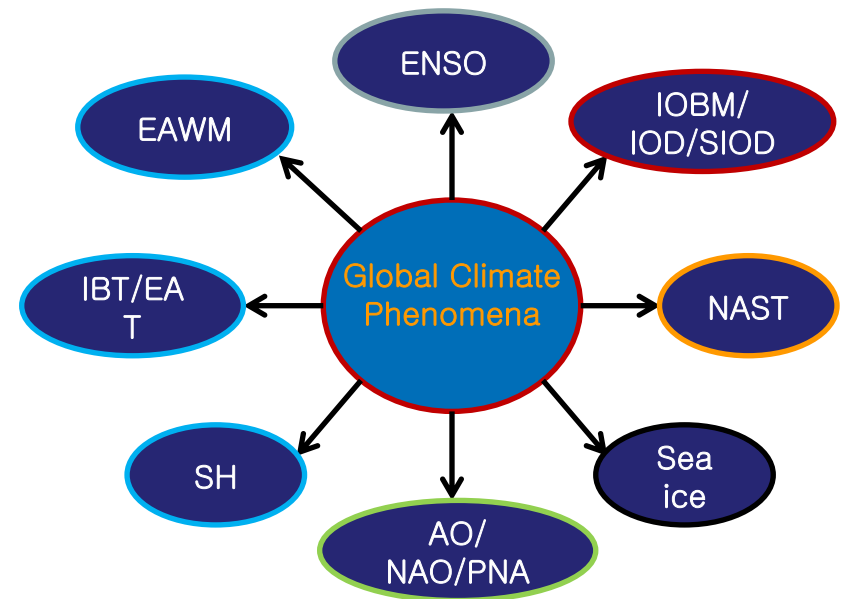
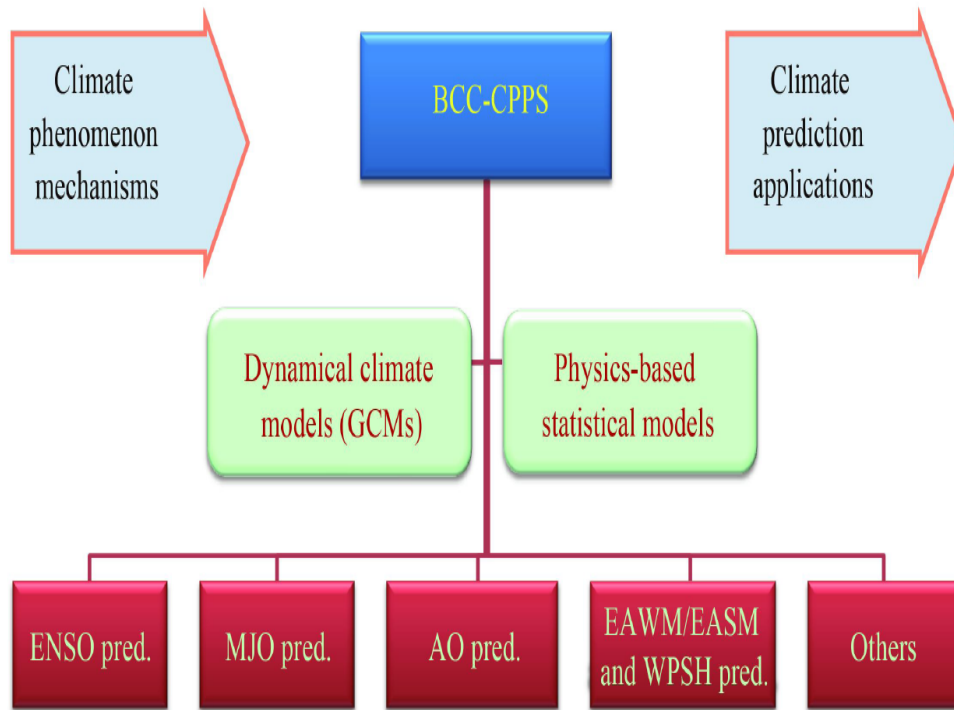


# Climate phenomenon prediction system

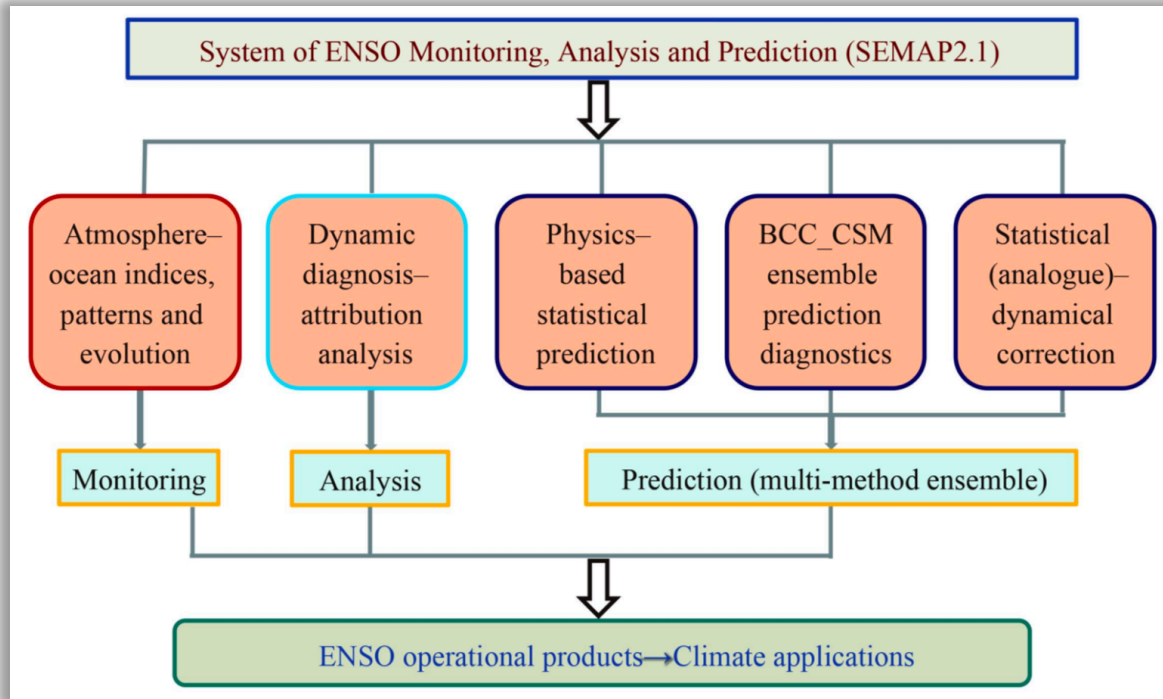
--Support operational seasonal prediction



(Ren et al. 2017)

Prediction of primary Climate Phenomena/circulation patterns is of great significance for LRF and understanding Model behaviors

# ENSO prediction



Statistical Method:

$$\text{Niño}(t) = \alpha \text{Niño}(t) + \beta \text{WWV}(t) + \gamma \text{ZWS}(t) + \delta \text{NTA}(t).$$

Dynamical model:

**BCC-CSM1.1m**

24 members

**LAF**

**SVD**

(Ren et al. 2014)

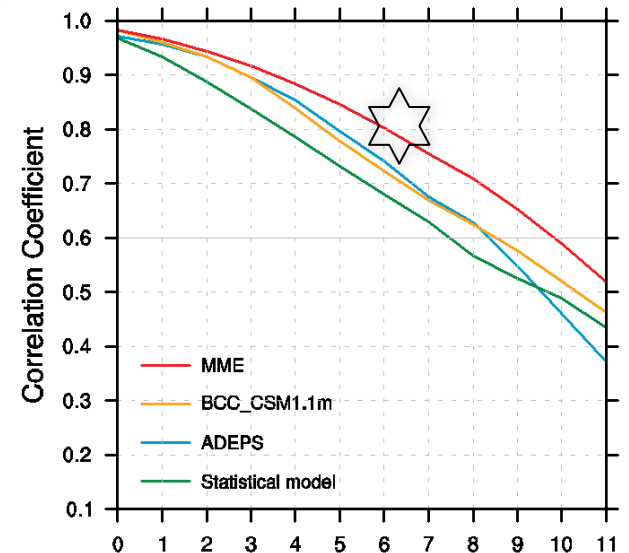
Analogue-dynamical ENSO prediction (ADEPS)

$$\hat{P}_M(\psi_0) = P_M(\psi_0) + \tilde{P}_M(\tilde{\psi}_j) - P_M(\tilde{\psi}_j)$$

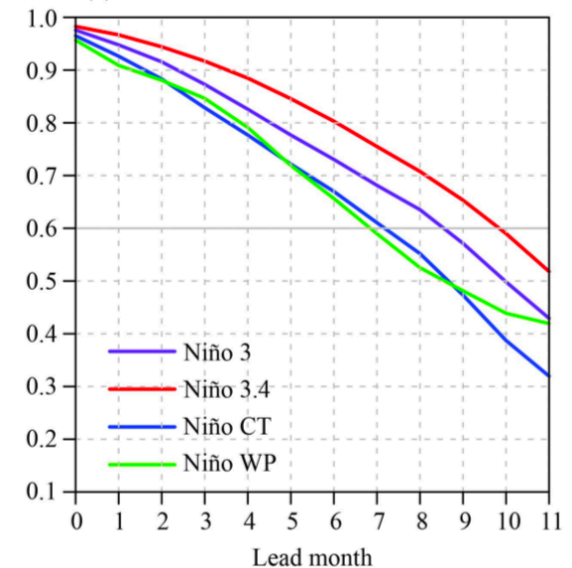
## Multi-Method Ensemble (MME)

