



WCRP/WGSIP, 21st session, 29-31 May 2019,
Moscow Russia



Climate prediction research and operations in China

Hong-Li REN

Lab for Climate Studies, Beijing Climate Center, CMA

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Outline

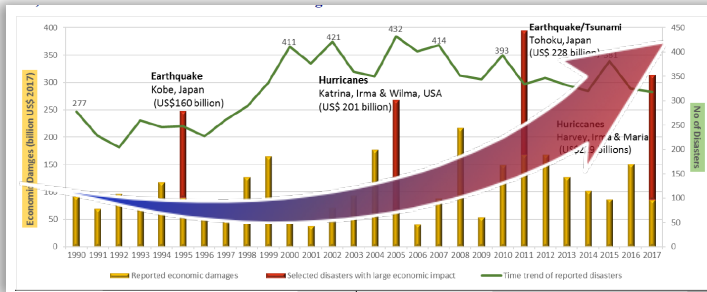


- ❑ Introduction
- ❑ Operational model system
- ❑ Climate prediction operation
- ❑ Climate prediction research
- ❑ Summary and outlook

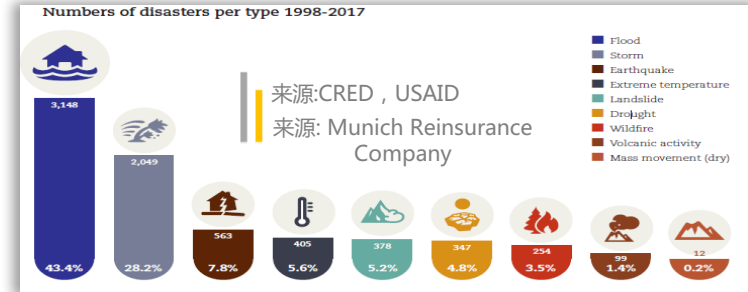


Disaster Prevention & Mitigation: demand for climate prediction

Global heavy natural disaster loss and frequency in 1990-2017

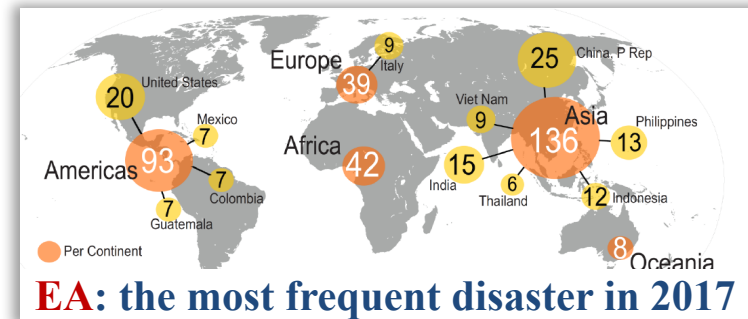
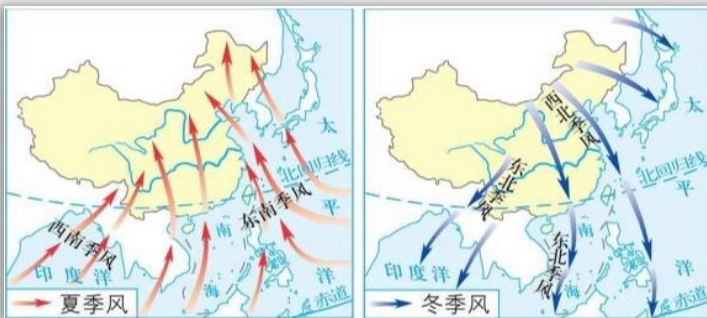


Numbers of disasters per type during 1998-2017



China is located in EA monsoon and has complex climate and frequent disaster \Rightarrow better climate prediction

