

**The 3rd Session of the Third Pole Climate Forum
and Meeting of the Third Pole RCC-Network Task Team**



Seasonal Climate Outlook for JJAS 2025

ZHANG Daquan, ZHAO Junhu, GAO Hui

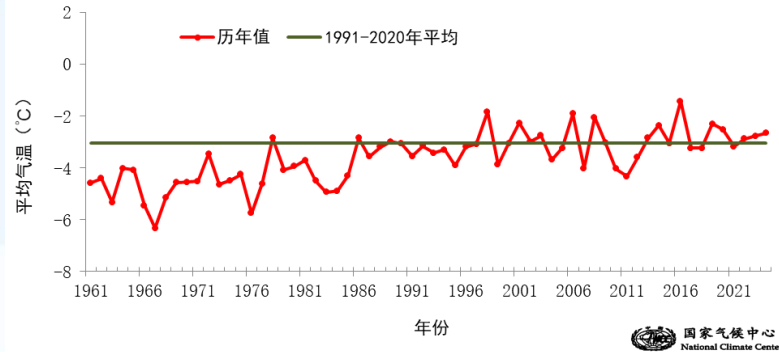
Beijing Climate Center, June 4, 2025

Outline

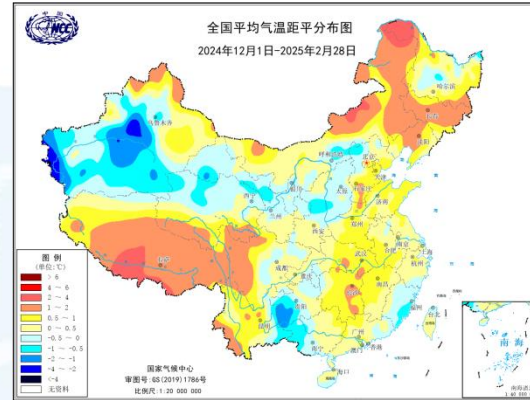
1. **Current Climate Conditions in China**
2. **Monitoring of Atmospheric Circulation and External Forcing**
3. **Prediction and Diagnostic Analysis**
4. **Outlook for JJAS 2025**

A Brief Review of Winter Climate in China

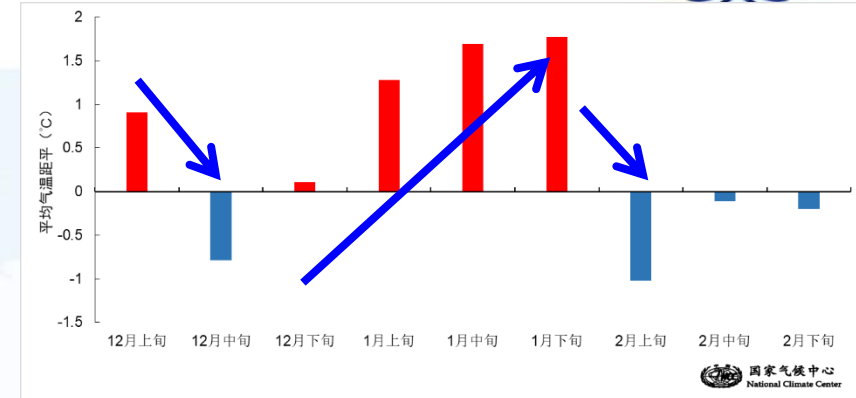
temperature



Time series of winter mean temperature(°C) in China



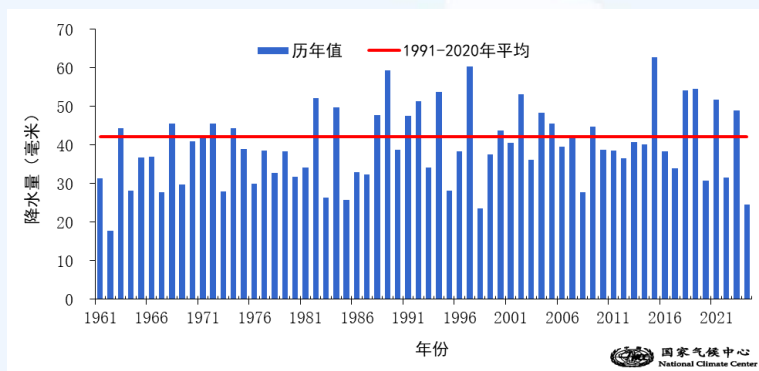
Winter mean temperature anomalies (°C) over China



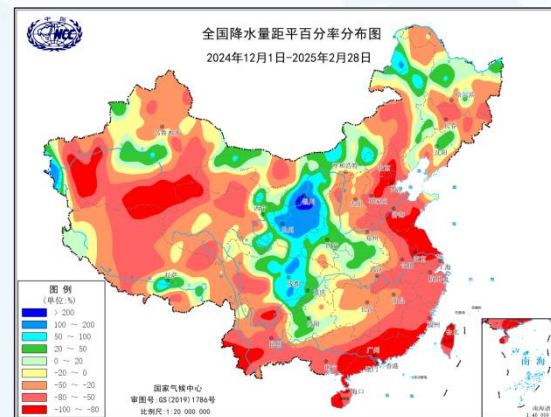
Time evolution of 10-day mean temperature anomalies (°C) during 2023/2024 winter in China

- In 2024/25 winter, seasonal mean temperature was slightly higher(0.4°C) than normal.
- The 10-day mean temperature fluctuated greatly in stages;
- Large temperature variation: cold in early winter and late winter, warm in mid-winter.

precipitation



Time series of winter mean precipitation(mm) in China



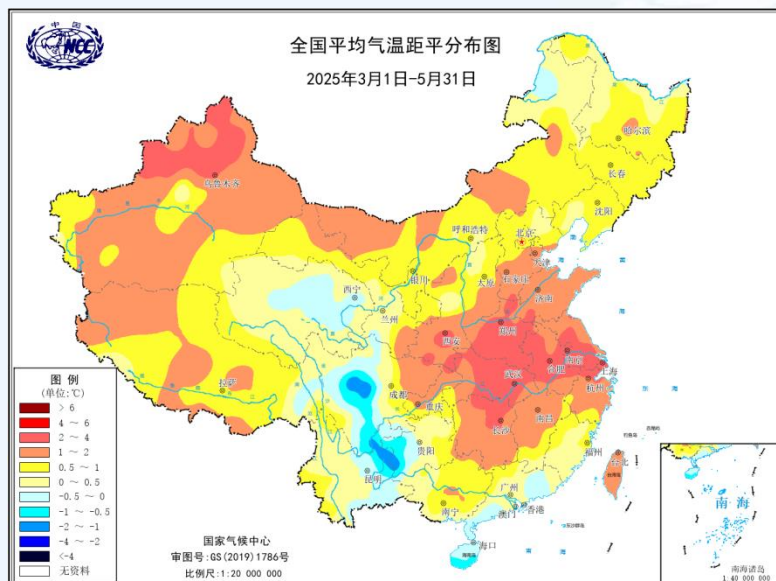
Winter mean precipitation percentage anomalies(%) over China

- The national average precipitation is 24.6 mm, 41.8% less than normal, the third lowest since 1961

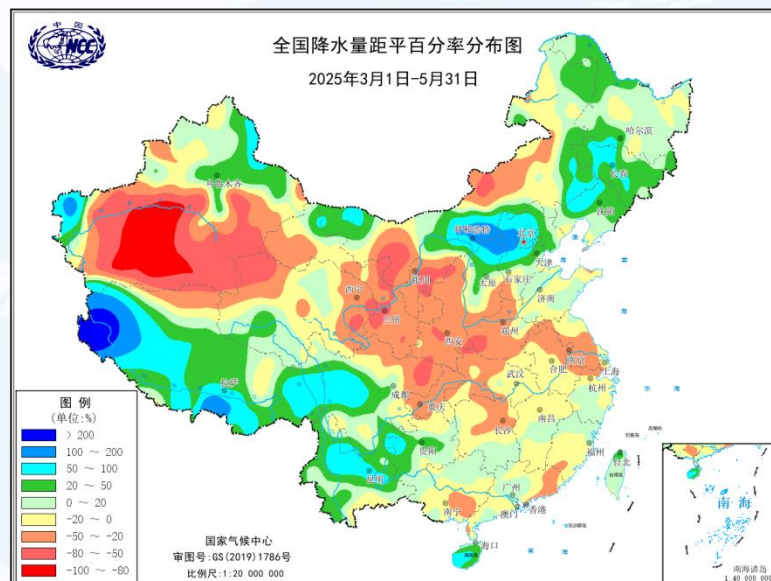
Current Climate Conditions in China-MAM



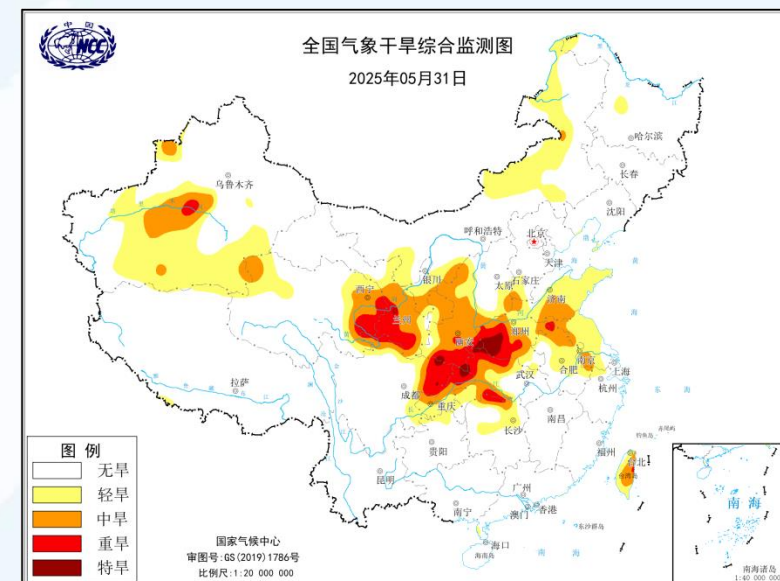
Mean temperature anomalies
2025.3.1-5.31



Mean precipitation percentage anomalies



Monitoring of drought index
2025.5.31



- Since May, the meteorological drought in most parts of North China, the middle and lower reaches of the Yangtze River, and South China has eased, while the drought in Shaanxi, Gansu, Ningxia, Henan, Shanxi and other areas has continued to develop.

Outline

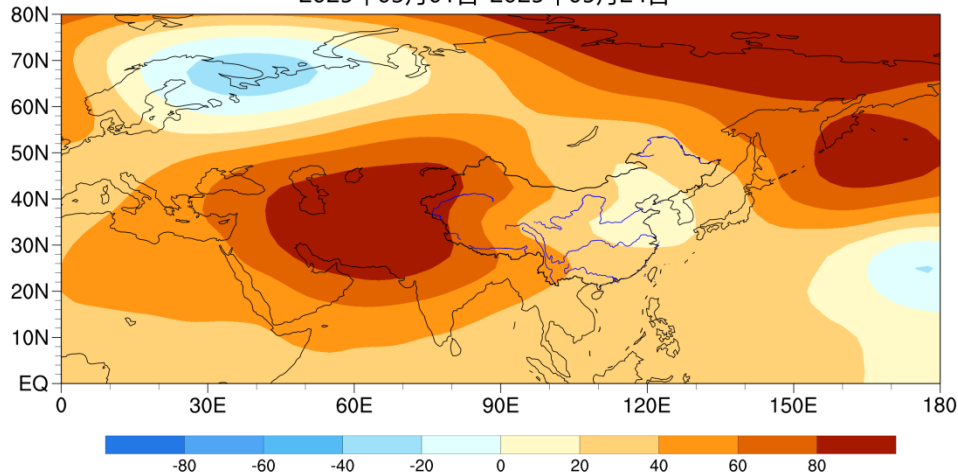
1. **Current Climate Conditions in China**
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Monitoring of Circulation and External Forcing-SA H

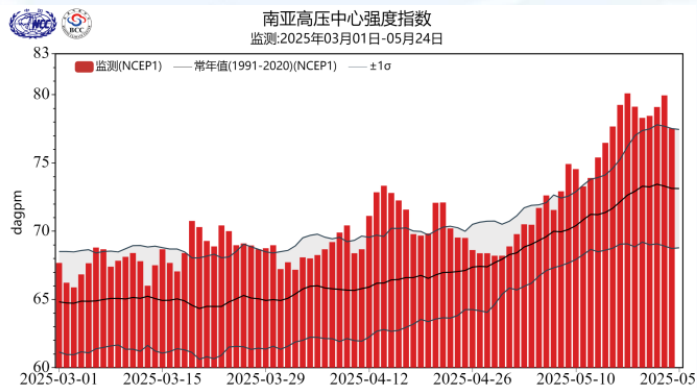


GPH anomaly at 100hPa since Mar 2025

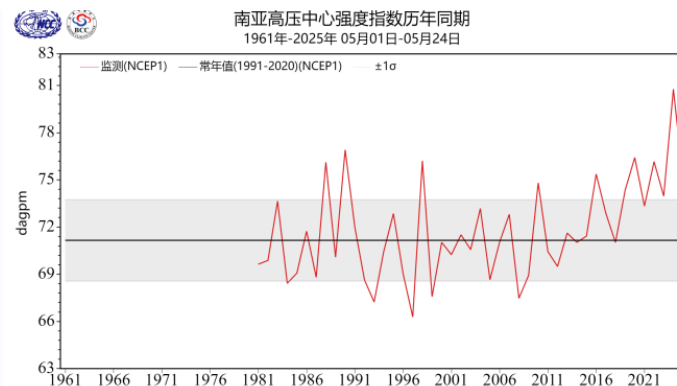
2025年03月01日-2025年05月24日



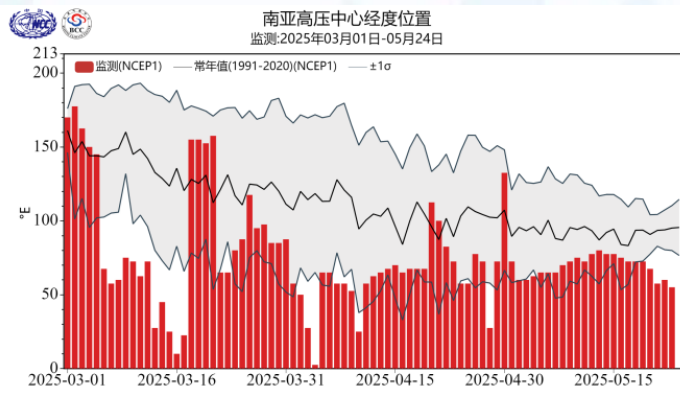
Daily index of SAH intensity



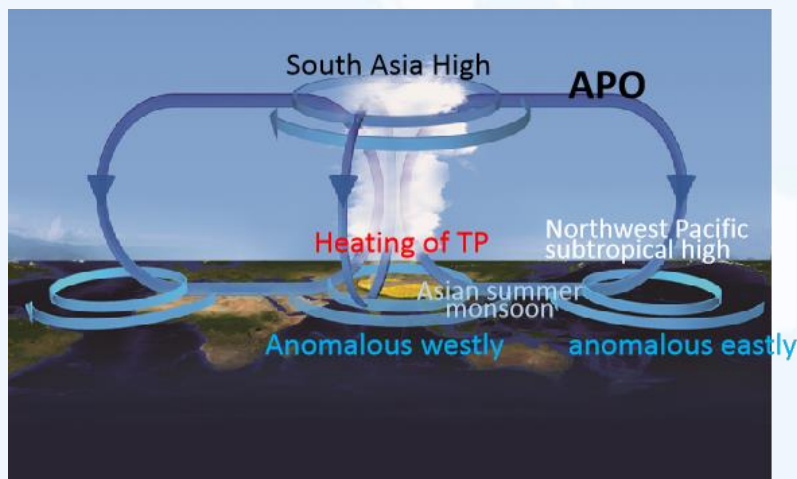
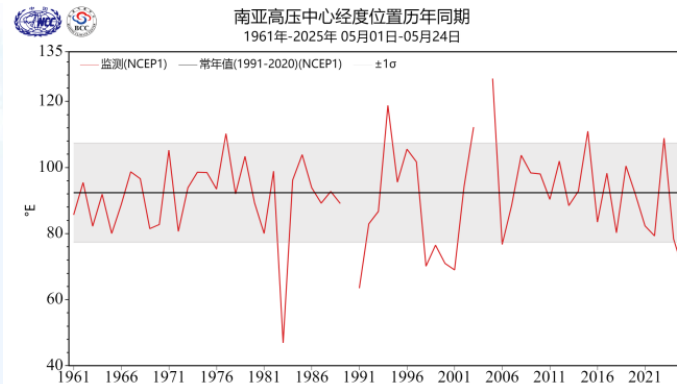
Inter-annual variation of SAH intensity in May



Daily index of SAH zonal center



Inter-annual variation of SAH zonal center in May



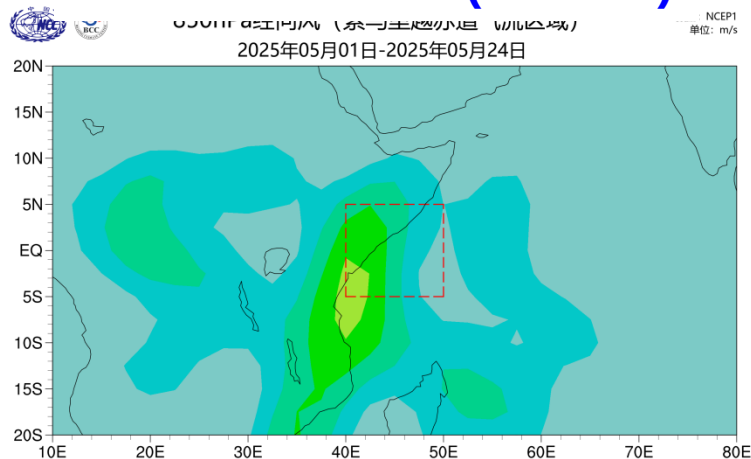
➤ Strong and westward shifted SAH since March 2025.



