



EASCOF-5 2017, Tokyo Japan

# **BCC predictions of ENSO and primary East-Asian circulation patterns in 2017/18 winter**

**Hong-Li Ren**

**Contributors: Fang Zhou, Ben Tian, Yu Nie, Chongbo Zhao, Ying Liu, Yujie Wu, Bo Lu, Jinqing Zuo**

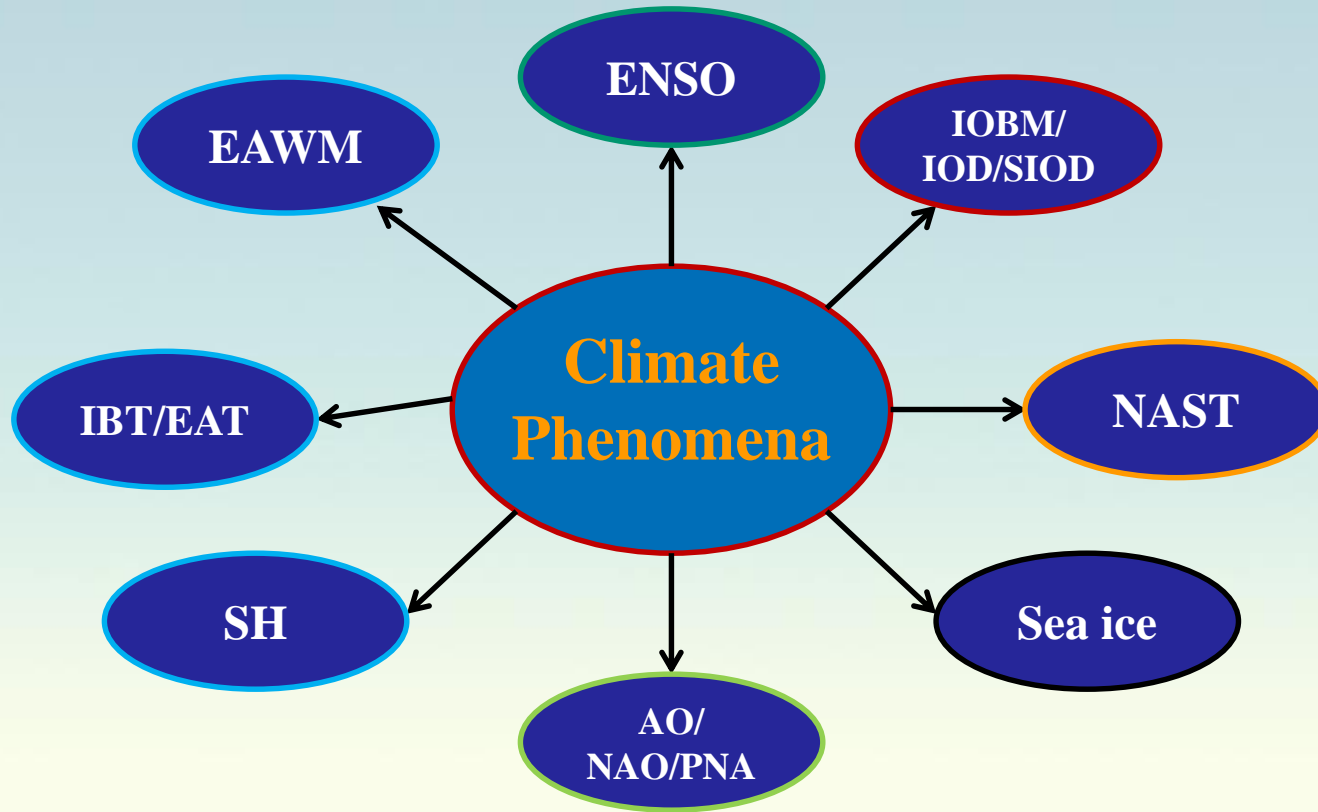
*Lab for Climate Studies, Beijing Climate Center, CMA*

**Nov 8-10<sup>th</sup>, 2017 Tokyo**





# Primary climate phenomena impacting EA climate



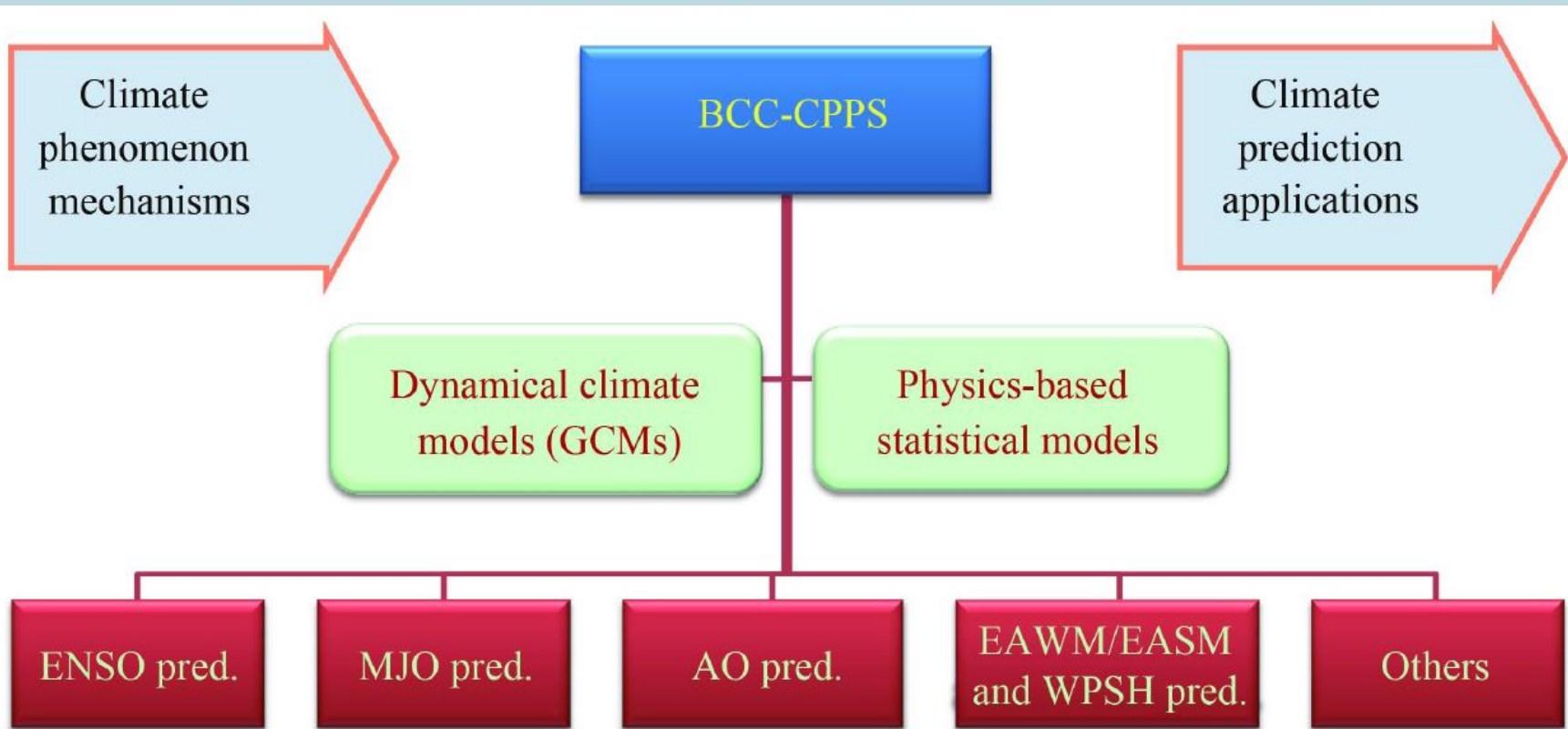
## Methods

- Using BCC\_CSM1.1m, and some CMME models
- Using physics-based statistical models
- Forecast a group of climate indices

CMME models	Ensemble members
BCC-CSM1.1m	24
FGOALS-s2	4
NZC-PCCSM4	4
FGOALS-FAMIL	24