1996–2015

NINO3.4 独立样本检验

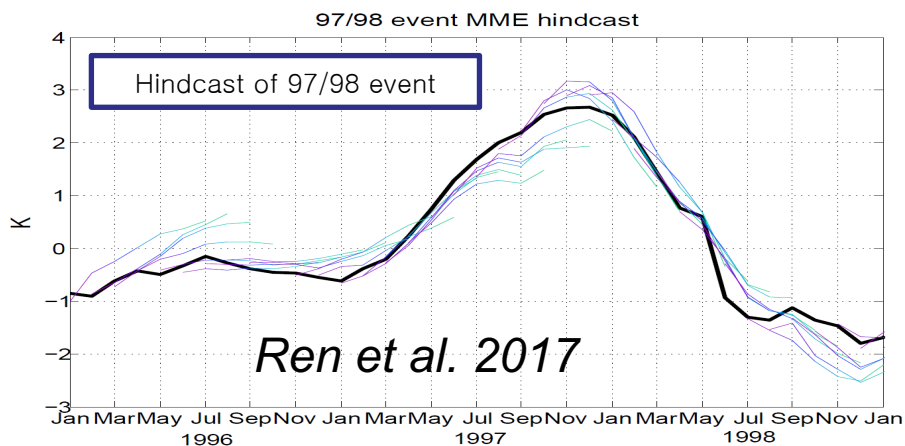
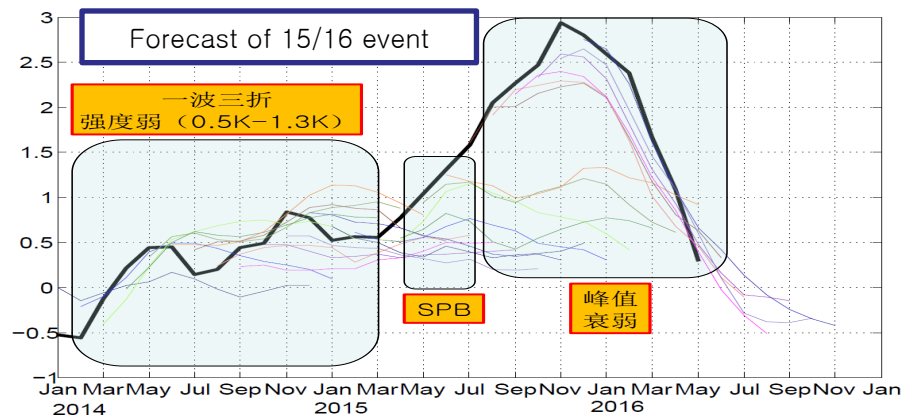
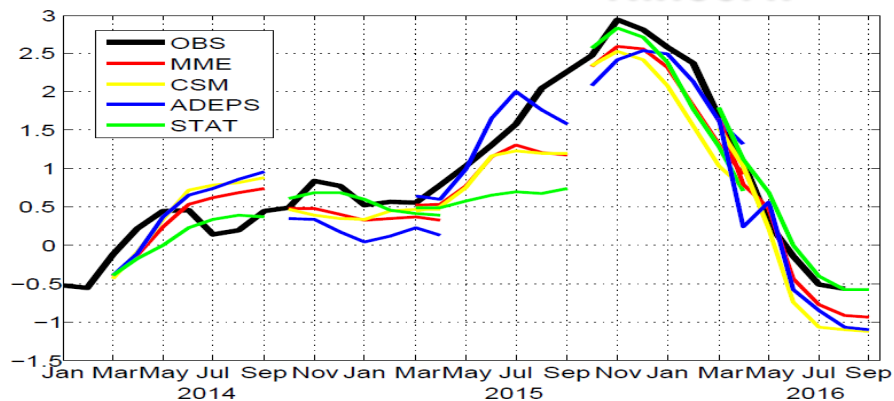


(b) MME

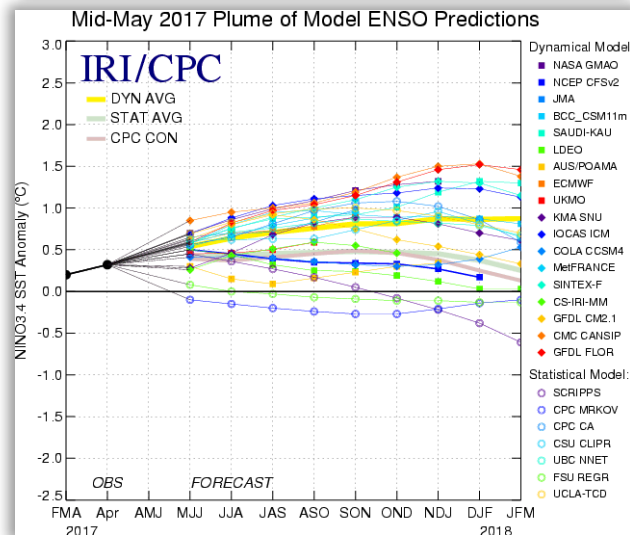


# 2014-2016

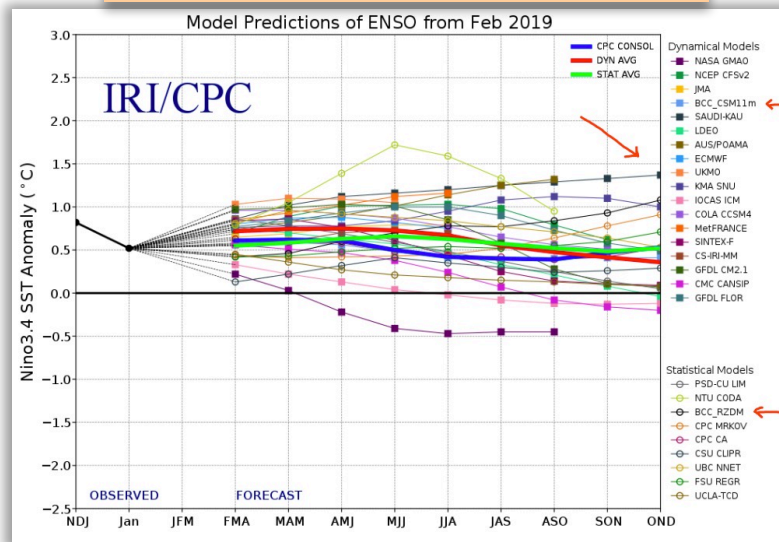
## Nino3.4I



## 2017.05 ⇒ IRI/CPC



## 2019.01 ⇒ IRI/CPC



# MJO prediction

## ISV/MJO Monitoring and Prediction System (IMPRESS2.0)

CMA analysis  
and FY satellite  
observation

BCC\_AGCM  
prediction  
diagnostics

BCC\_CSM  
prediction  
diagnostics

ISV-based MJO  
STPM statistical  
prediction

Real-time monitoring ISV/MJO  
indices, fields and impacts

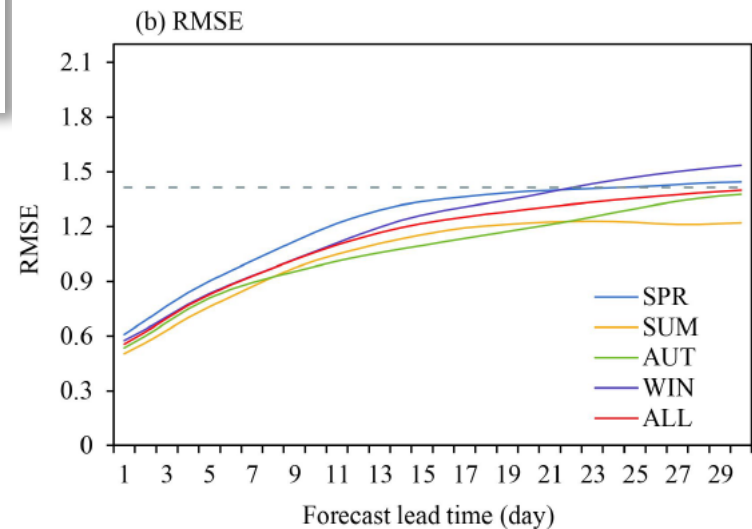
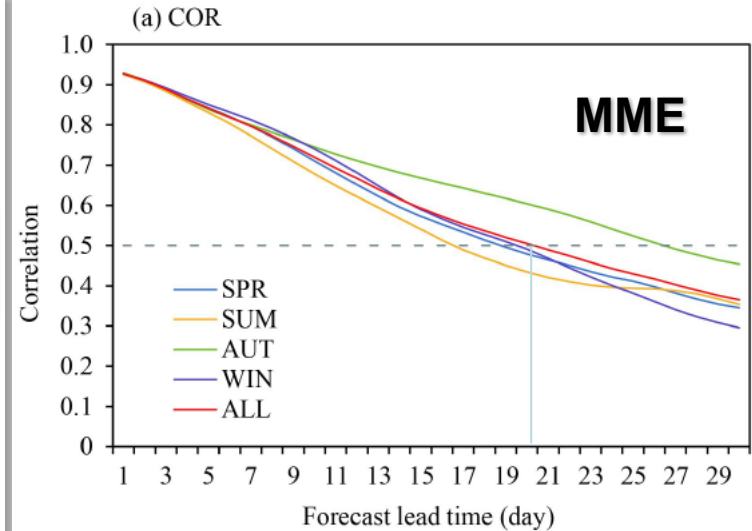
Ensemble prediction of ISV/MJO  
indices and reconstructed fields

