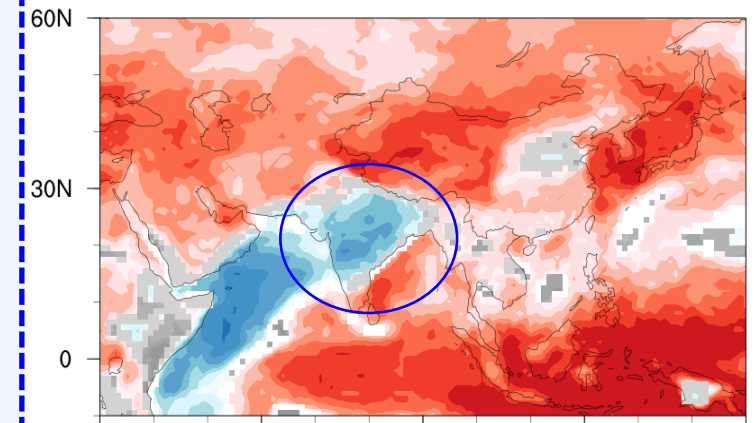
T2m Forecast: lead 4 month (issue at 202202)



T2m Forecast: lead 3 month (issue at 202203)



T2m Forecast: lead 2 month (issue at 202204)

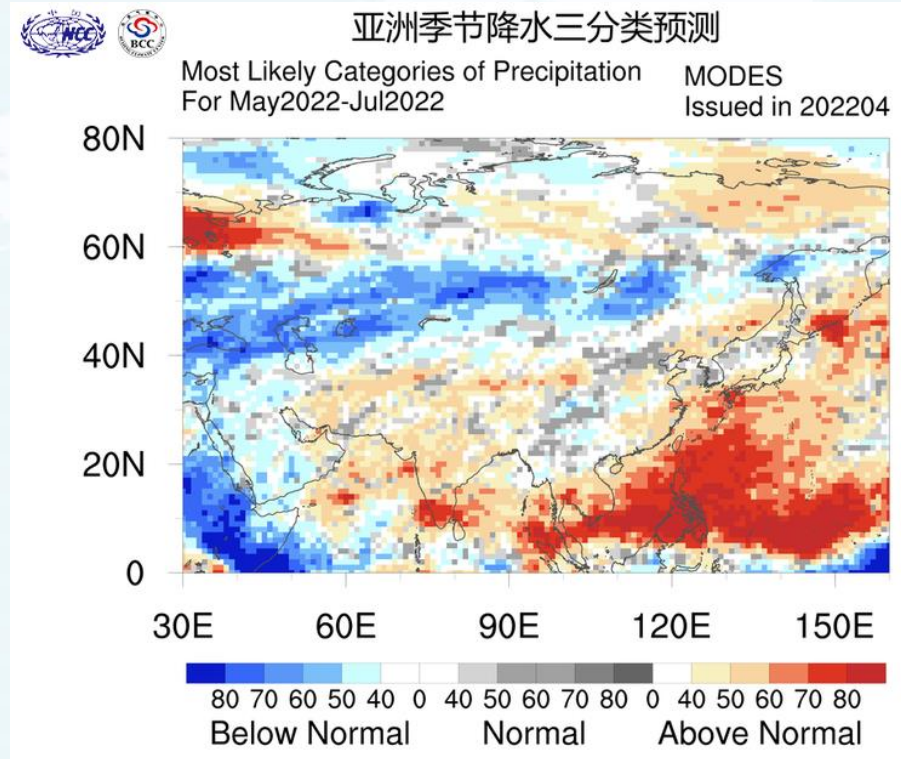


The prediction of South Asia is significantly different with different initial date, which might be associated with the abrupt change of Tibetan Plateau snow cover from winter to spring.

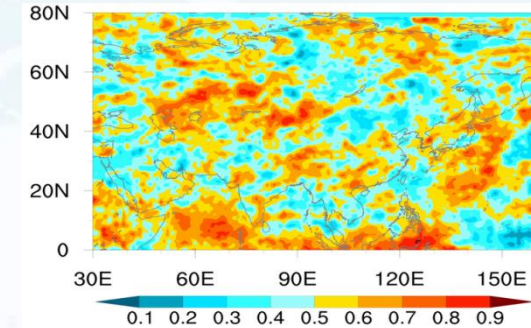
Probability MME Prediction(BCC, MetOffice and CFSv2)



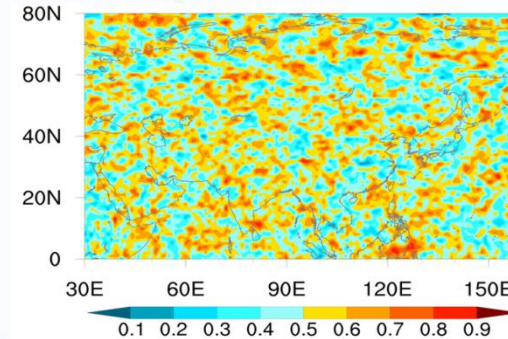
Precipitation



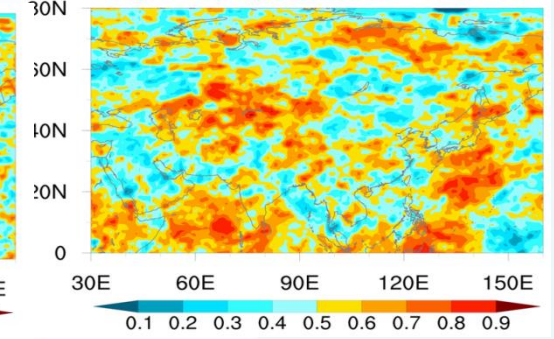
AROC of Below Normal



AROC of Near Normal



AROC of Above Normal

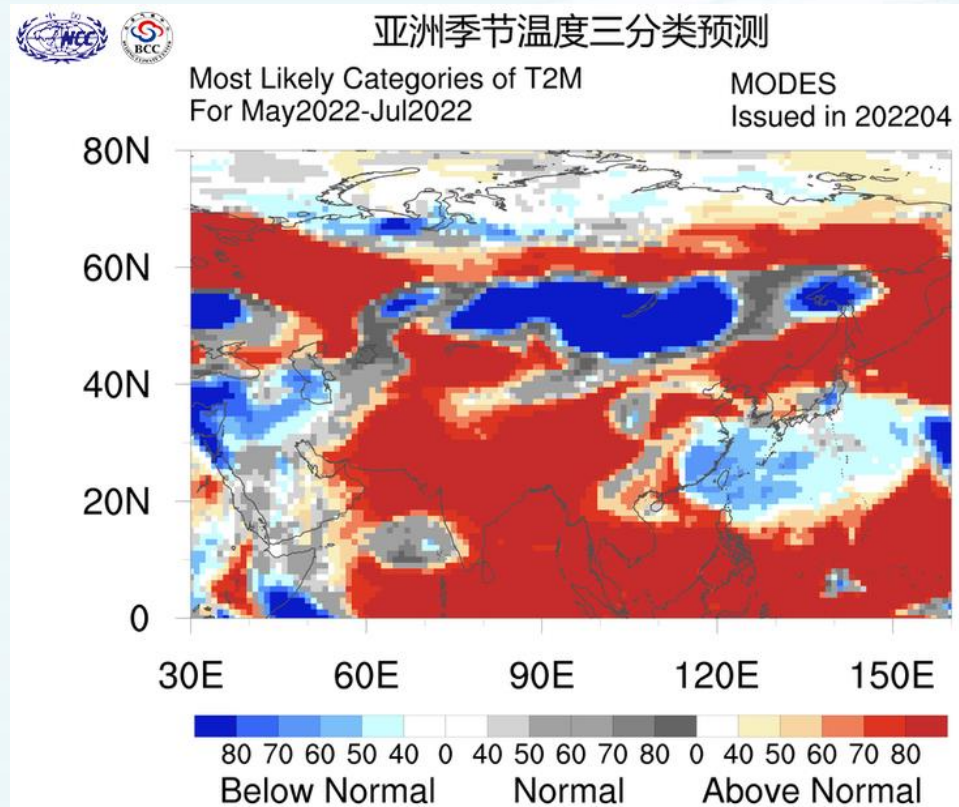


above normal: Northeast Asia, Tibetan Plateau, India and southern part of Indo-China peninsula
below normal: Northwest China, and Southwest China