# Climate Phenomenon Prediction System (CPPS)



**Support the BCC operational climate prediction**

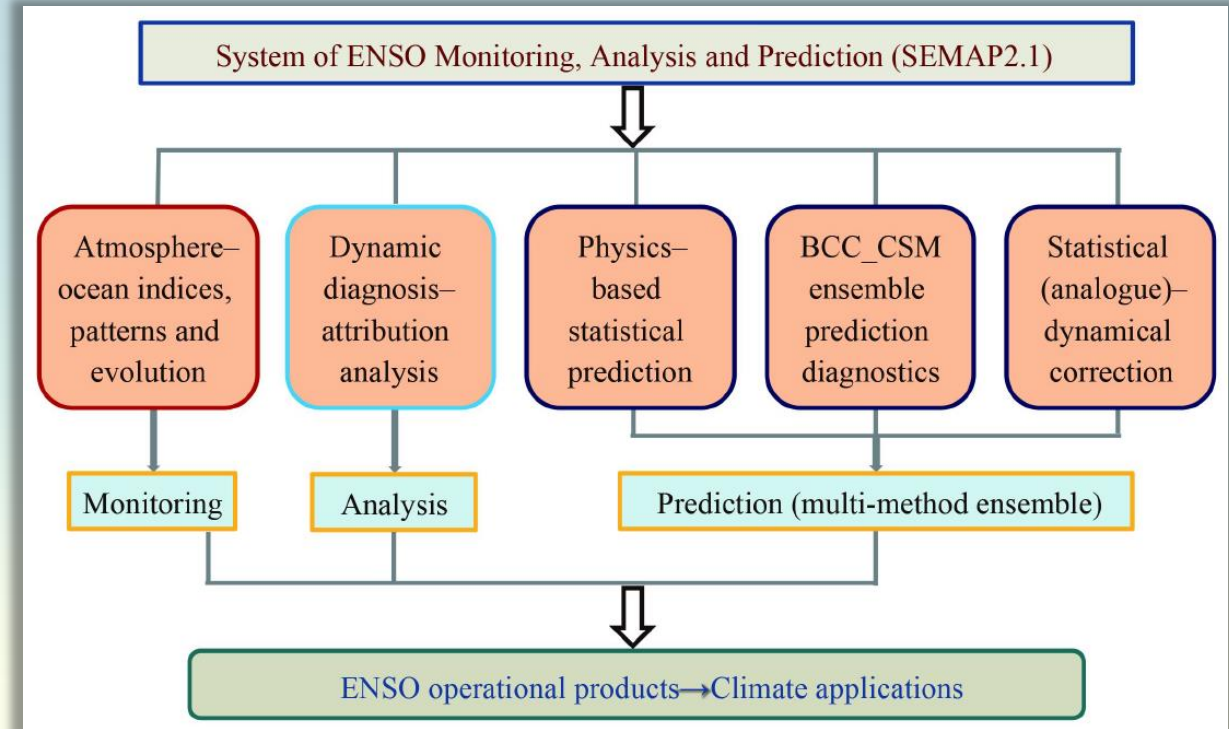
# (1) ENSO prediction in BCC

Dynamical method:

**BCC-CSM1.1m**

**LAF、ESVD**

**24 members**



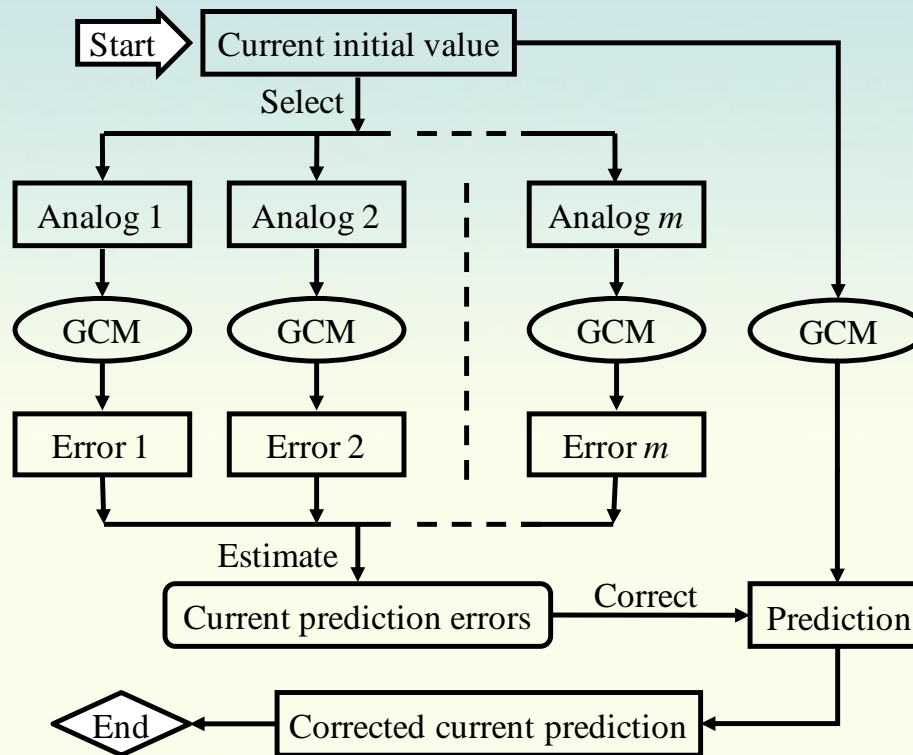
Statistical Method:

$$\text{Nino}(t + \Delta t) = \alpha \text{Nino}(t) + \beta \tau(t) + \gamma \text{WWV}(t) + f \text{FORCING}(t) + c$$

# (1) ENSO prediction in BCC

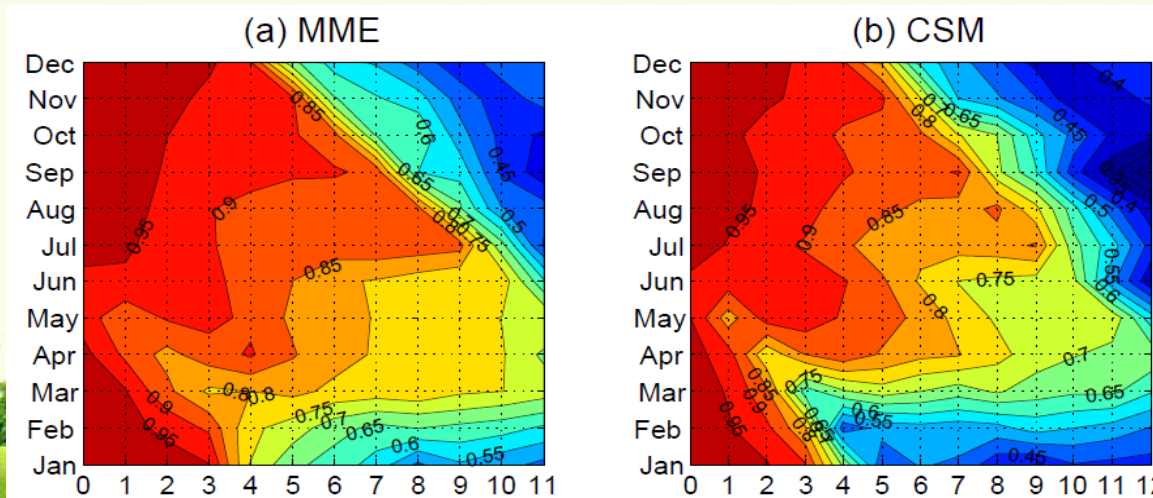
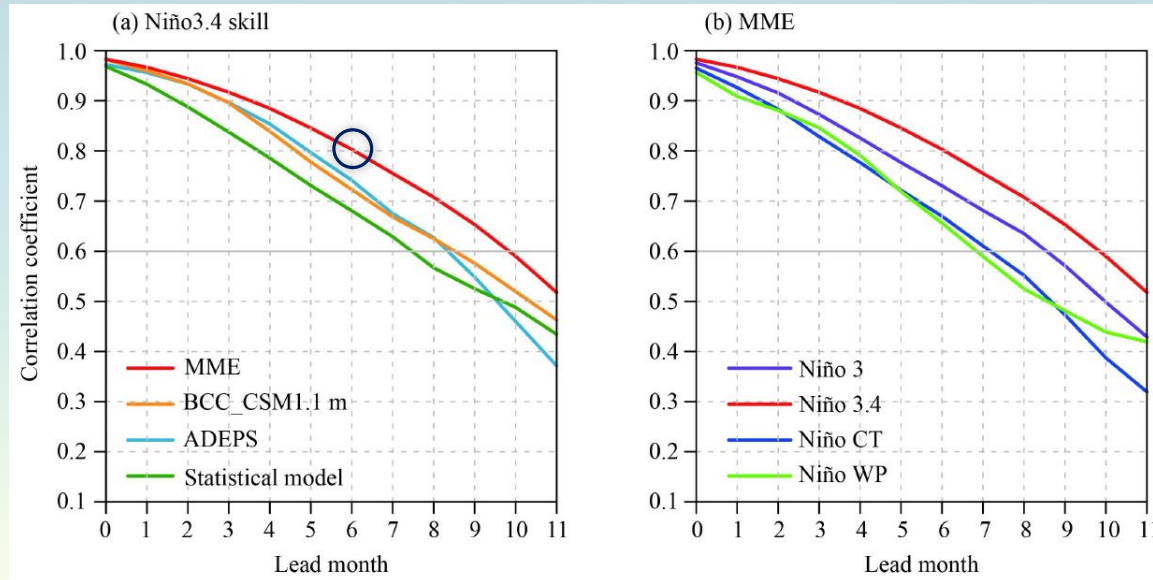
## Analogue-dynamical ENSO prediction (ADEPS)