ISV/MJO-based subseasonal forecasting and applications

## Multi-initial-value ensemble:

$$\text{Ens\_fcst}(t_0) = \frac{1}{6} \left[ \sum_{i=t_0-2}^{t_0} \text{Ens}_{\text{BCC\_AGCM2.2}}(i) + \sum_{i=t_0-2}^{t_0} \text{Ens}_{\text{BCC\_CSM1.2}}(i) \right],$$

## MJO skill: 20d



# MJO monitoring and prediction

## Framework of products

Categories	Datasets	Products
Monitoring	1) NCEP+NOAA_OLR 2) T639+FY3B_OLR	1) Up-to-now monitoring text of RMM indices (Oyear) 2) RMM phase diagram: recent 45d monitor (O45) 3) Up-to-now RMM indices/amplitude time series (Oyear)
Prediction	1) DERF2.0 2) S2S 3) T639 4) STPM	1) Prediction text of RMM indices (P50) 2) RMM phase diagram: Monitor & prediction (O30P30) 3) RMM indices/amplitude time series: M&P (OyearP50)
Impact	1) DERF2.0 2) S2S 3) T639 4) STPM	1) Time-Lon & -Lat evolutions: U850 & OLR (O120P50) 2) Reconstructed tropical wind850+PREC+OLR (O5P20) 3) Reconstructed T anom at 2400 stations (O5P25) 4) Reconstructed PREC anom at 2400 stations (O5P25)
Verification	1) DERF2.0 2) S2S 3) T639	1) RMM phase diagram: 45d M & P 10d ago (O45L10) 2) RMM phase diagram: 45d M & P 20d ago (O45L20)

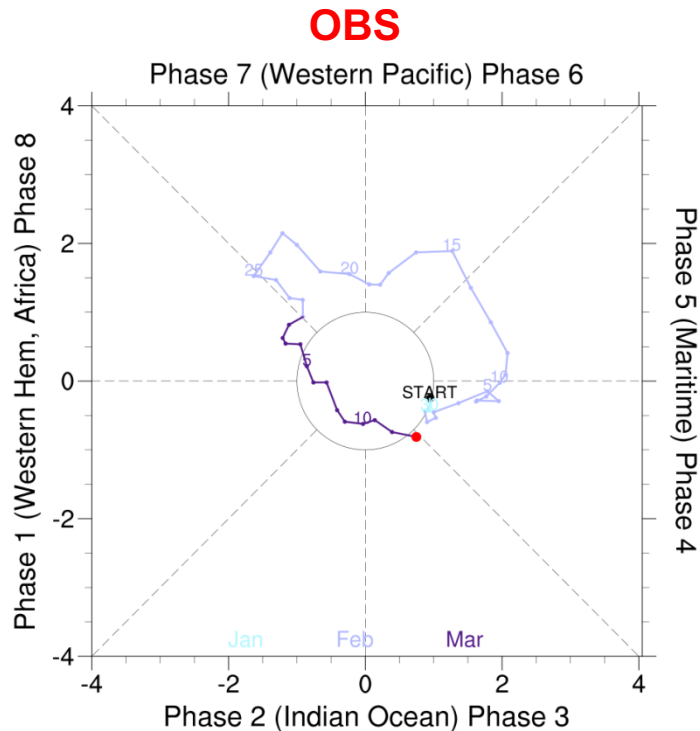
BCC website for **real-time updated products**:

[http://cmdp.ncc-cma.net/Monitoring/moni\\_mjo.php](http://cmdp.ncc-cma.net/Monitoring/moni_mjo.php)

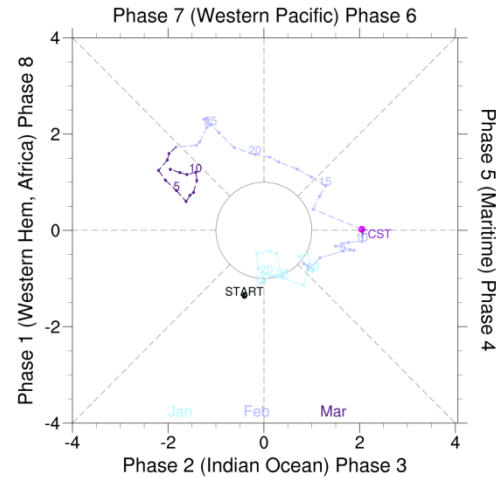
# MJO prediction products

## Multi-data & models

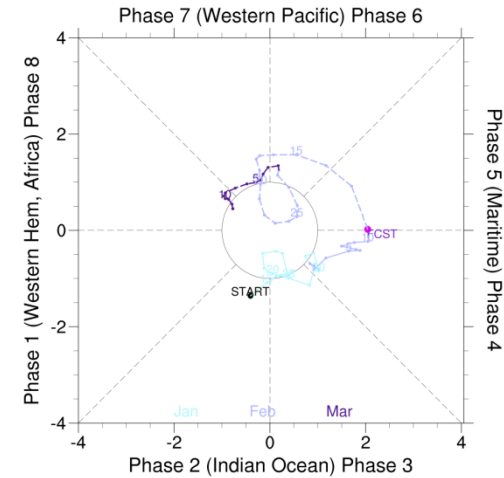
- a) DERF2.0: prediction for future 50 days
- b) BCCCSM1.2: future 60 days
- c) T639 model: ensemble of 15 days
- d) STPM: future 30 days