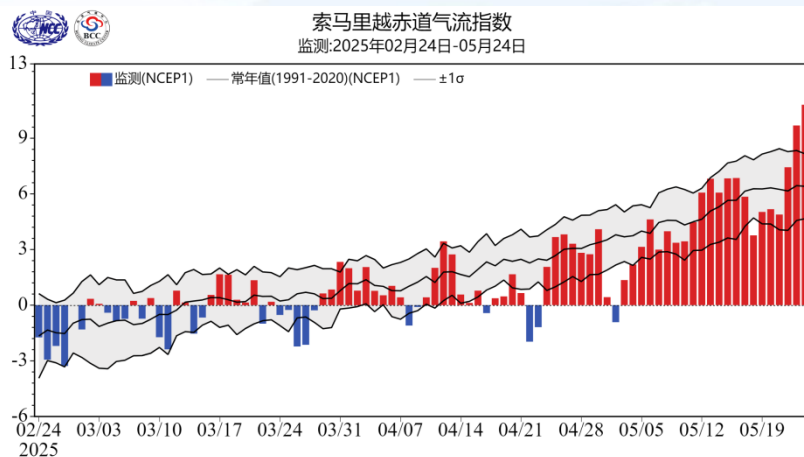
Monitoring of Cross-Equatorial Flows (CEFs)



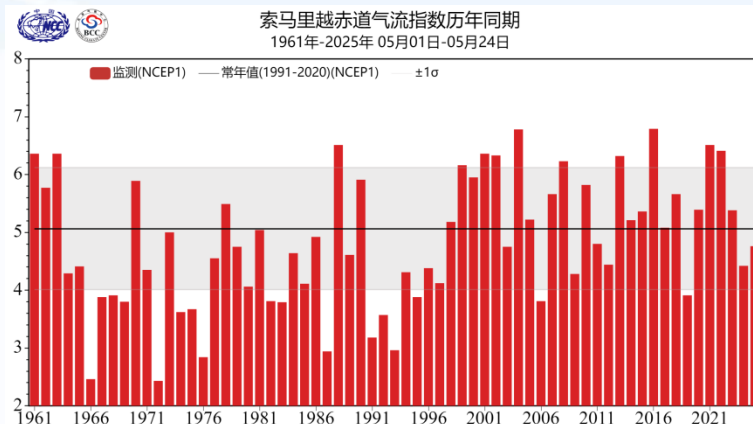
Somali Jet index (5.1-5.24)



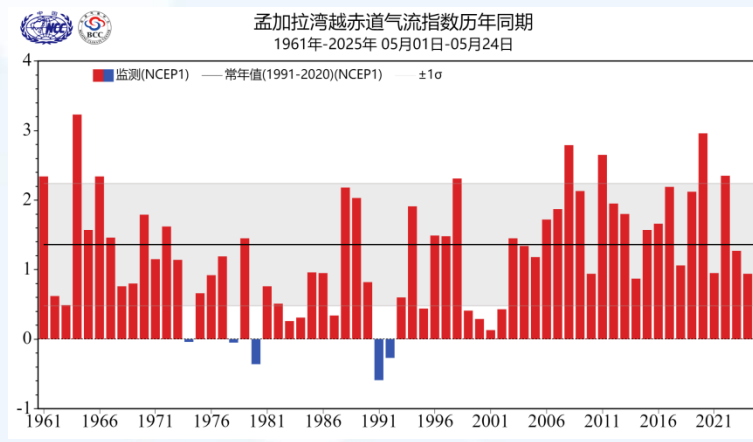
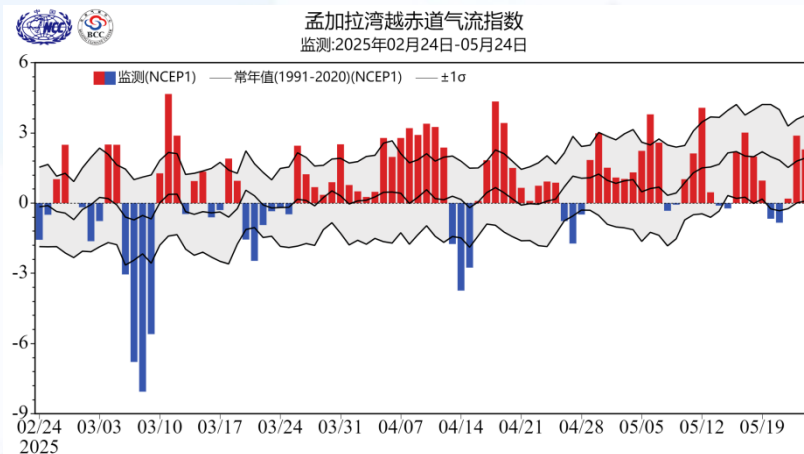
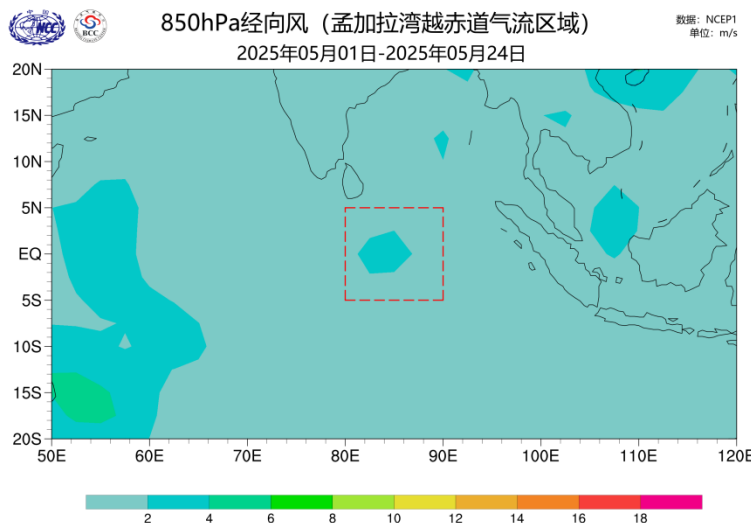
Daily index of Somali Jet from Feb 2025



Inter-annual variability



CEF of Bay of Bengal (5.1-5.24)

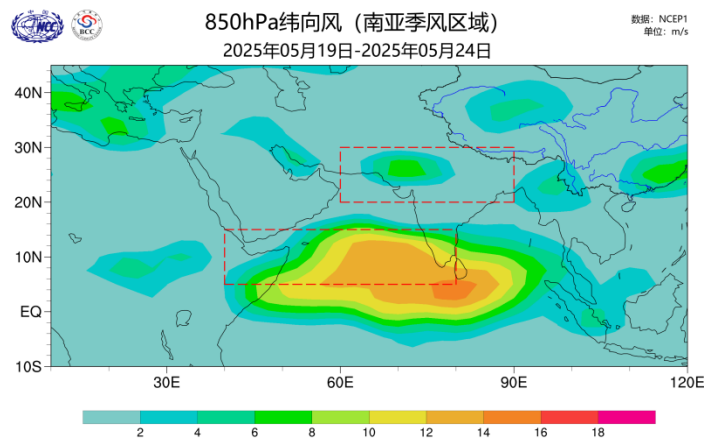


➤ Weak Somali Jet in May 2025 compared to climatology.

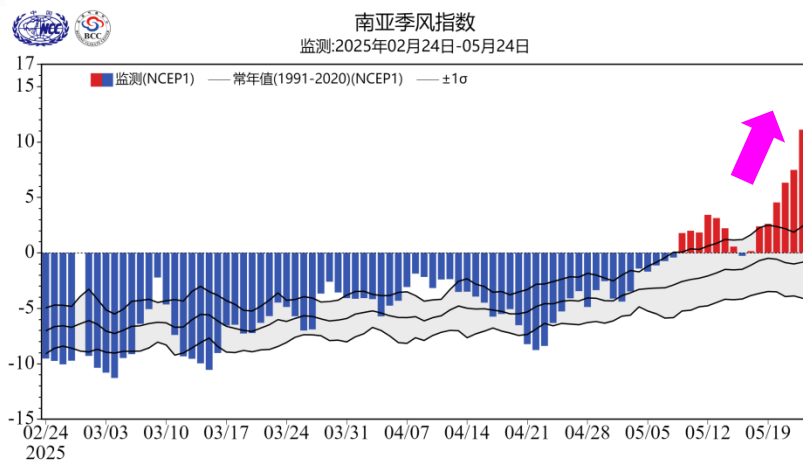
Monitoring of South Asia Monsoon



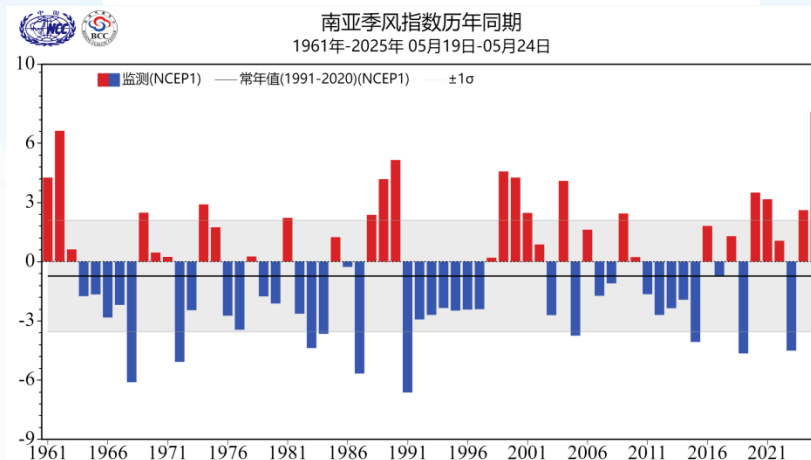
South Asia Monsoon index



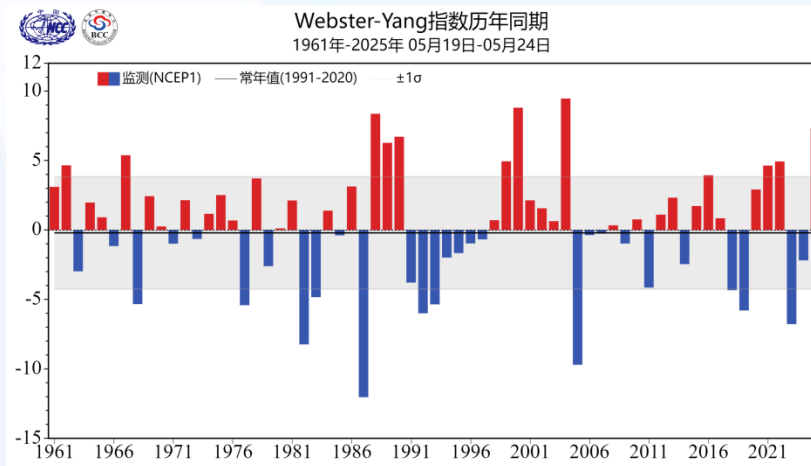
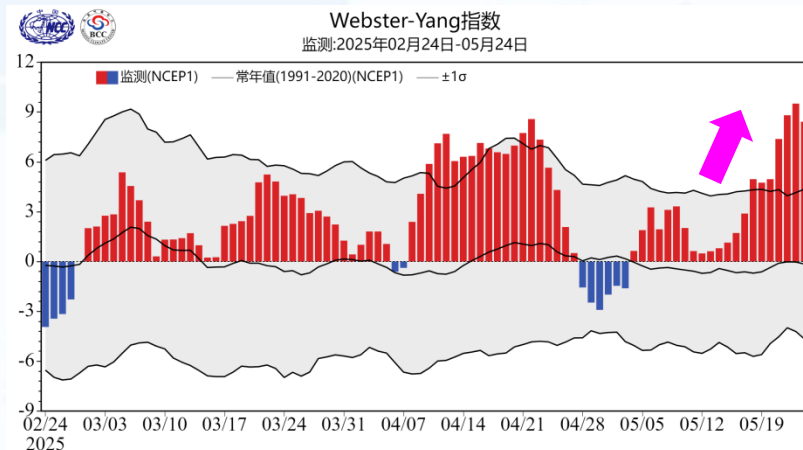
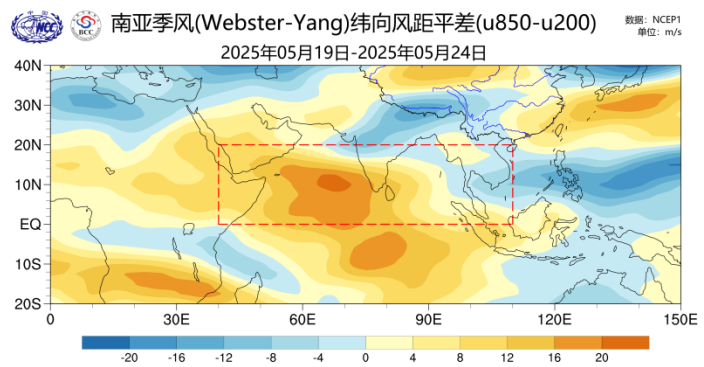
Daily index of SAM from Feb 2025



Inter-annual variability



SAM index (Webster-Yang)

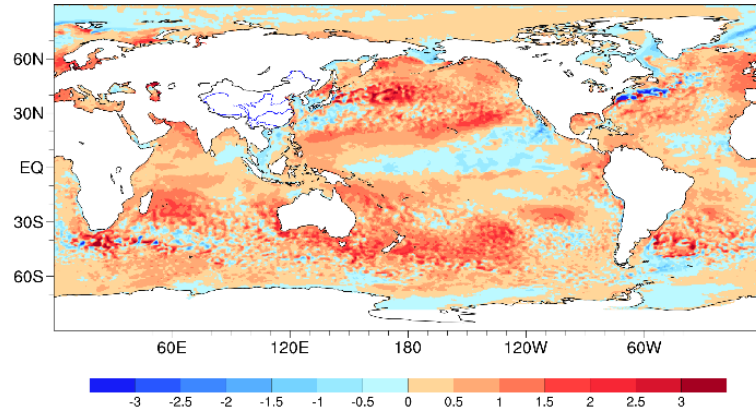


Monitoring of Global SSTA and ENSO index

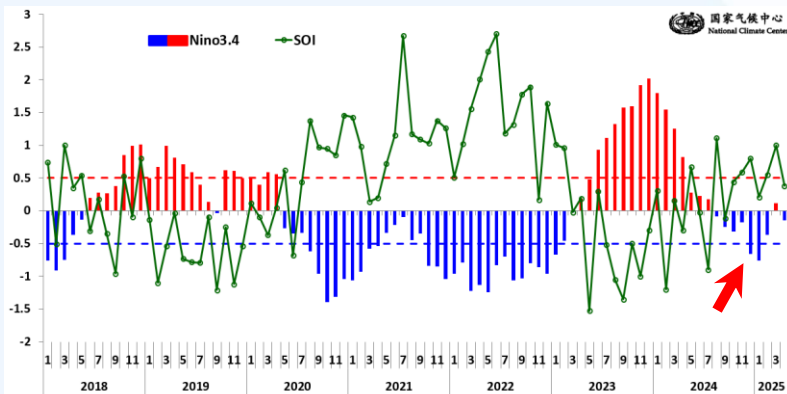


SSTA , Apr 2025

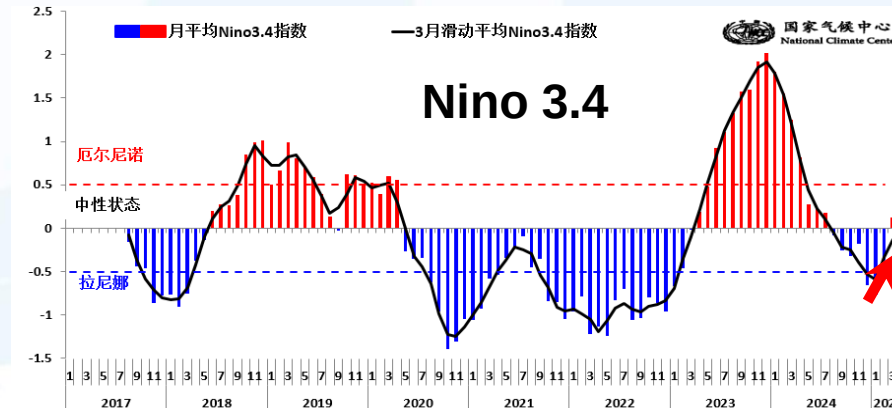
范围: 1991-2020年
数据来源: NOAA
单位: °C



Monthly ENSO index



	Nino3.4	3 month running mean of Nino3.4	Nino3	Nino4	SOI
2024.01	1.80	1.79	1.91	1.50	0.31
2024.02	1.55	1.53	1.48	1.26	-1.20
2024.03	1.25	1.21	1.03	0.93	0.16
2024.04	0.82	0.78	0.61	0.8	-0.3
2024.05	0.28	0.44	-0.09	0.7	0.67
2024.06	0.23	0.23	-0.18	0.63	-0.02
2024.07	0.18	0.11	-0.11	0.60	-0.9
2024.08	-0.08	-0.05	-0.28	0.48	1.11
2024.09	-0.25	-0.22	-0.06	0.16	-0.12
2024.10	-0.32	-0.25	-0.08	0.13	0.44
2024.11	-0.18	-0.39	-0.05	0.1	0.59
2024.12	-0.66	-0.53	-0.38	-0.42	0.8
2025.01	-0.76	-0.6	-0.21	-0.7	0.21
2025.02	-0.37	-0.34	0.1	-0.63	0.55
2025.03	0.12	-0.13	0.54	-0.4	1.00
2025.04	-0.15		-0.01	-0.18	0.38

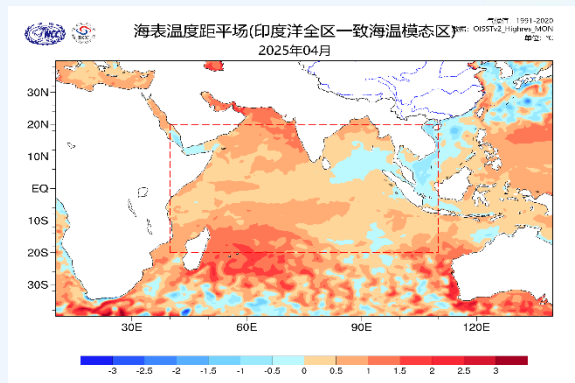


- The warming trend of eastern equatorial Pacific continues in April 2025.
- The 3 month running mean of Nino3.4 index keeps increasing to **-0.13°C** in March, i.e. ENSO neutral phase.
- Southern Oscillation index in April 2025 is **0.38**.