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



# (1) ENSO prediction in BCC

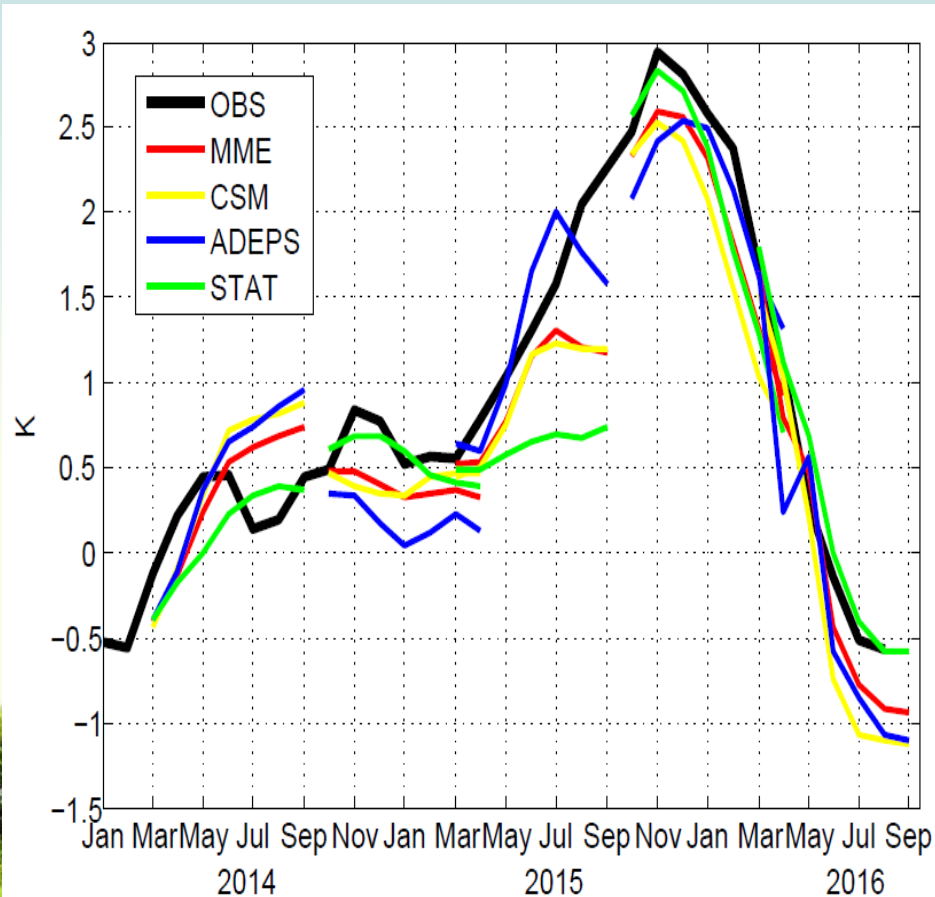
## ACC skill (1996-2016)



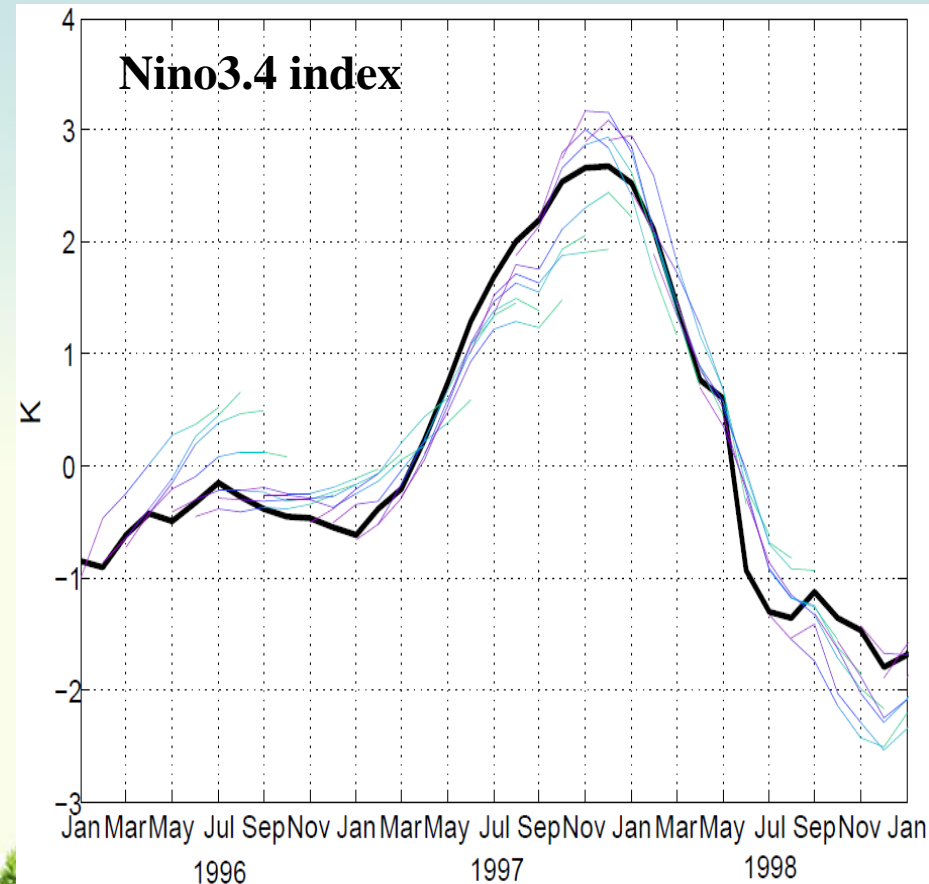
# (1) ENSO prediction in BCC

## Predictions of extreme El Nino events

Real-time forecast of 15/16 events



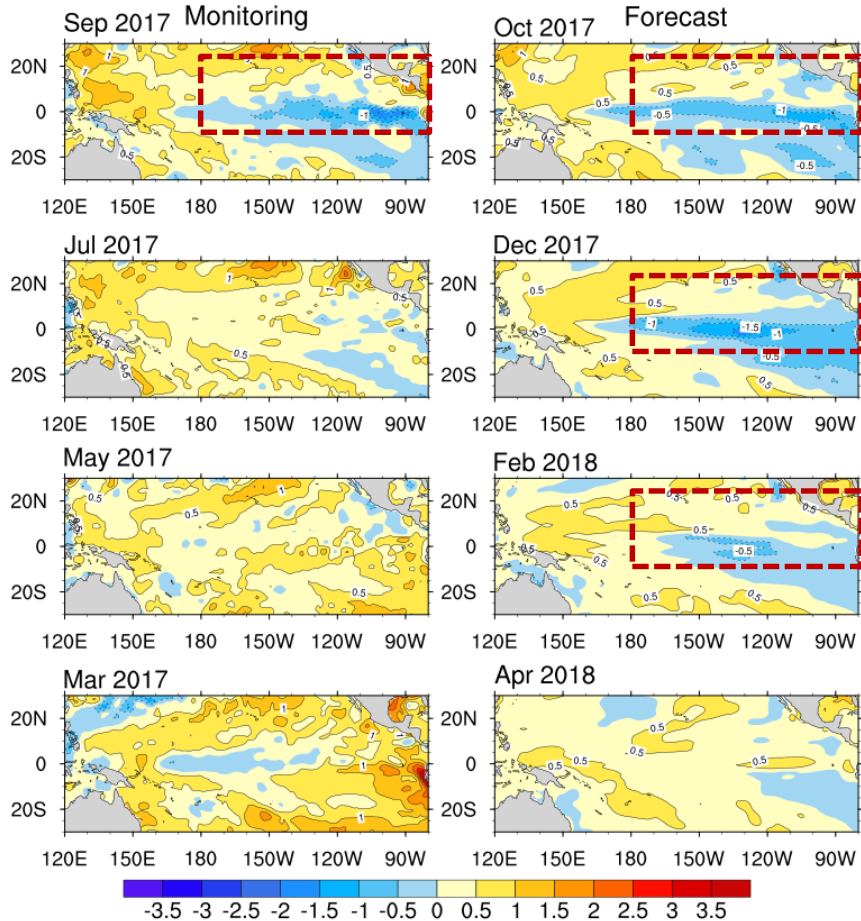
Hindcast of 97/98 events



# 2017/18 winter: ENSO indices monitoring and predictions

Tropical Pacific SSTA (K): BCC\_CSM1.1m forecast

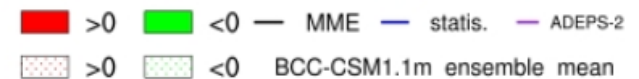
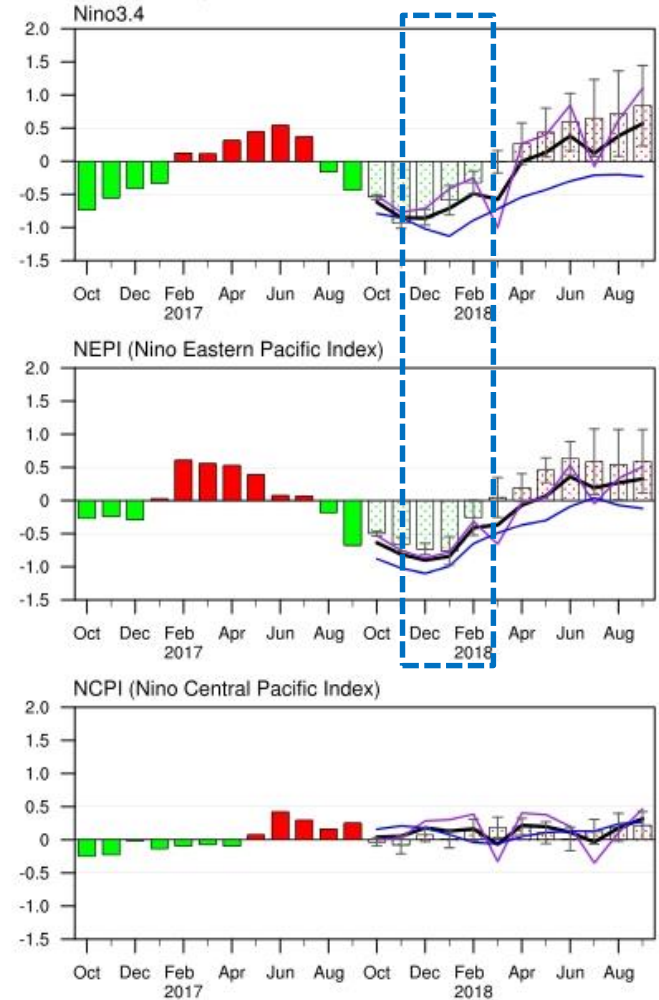
Monitor (OISST): 201703-201709; Forecast: 201710-201804