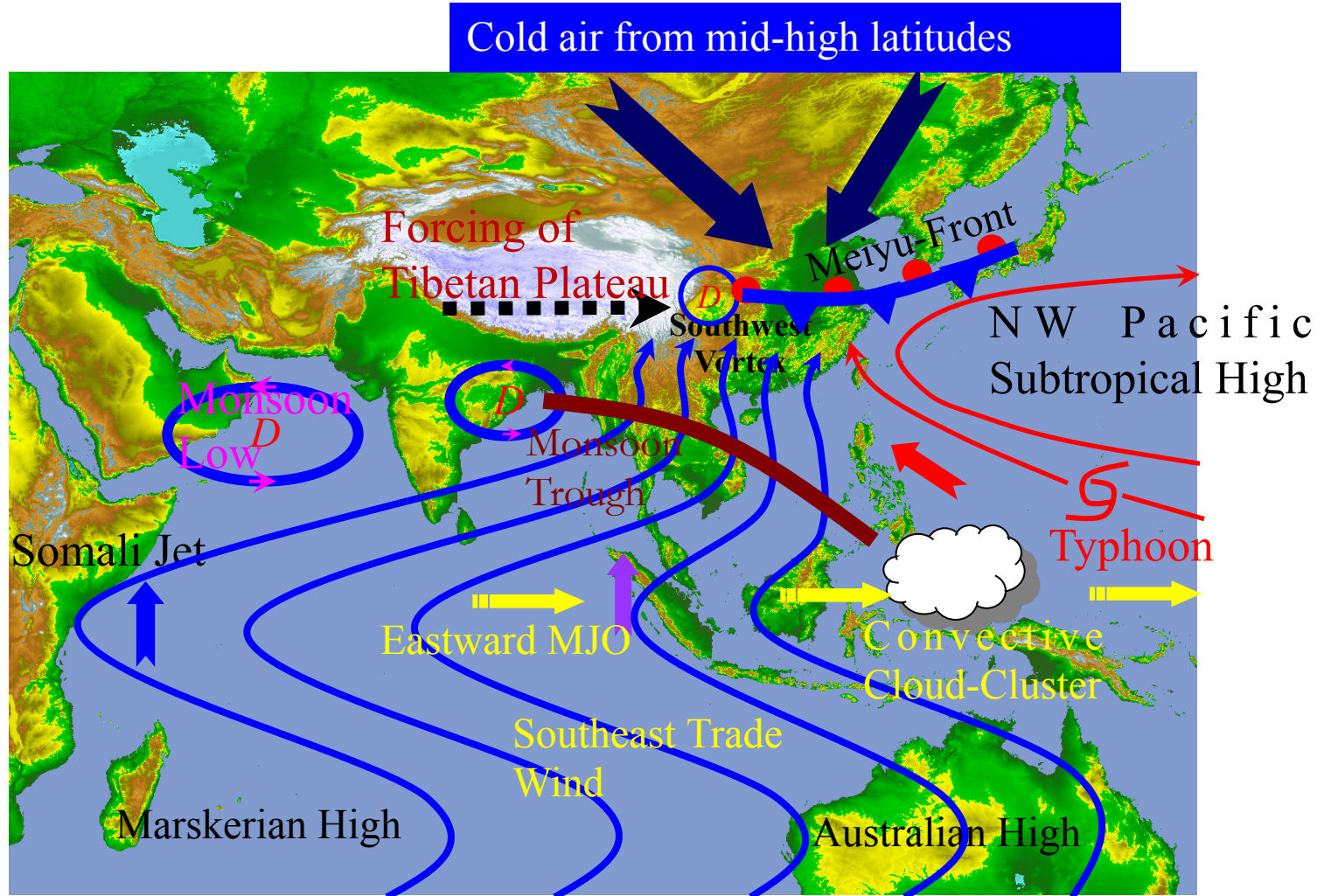
The key is to improve capability of operational climate prediction