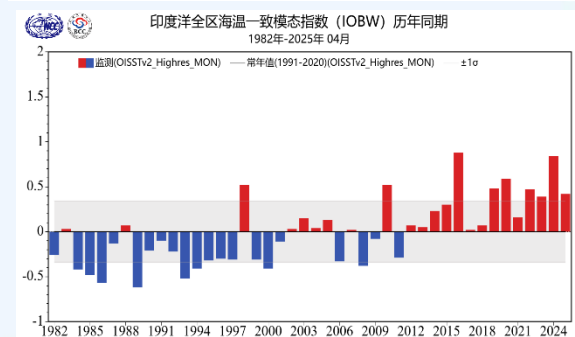
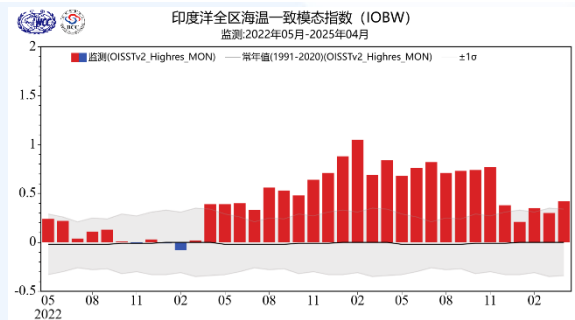
Monitoring of Indian Ocean SST index-April 2025



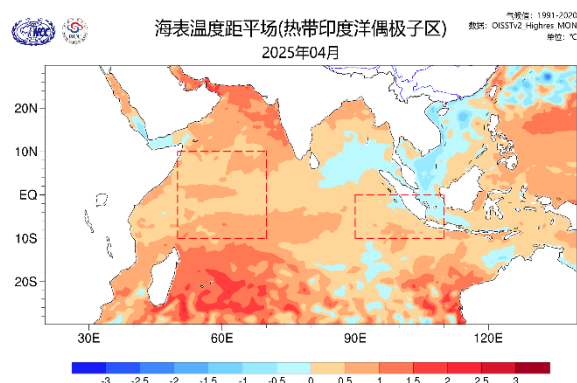
Indian Ocean Basin Warming



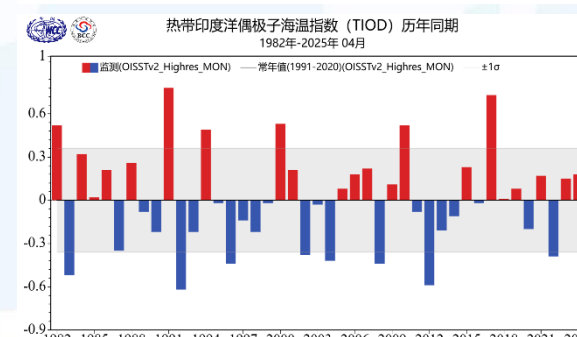
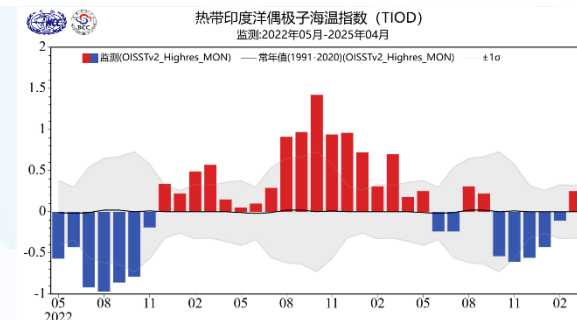
IOBW: 0.42 keeps warming phase



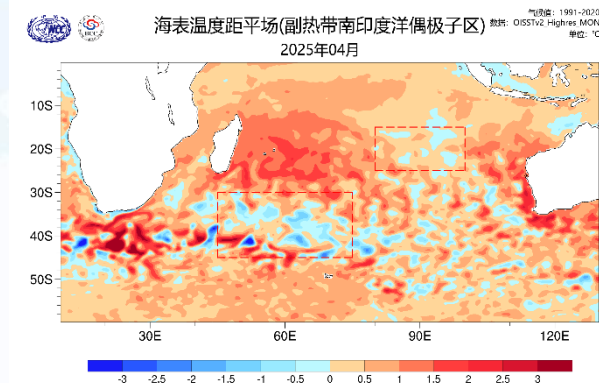
Tropical Indian Ocean Dipole



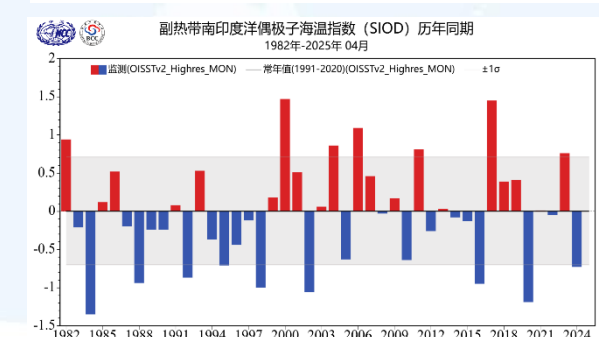
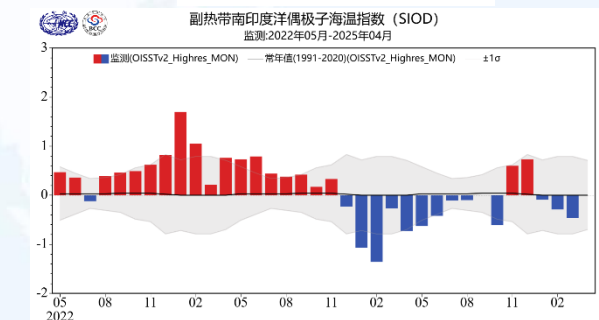
TIOD: 0.27 turn to positive phase



Southern Indian Ocean Dipole



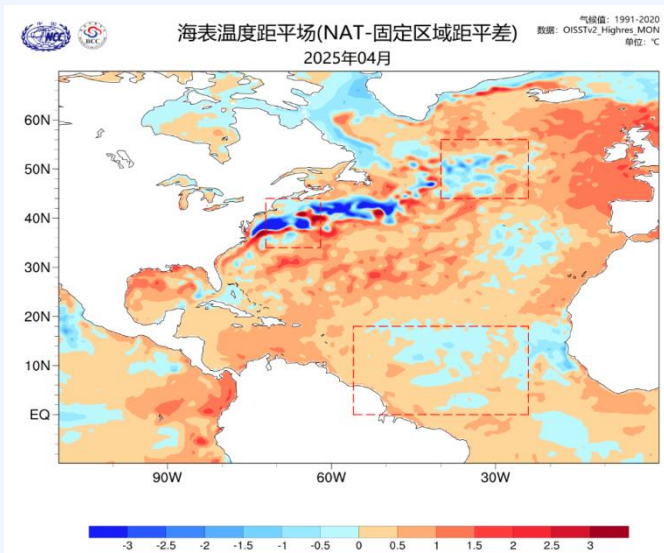
SIOD: 0.00



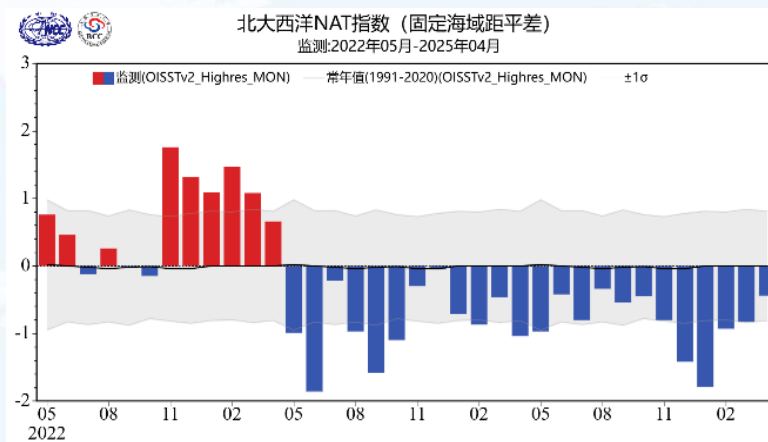
Monitoring of Atlantic Ocean SST index



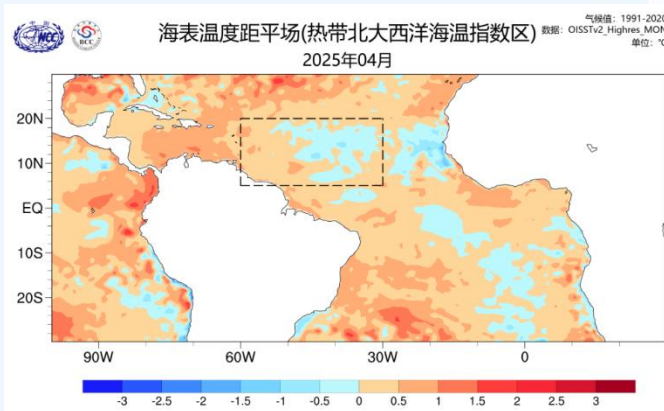
North Atlantic Triple Mode of SST



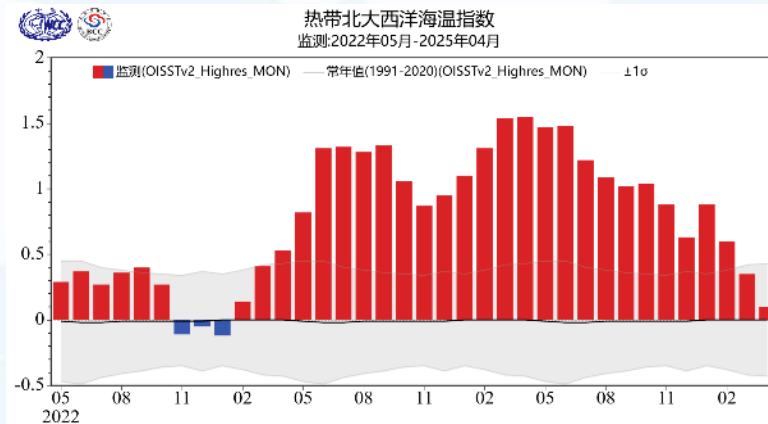
NAT index: -0.44



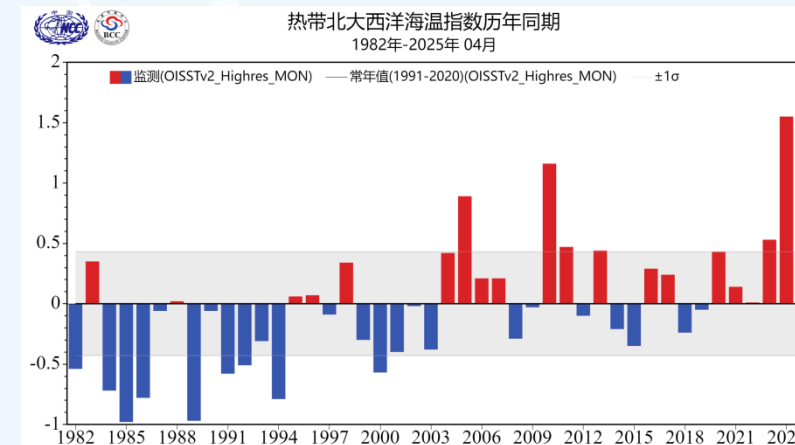
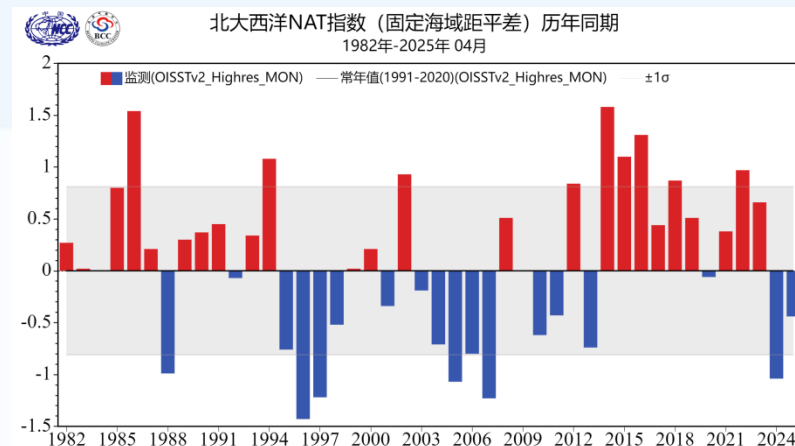
Tropical North Atlantic SST



TNA index : 0.10



Inter-annual variation



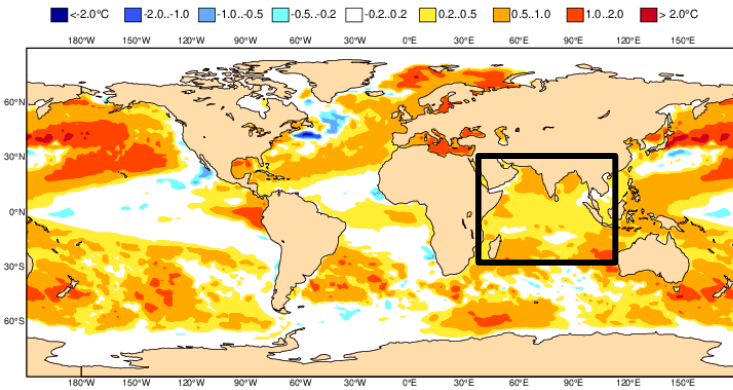
Potential Impact of Indian Ocean SSTA



ECMWF Seasonal Forecast
Mean forecast SST anomaly
Forecast start is 01/03/25, climate period is 1993-2019
Ensemble size = 51, climate size = 600