Monitoring  
Prediction

ENSO SST Indices (K): BCC SEMAP2.0 forecast

Monitor (OISST): 201610-201709; Forecast: 201710-201809



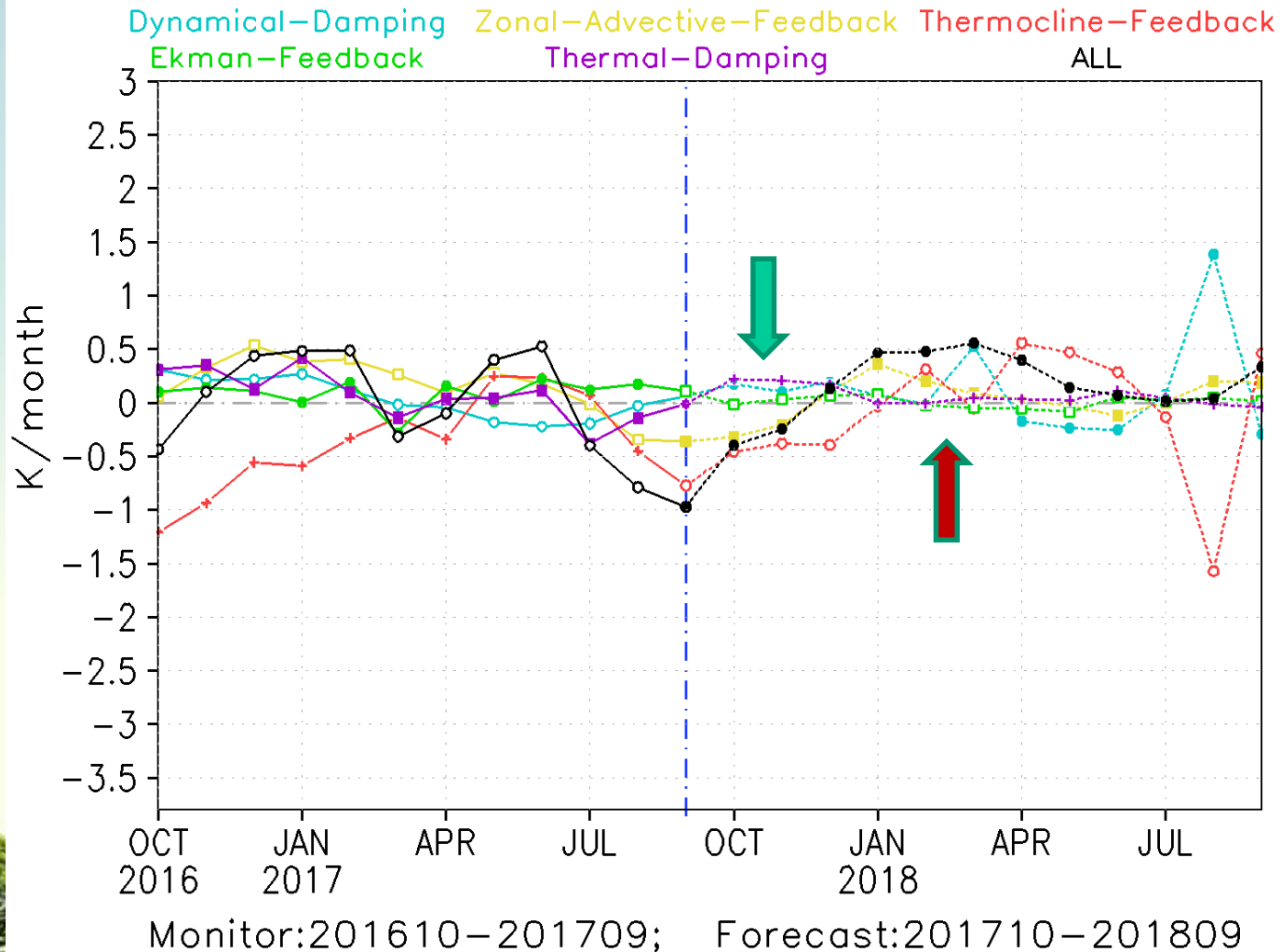
La Niña state will be persistent thru this winter up to next spring





# ENSO dynamical feedbacks

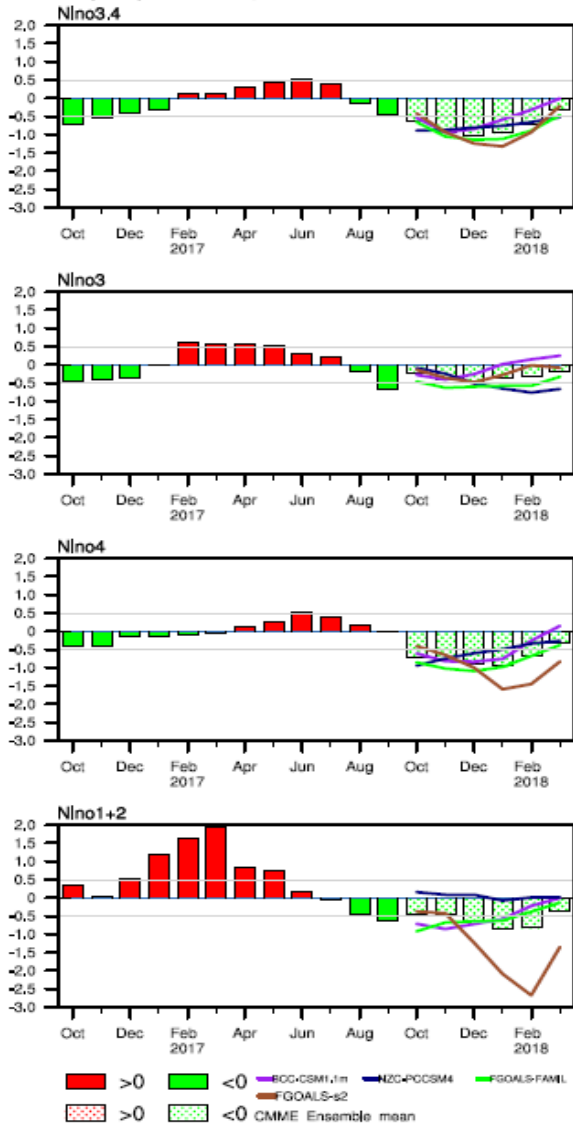
Diagnosis and Prediction of ENSO Feedback Processes



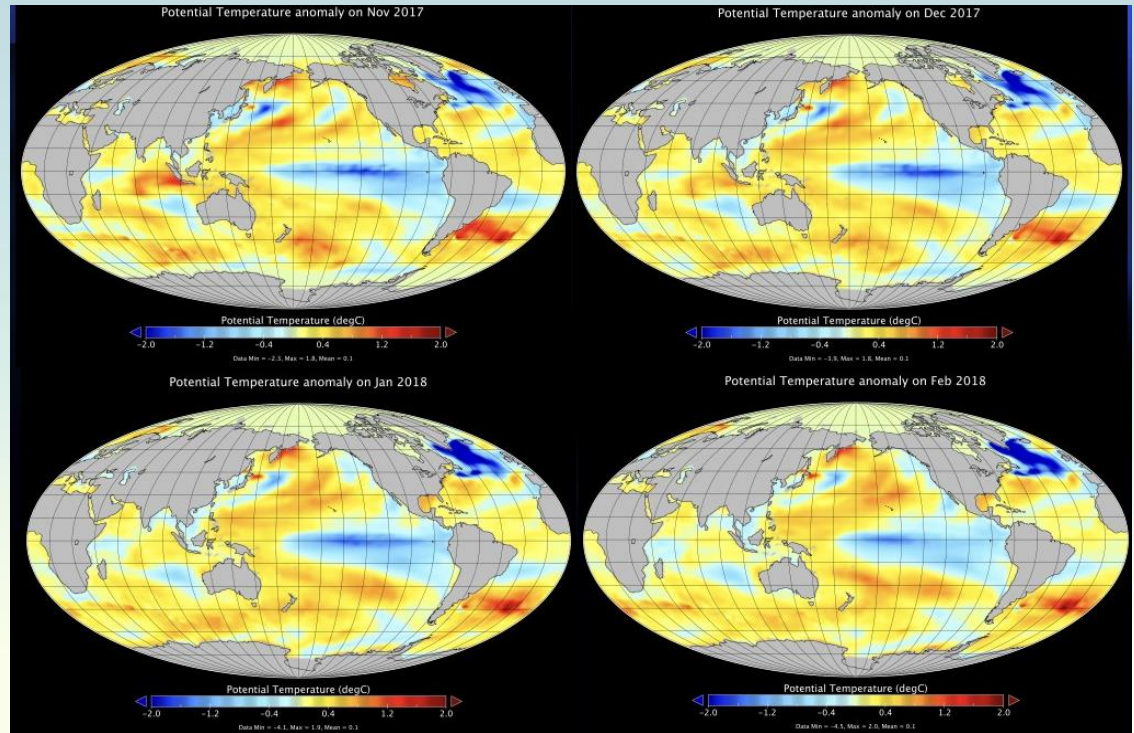
# CMME : ENSO forecasts (ensemble of 4 models)