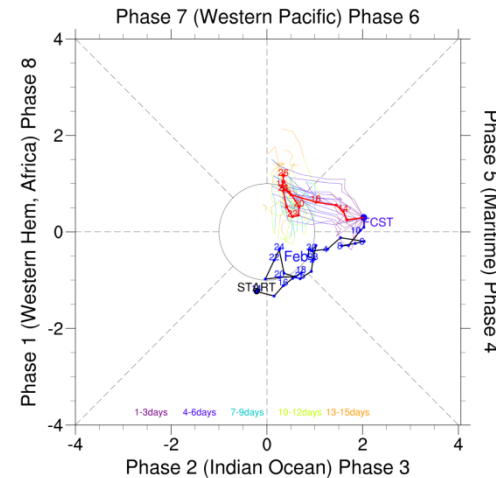
## DERF2.0



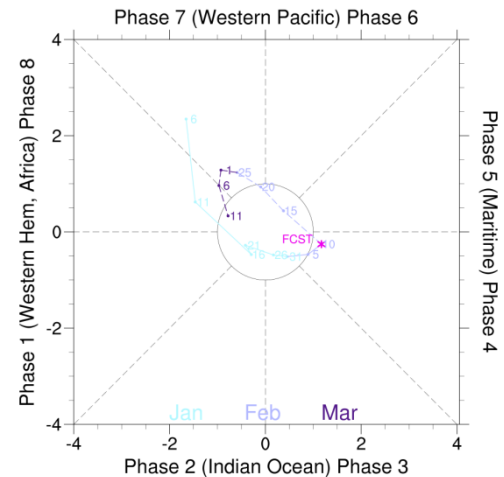
## BCCCSM1.2



## T639



## STPM

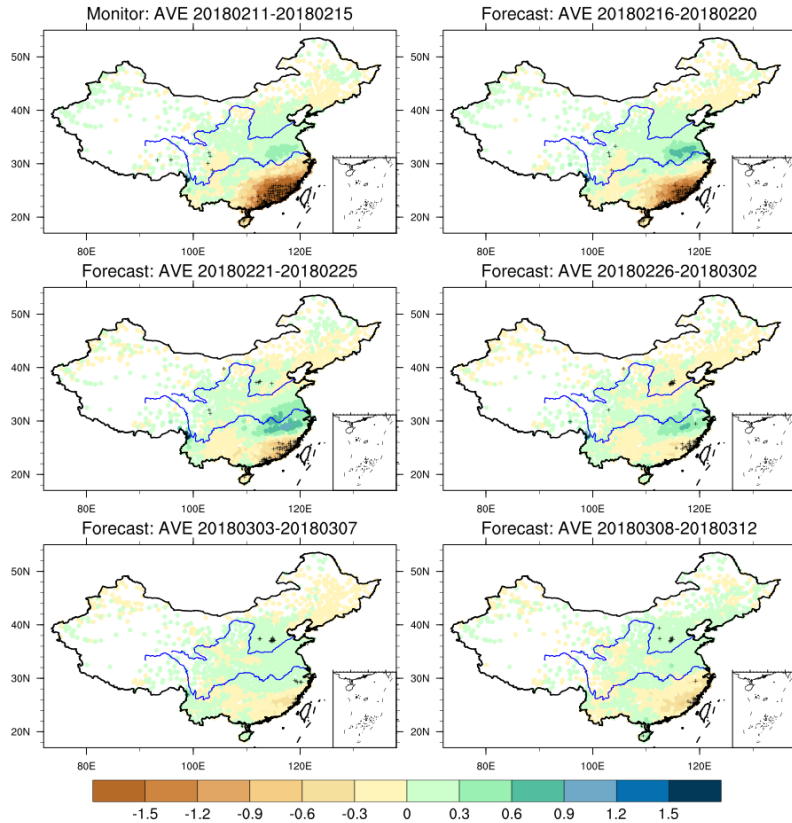


# Extended-range forecasts

## Pentad PRCP forecasts

RMMI Reconstructed Pentad-mean Precipitation Anomaly in China

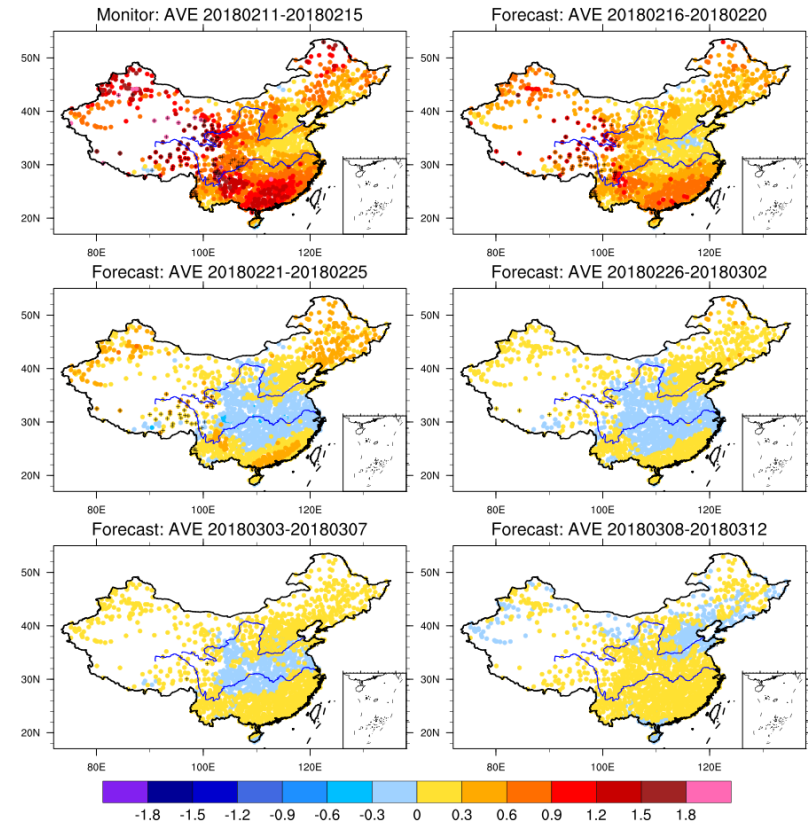
RMMI: Monitor(T639+FYB) Forecast(BCC\_AGCM2.2)



## Pentad T2m forecasts

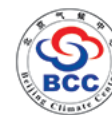
RMMI Reconstructed Pentad-mean 2m Temperature Anomaly in China

RMMI: Monitor(T639+FYB) Forecast(BCC\_AGCM2.2)

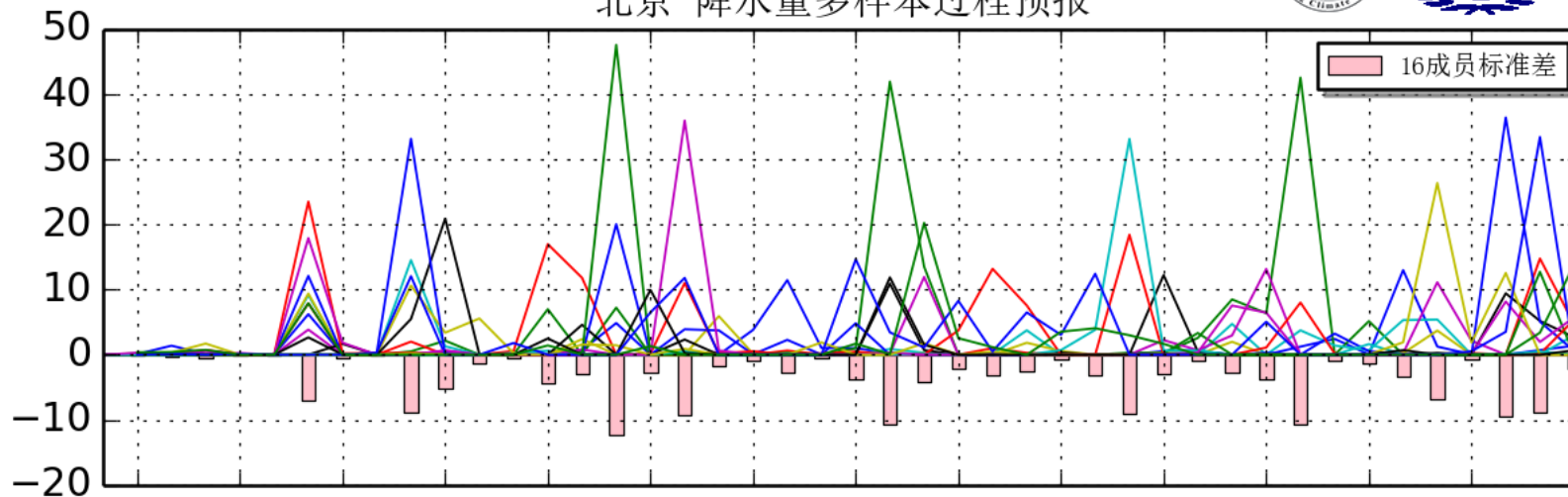


# Rainfall process forecasts

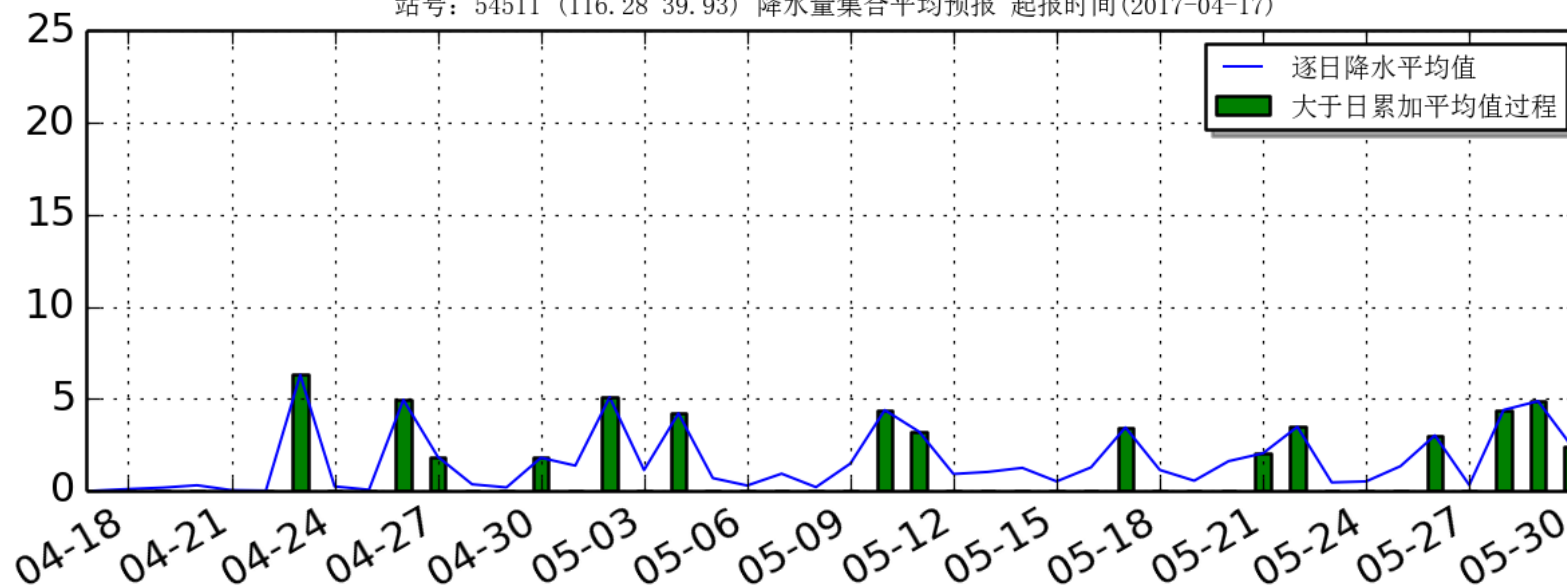
## Beijing



北京 降水量多样本过程预报



站号: 54511 (116.28 39.93) 降水量集合平均预报 起报时间(2017-04-17)