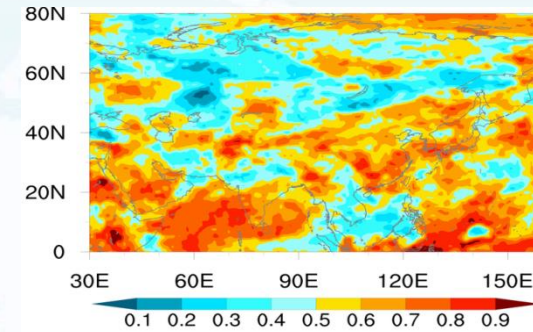
Probability MME Prediction(BCC, MetOffice and CFSv2)



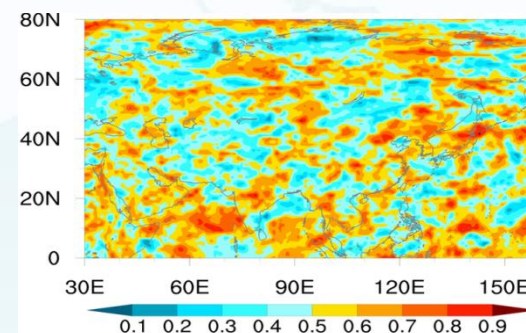
Temperature



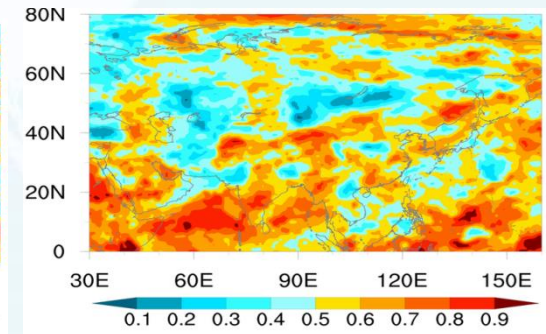
AROC of Below Normal



AROC of Near Normal



AROC of Above Normal



above normal: Most part of tropical and subtropical Asia

below normal: Southeast China, East Japan

Prediction of WNP TC activity in 2022



- It is expected that in 2022, the number of tropical cyclone (TC) genesis over western North Pacific and South China Sea will be 22-25, close to or less than the climatology (25); the number of TC landing in China will be 7-9, close to or more than the climatology (7);
- The overall intensity of TCs will be weak, and the prevailing TC tracks will be mainly westward and northwestward, which might affect the eastern coast of South China, East China and parts of the northern China, with higher possibility of northward landing TCs. The first landing time of TC in China will be earlier than normal (June 29), and the last landing time will be later than normal (October 3).

Composites of TC track density anomalies with different ENSO trend



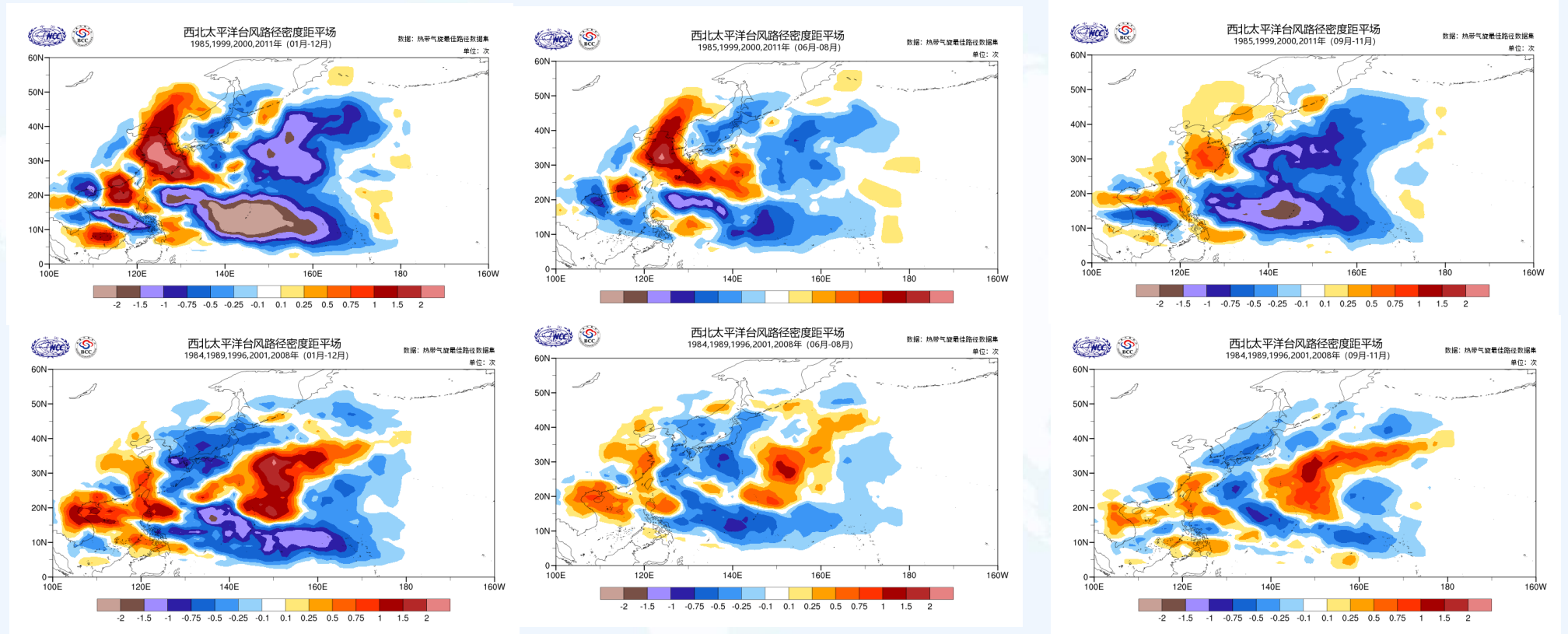
Jan to Dec

Jun to Aug

Sep to Nov

La Niña persists
through summer

ENSO neutral
phase in summer



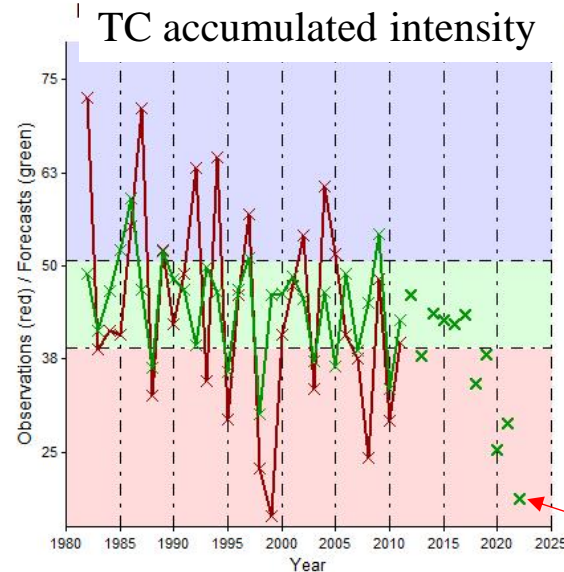
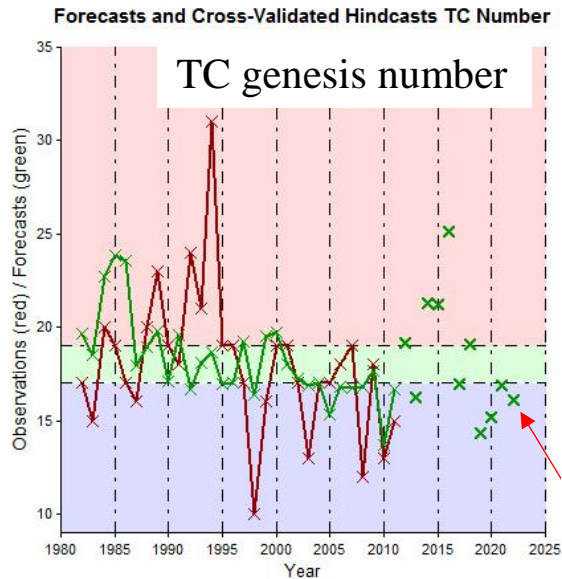
Under the background of both La Niña and ENSO neutral phase, statistical analysis indicates that the total account of WNP TC genesis is below normal. However, due to the location of TC genesis and prevailing TC tracks, the number TCs making landfall is above normal.