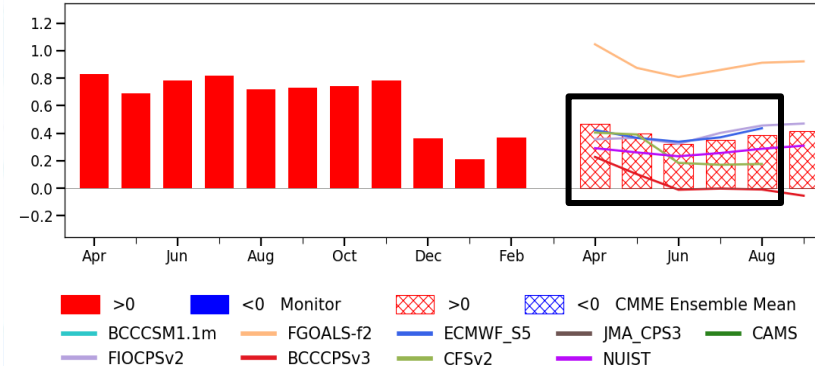
EC-AMJ SSTA

n 5
25



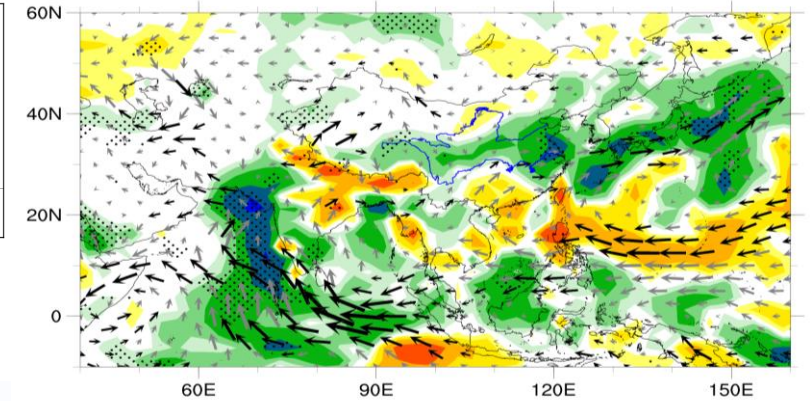
IOBW-positive phase

Monitor(OISST):202404-202503;Forecast:202504-202509



Impact on circulation and precipitation

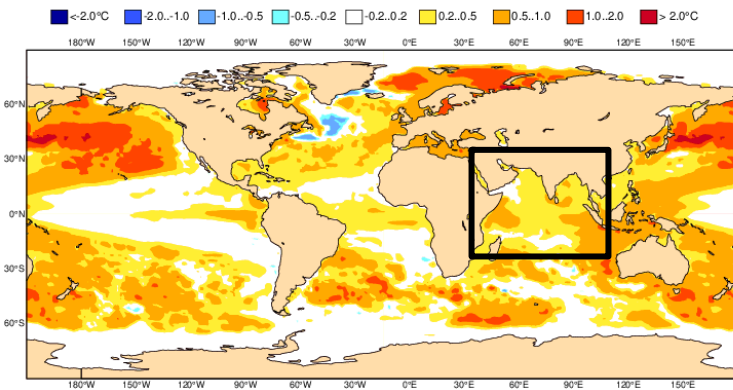
(b) Reg JJA Pre and UV850 on JJA-IOBW



ECMWF Seasonal Forecast
Mean forecast SST anomaly
Forecast start is 01/03/25, climate period is 1993-2019
Ensemble size = 51, climate size = 600

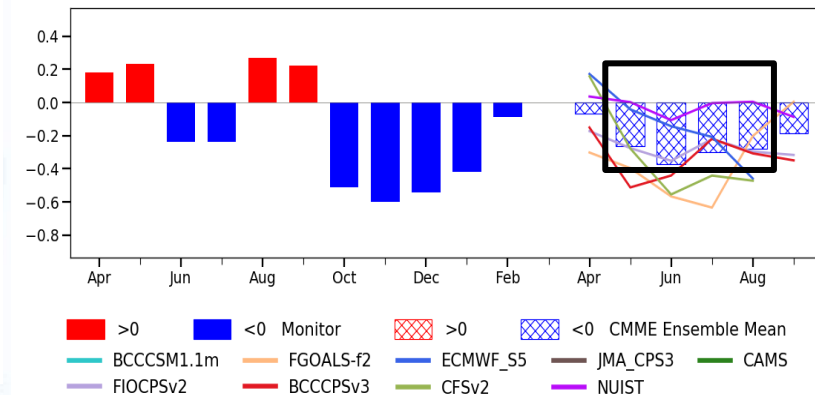
EC-JJA SSTA

n 5
25

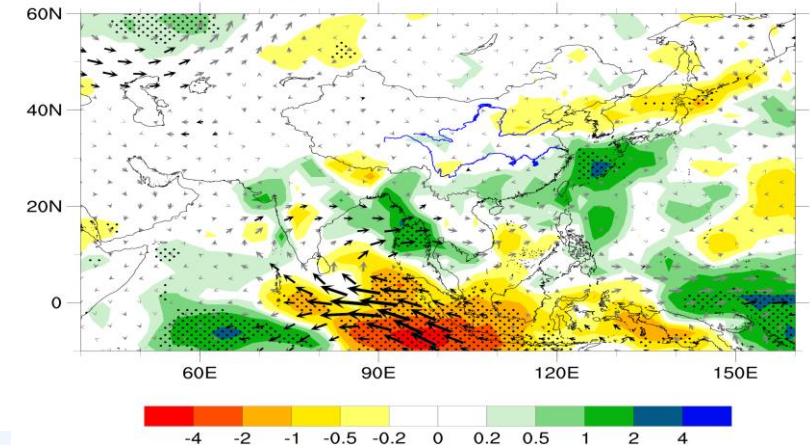


IOD-negative phase

IOD SST Index:CMME 202503 Forecast
Monitor(OISST):202404-202503;Forecast:202504-202509



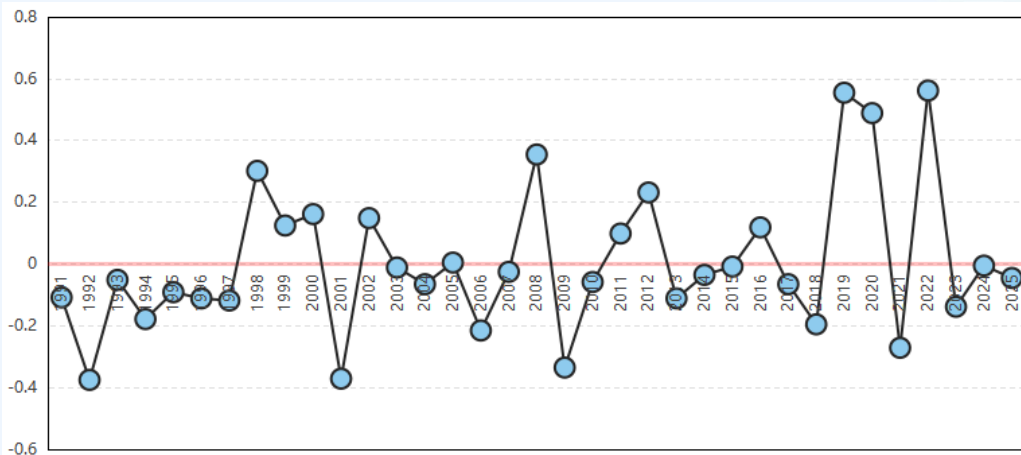
(c) Reg JJA Pre and UV850 on JJA-TIOD



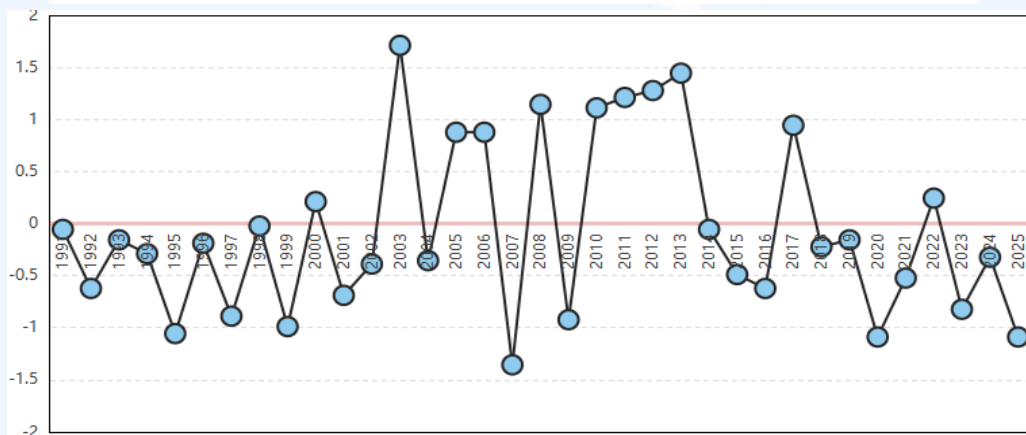
Potential Impact of TP and Eurasian snow cover



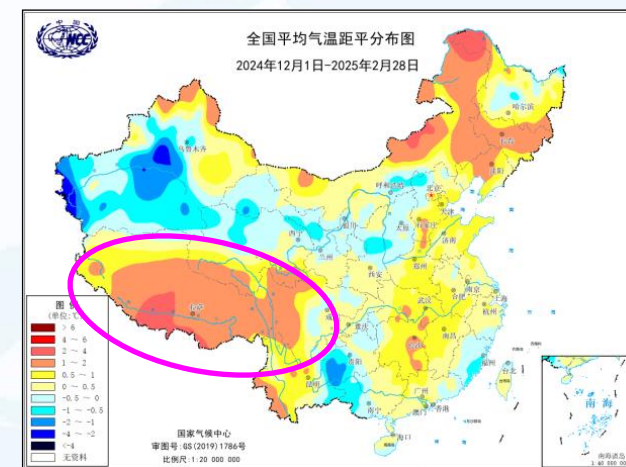
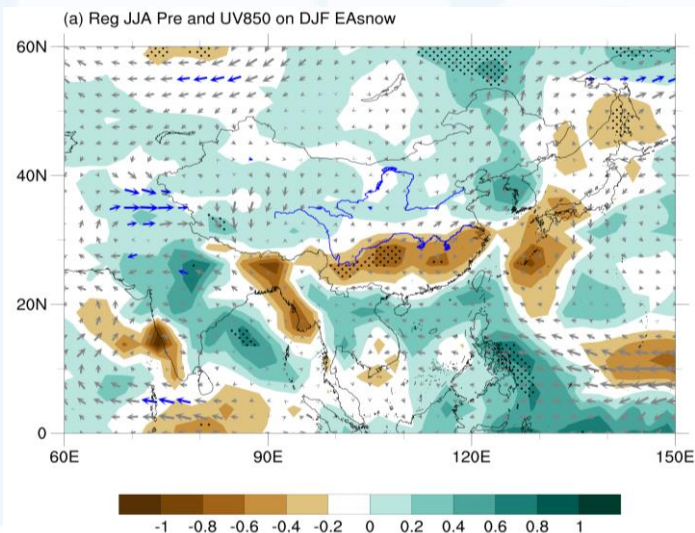
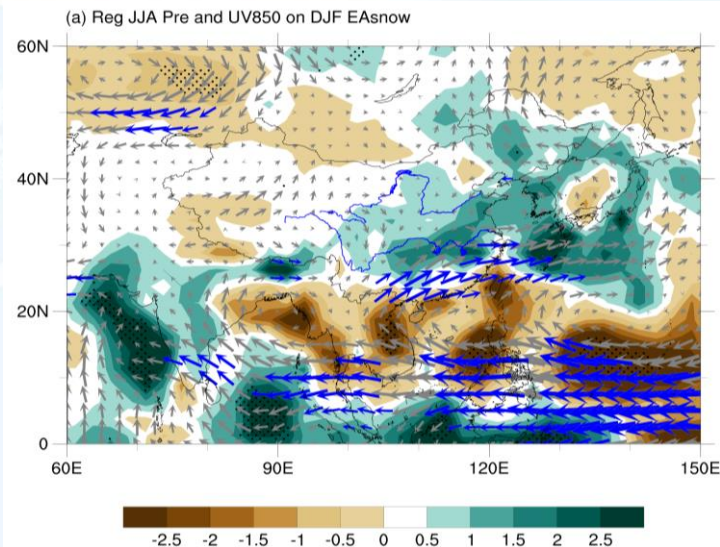
Area of Snow Cover on Tibetan Plateau in DJF



Area of Eurasian Snow Cover in DJF



Regressed circulation on DJF TP snow





Conclusion



Monitoring of atmospheric circulation around TP:

- ◆ Strong and westward shifted SAH since March 2025.
- ◆ Weak Somali Jet in May 2025 compared to climatology, while intensity of CEF in Bay of Bengal is near normal.
- ◆ SAM index increased rapidly since mid-May, however, monitoring results varies among different Indian Monsoon index.

External forcing

- ◆ The 3 month running mean of Nino3.4 index keeps increasing to -0.13°C in March, i.e. ENSO neutral phase.
- ◆ IOBW in its warming phase, and TIOD in positive phase. Negative NAT index and warm tropical north Atlantic.

- Positive IOBW is favorable for anti-cyclonic circulation above Bay of Bengal, **above normal precipitation** for western India and southern part of Qinghai-Xizang Plateau.
- Less Qinghai-Xizang Plateau snow cover in preceding winter also favorable for **more rainfall over southern TP region**.



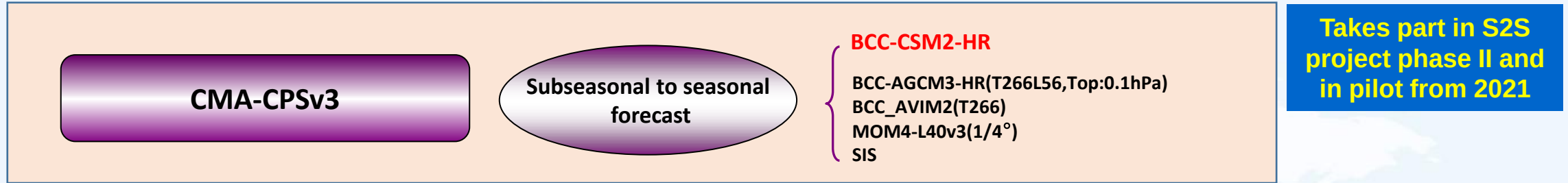
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Dynamic Models

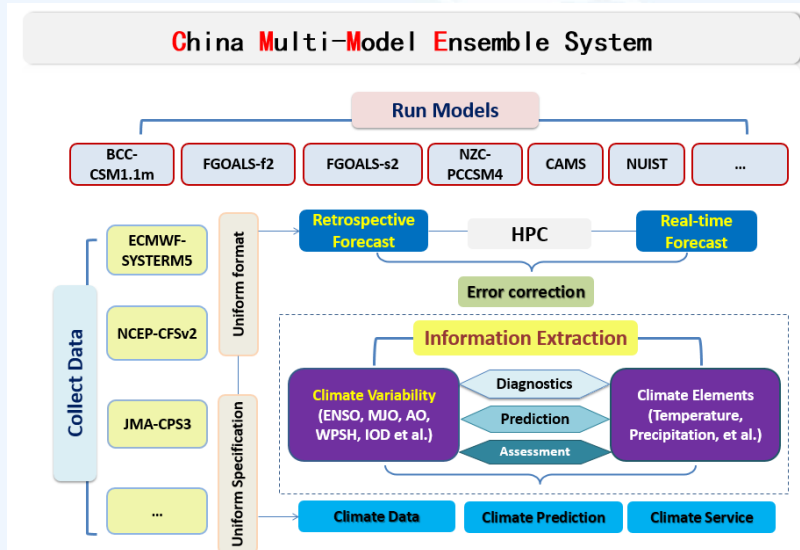


- 2016-2021 CMA Developed a Subseasonal-to-Seasonal Climate Prediction System (CMA-CPSv3)



- 2016-2020: China Multi-Model Ensemble Prediction System (CMMEv1.0) Ren et al., 2016, JMR
- 2021-2025: China Multi-Model Ensemble Prediction System (CMMEv2.0) Wu et al., 2024, JMR

Model Members of CMMEv2.0

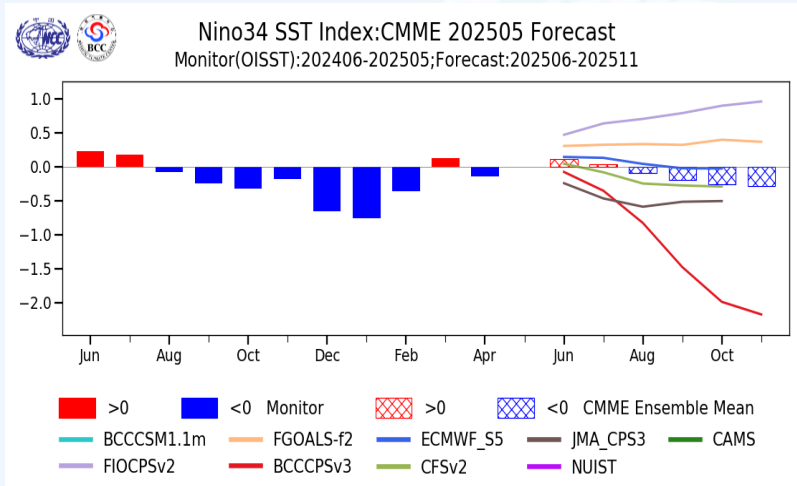


Models	Institution	Atm.Resolution	Ocn. Resolution	Ensemble Size	Lead times (months)
BCC-CSM1.1m	BCC(China)	T106, L26	1×1 L40	24	13
BCCCPSv3	BCC(China)	T266, L56	1/4°	20	6
FGOALS-f2	IAP(China)	100km.100km,L3 2	1×1 L50	35	6
CAMS-CSM	CAMS(China)	T106, L31	1×1, L50	8	6
NUIST	NUIST(China)	T106, L19	2×2(tropic 0.5), L40	9	24
FIO-CPS	FIO/MNR (China)	0.9×1.25,L30	1.1× (0.27-0.54) ,L61	10	13
ECMWF-SYSTEM5	ECMWF(EURO)	T319, L91	ORCA 0.25 L75	15	6
NCEP-CFSv2	NCEP(USA)	T126, L64	1×1 L40	4	9
JMA-CPS3	JMA(Japan)	TL319, L100	0.25 x 0.25, L60	100	6