# Probability forecasts

## 基本气候特征

温度 降水

500hPa高度场

## 监测与诊断

基本要素和极端事件

大气环流和季风

ENSO监测分析和预测系统  
(SEMAP2.1)

陆面冰雪

气候异常诊断

气候事件与过程

快报/月报/季报/年报

## 预测与检验

延伸期(常规要素 极端要素)

月(动力 统计)

季节(动力 二代 统计 滚动)

检验(月 季节)

气候预测模式产品检验评估

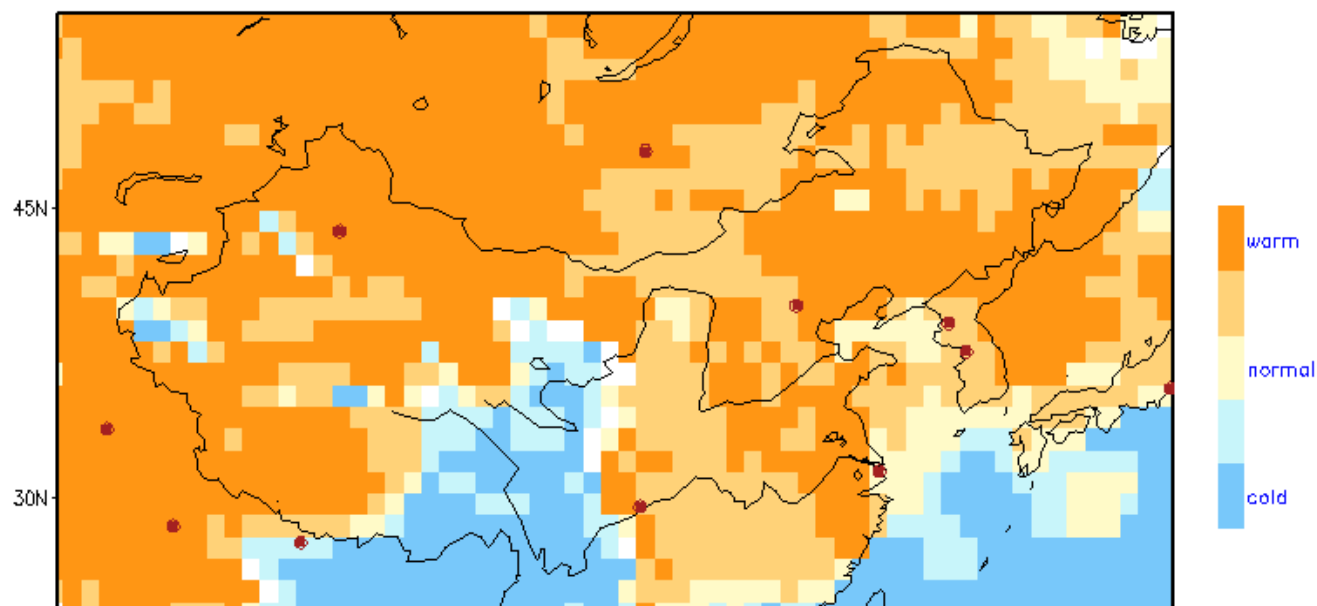
气候现象(ENSO、MJO等)

## 月动力延伸集合预测二代产品 DERF2.0

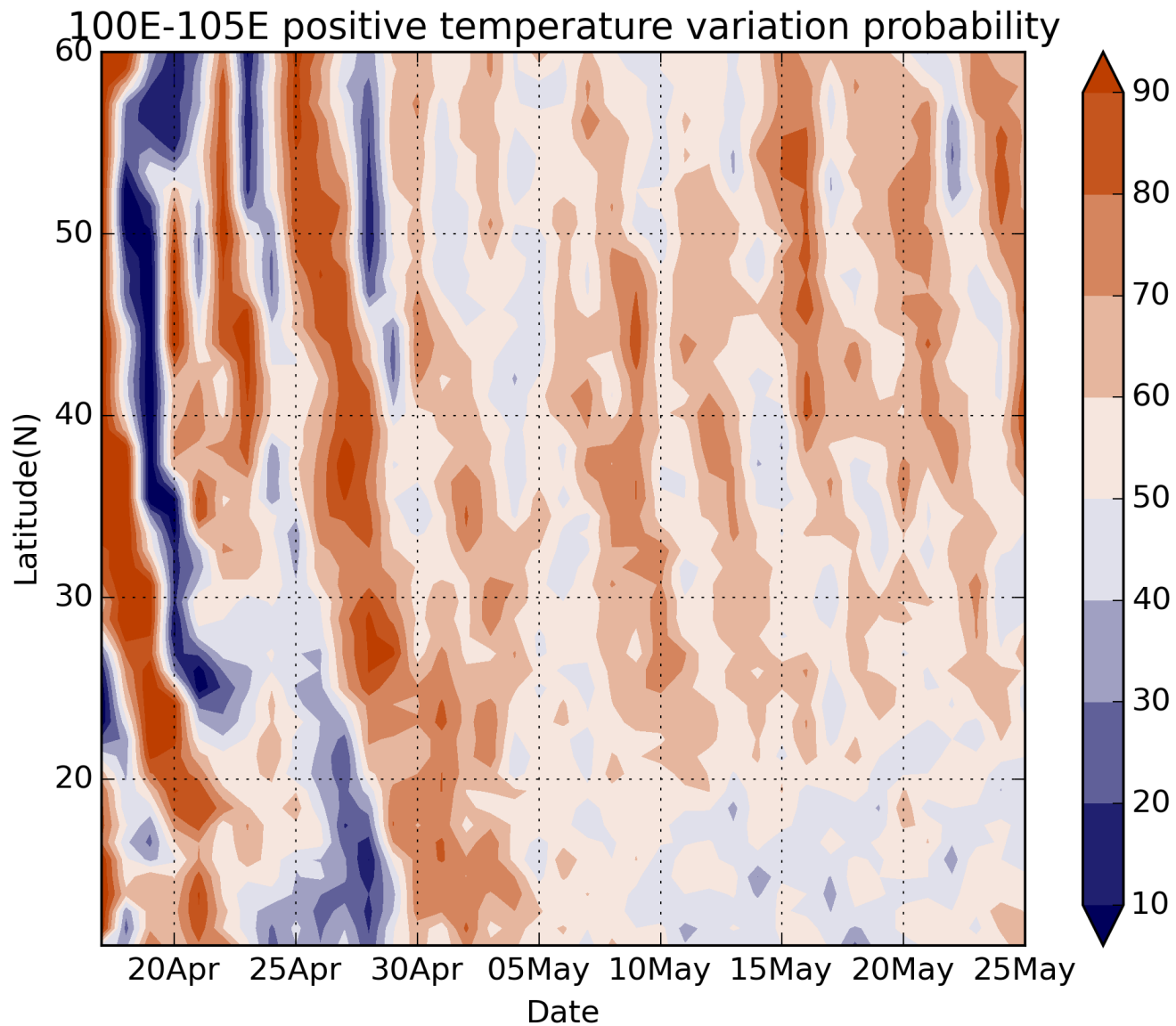
预测起始日期 2017 ▾ Apr ▾ 16th ▾ 时段 01-30天 ▾ 变量 降水距平百分率 ▾ 范围 中国 ▾ 注: 请先选择变量, 再选择范围。 show\_detail

NCC/BCC Monthly Forecast  
Most Likely Temperature Categories  
Fcast Started Refer Date 2017/04/15  
Member Size=20

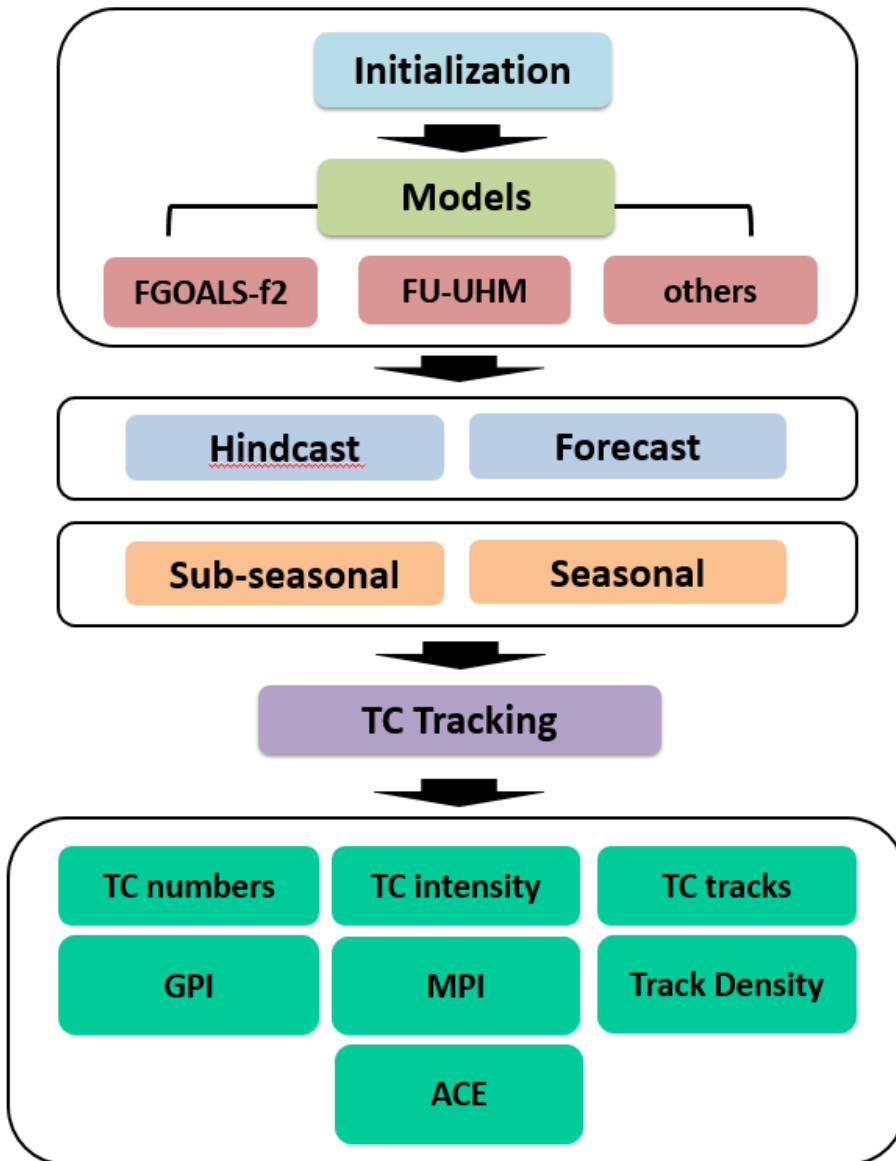
DERF2.0: BCC\_AGCM2.2(T106L26)  
For 2017/04/16-2017/05/15  
Fcast Produced Date 2017/04/16