Statistical downscaling predictions

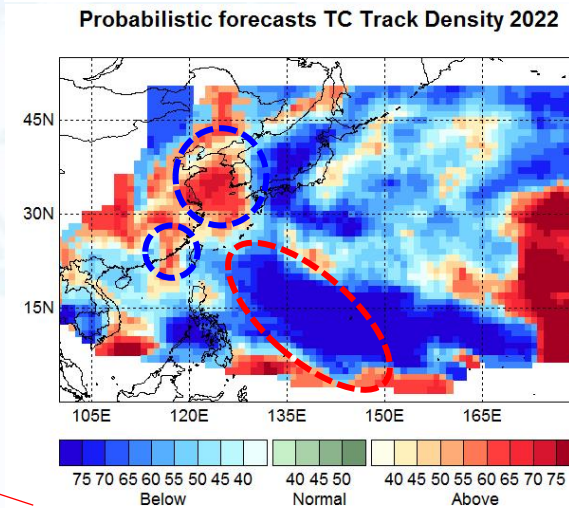


——Based on the CFSV2 forecast starting in March

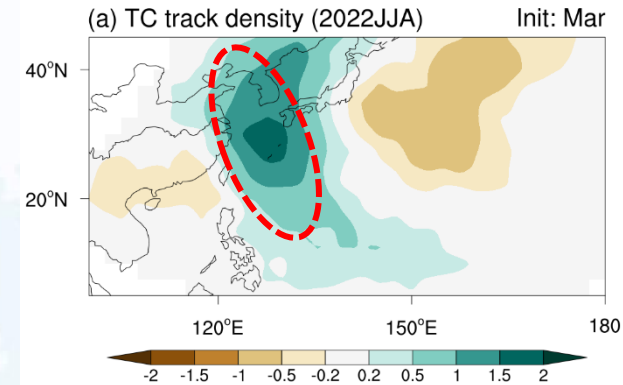
Cross-Hindcasts and independent sample predictions



3 classification probability prediction of TC track density



prediction of TC track density anom.



Based on the BCC_CSM1.1m initial in Mar

Both statistical and hybrid dynamical-statistical prediction models show that number of WNP TC genesis in 2022 will be below normal, the overall intensity is weak, and the prevailing TC tracks is westward and northwestward.

Forecast based on dynamical models



Atmospheric circulation

- A positive anomalous height center in the mid-high latitude areas of Northeast Asia.
- East Asia Summer Monsoon: strong.
- WPSH: the intensity would be near normal with northward displacement.

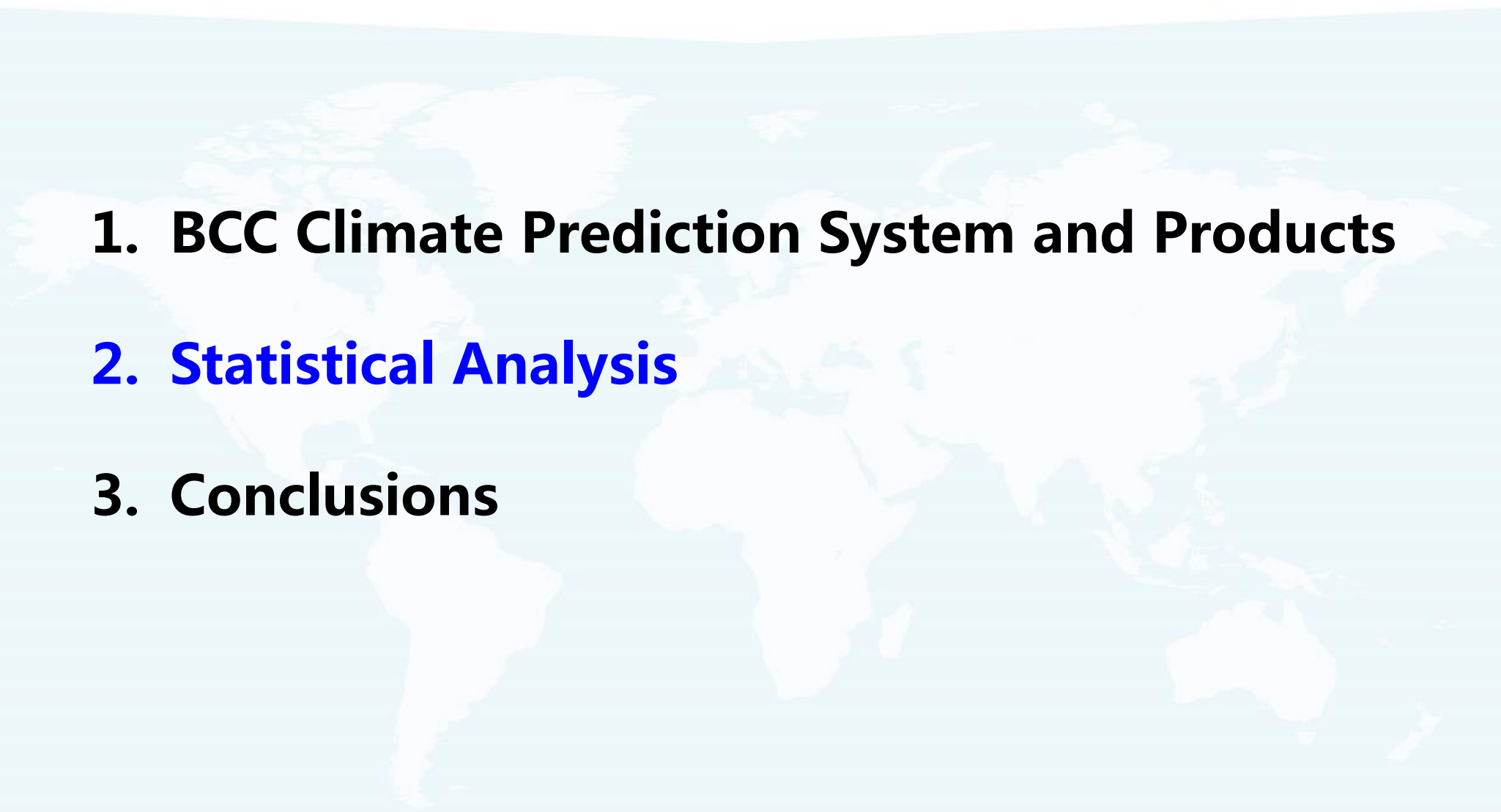
Precipitation and temperature

- Enhanced precipitation over northeast Asia, depressed TC activity over WNP
- Warmer than normal for most of Asia except for India.