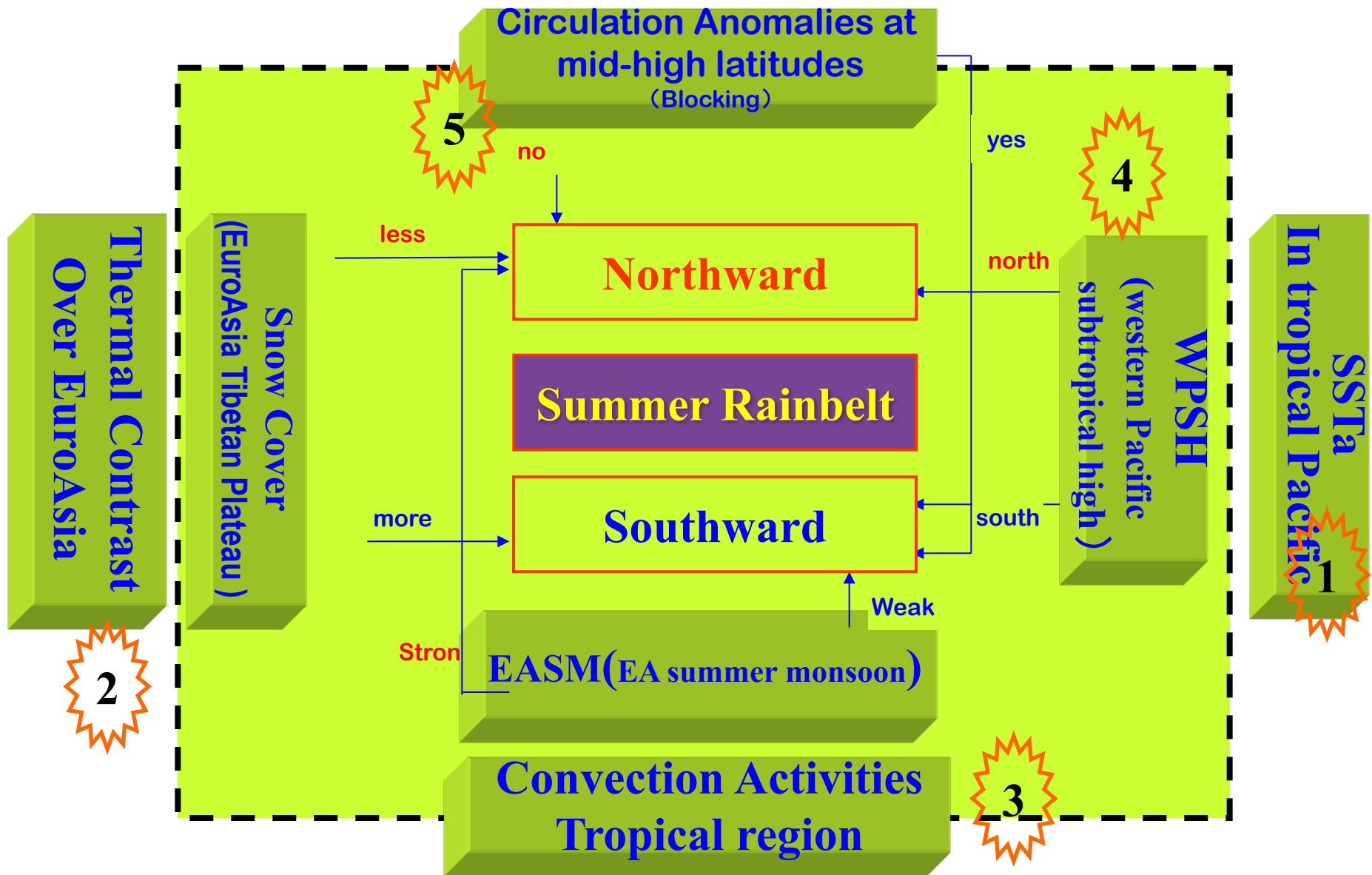
EA: the most frequent disaster in 2017

How to do climate prediction?

East-Asian Summer Monsoon System



Seasonal Forecast Model for Summer Rainfall prediction of China



International cooperation

FOCRAII

As a RCOF in Asian area, **the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII)** was annually held since 2005 by Beijing Climate Center (BCC), China Meteorological Administration (CMA). WMO became a co-sponsor since the second session of FOCRAII in 2006.

More than **120** NMHSs staffs from **35** countries/territories or regional groupings attended the Forum.



The main objectives of the Forum

- Review progress made in CliMAP programs and activities both within RA II and internationally with specific focus on the challenges and opportunities to **seasonal-to-interannual climate prediction** methodologies and systems unique to the RAI region;
- Provide a platform for members of the RA II to share and exchange experience and knowledge on CliMAP;
- Build collaboration and partnerships among members of RA II in CliMAP programs and activities.