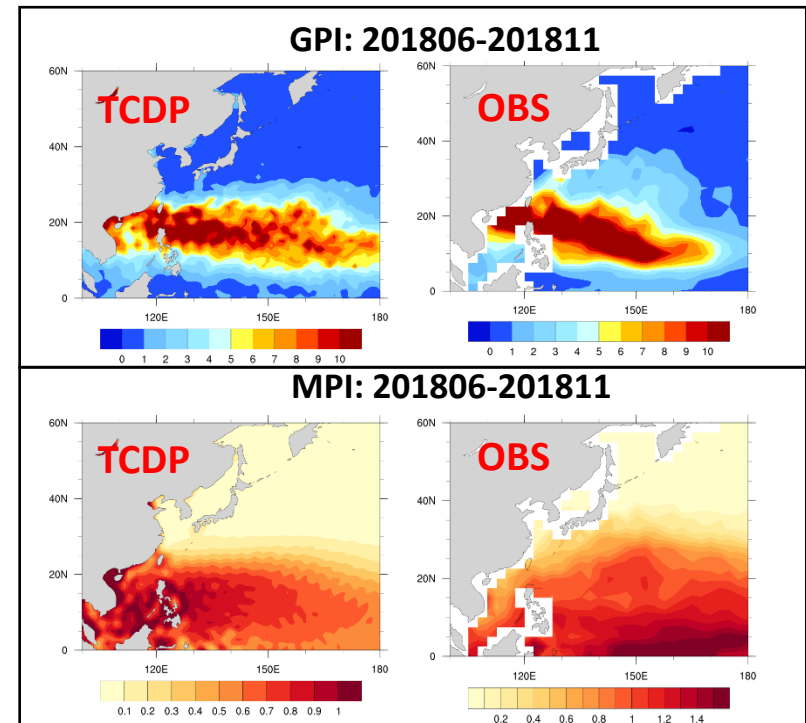
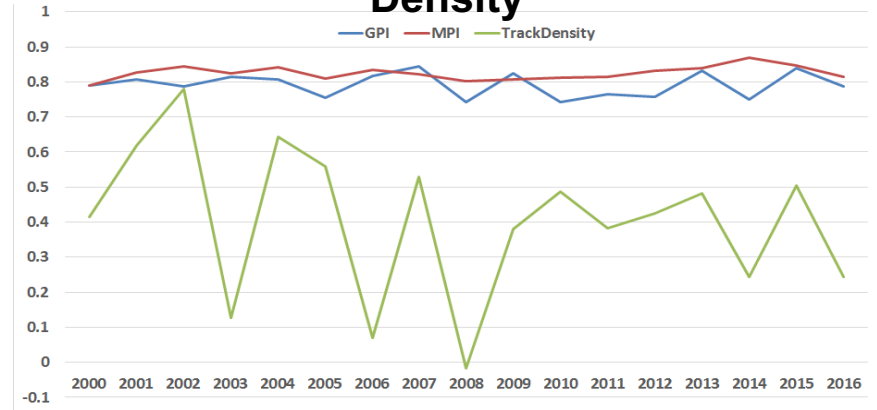
# Probability forecasts