## ENSO SST Indices (K): CMME forecast

Monitor (CISST): 201610-201709; Forecast: 201710-201809

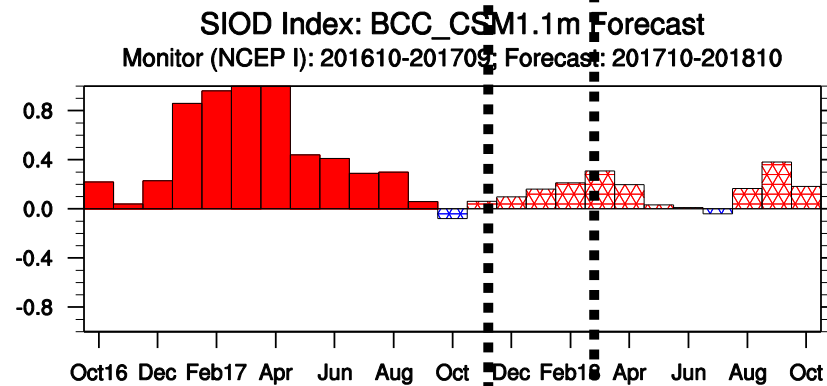
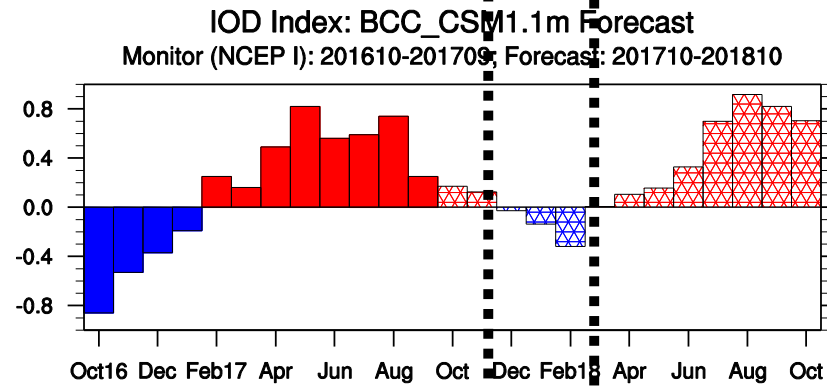
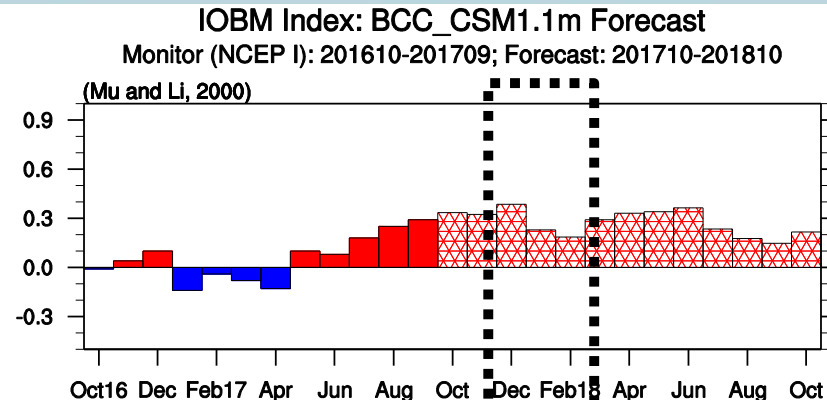
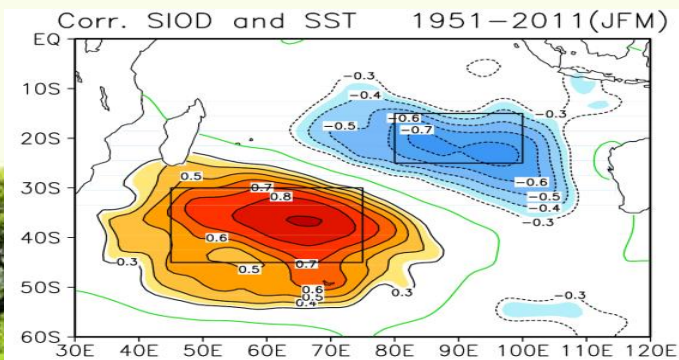
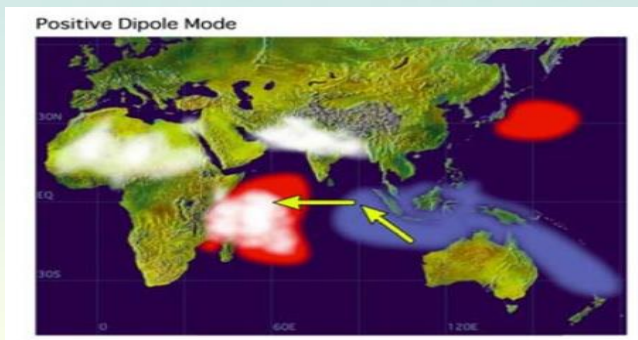
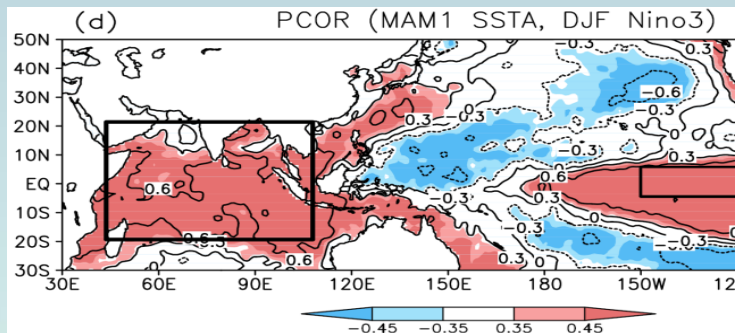


## FGOALS-F forecast SSTA patterns



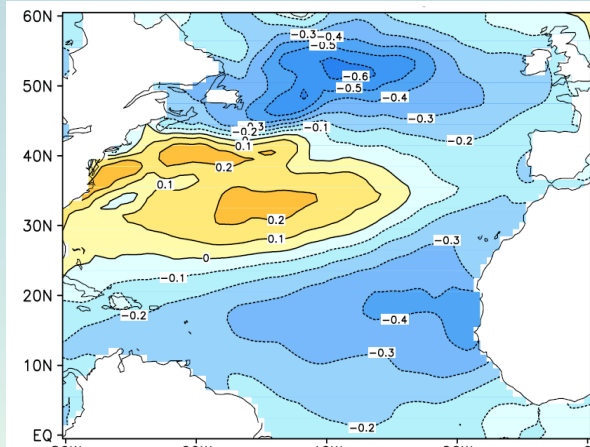
CMME results show that a weak La Nina event will occur this winter