Outline



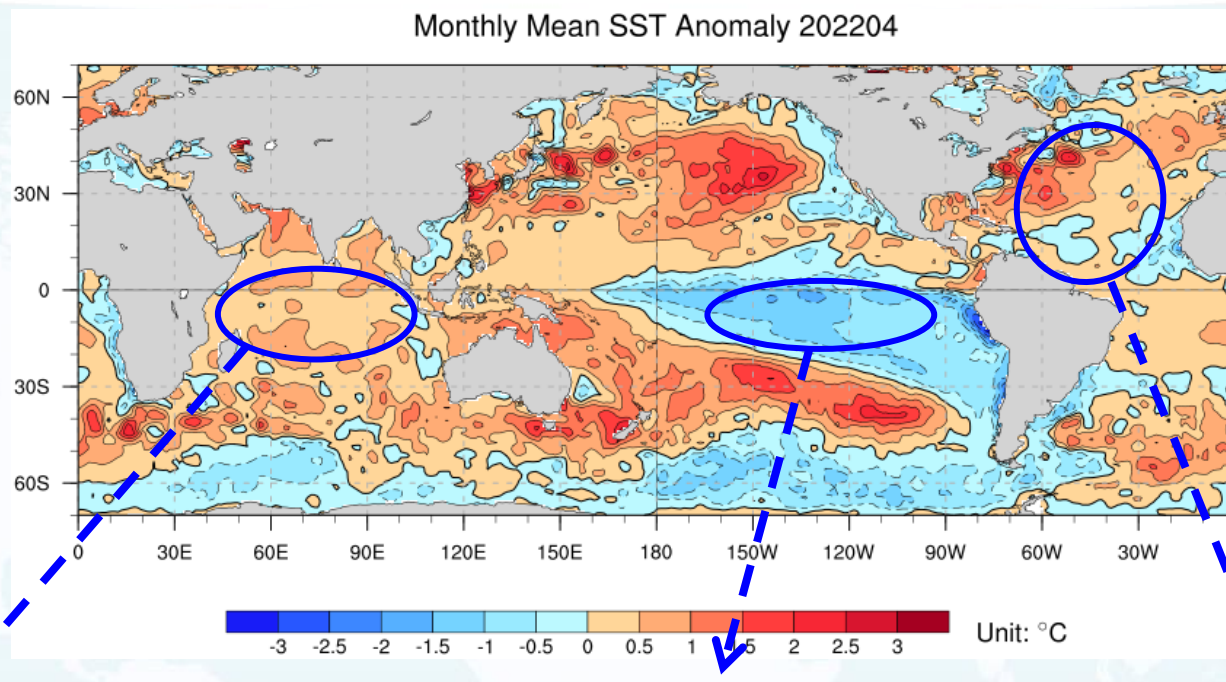
- 
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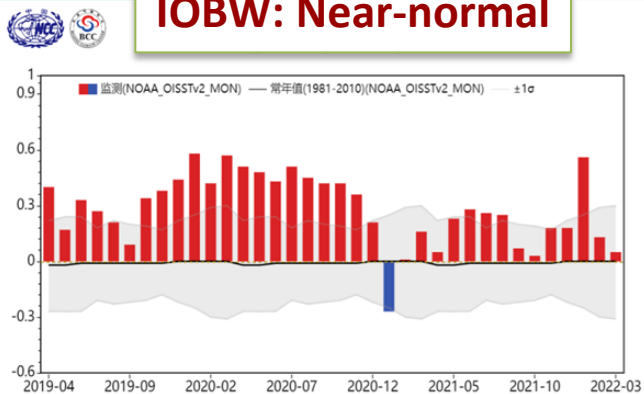
Possible impacts from the external-forcing:

- **Decaying phase of the La Nina event;**
- **Positive phase of North Atlantic Tripole (NAT) SSTA pattern;**
- **Less snow cover over Tibet plateau in spring;**

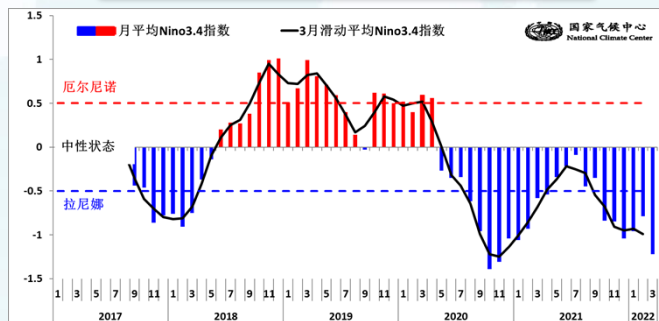
Monitoring of monthly sea surface temperature anomalies



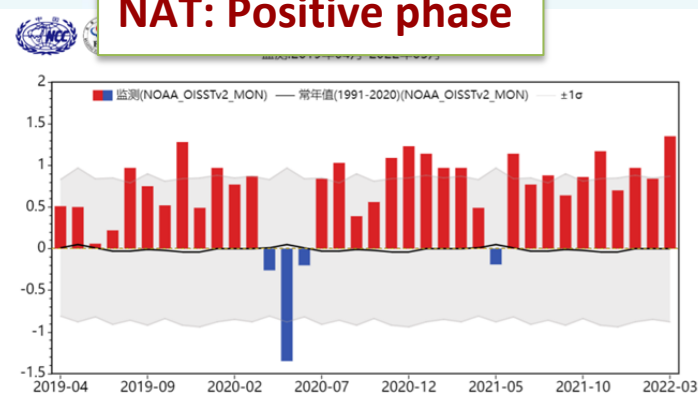
IOBW: Near-normal



ENSO: La Nina event



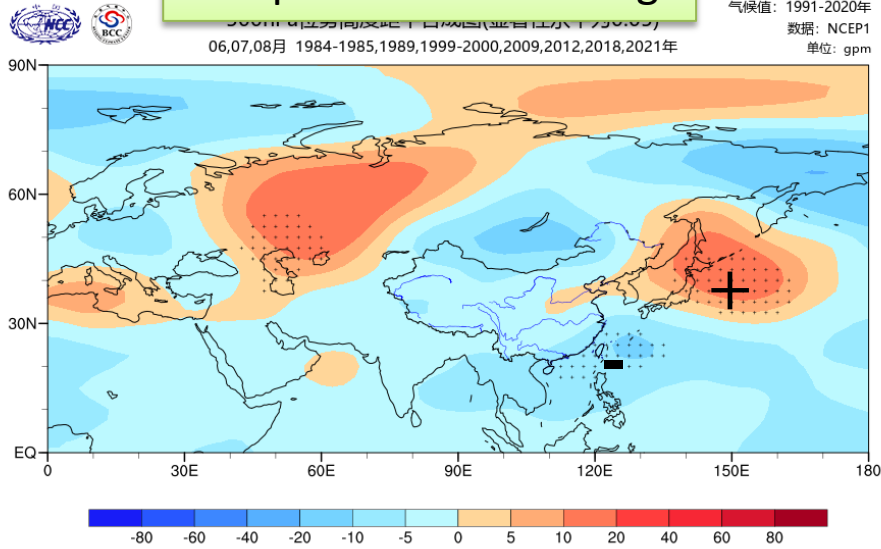
NAT: Positive phase



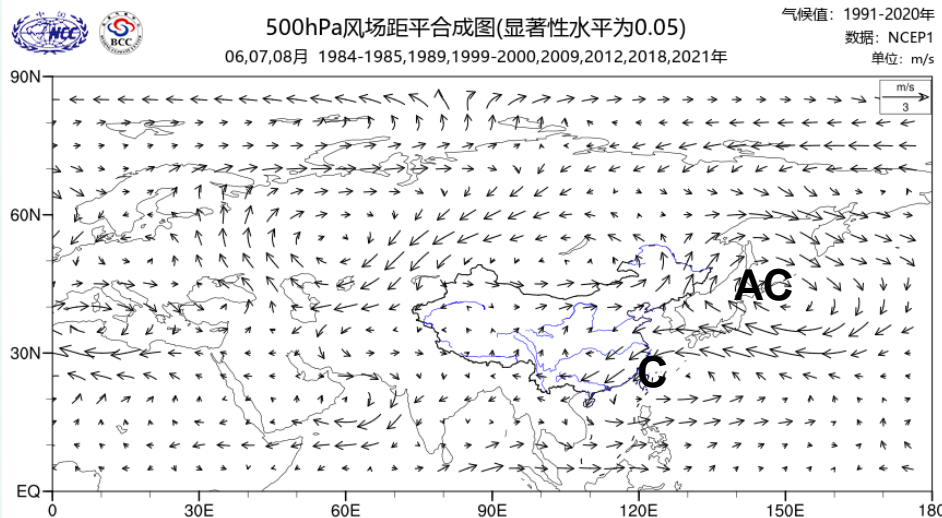
Joint impact of La Nina event and positive NAT on EASM