# Tropical Cyclones Dynamical Prediction System 1.0 (TCDP1.0)

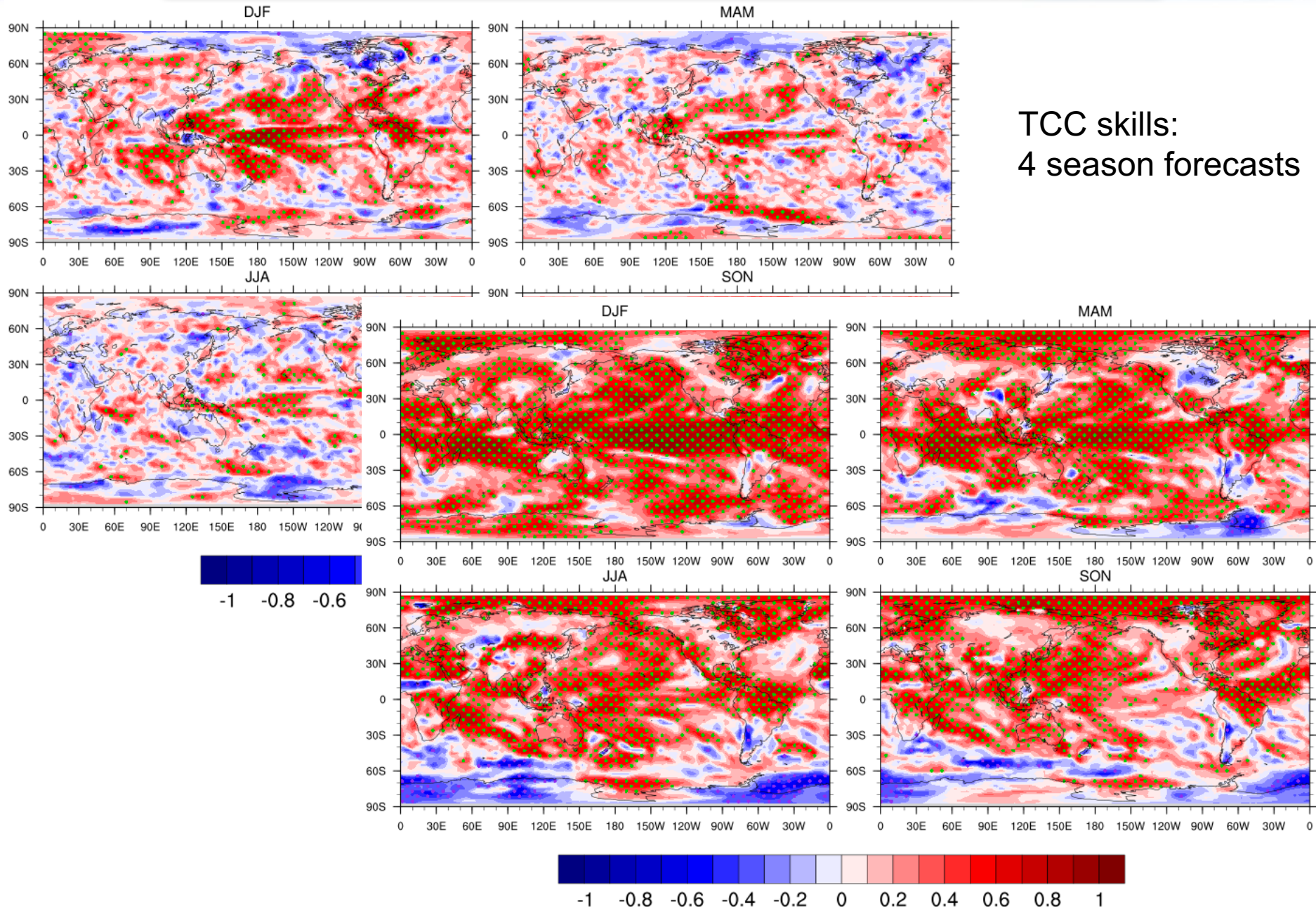


## TCDP1.0: ACC skill of GPI, MPI, Track Density



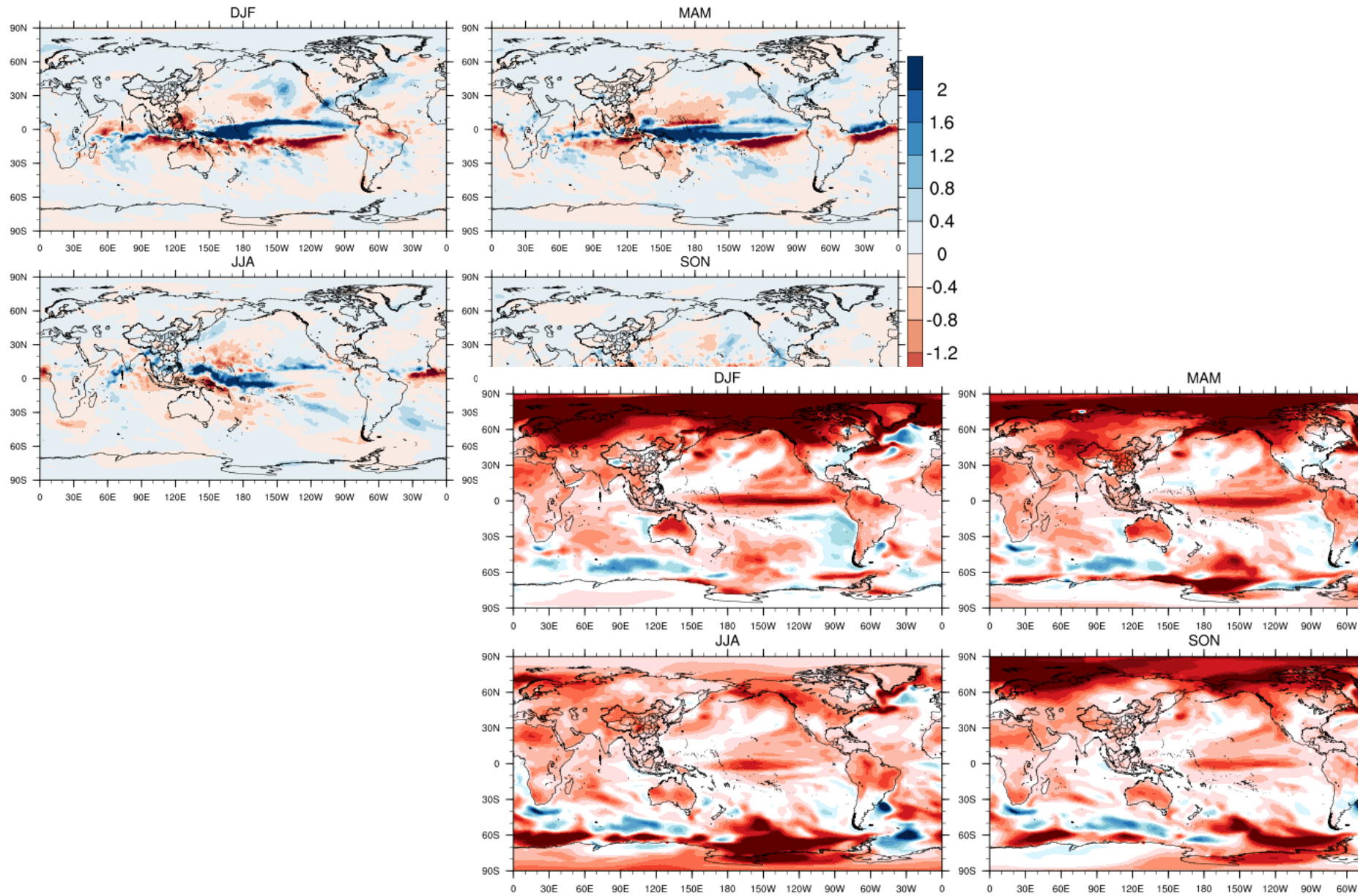
# Seasonal-interannual prediction in BCC

TCC skills:  
4 season forecasts



# 2019: four season forecasts

Precipitation: BCC\_CSM1.1m 201811 forecast



# Outline

---

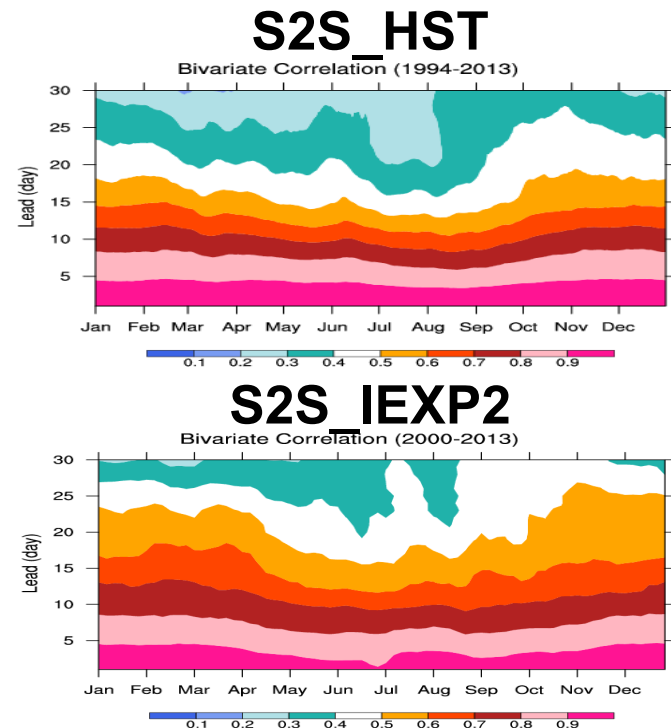
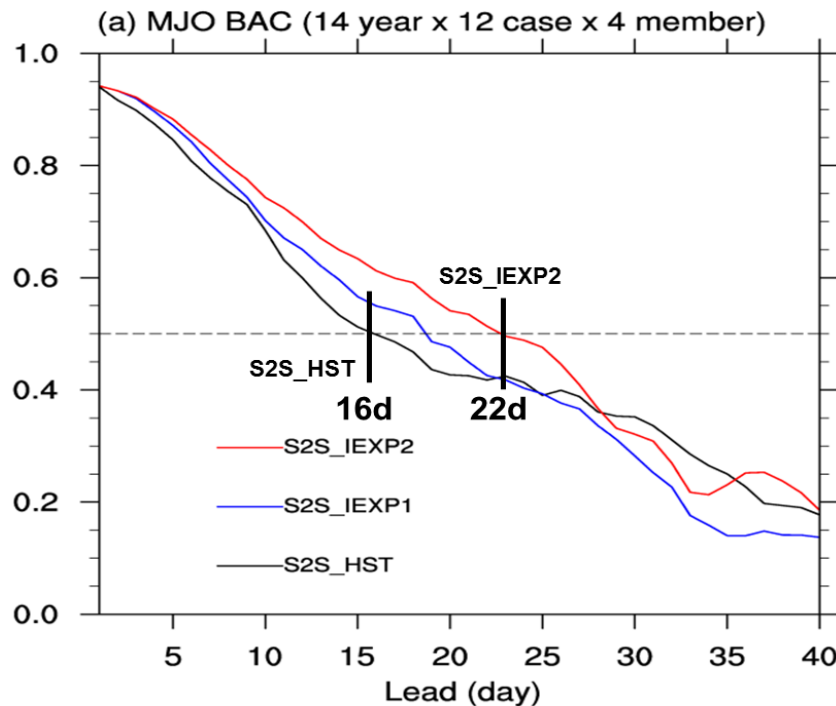


- ❑ Introduction
- ❑ Operational model system
- ❑ Climate prediction operation
- ❑ Climate prediction research
- ❑ Summary and outlook



# Improved experiments of BCC S2S prediction

## MJO prediction skill in BCC\_CSM1.2



S2S\_HST: ocean initials (BCC\_GODAS)+atmosphere initials (NCEP R1)  
S2S\_IEXP1: ocean initials (BCC\_GODAS) + atmosphere initials (NCEP FNL)  
S2S\_IEXP2: ocean initials (BCC\_GODAS + OISST) + atmosphere initials (NCEP FNL)  
Conducted on 1<sup>st</sup>, 6<sup>th</sup>, 11<sup>th</sup>, 16<sup>th</sup>, 21<sup>st</sup>, and 26<sup>th</sup> of each month in 2000–2013