# (2) Indian Ocean SST modes

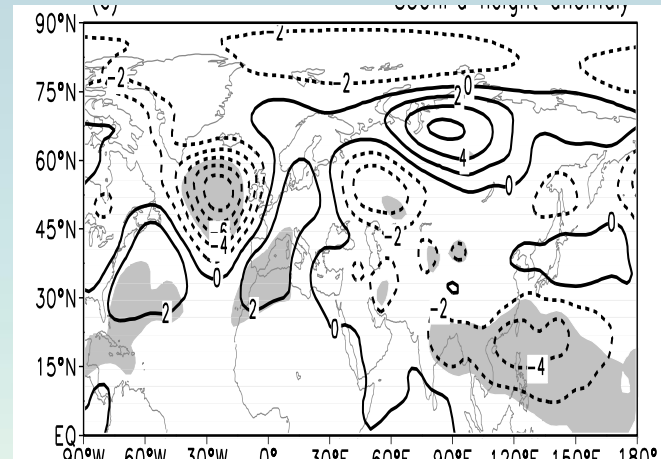


# (3) North Atlantic SST Tripole (NAST)

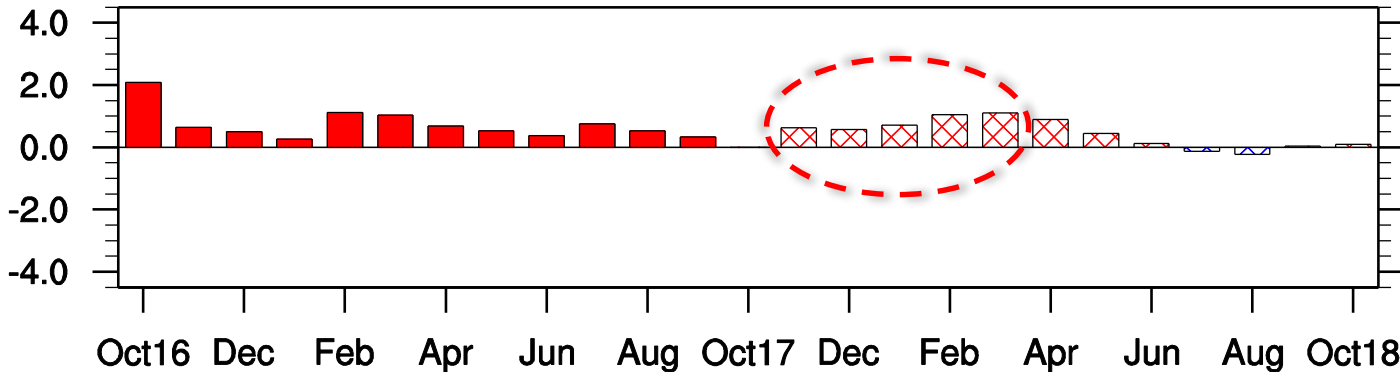
EOF1 pattern of detrended SST



Pattern of Z850 against NAST index

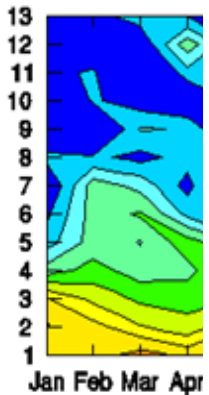
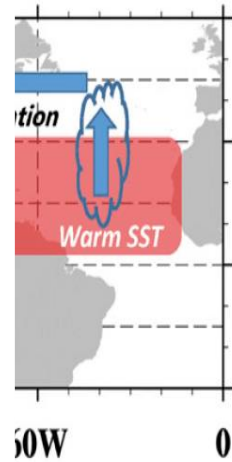


NAST Index (North Atlantic SST Triple Index): BCC\_CSM1.1m Forecast  
 Monitor (OISST): 201610-201709; Forecast: 201710-201810



Legend: ■ >0 ■ <0 Monitor ■ >0 ■ <0 Forecast

Oct 13, 2017

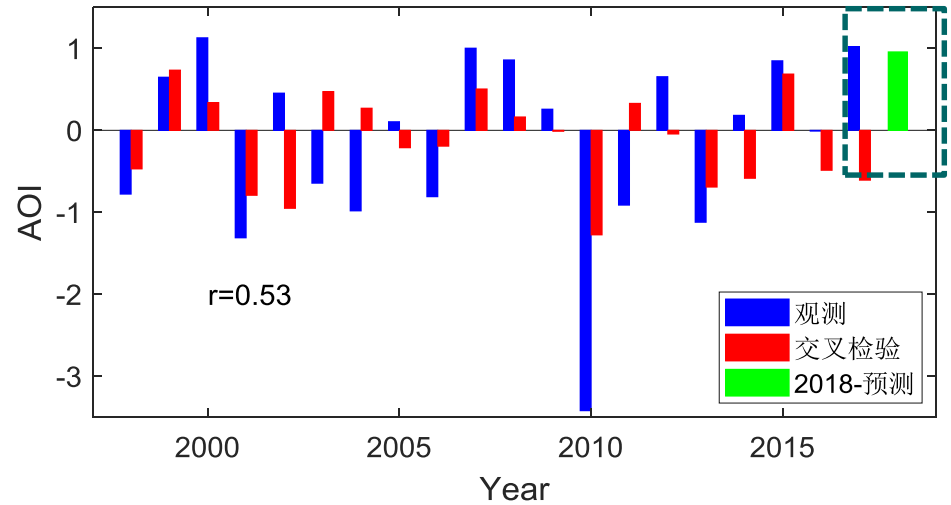
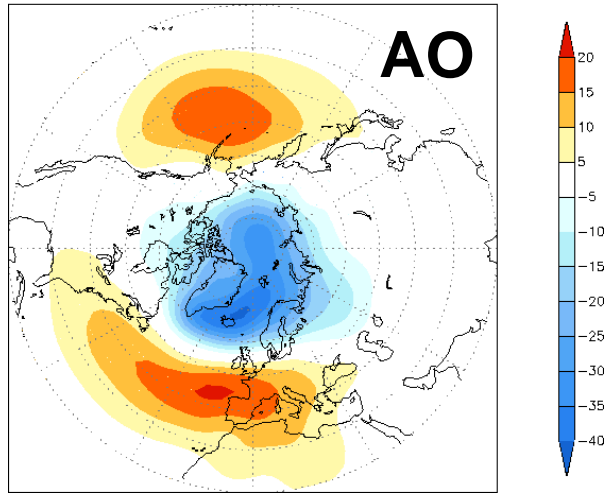


NAST in

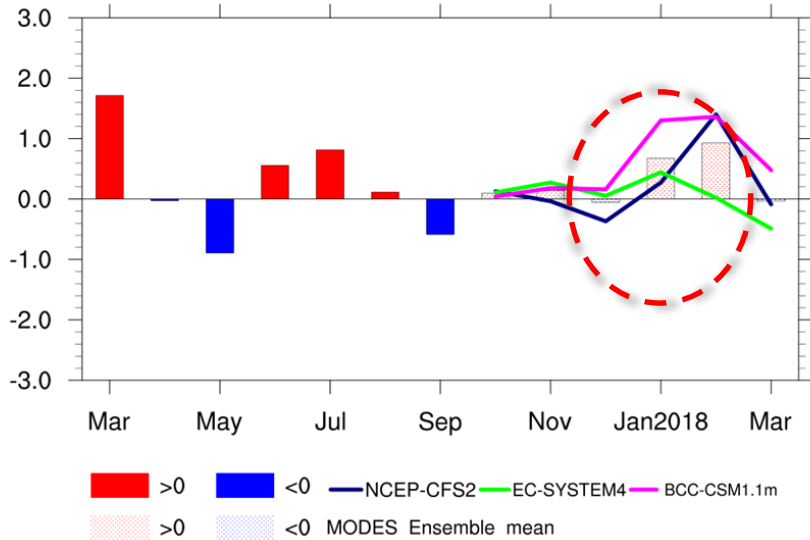
Difference between the SST anomalies averaged over 34°–44°N, 72°–62°W and the sum of regional-averaged SST anomalies over 0°–18°N, 46°–24°W and 44°–56°N, 40°–24°W (Zuo et al., 2012)

# (4) AO index monitoring & predictions

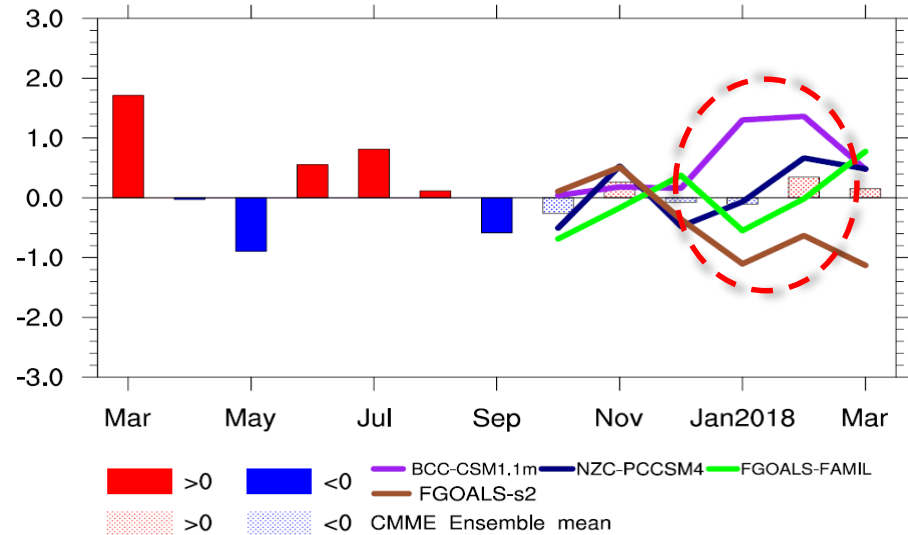
Leading EOF (19%) shown as regression map of 1000mb height (m)