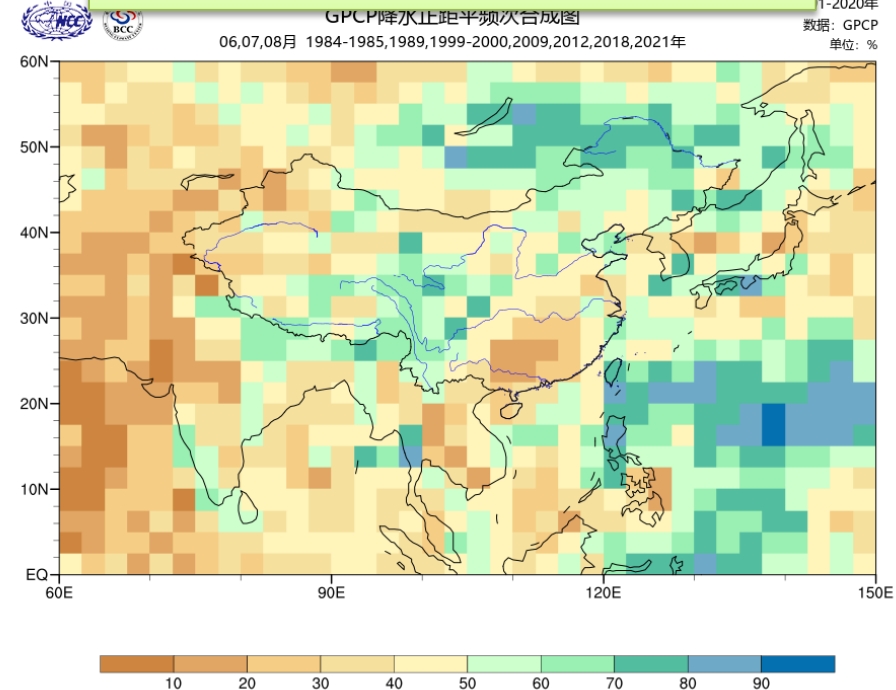
Composite of 500hPa hgt



500hPa风场距平合成图(显著性水平为0.05)



Composite of summer precipitation

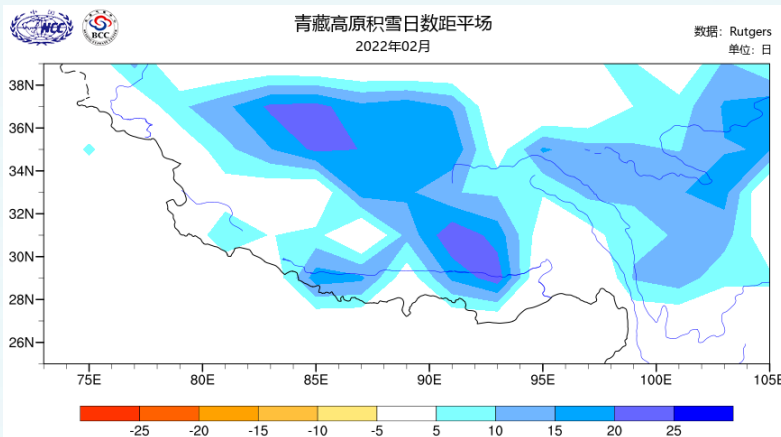


- More precipitation in Northeast Asia, Southwest China, south Japan, north India, and Philippines.
- Less precipitation near Yangtze River Valley, Northwest and South China, west Indian and southern part of Indo-China Peninsula.

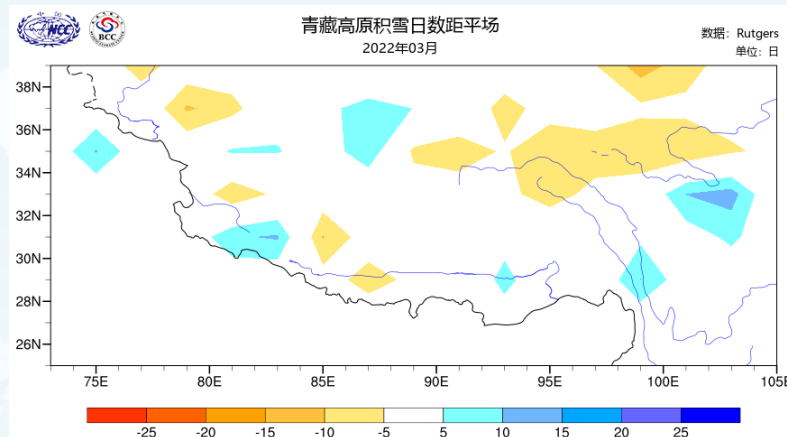
Snow extent across Tibet Plateau is below normal