Outline



- Introduction

- Operational model systems

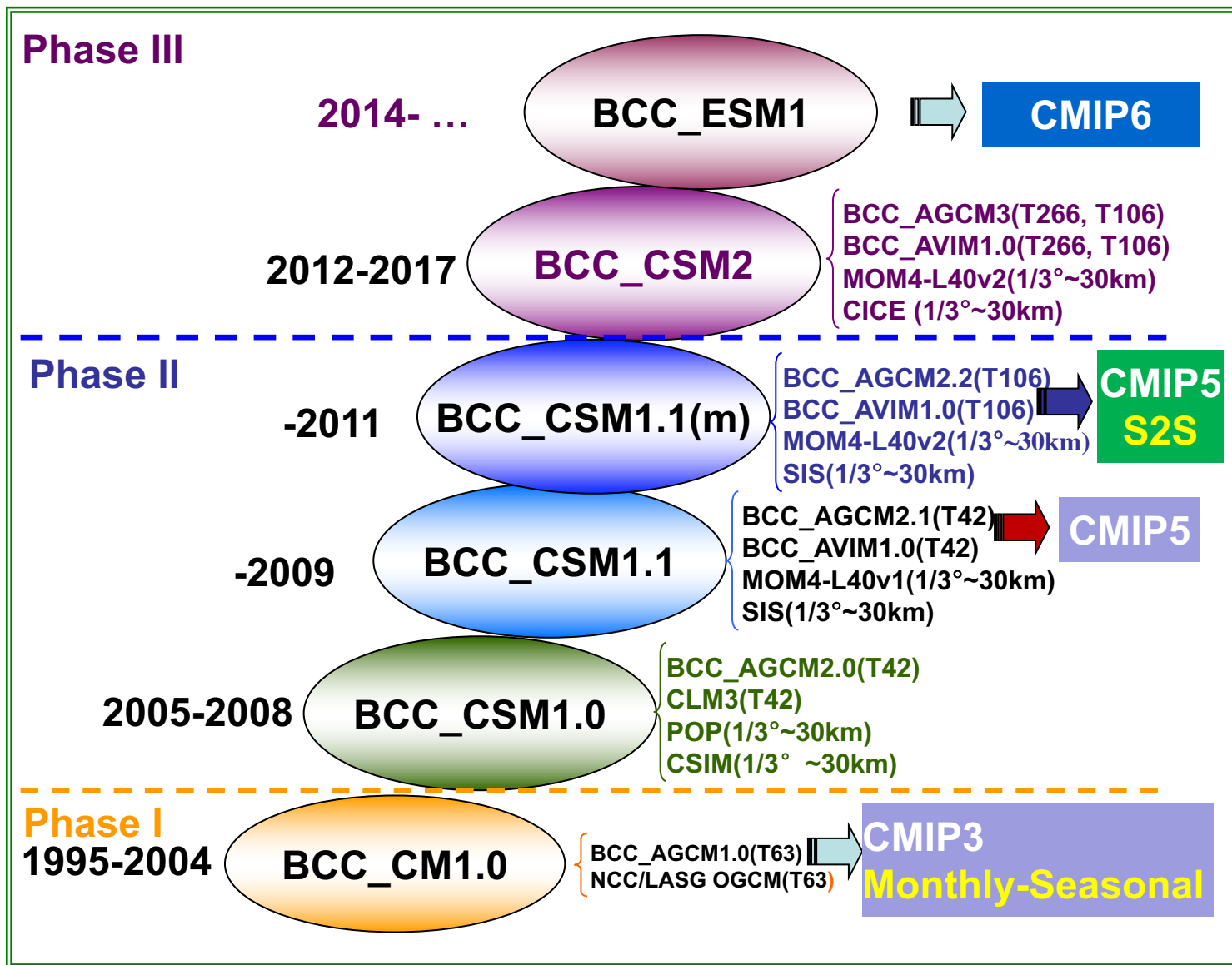
- Climate prediction operation

- Climate prediction research

- Summary and outlook

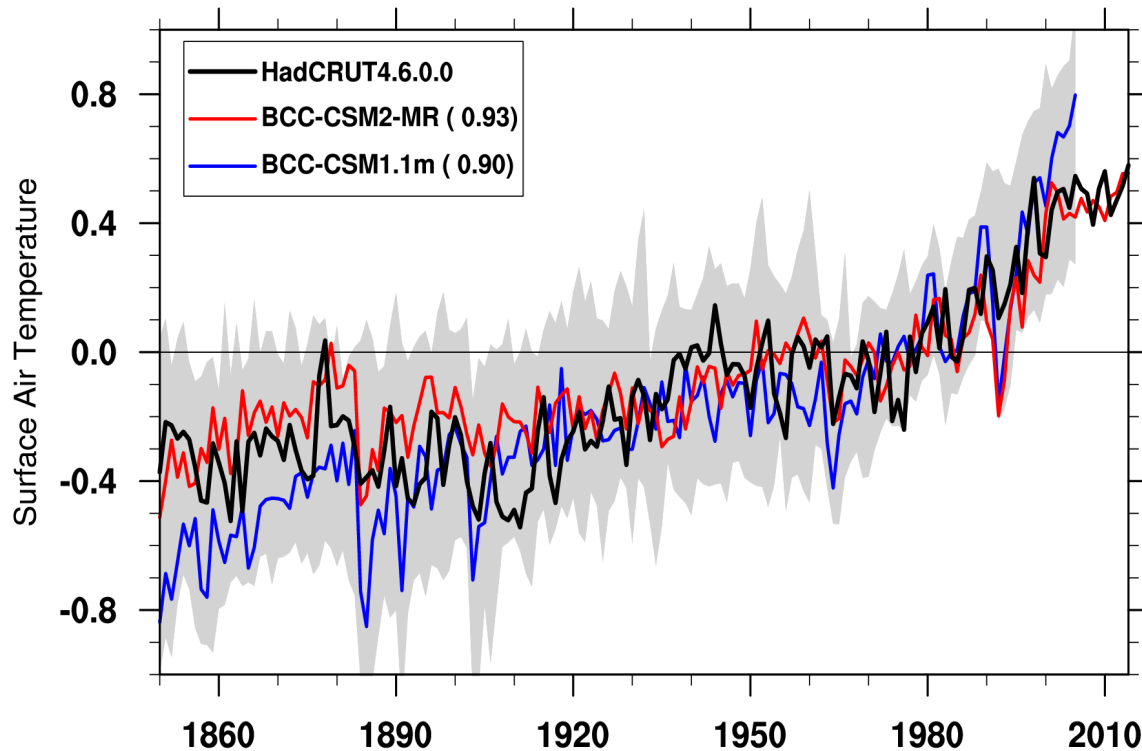


Roadmap for development of Climate Model System at BCC



Global annual mean temperature anomalies

(relative to the climate mean: 1961-1990)



BCC-CSM2-MR (T106L46)

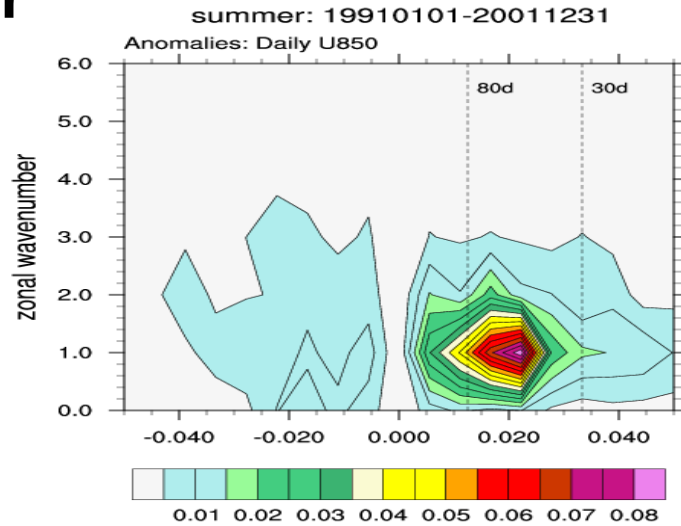
Forcing data used:

- CMIP6 historical GHG concentrations (2-D data: CO₂, CH₄, N₂O, CFC11, CFC12)
- CMIP6 ozone concentrations (3-D data)
- CMIP6 aerosol Optical Properties (including extinction optical depth, single scattering albedo, asymmetry parameter) for radiative computation
- CMIP6 solar forcing dataset
- CMIP5 aerosol masses used to diagnose cloud droplet Number concentration

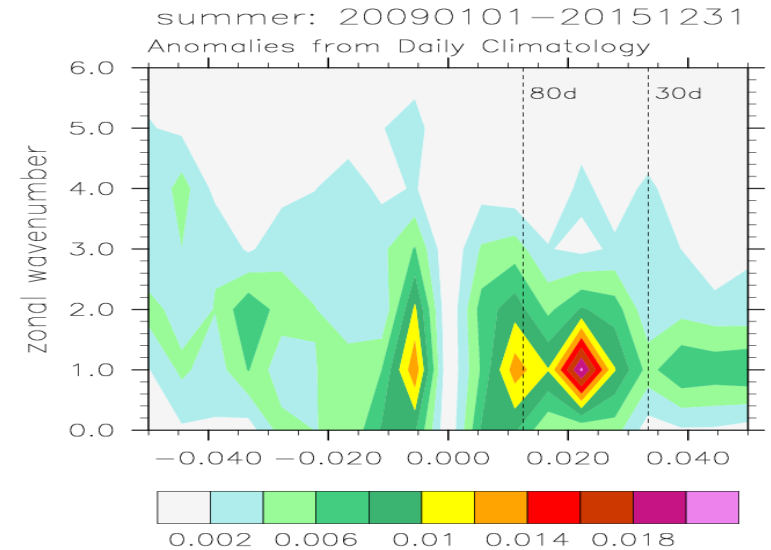
Madden-Julian Oscillation (MJO)