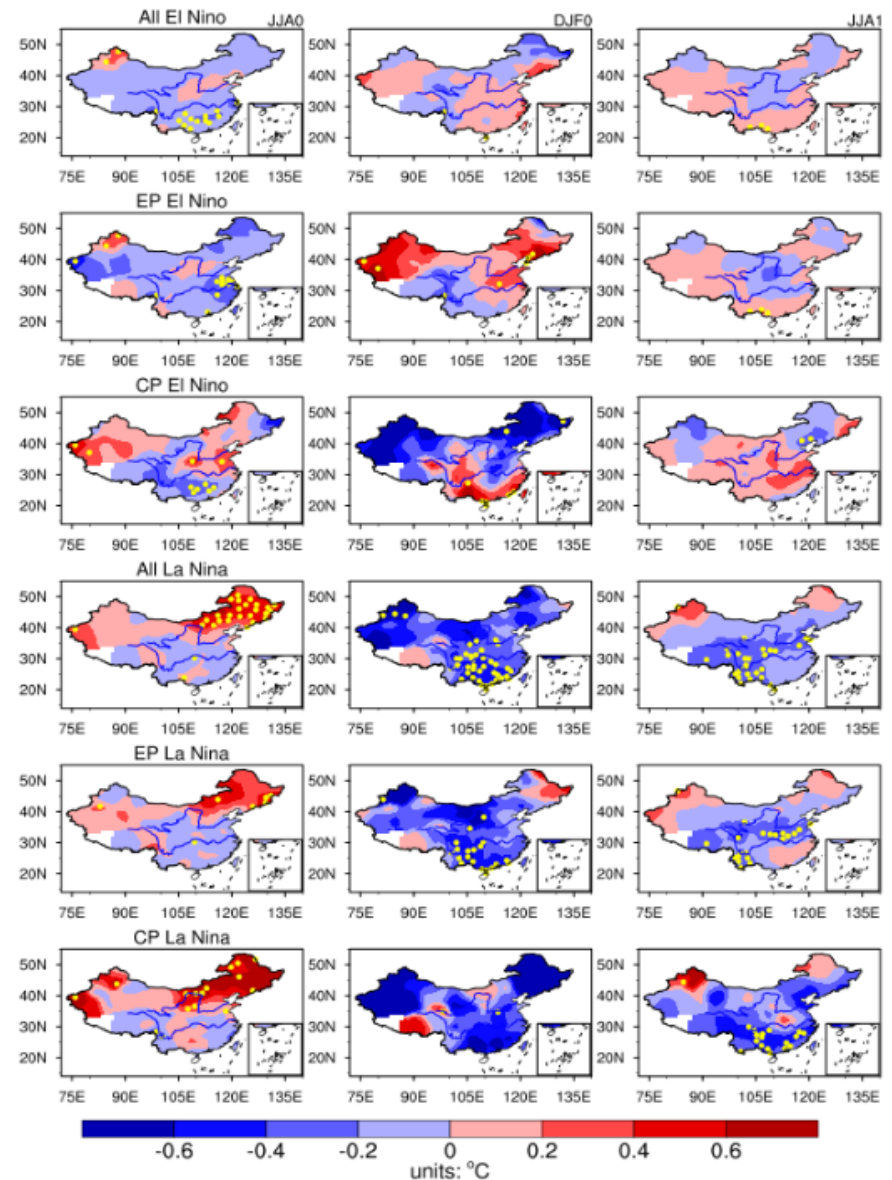
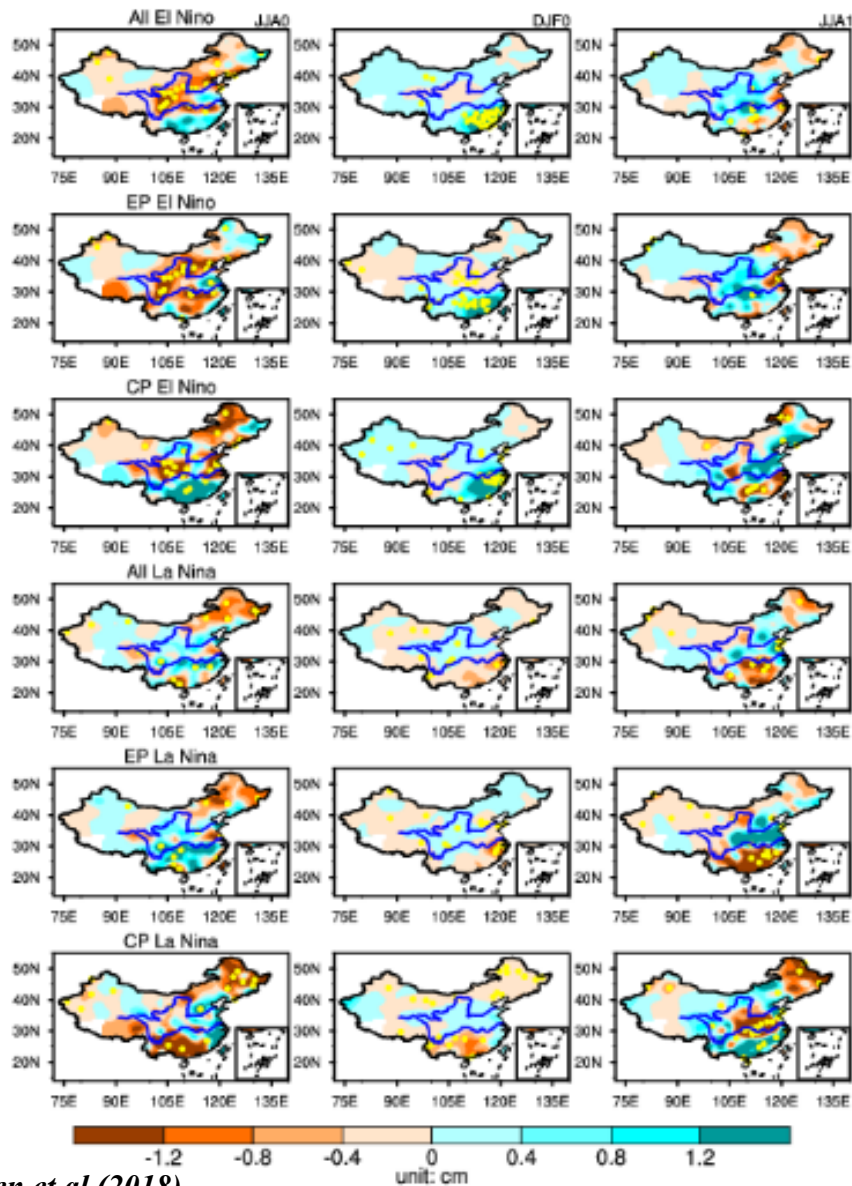
Further experiments using BCC model show that oceanic initial states largely impact on the East Asian summer monsoon and MJO forecast skill.

# Impacts: Two types of ENSO on China T2m & PRCP

## PRCP patterns

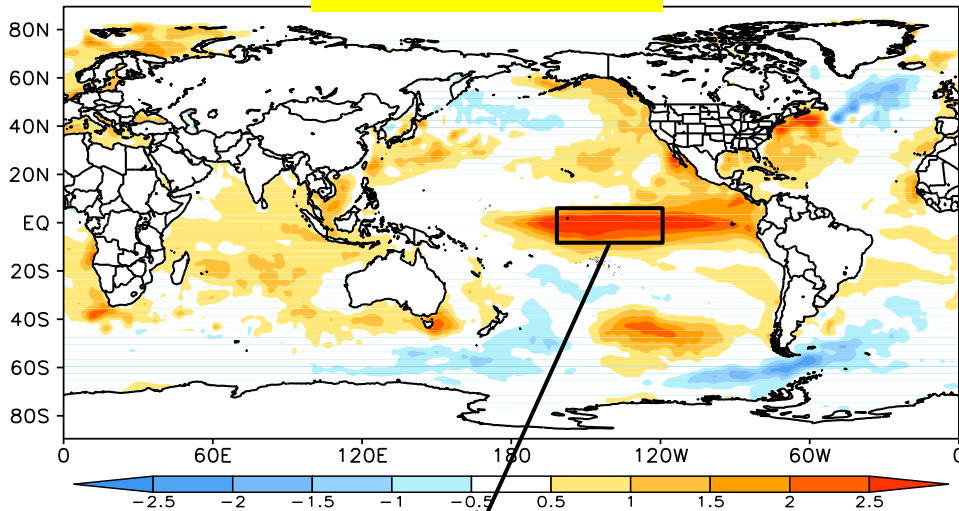
1950~2016

## T2m patterns

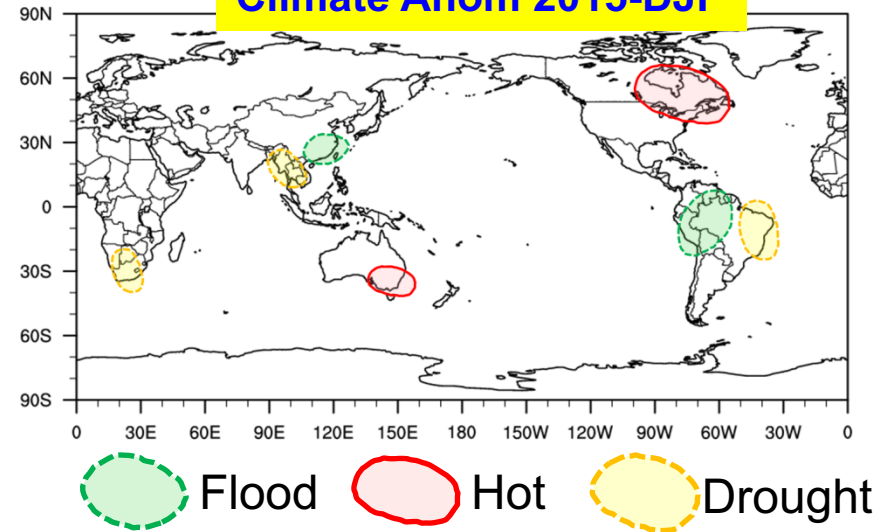


# Example: Climate impacts of 2014-2016 super El Nino event

SSTA 2015-DJF



Climate Anom 2015-DJF



Nino3.4-DJF