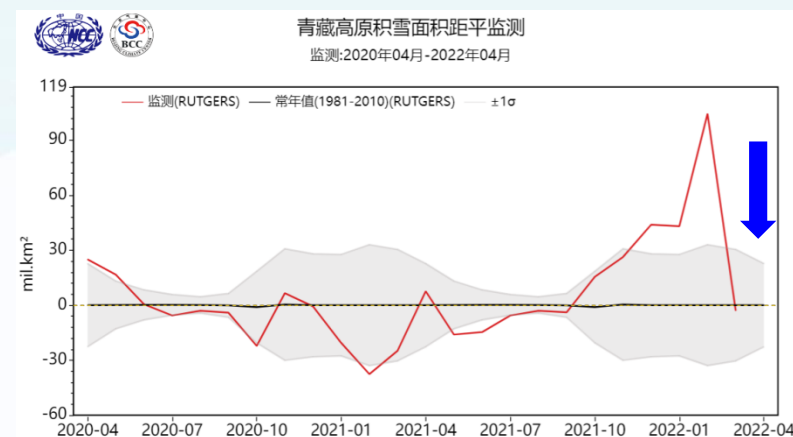
Days with snow cover over TP in Feb



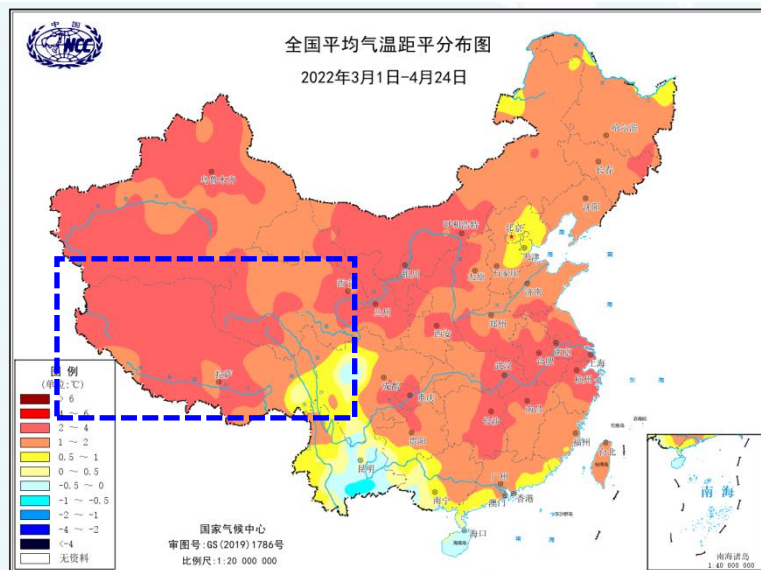
Days with snow cover over TP in Mar



Monthly areas of snow cover over TP



Monthly temperature anomalies since Mar 1

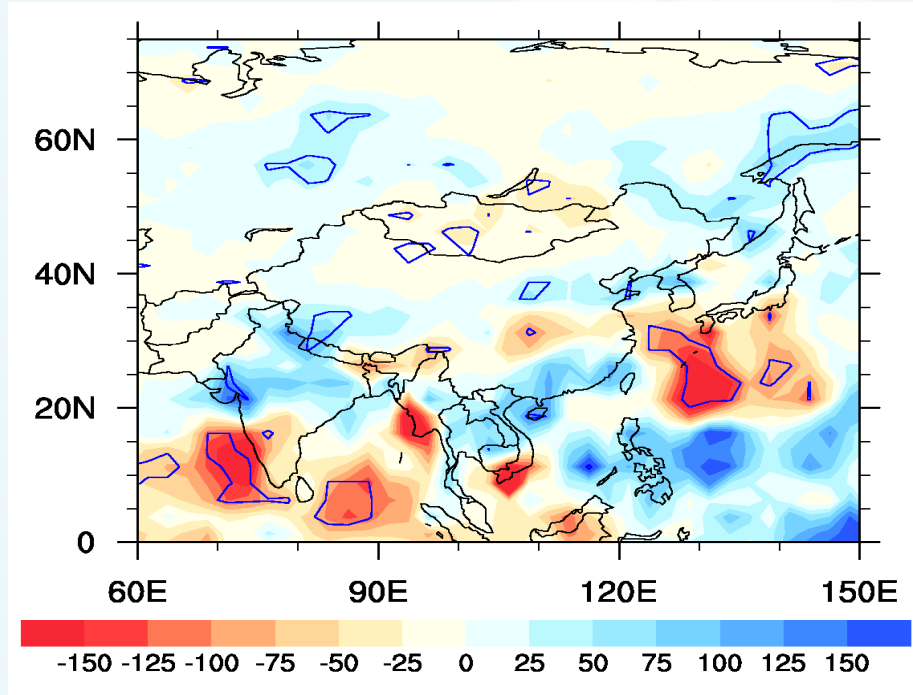


- Due to the abnormal warm March of 2022, the snow cover over Tibetan Plateau decays rapidly and below normal in April;
- Below normal snow cover over TP is favorable for strong EASM.

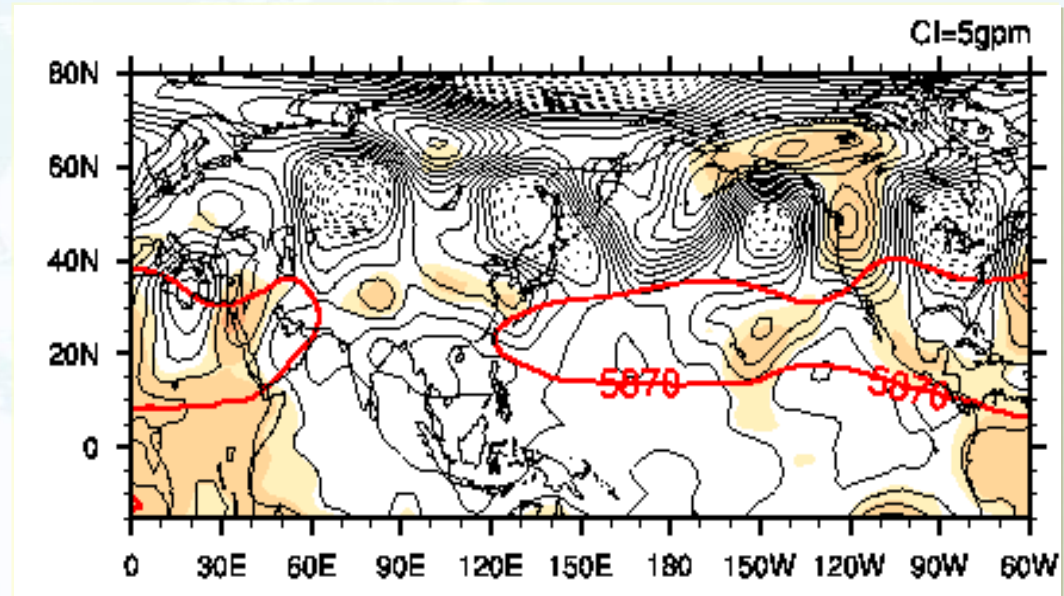
Impacts from Tibet Plateau snow on EASM



Composite of precipitation anomalies in JJA



Composite of 500hPa in JJA

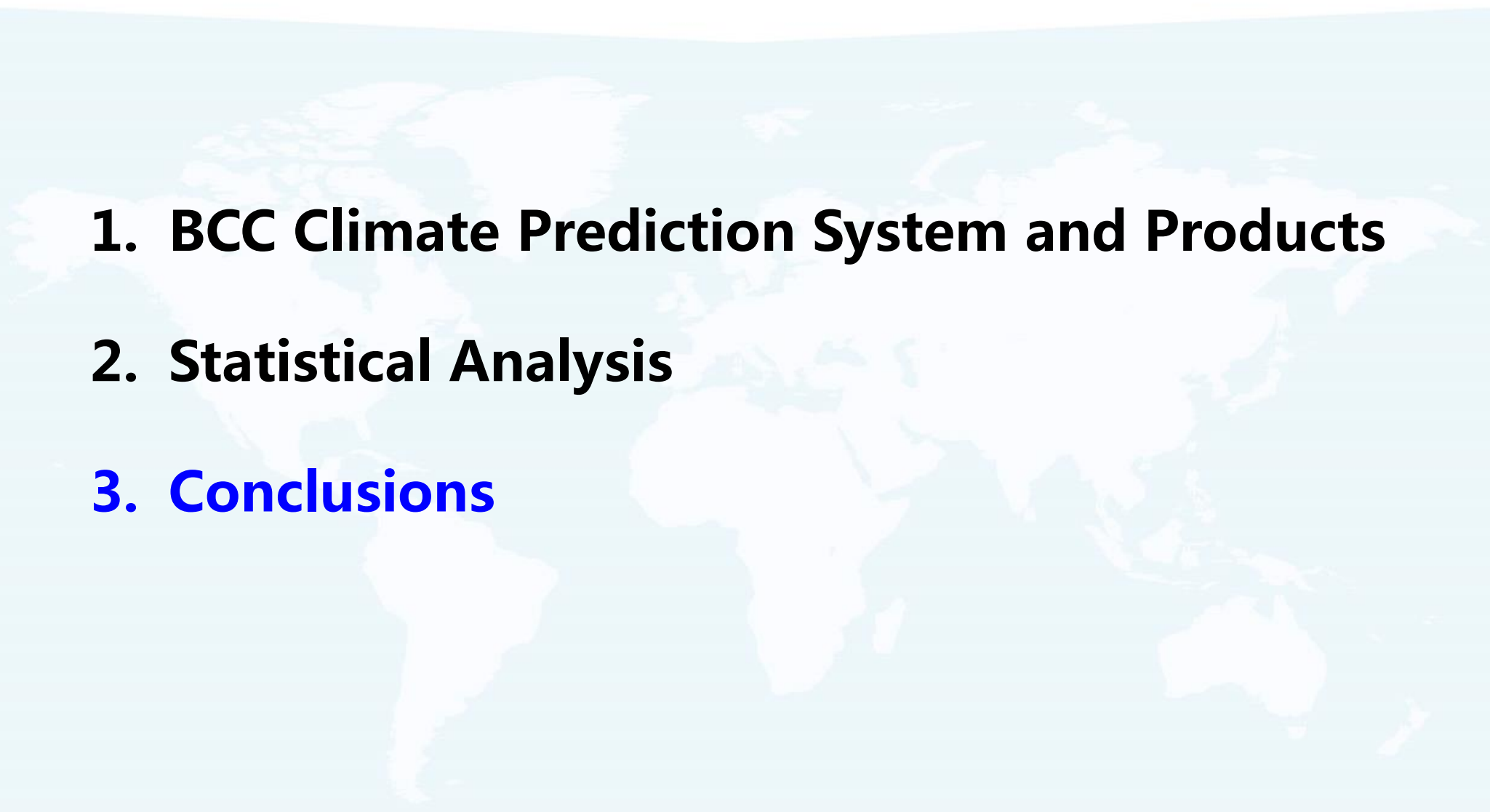


**More precipitation in Northeast Asia, North China, South China, and North India.
Less precipitation near Yangtze River Valley, and South India.**