Monthly AO index: Observed & MODES Forecasts



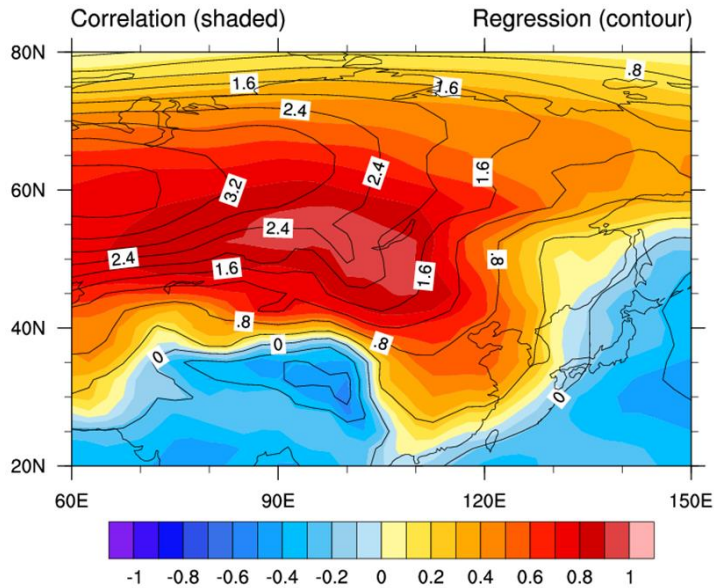
Monthly AO index: Observed & CMME Forecasts



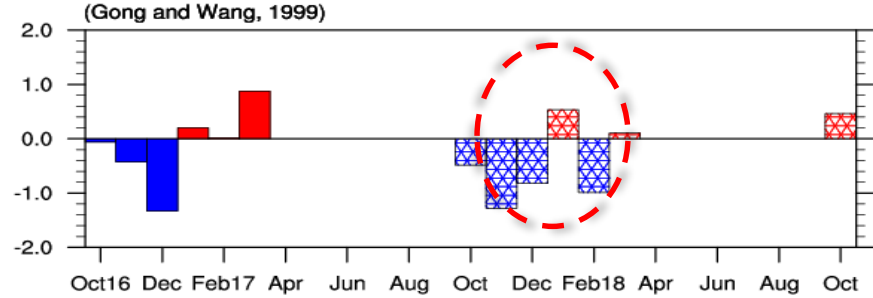
In 2017/18 winter, AO will be possible in the positive phase

# (5) Siberian High predictions: BCC\_CSM1.1m & CMME

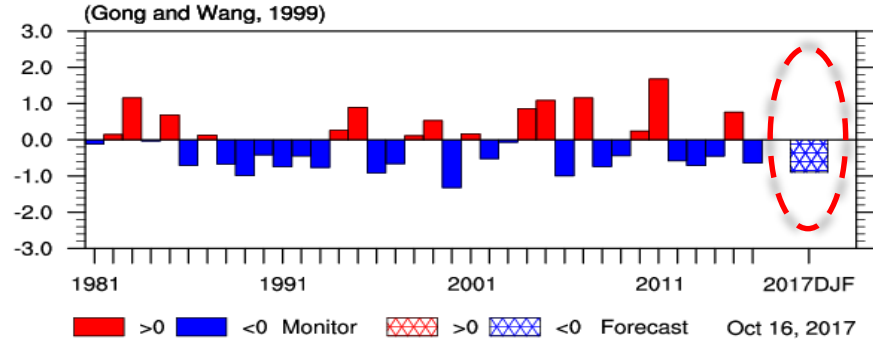
## Siberian High Pattern in DJF



SibH Intensity Index: BCC\_CSM1.1m Forecast  
Monitor (NCEP I): 201610-201709; Forecast: 201710-201810  
(Gong and Wang, 1999)



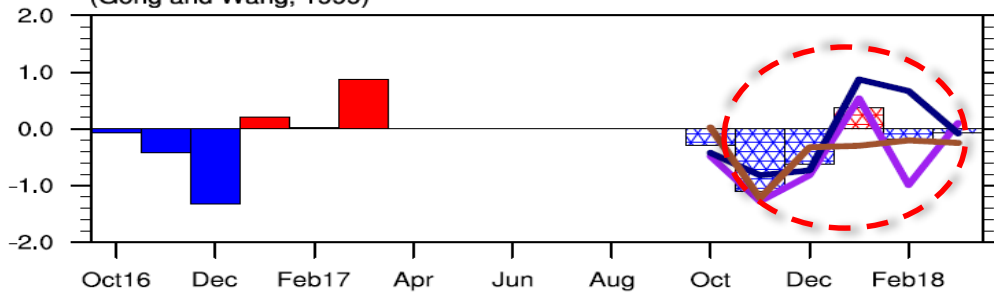
SibH Intensity Index: BCC\_CSM1.1m Forecast  
Monitor (NCEP I): 1981-2016; Forecast: 2017 DJF  
(Gong and Wang, 1999)



## SibH Intensity Index: CMME Forecast

Monitor (NCEP I): 201610-201709; Forecast: 201710-201803

(Gong and Wang, 1999)



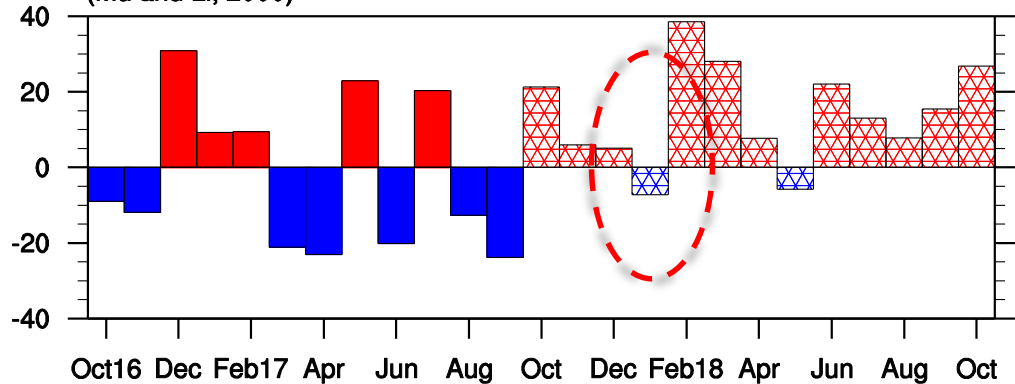
Legend:  
 ■ >0 ■ <0 Monitor  
 ▨ >0 ▨ <0 CMME Ensemble Mean  
 — BCC-CSM1.1m — NZC-PCCSM4 — FGOALS-s2

**Siberian High may become weaker in this winter**

# (6) East Asian Trough index prediction: BCC\_CSM1.1m

East Asia Trough Index: BCC\_CSM1.1m Forecast  
Monitor (NCEP I): 201610-201709; Forecast: 201710-201810

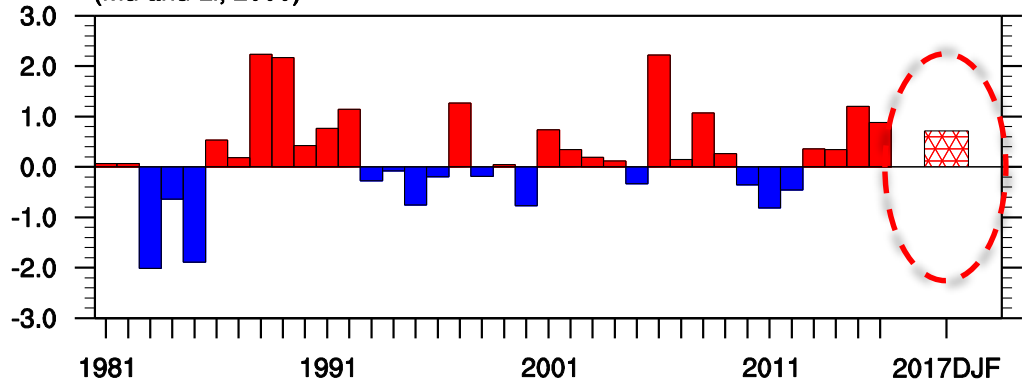
(Mu and Li, 2000)



weak  
strong

Monitor (NCEP I): 1981-2016; Forecast: 2017 DJF

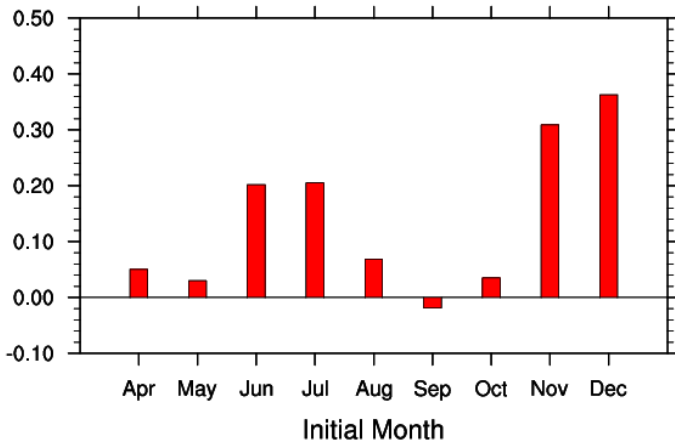
(Mu and Li, 2000)