Prediction for JJAS 2025 by BCC model: SSTA

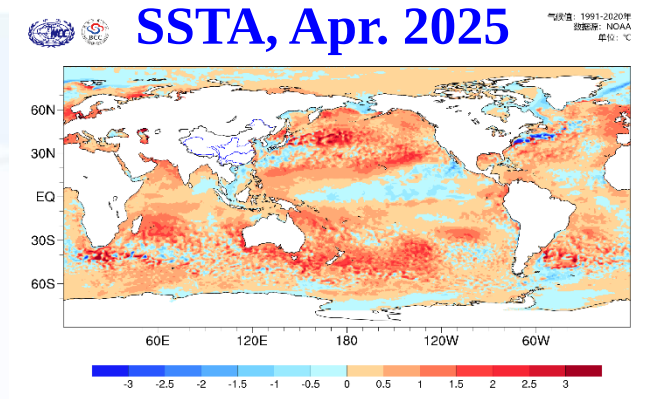
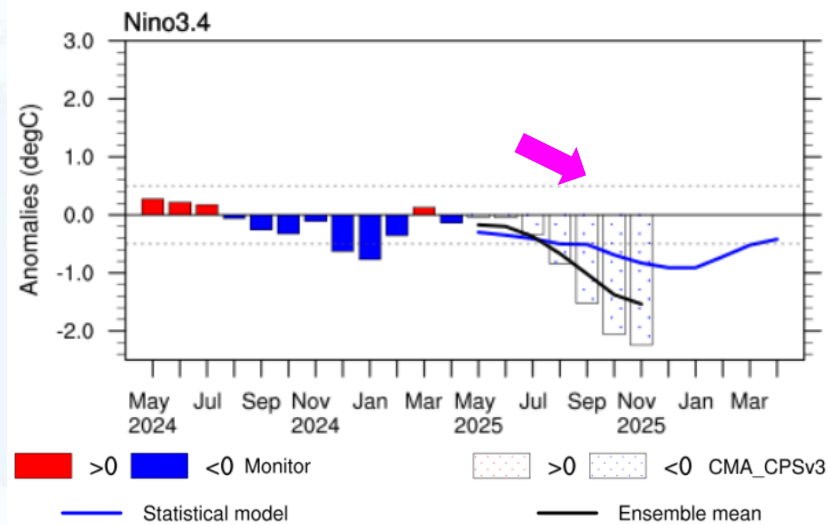


BCC-CMME2.0

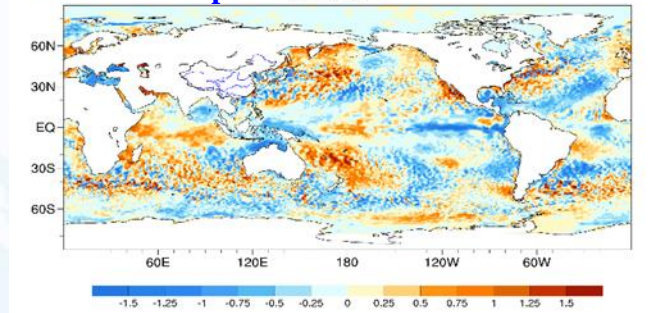


CMA-CPSv3

Initial date: 1st May



Change in monthly SSTA Apr. minus Mar. 2025



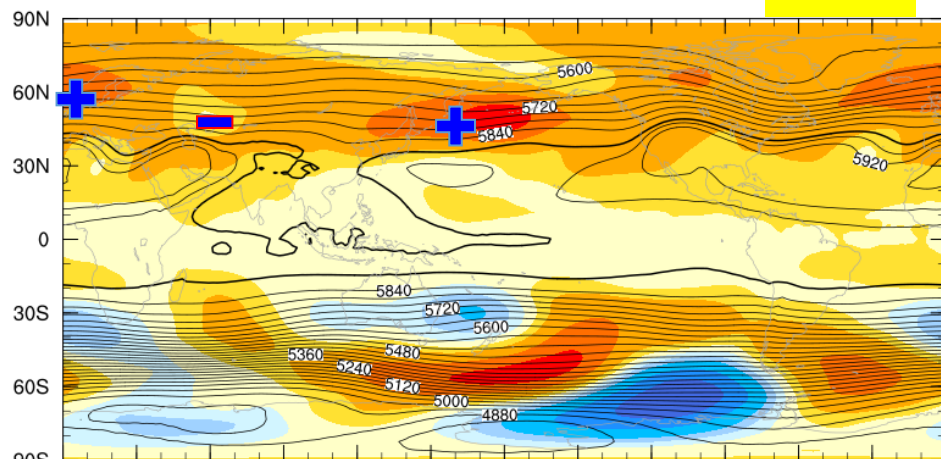
- CMME predicts an ENSO-neutral condition through out summer 2025. This prediction is agreed with the NMME, EC and JMA_CPSv3, etc.
- The CMA-CPSv3 model predicts that La Niña will develop in summer.

Prediction for JJAS 2025 by BCC model: 500hPa



CMA-CPSv3 Initial date: 1st May Dates: 202506 - 202508

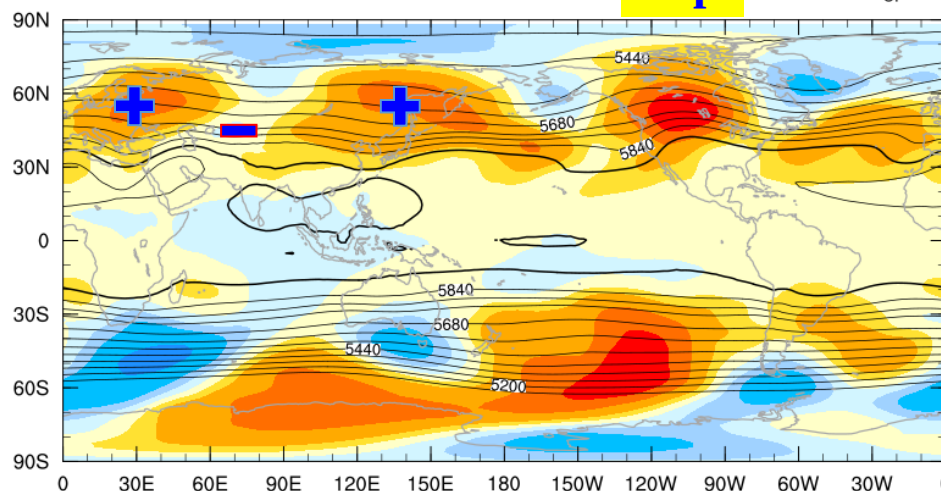
JJA



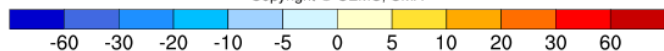
500hPa Geopotential Height (lines) and its Anomaly (shading)
CMA-CPSv3 monthly forecast
Initial date: 20250501

Sep

Dates: 202509
Ensemble Size = 21
Units: gpm



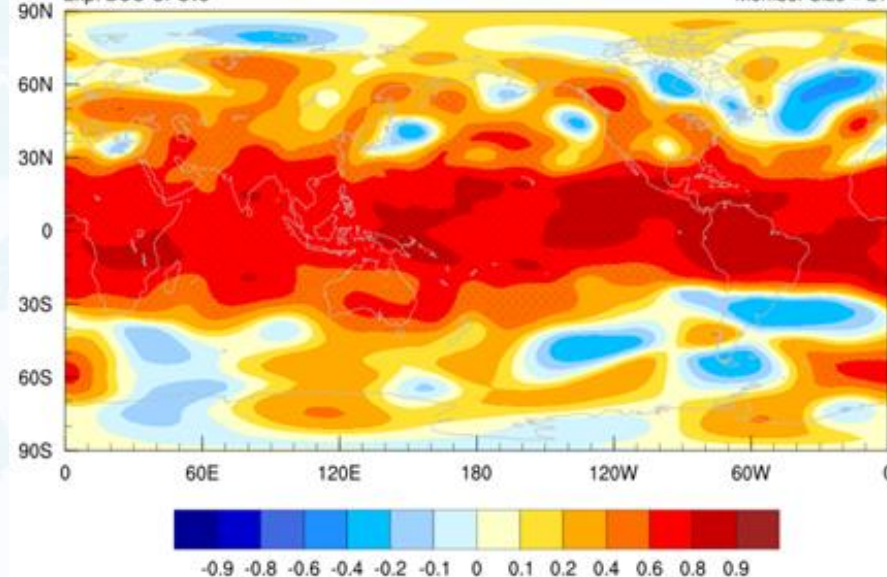
Copyright © CEMC, CMA



Correlation Model & observation (2000-2019)

Correlation of atm_Z3 on 500hPa
Data: Model & Observation
Exp: BCC-CPSv3

year range: 2000-2019
month averaged: 06-08
Member Size = 21

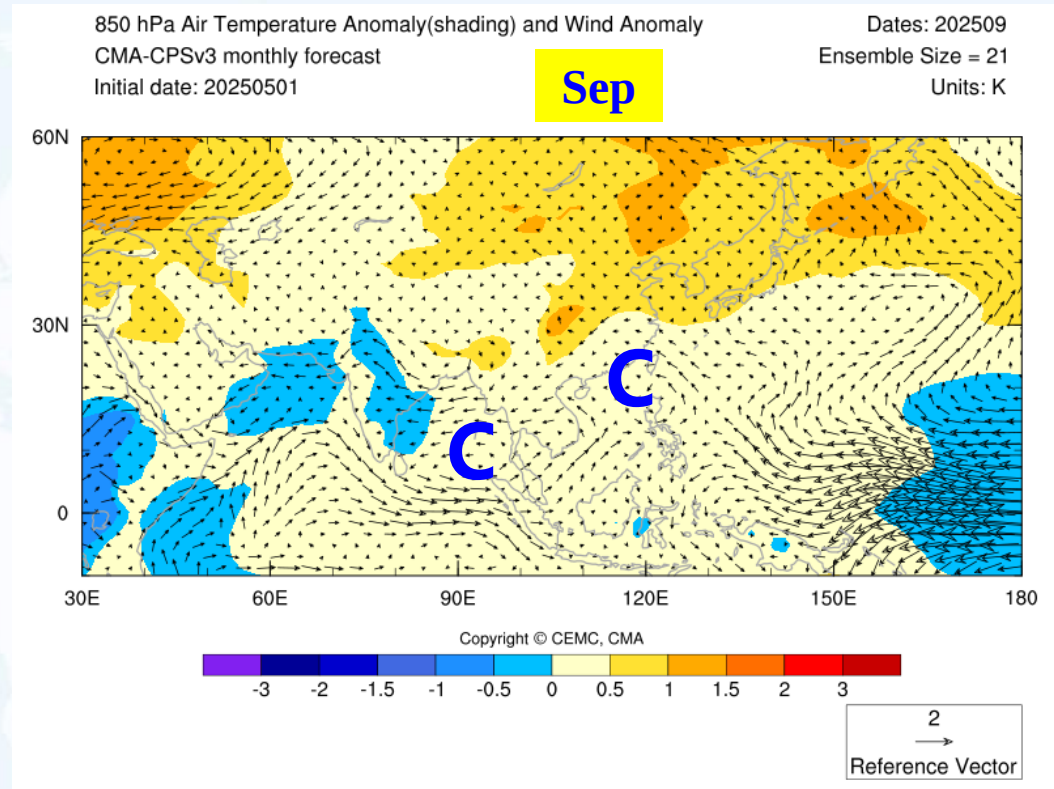
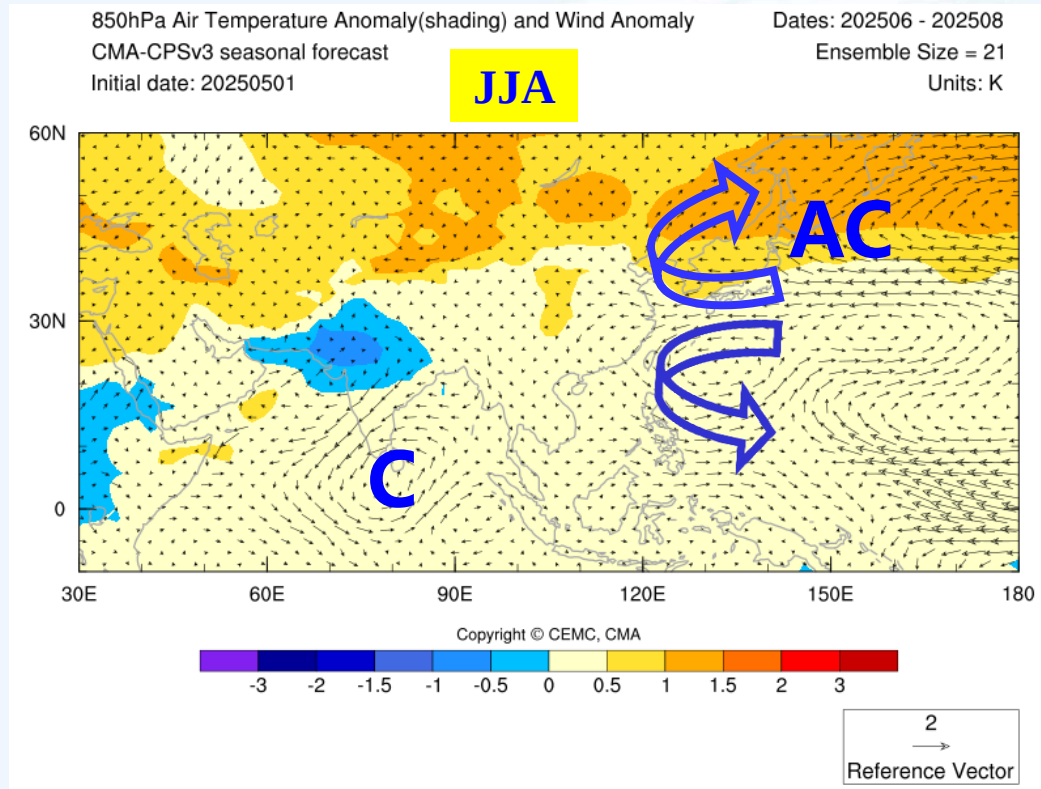


- The BCC model forecast for JJA 2025 shows positive anomalous height centers over Eastern Europe and the Sea of Okhotsk, a slightly relative lower value area near Ural Mountain. In September, the spatial patterns of GPH anomaly continues.
- The geopotential height in tropical and subtropical regions is relatively higher than normal in JJA.
- The intensity of the Western Pacific Subtropical High(WPSH) is above normal.

Prediction for JJAS 2025 by BCC model: UV850

CMA-CPSv3

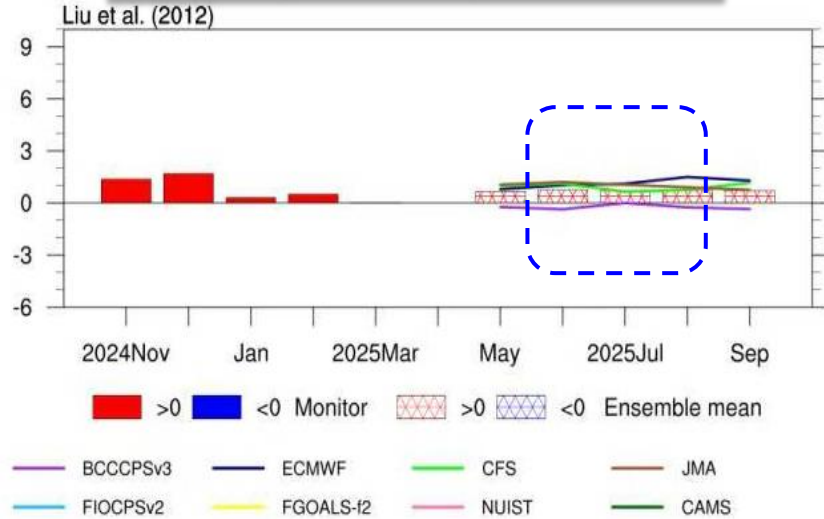
Initial date: 1st May



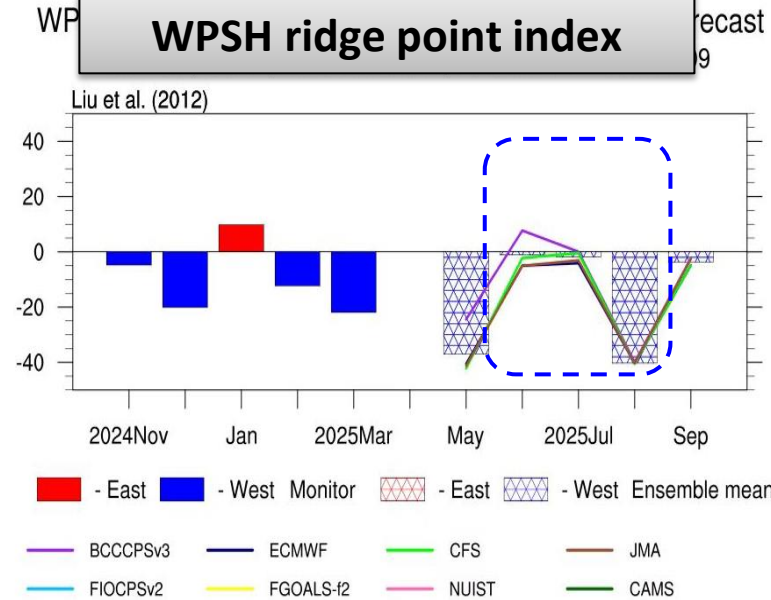
- The BCC model forecast shows over Western Pacific anomalous low-level cyclone in summer, while anti-cyclone in Northeast Asia.
- A cyclonic circulation prevails to the south of India in JJA. In September, it shifts to Bay of Bengal.