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Summary



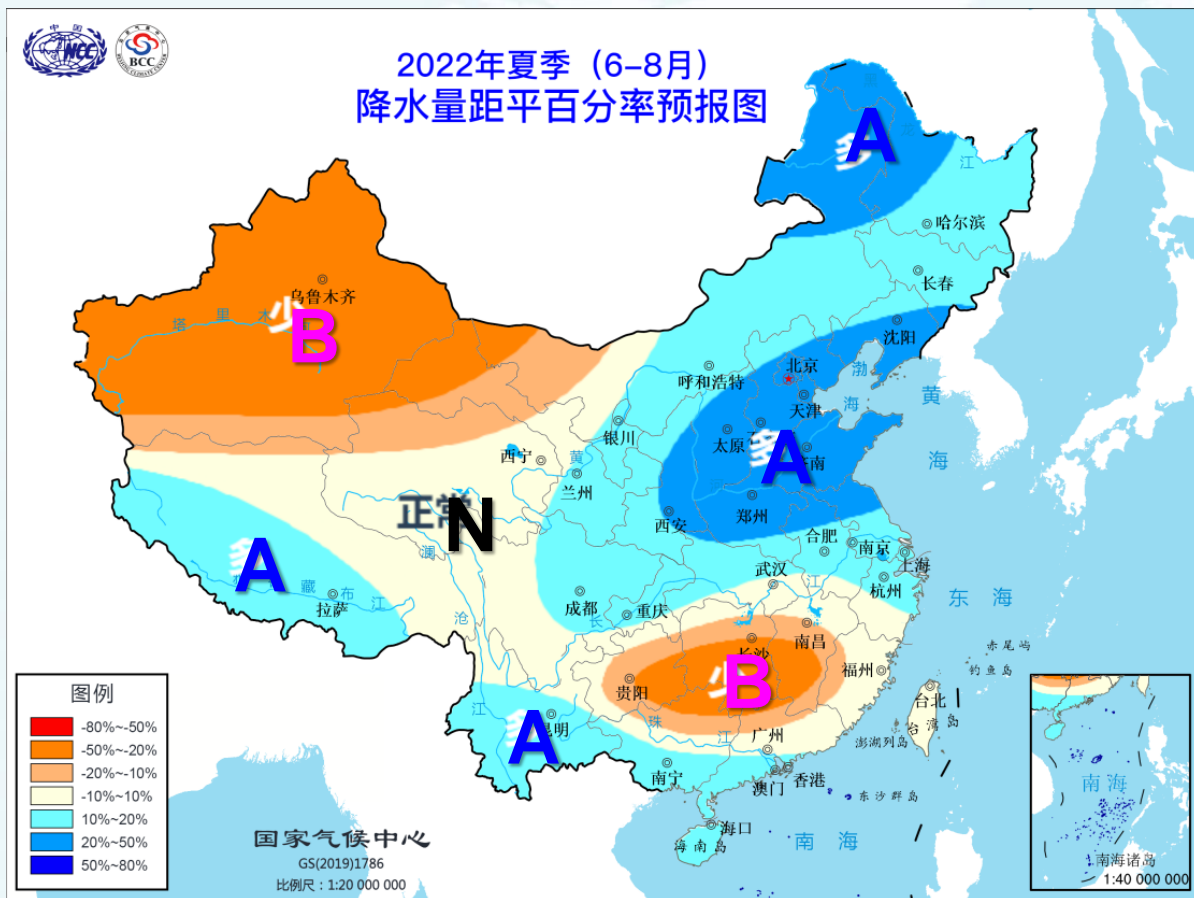
- ❑ The La Nina event will weaken in the next three months, and the SSTA in summer would be near or below normal, which favors a strong EASM and northward displacement of WNPSH.
- ❑ Statistic analysis show that both the decaying La Nina and the reduced snow cover over the Tibet plateau in winter and spring favor a northward displaced WPSH and a strong EASM.
- ❑ Correspondingly, more precipitation may occur in Northeast Asia, India and southern part of Southeast Asia. And less precipitation may occur near the middle and lower reaches of Yangtze River Valley, Korea, part of Japan and western part of Indo-China Peninsula. Below normal WNP TC frequency with prevailing northward and northwestward moving track.
- ❑ The temperature may above normal for most Asia regions except for India and Southwest China .

A light blue world map serves as the background for the central text.

Thanks!

A row of stylized wind turbines is visible along the bottom edge of the slide.

Prediction of precipitation anomaly percentage in JJA 2022



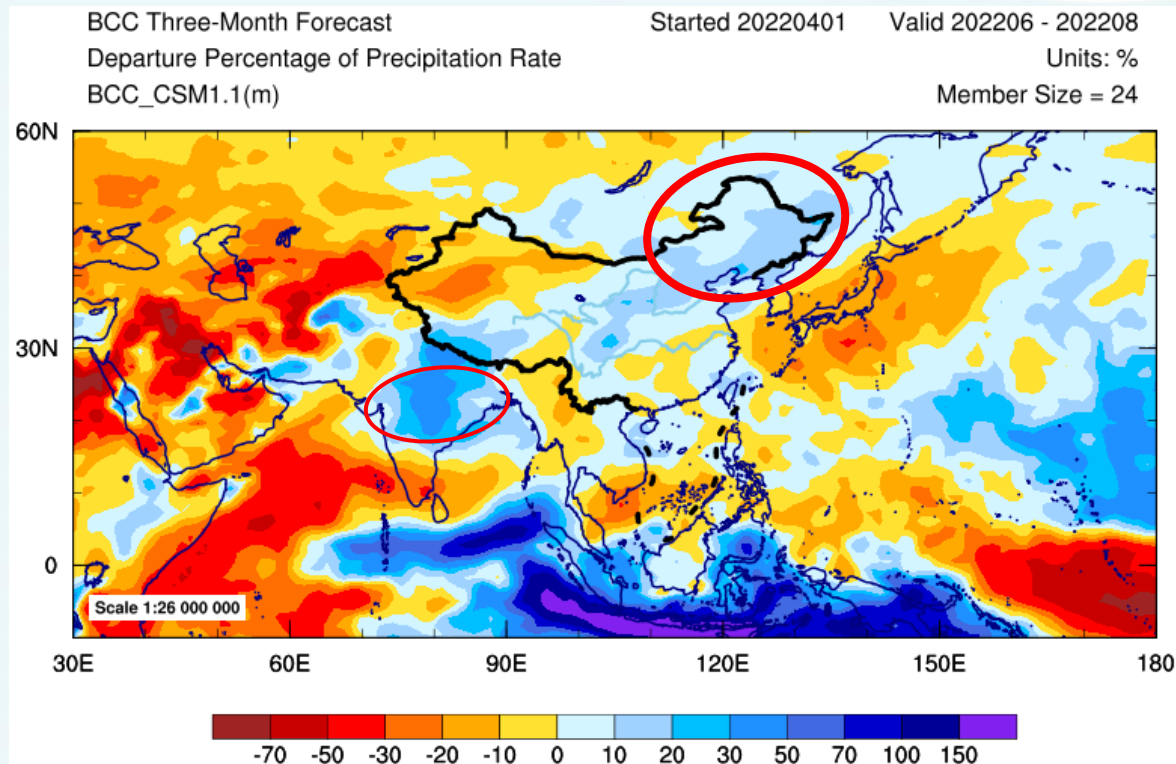
A: above normal
B: below normal
N: near normal

The precipitation over China in JJA 2022 may be more than normal in Northeast and North China, northern part of East China, southern part of South and Southwest China, and southern Tibet plateau. Less than normal precipitation might appear near southern part of Yangtze River basin and northern part of South China, Northwest China.