weak  
strong

Legend:   
■ >0 ■ <0 Monitor ■ >0 ■ <0 Forecast Oct 16, 2017

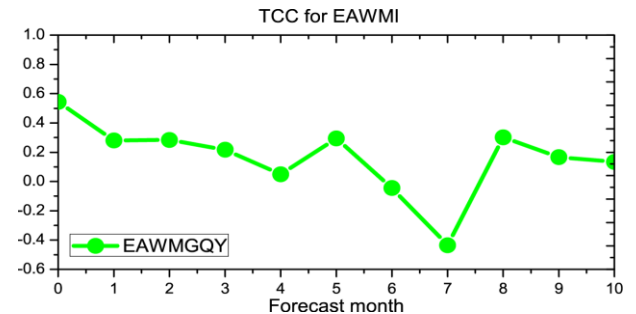
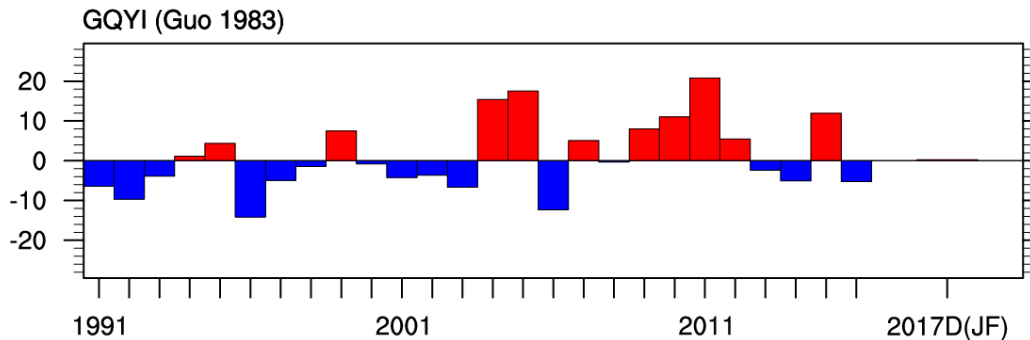
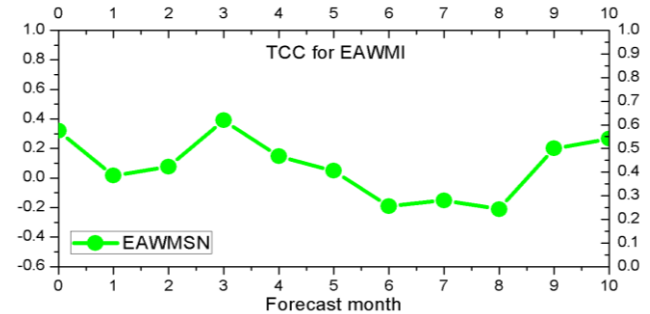
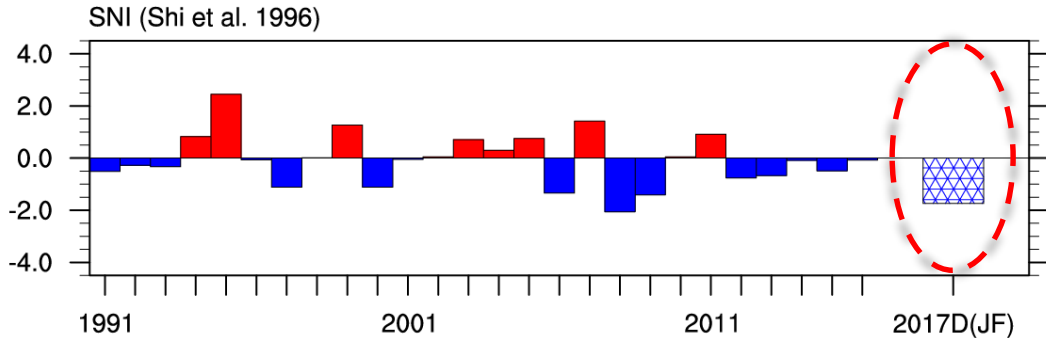
Forecasting Skill of East Asia Trough Index



EAWM may be weaker than normal in 2017/18 winter

# (7) EAWM indices monitoring & predictions: BCC\_CSM1.1m

East Asian Winter Monsoon Indices: BCC\_CSM1.1m Forecast  
 Monitor (NRA1): 1991-2016; Forecast: 201710-201810



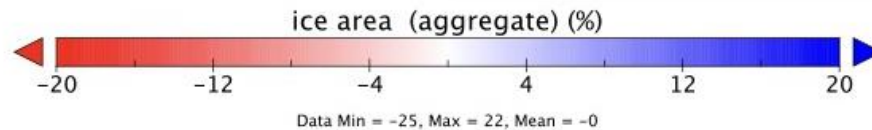
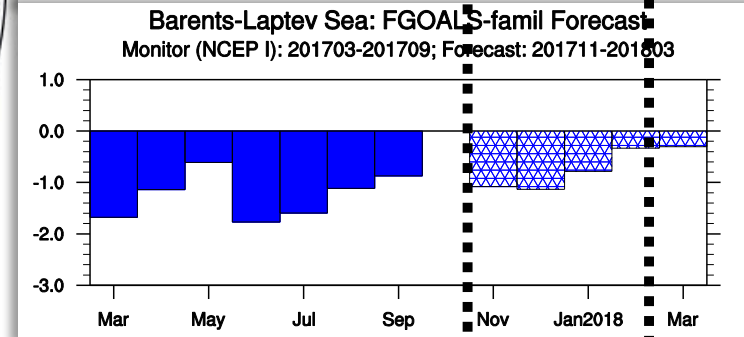
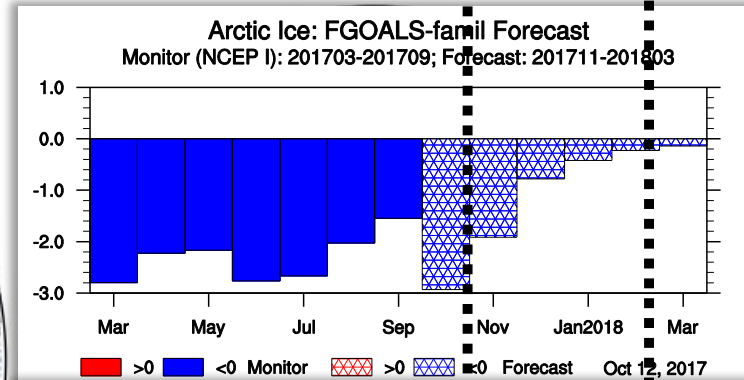
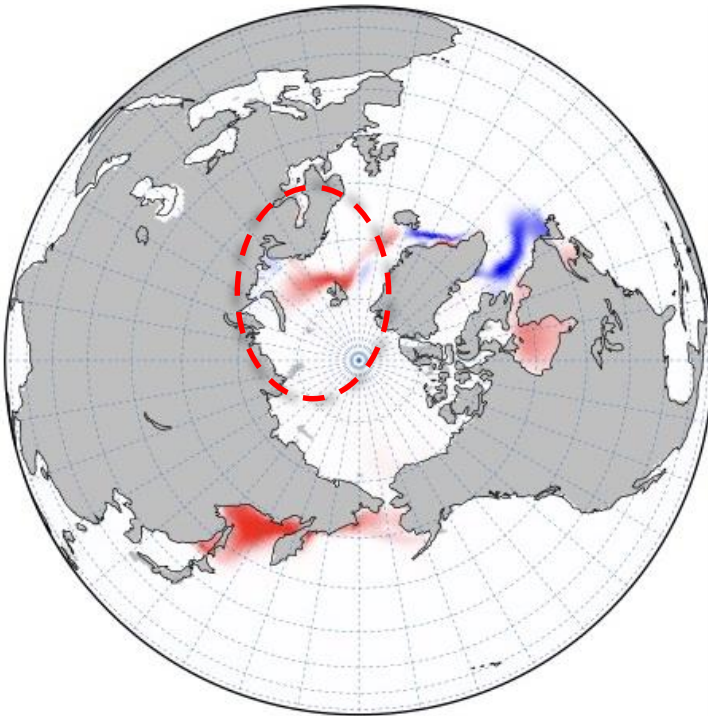
■ >0    ■ <0    Monitor    ■ >0    ■ <0    Forecast    Oct 17, 2017

EAWM may be weaker than normal in 2017/18 winter



# (8) Arctic sea ice concentration: FGOALS-f in CMME

ice area anomaly (aggregate)



## Summary: 2017/2018 winter

Climate phenomena	Predictions	Implications for precip	Implications for SAT
ENSO	La Nina	Less in SC	Colder in most C, warmer in SWC
IOBM	Positive	More in SEC	
IOD	Weakly negative		Colder in most C
SIOD	Weakly positive		
NAST	Positive	Less in most C	Warmer in NEC-EC
Sea Ice	Less		Colder in most C
AO	Positive		Warmer in NEC&NWC, colder in WC
SH	Weaker	More in YZR-HR	Warmer in most C
EAT	Weaker		Warmer in most C
EAWM	Weaker		Warmer in most C



*Thank you* 谢谢!