Summer

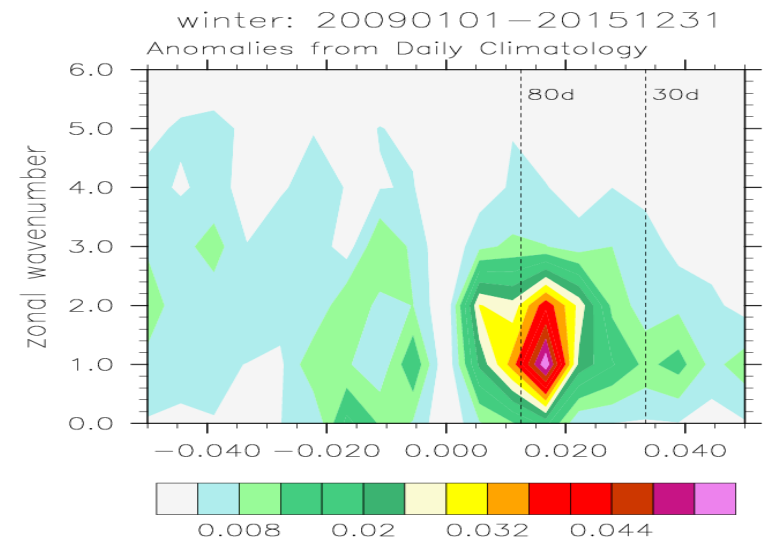
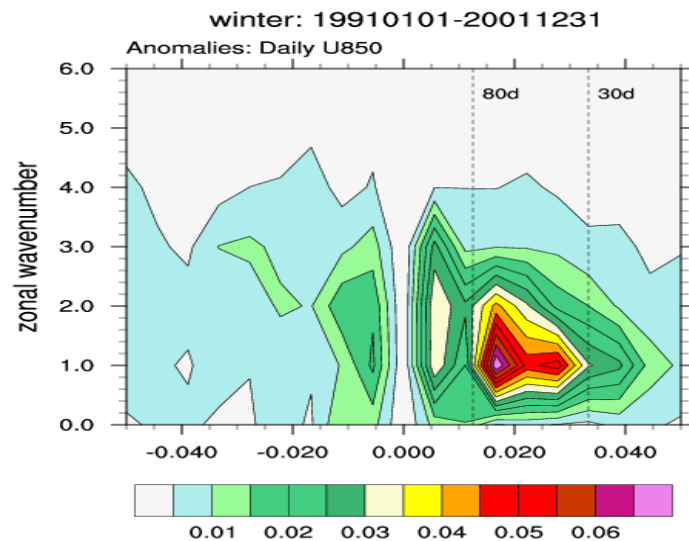
OBS



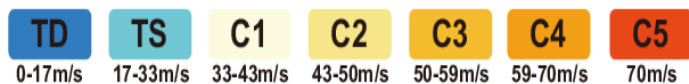
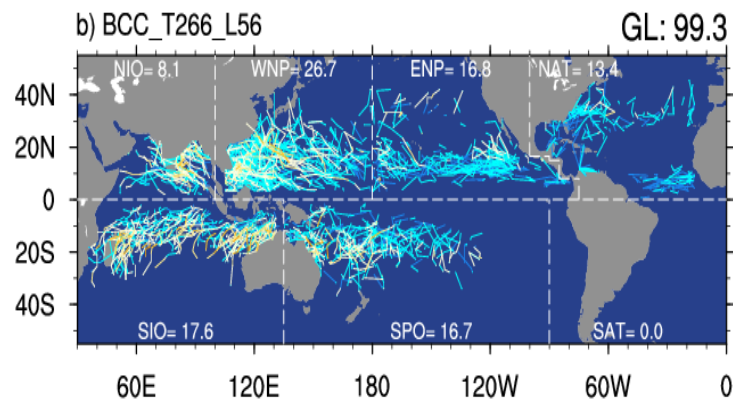
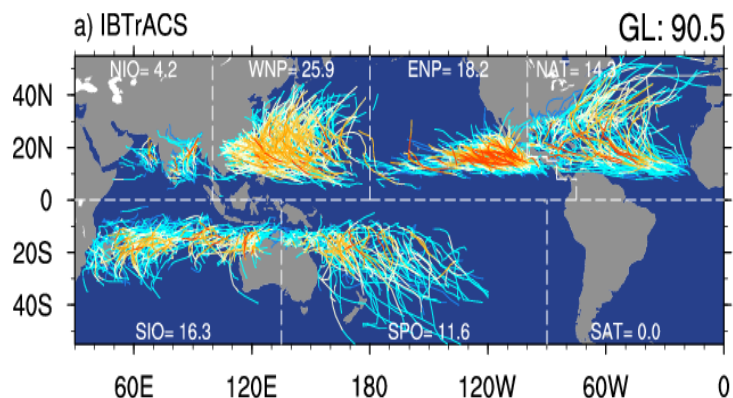
BCC-CSM2-HRv1



