

## Seasonal Climate Outlook of East Asia in Summer 2021

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## Outline

### ✓ BCC Climate Prediction System and products

- Statistical analysis
- Conclusion

### **BCC** Climate Prediction Models



## **BCC** Climate Prediction Models in operation

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



### http://forecast.bcccsm.ncc-cma.net/htm/



## Multi-model Ensemble(MME) can sample the uncertainties of initial conditions and modes



### China MME system-CMME



### **SSTA monitoring**







### SSTA prediction for summer 2021 by BCC models



-0.9 -0.8 -0.6 -0.4 -0.2 -0.1 0 0.1 0.2 0.4 0.6 0.8 0.9



# ENSO outlook by CMME : from La Nina to ENSO-neutral is most likely during late spring.





### **BCC-CPSv2 and CPSv3 forecasts: H500**



#### Prediction of 500hPa \_started from 1<sup>st</sup> April/March



BCC-CPS forecast for JJA 2021 shows a weak and northward displaced western 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.

### BCC-CPSv2 and CPSv3 forecasts: UV850



CPSv3

#### CPSv2



BCC-CPSv3 forecast for JJA 2021 shows:

Anomalous low-level cyclone over the Northwest Pacific and southerly anomalies wind over NC in summer.

### **CMME forecast: WPSH**



#### **WPSH** intensity index WPSH Intensity: CMME 20210420 Forecast Monitor (NCEP I): 202011-202104; Forecast: 202105-202110 Liu et al. (2012) 6.0 4.0 2.0 0.0 -2.0 -4.0 -6.0 2021Jul 2020Nov 2021Mar May Sep Jan <0 Monitor >0 (XXX) <0 Ensemble mean NZC-PCCSM4 FGOALS-f2 FGOALS-s2 BCC-CSM1.1m NCEP CFSv2 ECMWF

#### Forecasting Skill of WPSH: BCC\_CSM1.1m



#### WPSH ridge point index



- 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): 202010-202103; Forecast: 202104-202110



#### **EASM index**



#### **CMME** forecast: Precipitation

-30 -20 -10 0 10 20 30 50 70 100

-70 -50





More precipitation over northeast Asia, East India, North part of Southeast Asia

### **CMME forecast: Temperature**

90E

-5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 5





Mostly above normal.

### **Probability MME Prediction**



Normal

120E

150E



- above normal: northeast Asia, Central India
- below normal: northwest China, middle reaches of Yangtze river, Japan, South India, middle and west Asia



150E

- above normal: most parts of Asia
- below normal: part of northwest China, north Japan

### Statistical-Dynamical TC track prediction





### Statistical-Dynamical TC track prediction



#### Verification of Independent samples



### Statistical-Dynamical TC track prediction



#### WNP TC track density forecast of JJA2021



- The northwestward-moving track would be the dominant track mode during JJA of 2021 (red contours denote climatology);
- The total account of TC genesis landfalling TCs over western North Pacific and South China Sea would be above normal.

### WNP TC activity based on model forecast



#### ■Large scale circulation background affect WNP TC activity ■850hPa wind field anomalies forecast of BCC\_CSM1









### Circulation

- WPSH: near normal intensity; eastward ridge point and maybe northward displaced ridge line.
- A positive anomalous height center in the mid-high latitude areas of Northeast Asia.
- East Asia Summer Monsoon: strong.

### **Precipitation and Temperature**

- Enhanced precipitation over northeast Asia, more TC activity over WNP
- Warmer than normal in most of Asia



## Outline

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- ✓ Statistical Analysis
- Conclusion



### **Possible impacts from the external-forcing:**

• Evolution of the La Nina event

• Less snow cover over Tibet plateau in winter and spring

### Joint impact of La Nina event and positive NAT on EASM 🥐





More precipitation in Northeast Asia, Northwest China, Southwest China, the coastal areas in Southeast China, the middle and north of Indo-China peninsula, east India, and Philippines.

Less precipitation near Yangtze River Valley, Korea and south part of Indo-China Peninsula.

### Snow extent across Tibet Plateau is below normal

March 2021 青藏高原积雪日数距平分布

2021年03月

### BCCC

#### **Snow extent index across Tibet Plateau**



#### Air temperature anomaly during last winter



#### Snow days anomaly



### Impacts from Tibet Plateau snow on EASM

Composite of summer precipitation (mm)

Composite of summer 500hPa (gpm)



- 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**



- CMME predict the La Nina event will end in late spring and may lead a weak and eastward/northward displaced WPSH and strong EASM.
- Statistic analysis show that both the decaying La Nina and the reduced snow cover over the Tibet plateau in winter and spring favor a weak and northward displaced WPSH and a strong EASM.
- Correspondingly, more precipitation may occur in Northeast Asia, the coastal areas in Southeast China, most of Indo-China Peninsula, northern India and the Philippines. And less precipitation may occur near the middle and lower reaches of Yangtze River Valley, Korea, part of Japan and south part of Indo-China Peninsula. Above normal WNP TC frequency with prevailing northwestward moving track.
- The temperature may above normal over most Asia regions except part of India and Southwest China .





# Prediction of precipitation anomaly percentage in JJA 2021





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

The precipitation over China in JJA 2021 may be more than normal in North China and the coastal areas in Southeast China. Less than normal precipitation might appear near the middle and lower reaches of Yangtze River and Northeast China.



### 参加2021年汛期预测的两套模式系统

|                     | 第三代季节预测系统<br>BCC-CPSv3  | 第二代季节预测系统<br>BCC-CPSv2   |
|---------------------|---|--|
| 投入业务运行时间            | 2021年投入准业务化运行   | 2015年正式业务运行-至今   |
| 模式版本                | BCC-CSM2-HR<br>BCC-AGCM3-HR(T266L56)<br>BCC-AVIM2.0(T266)<br>MOM5-L50(1/4°)<br>SISv2 (1/4°) | BCC-CSM1.1m<br>BCC-AGCM2.2(T106L26)<br>BCC-AVIM1.0(T106)<br>MOM4-L40(1/3°~30km)<br>SISv1 (1/3°~30km) |
| 运行频率                | 隔月运行一次(预测未来7个月)   | 每月滚动 (预测未来13个月)  |
| 模式初始场               | 多圈层耦合同化系统   | 大气NCEP R1,海洋<br>NCEP_GODAS   |
| 样本数                 | 21个 (SPPT+LAF)  | 24个 (15LAF+9SV)  |
| 历史回算时间              | 2001-2020年  | 1991-2020年   |
| 参加会商的结果为3月1日起报的模式预测 |   |  |

**Re-forecast configurations for seasonal prediction** Model: The fully coupled climate model BCC\_CSM1.1m (T106L26) Forecast: initialized on 1<sup>st</sup> of each month, 13-month integration Ensemble forecast: 24 samples (15 lagged-average-forecast (LAF) and 9 singular-vector (SV) method) Initial data: Atmosphere: NCEP reanalyses for hindcast, and NMC/CMA T639 assimilation for real-time Ocean: NCEP-GODAS oceanic data Hindcast period: 1991-2013 Data preprocess: 0-month lead (LM0); 1-month lead (LM1); ...; 6-month lead (LM6) teal-forecast for 2021: initialized on 1<sup>st</sup> of March/April

### BCC-CPSv2 and CPSv3 forecasts: precipitation rate CPSv2 CPSv3



CPSv2: more precipitation over northeast Asia, East India, North part of Southeast Asia CPSv2: more precipitation over North China and South China, less precipitation over Vanger River Valley

### BCC-CPSv2 and CPSv3 forecasts: temperature anomaly

CPSv2



CPSv3



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