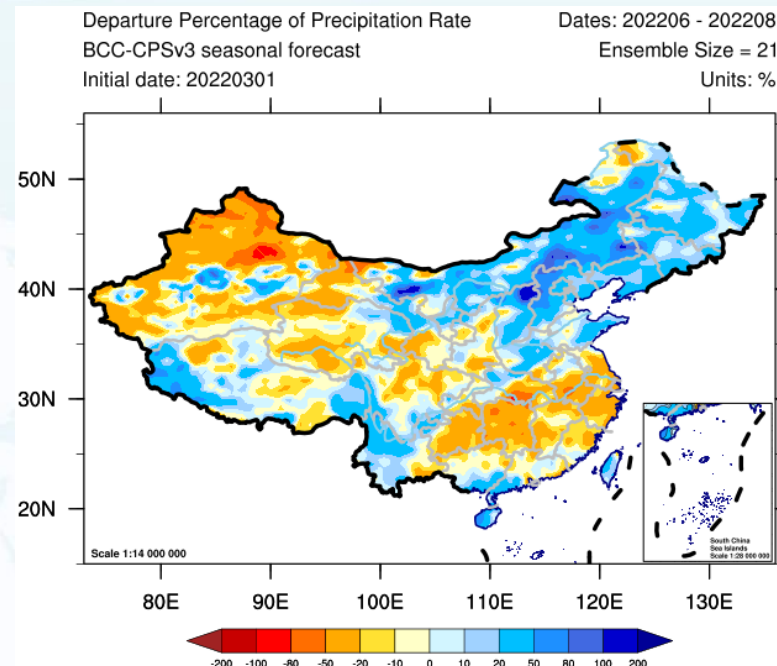
BCC-CPSv2 and CPSv3 forecasts: precipitation rate



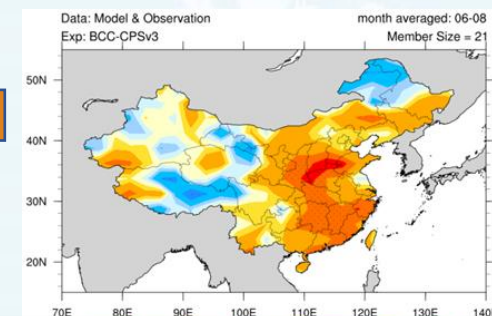
CPSv2



CPSv3



TCC of JJA Prcp



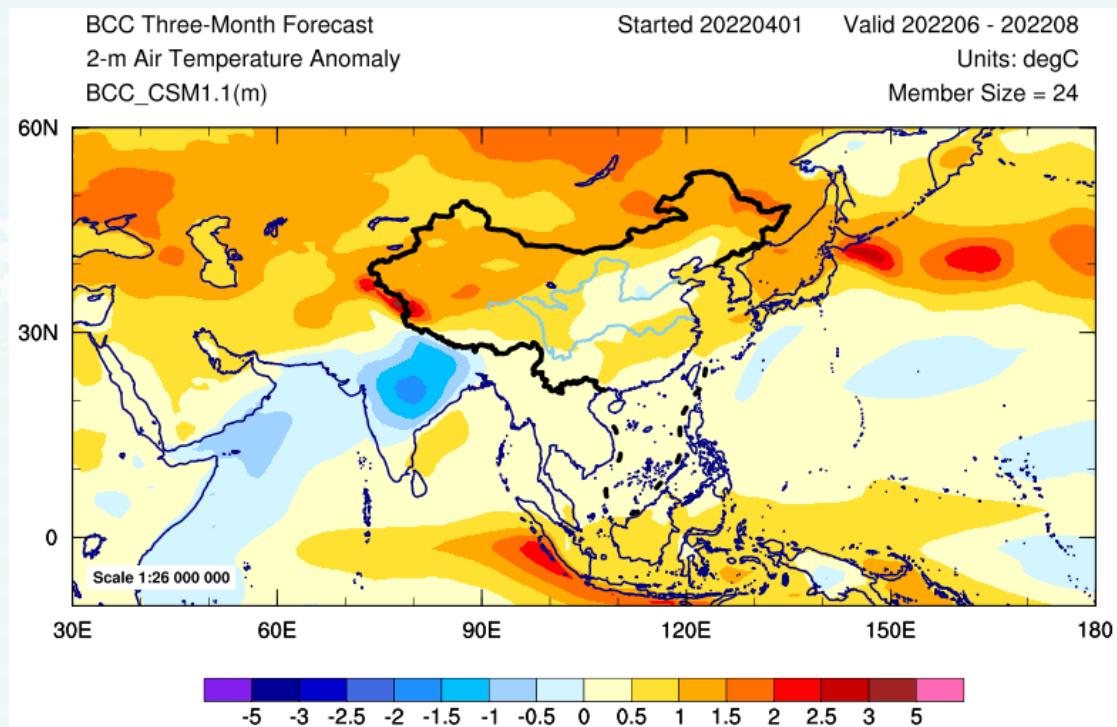
CPSv2: more precipitation over Northeast Asia, India, southern part of Southeast Asia

CPSv3: more precipitation over North China and North China, less precipitation over Yangtze River Valley

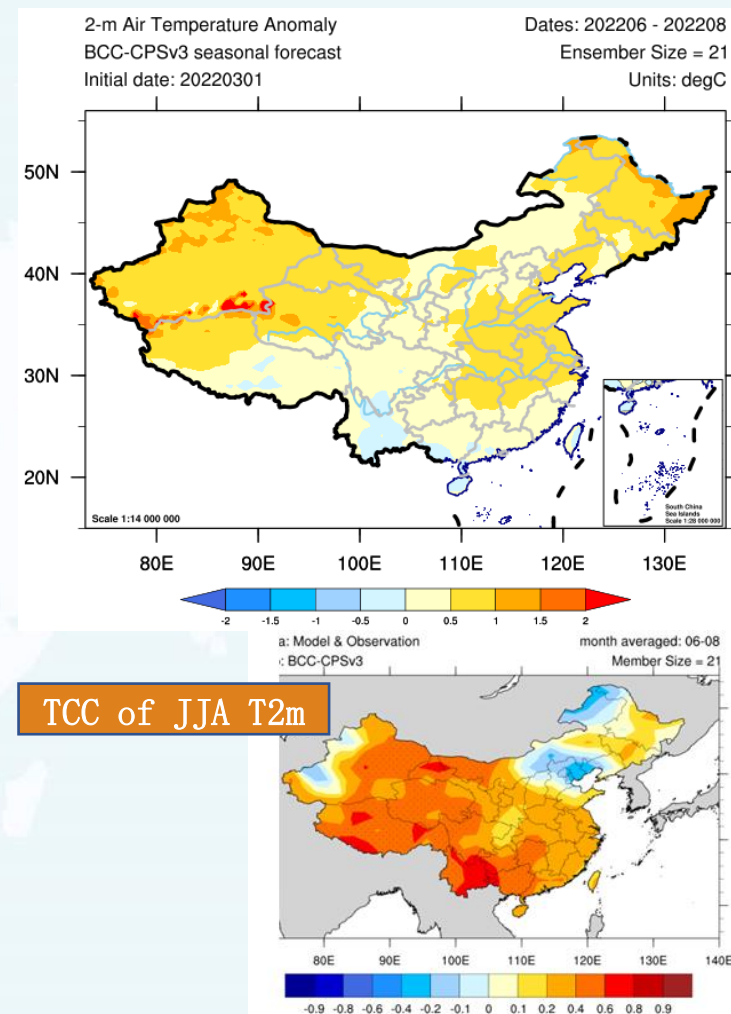
BCC-CPSv2 and CPSv3 forecasts: temperature anomaly



CPSv2



CPSv3



below normal: part of India (CPSv2), part of Southwest China (CPSv3)

CMME