Forecasts for monsoon circulation factors

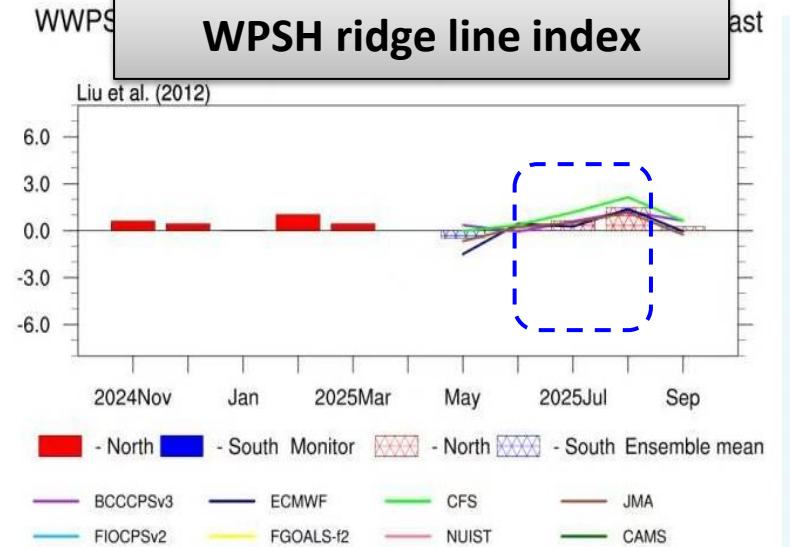
WPSH intensity index



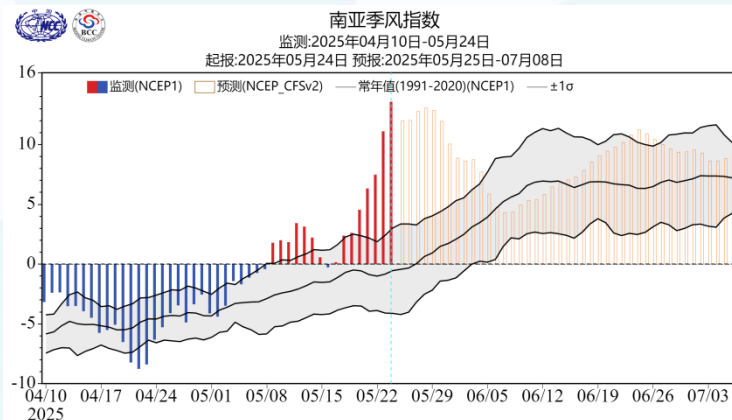
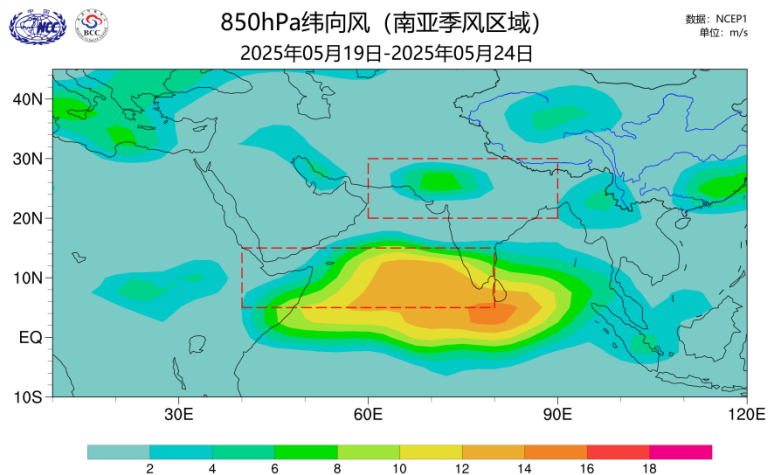
WPSH ridge point index



WPSH ridge line index



South Asian Monsoon index



- During summer 2025, the Western Pacific Subtropical High (WPSH) will stronger than normal.
- For July and August, WPSH is predicted to expand north-westwards than average.

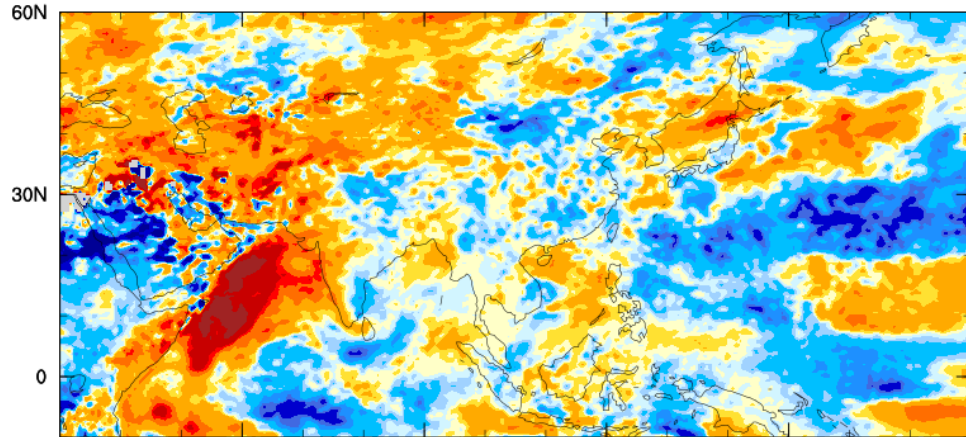
Prediction for JJAS 2025 by BCC model: precipitation

CMA-CPSv3 Initial date: 1st May

JJA

Departure Percentage of Precipitation Rate
CMA-CPSv3 seasonal forecast
Initial date: 20250501

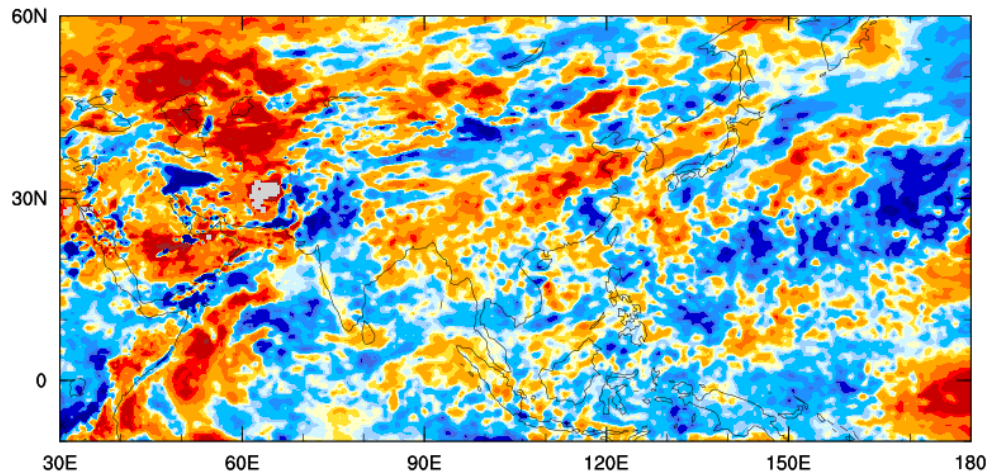
Dates: 202506 - 202508
Ensemble Size = 21
Units: %



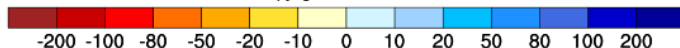
Sep

Departure percentage of Precipitation Rate
CMA-CPSv3 monthly forecast
Initial date: 20250501

Dates: 202509
Ensemble Size = 21
Units: %



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- The BCC model forecast shows that departure percentage of precipitation rate will be **above normal over most of the eastern part of China** and **below normal in Xinjiang, parts of Southwest China, etc. for JJA**, and **below normal in northern East China, central and parts of Southwest China in September**.
- Wet regions are also expected over East Asia, parts of South Asia, Southeast Asia, etc. for JJA, while western South Asia, etc. in September.
- Dry regions are also expected over the West Asia, etc. for JJAS.

Prediction for JJAS 2025 by BCC model: temperature



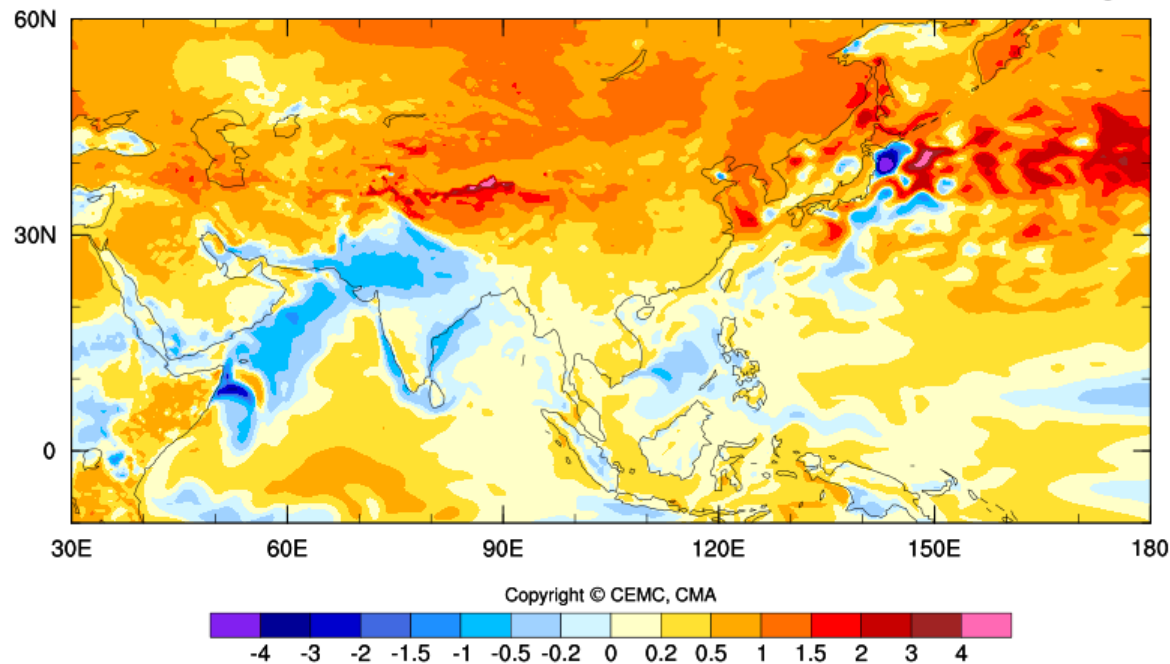
CMA-CPSv3

Initial date: 1st May

JJA

2-m Air Temperature Anomaly
CMA-CPSv3 seasonal forecast
Initial date: 20250501

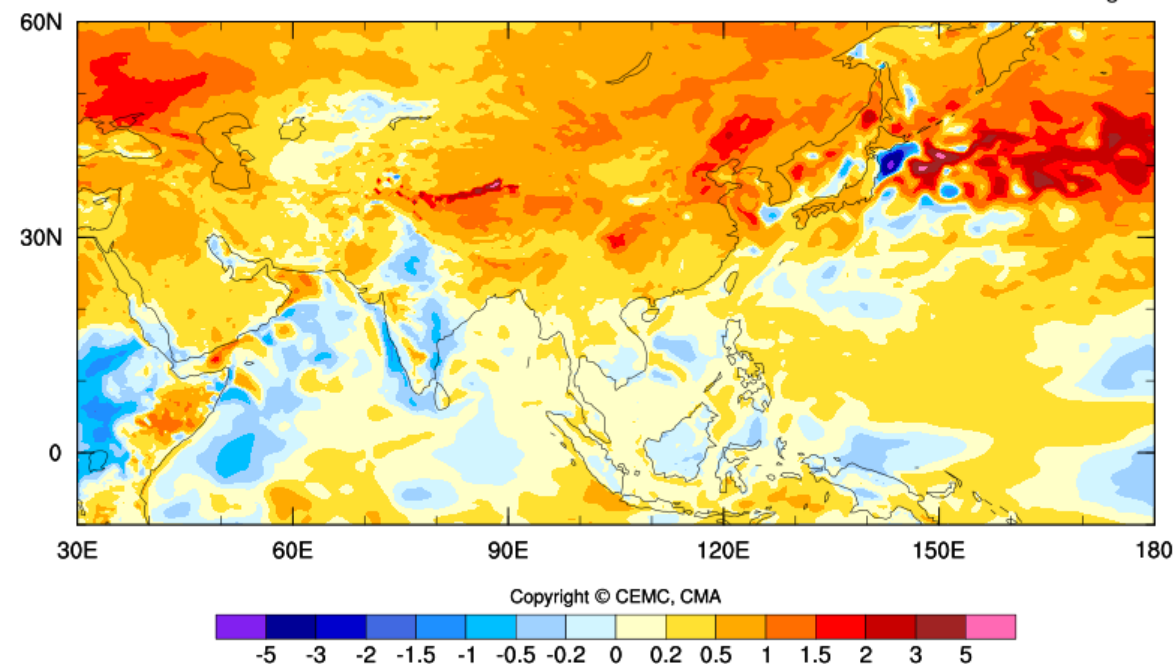
Dates: 202506 - 202508
Ensemble Size = 21
Units: degC



Sep

2-m Air Temperature Anomaly
CMA-CPSv3 monthly forecast
Initial date: 20250501

Dates: 202509
Ensemble Size = 21
Units: degC



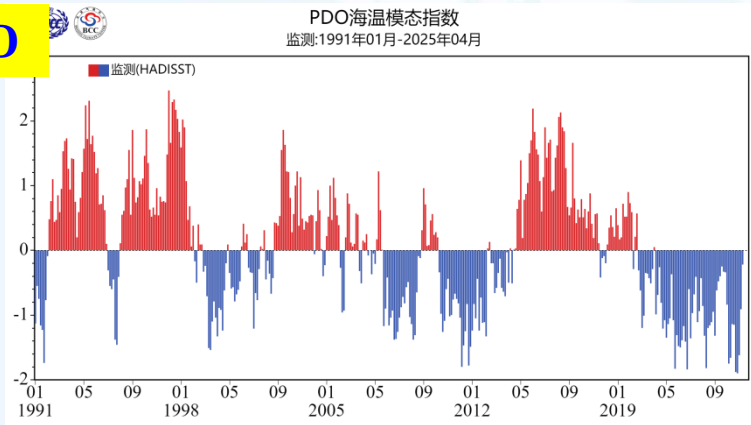
- The BCC model forecast for JJAS 2024 shows the temperature will be higher than normal in most areas of Asia except for India.
- The heat wave frequency in Eastern Asia will be above normal.

Impact of PDO and AMO on Precipitation for summer 2025

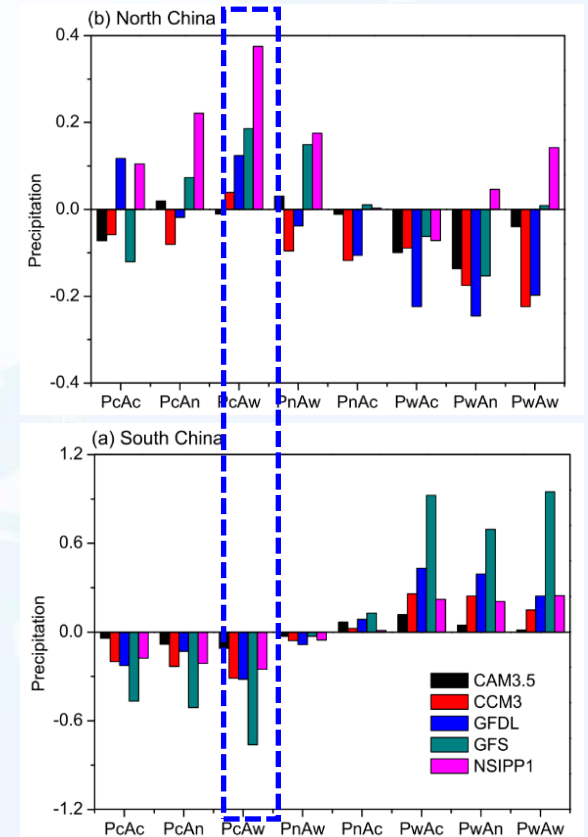
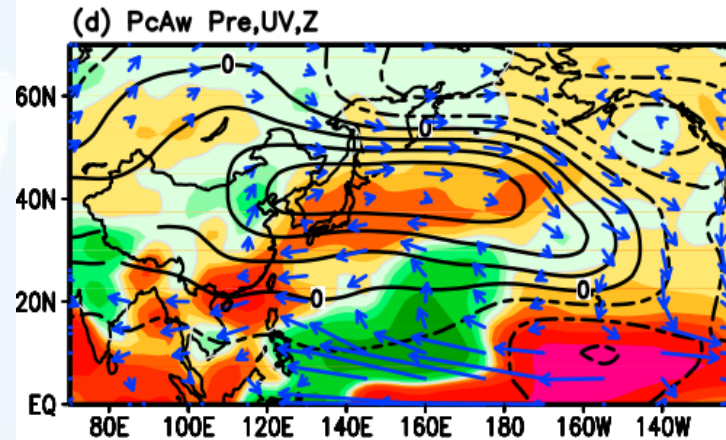
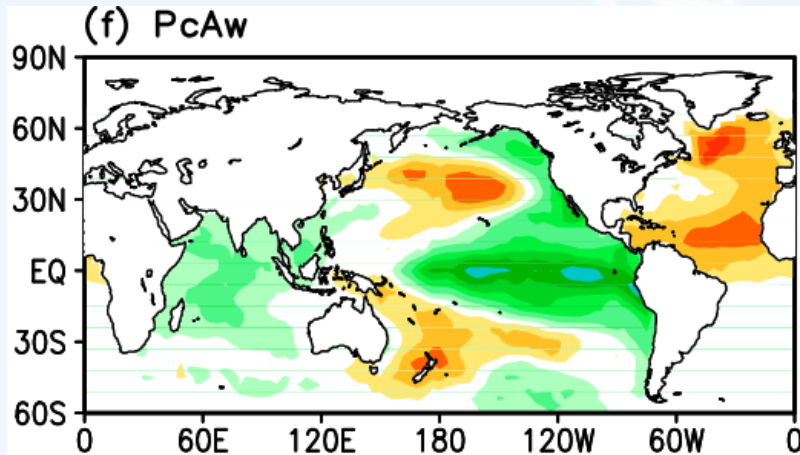
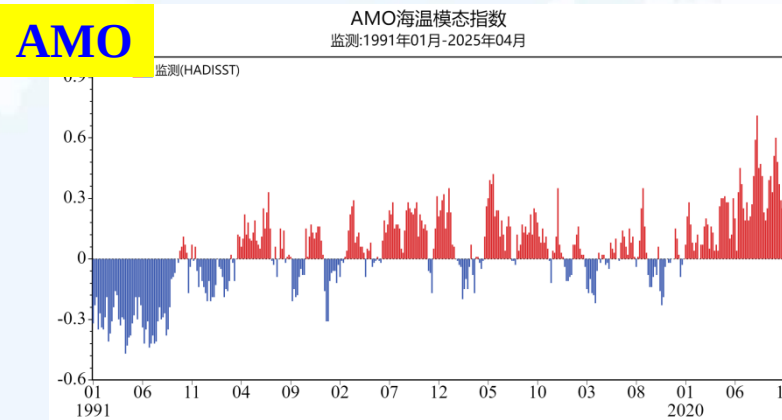


- Under the **cold phase of PDO** and the **warm phase of AMO**, the Western Pacific Subtropical High in summer will be northward, East Asian Summer Monsoon circulation will be stronger, leading to more rainfall over North China, and less rainfall over South China.

PDO



AMO



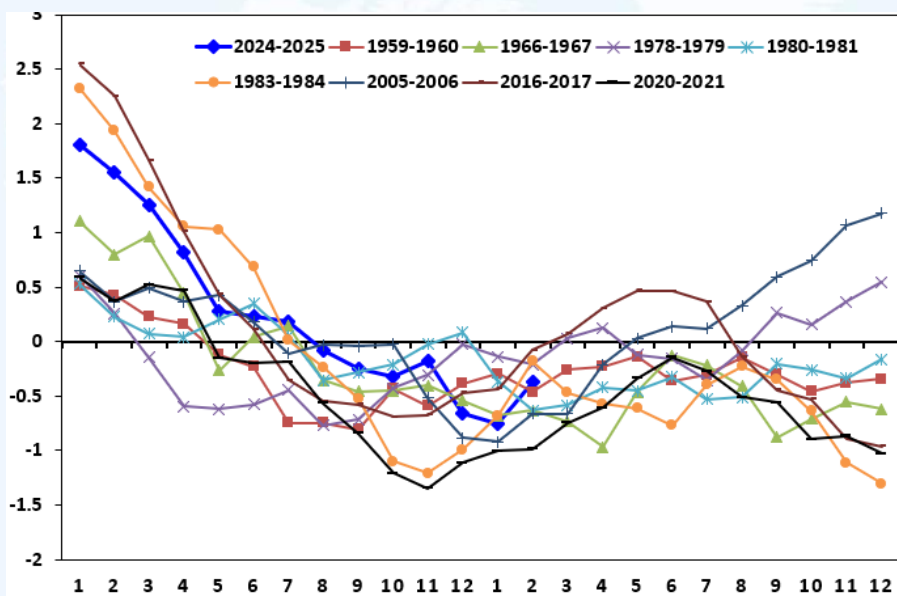
Yang et al., 2017. JC



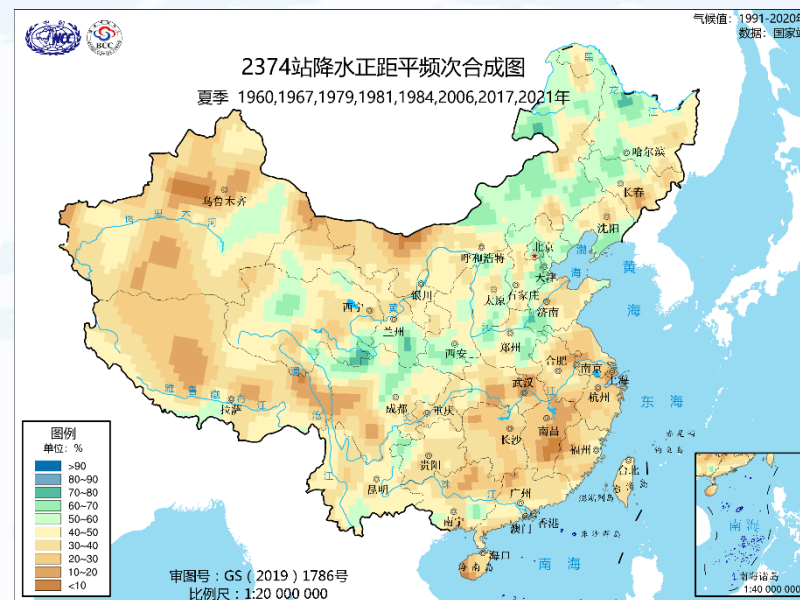
Impact of ENSO on Precipitation for summer 2025



Historically similar year for the evolution of ENSO during 2024-2025



Composite of positive anomaly frequency of summer precipitation



- Statistical analyses suggest that the transition from a winter La Niña phase to neutral ENSO conditions during spring and summer favors a distinct precipitation dipole: enhanced summer precipitation over North China and suppressed precipitation in South China.

Impact of Tropical Indian Ocean on Rainfall



CMA-CPSv3 and CMME2.0 Started from 1st April IOBW Index Prediction



IOBM SST Index:CMME 202504 Forecast
Monitor(OISST):202405-202504;Forecast:202505-202510

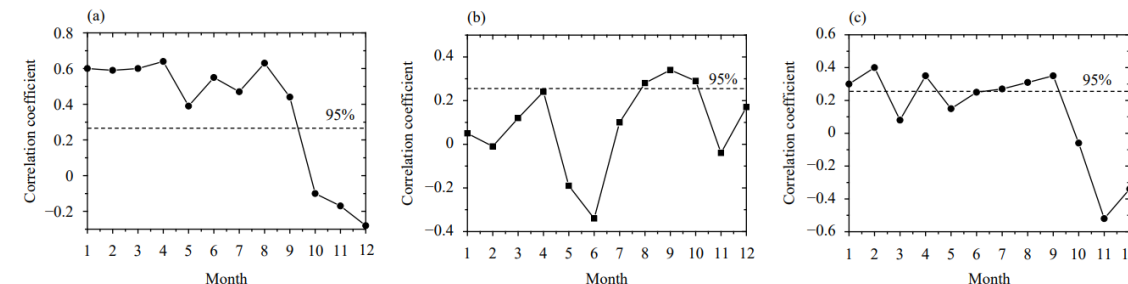
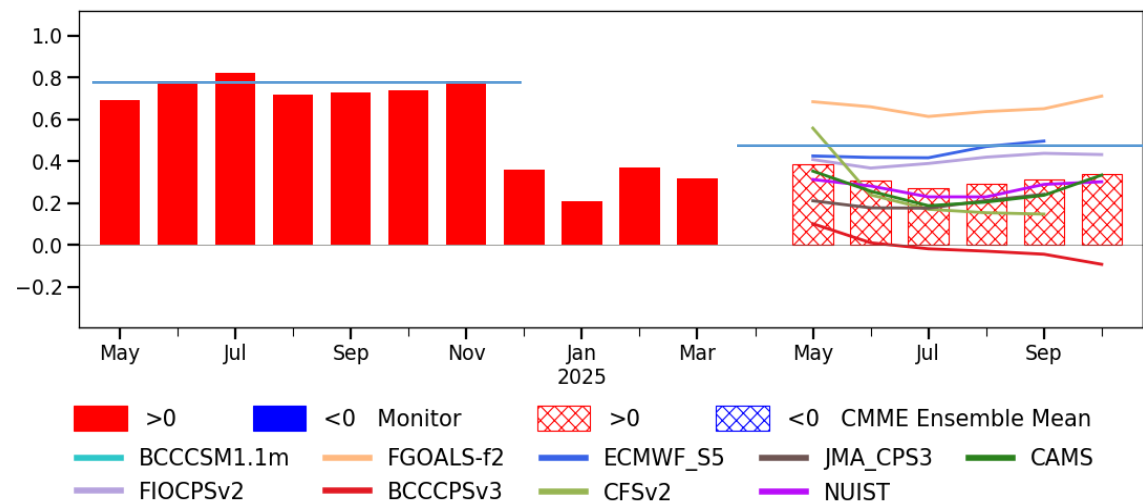
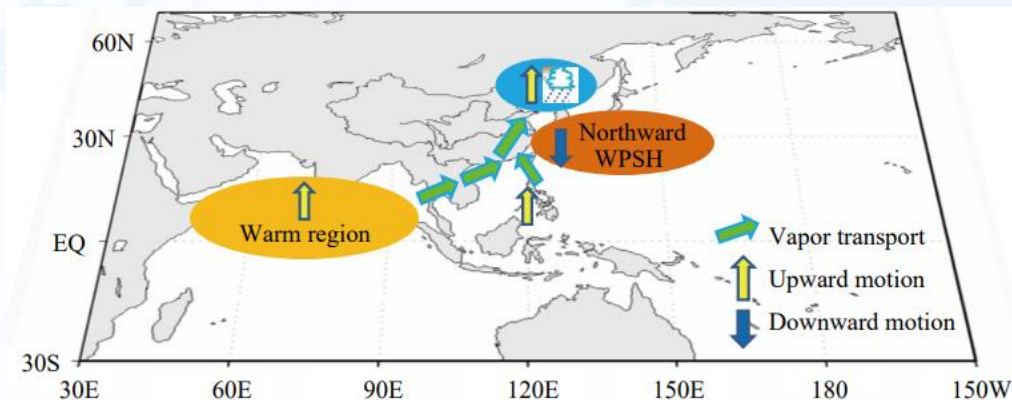


Fig. 10. Lead-lag correlations between the March–April IOBW index and (a) the western Pacific subtropical high (WPSH) intensity index, (b) the WPSH ridge position index, and (c) NEC south wind (NESW) index from January to December. The dotted line indicates the 95% confidence level.



Zhao et al. 2019. JMR

- CMME predicts a **warmer tropical Indian Ocean** during the late spring to summer.
- The warmer tropical Indian Ocean is favor northward movement of the western Pacific subtropical high and **more precipitation over North China in July–August**.

Outline

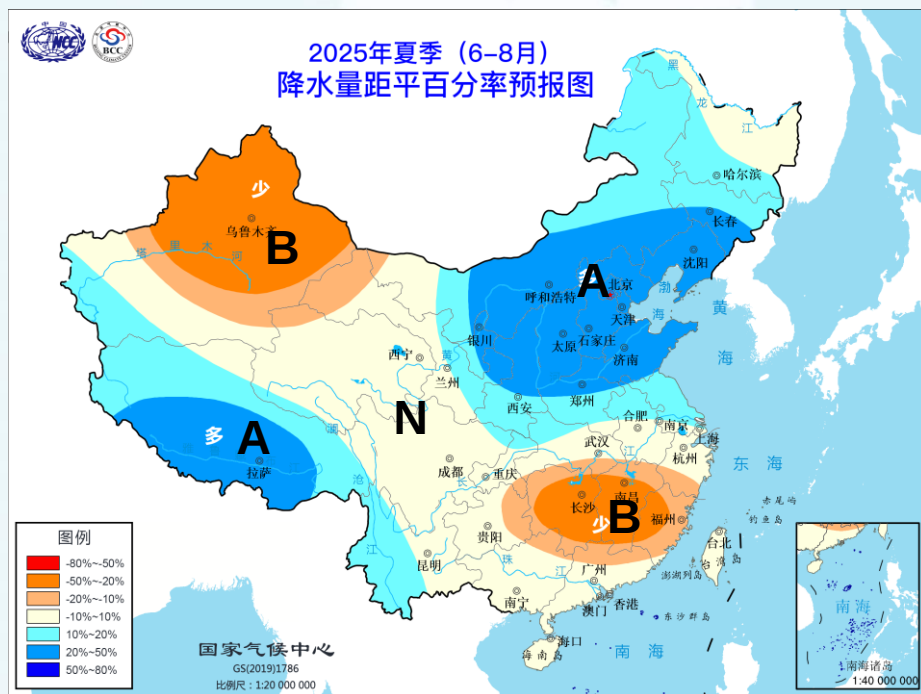
1. **Current Climate Conditions in China**
2. **Monitoring of Atmospheric Circulation and External Forcing**
3. **Prediction and Diagnostic Analysis**
4. **Outlook for JJAS 2025**

Seasonal outlook of climate for JJA 2025 over China

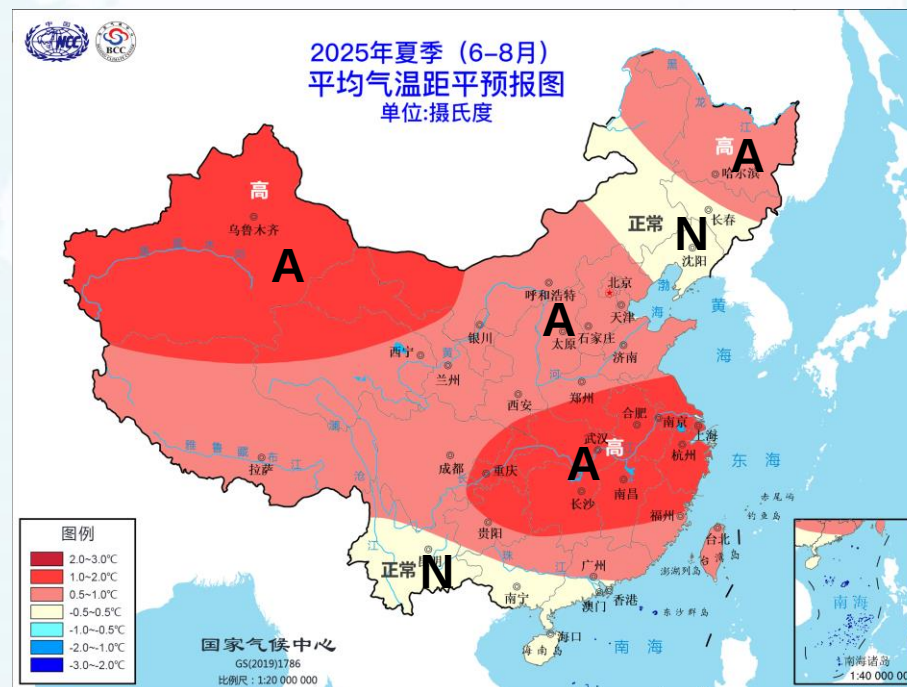


- ◆ The precipitation will be **above normal** over northern part of East China and Tibet. **Below normal** over **South China and Xinjiang**.
- ◆ Temperatures will be **above normal** over **most parts of China**. The **hot weather and heat extremes** in the coming summer will be **above normal**, but less than the value in 2022.

precipitation



temperature



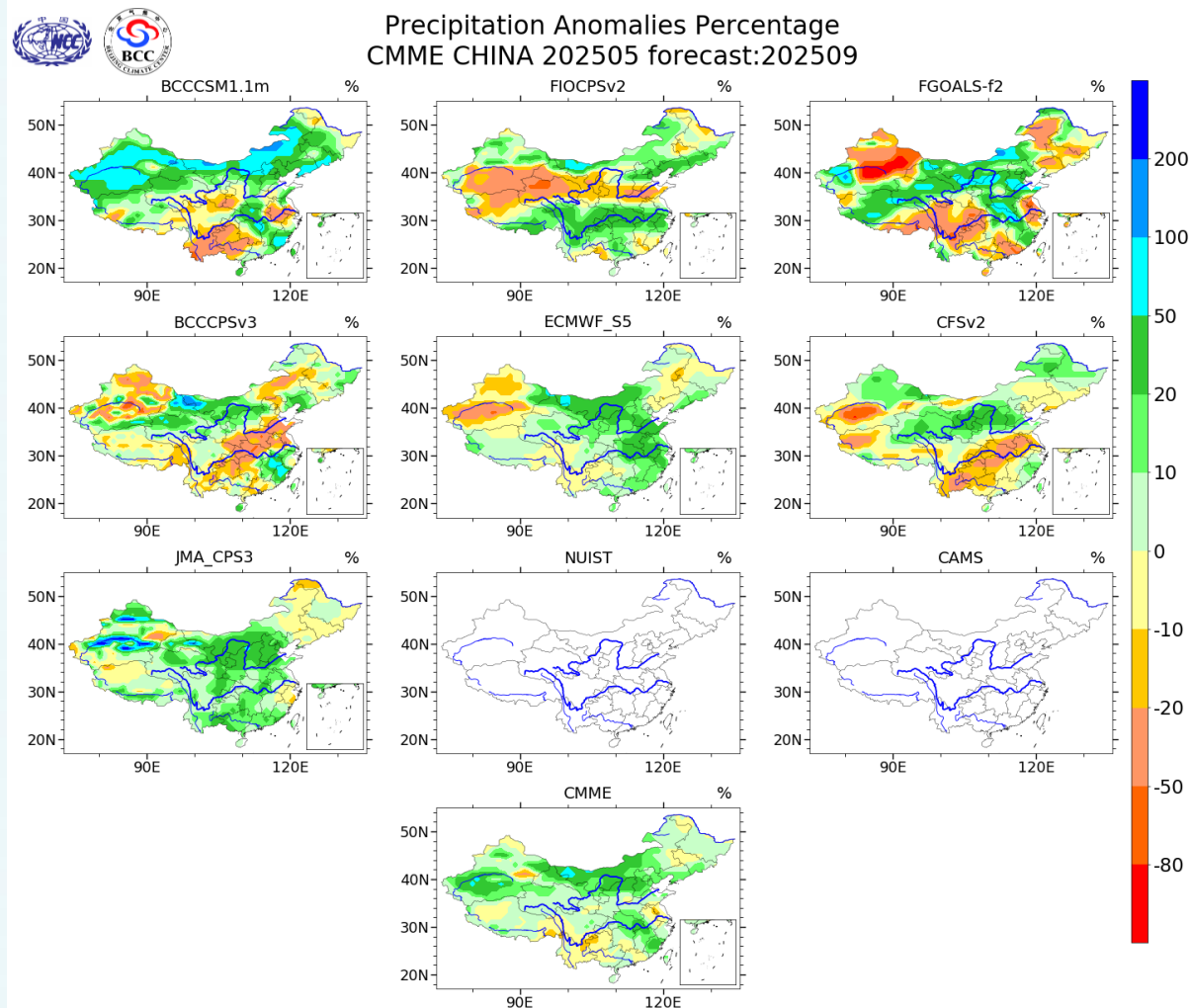
A: above normal
B: below normal
N: near normal

Monthly outlook of climate for Sep. 2025 over China



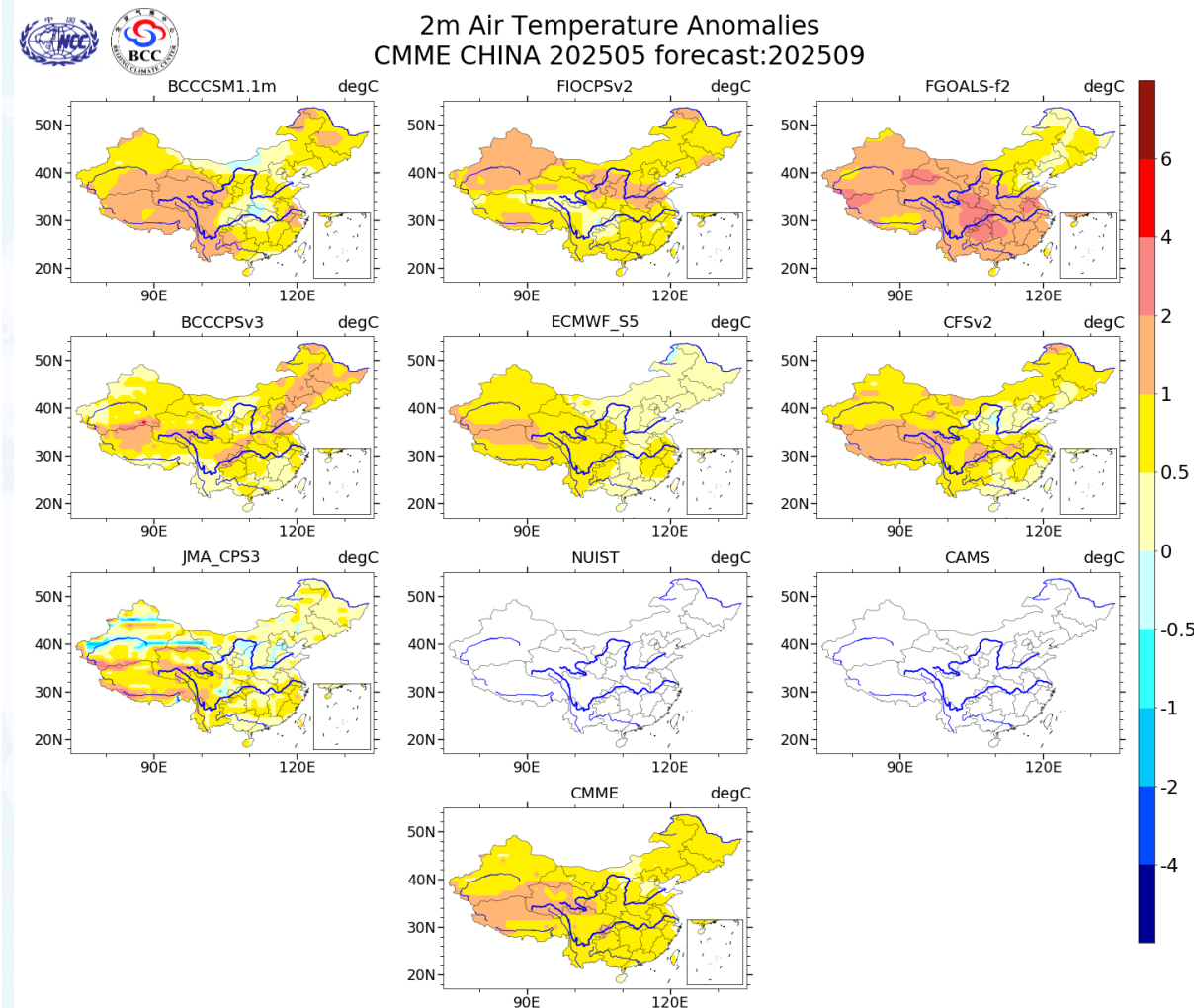
precipitation

Precipitation Anomalies Percentage
CMME CHINA 202505 forecast:202509



temperature

2m Air Temperature Anomalies
CMME CHINA 202505 forecast:202509



➤ Warm and wet climate for most part of Eastern China in September.

Thank you



WMO OMM

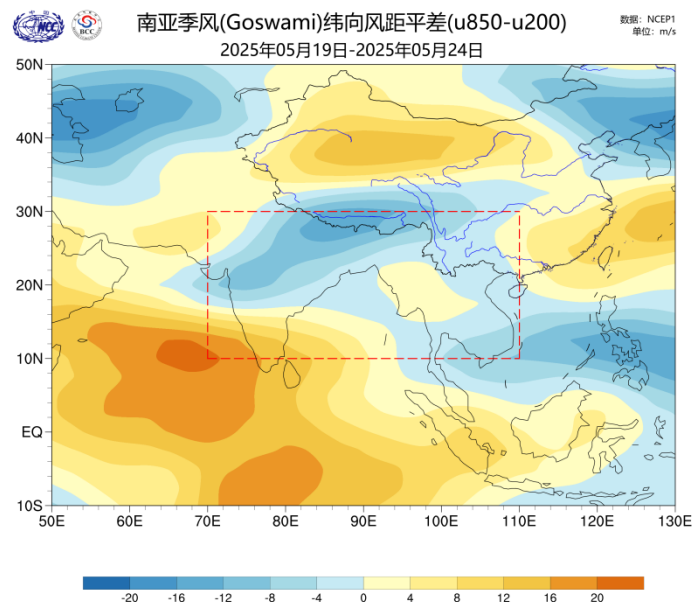
**World Meteorological Organization
Organisation météorologique mondiale**

ZHANG Daquan
National Climate Centre, CMA
zhangdq@cma.gov.cn

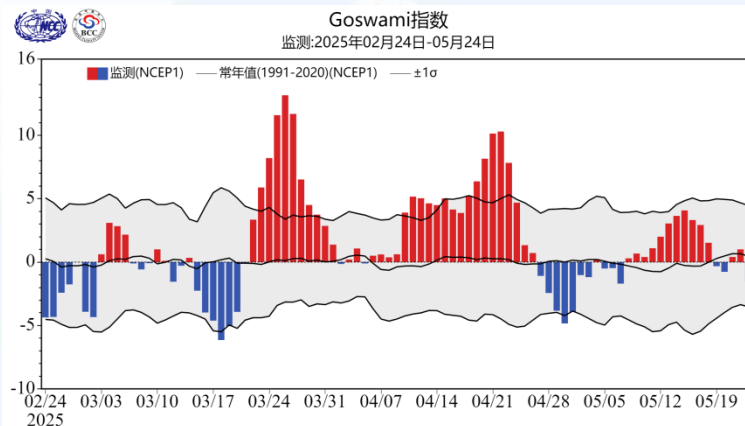
Monitoring of South Asia Monsoon



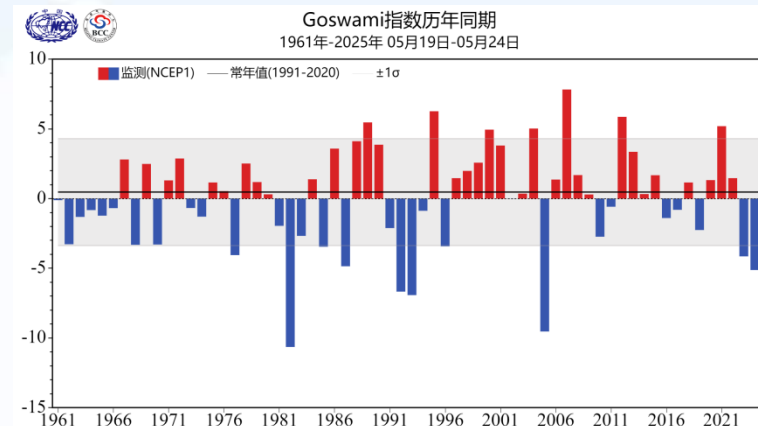
SAM index (Goswami)



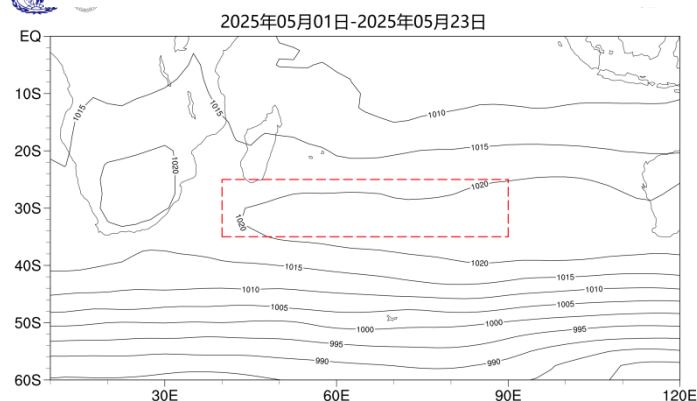
Daily index of SAM (2.24-5.24)



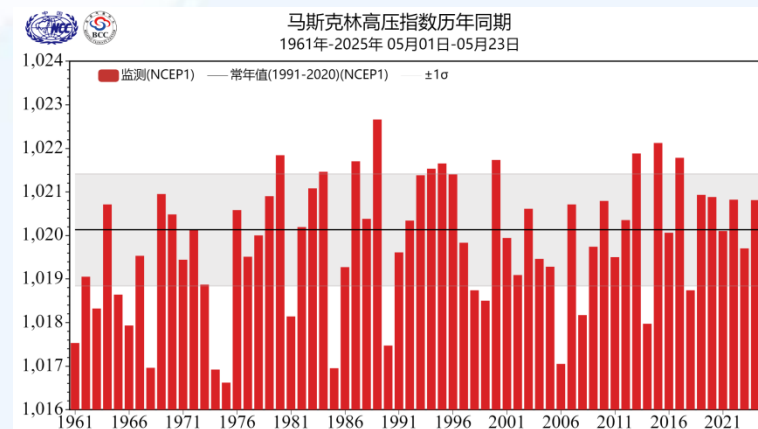
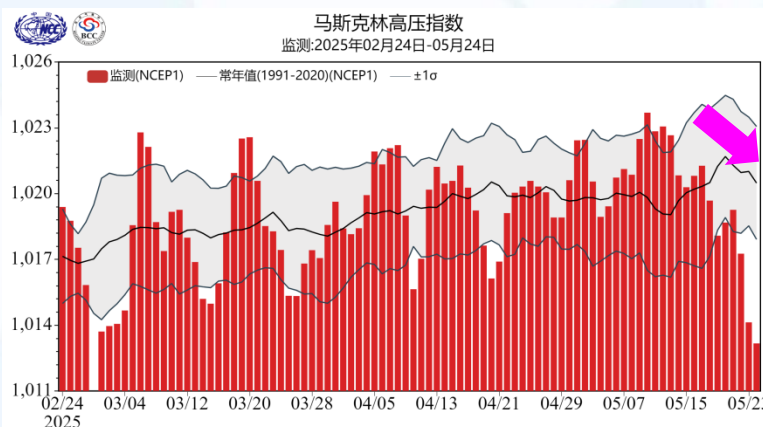
Inter-annual variability



Mascarene high (5.19-5.24)



Daily index of Mascarene high



➤ Strong Mascarene high in May 2025 compared to climatology.

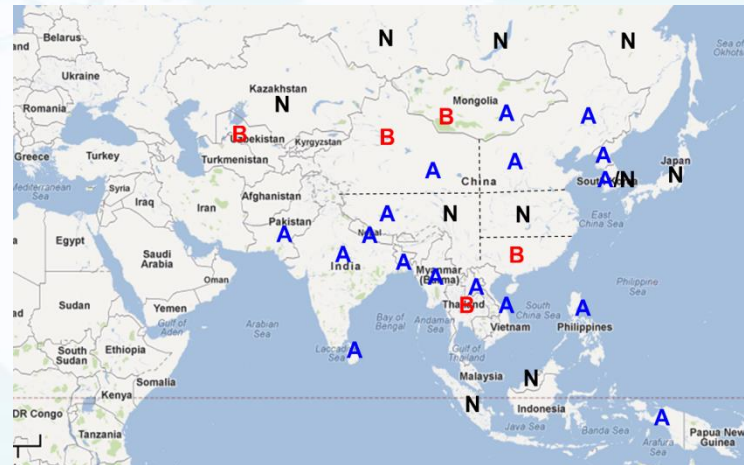
FOCRAII: Outlooks of Summer Climate in 2025 over Asia



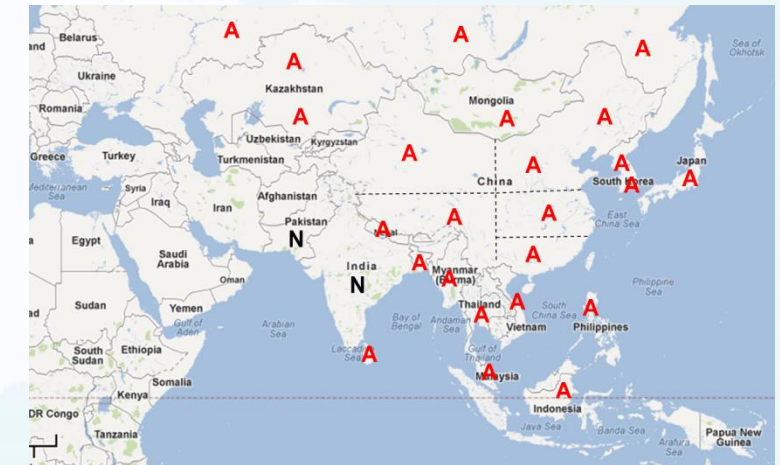
- ENSO Outlook: Forecasts from the WMO Global Producing Centers for Seasonal Prediction indicate that the current cooler than average sea surface temperatures in the equatorial Pacific are expected to return to normal. Most ENSO models predicted an ENSO neutral phase. All forecasters of FOCRAII 2025 agreed an **ENSO neutral phase**.

Deterministic precipitation prediction for summer 2025

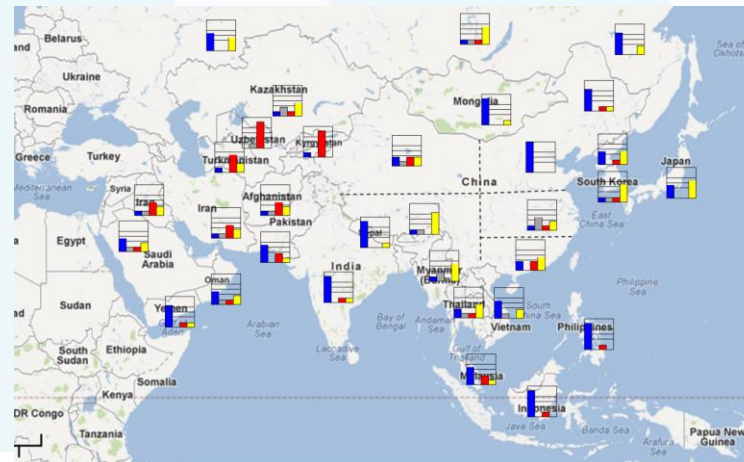
(A: above normal; N: near normal; B: below normal)



Deterministic temperature prediction



Precipitation prediction from dynamical models for summer 2025



Dynamical prediction for temperature