Winter

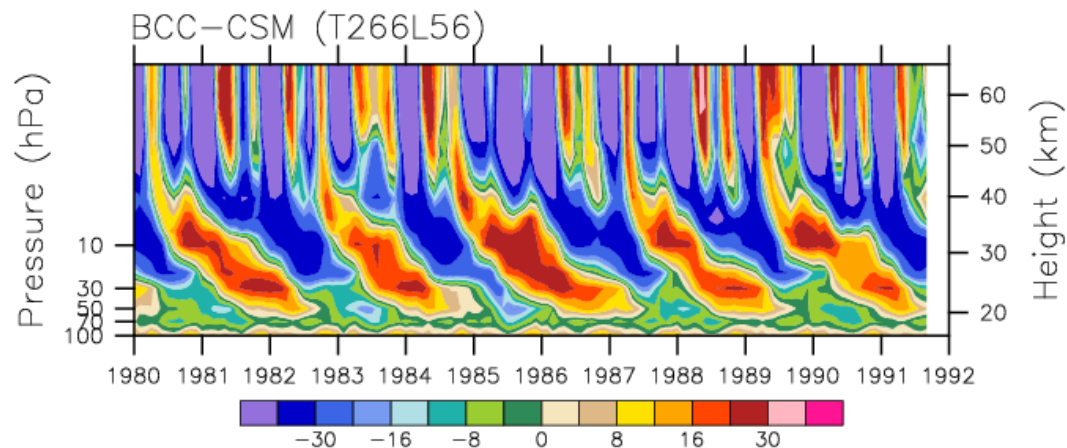
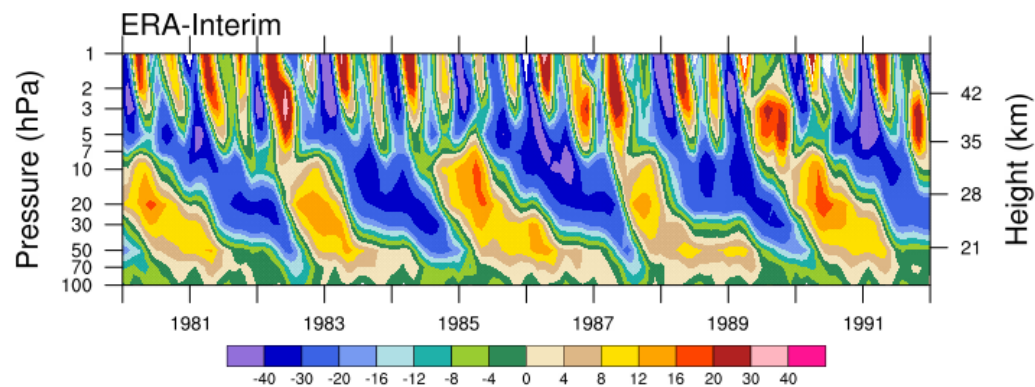


TC tracks (1987-2002)



QBO simulation

U at 5°N-5°S in m/s



Operational seasonal prediction in BCC



BCC_CSM1.1(m)

BCC_AGCM2.2(T106 ~110 km, L26) Top: 2.19 hPa
BCC_AVIM1.0(T106)
MOM4-L40v2(1/3°~30km)
SIS(1/3°~30km)

Initialisation:

Atmos: NCEP daily reanalysis (Air Temp., winds, SLP, etc)

Ocean: NCEP_GODAS monthly, Pentad reanalysis

Ensemble members: 24 (15 LAF+9 SV)

Forecasts: 13 months (Operational running since Dec., 2014)

Hindcasts: 1991~2014 (24 yrs)

Products: <http://bcc.ncc-cma.net/channel.php?channelId=22>

S2S Prediction by BCC_CSM1.2



BCC_CSM1.2

BCC_AGCM2.2(T106 ~110 km, L40,Top: 0.5 hPa)
BCC_AVIM1.0(T106)
MOM4-L40v2(1/3°~30km)
SIS(1/3°~30km)

Initialisation:

- Atmos: NCEP reanalysis 1
- Ocean: BCC Global Ocean Data Assimilation System (BCC_GODAS2.0)

Ensemble members: 20

- 5 days LAF with each day 4 members initialised at 00 UTC of 1st forecast day and 18, 12 and 06 UTC of the previous day

Forecasts: 60-day integrations

Hindcasts: Daily rolling forecasts from 1994/01/01-2014/04/30

Products: <http://S2S.cma.cn>

WWRP/WCRP Sub-seasonal to Seasonal Prediction Project (S2S)

The Implementation Plan for S2S (http://www.s2sprediction.net/file/documents_reports/S2S_Implem_plan_en.pdf) was written by the planning group that convened several times during 2011-2013 and it was published in 2013. The plan proposed the following set of activities toward realizing the S2S project goals, to be carried out over a 5-year period initially, with the option of extension for a further 5 years:

Phase I Final Report

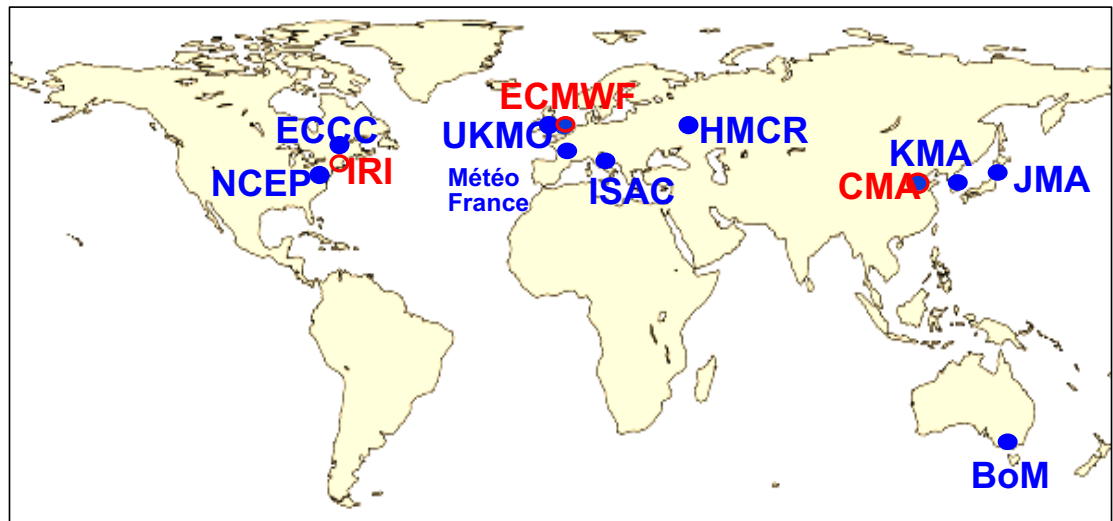
(November 2013–December 2017)

Phase II Proposal

(November 2018–December 2023)

● Centers providing S2S data

○ Centers archiving S2S data



CMA S2S database

<http://s2s.cma.cn>

The screenshot shows the CMA S2S Archiving Data Center website. The browser address bar displays `http://s2s.cma.cn/centers?mo=babj_CMA_37`. The website has a blue header with the CMA S2S logo, a search bar, and links for Login and Register. A navigation bar below the header contains links for Home, Description, Data Download (highlighted), and Help. A breadcrumb trail indicates the current location: Location : Data Download > Centers > CMA.

On the left side, there is a sidebar menu with two main sections: "Centers" and "Parameters". The "Centers" section lists various meteorological centers, with "CMA" currently selected. The "Parameters" section lists various meteorological parameters, including "10 metre u-velocity", "10 metre v-velocity", "CAPE", "Convective precipitation", "Eastward turbulent surface stress", "Geopotential height", "Land sea mask", and "Mean sea-level pressure".

The main content area displays the "Realtime forecasts" section, which is selected. It provides a date range from 2015-01-01 to 2017-02-23. Below this, the "Hindcasts" section is visible, showing a "Realtime date" of 2016-12-31 and a "Model version date" of 2014-05-01. A table of hindcast dates is provided, with checkboxes for each date. The "Parameters" section at the bottom allows users to select parameters for their query, with checkboxes for "10 metre u-velocity", "10 metre v-velocity", and "Mean sea-level pressure".

Centers

- BOM
- CMA**
- ECCC
- ECMWF
- HMCR
- ISAC-CNR
- JMA
- KMA
- Meteo-France
- NCEP
- UKMO

Parameters

- 10 metre u-velocity
- 10 metre v-velocity
- CAPE
- Convective precipitation
- Eastward turbulent surface stress
- Geopotential height
- Land sea mask
- Mean sea-level pressure

Realtime forecasts

Select a date in the interval 2015-01-01 to 2017-02-23. Dataset is available daily. [Read more](#)

Start date: 2015-01-01 End date: 2017-02-23

Hindcasts

Select a date after 2015-01-01. Dataset is available daily. [Read more](#)

Realtime date: 2016-12-31 Model version date: 2014-05-01

Hindcast dates: ☐ Select All

<input type="checkbox"/> 2014-12-31	<input type="checkbox"/> 2013-12-31	<input type="checkbox"/> 2012-12-31	<input type="checkbox"/> 2011-12-31
<input type="checkbox"/> 2010-12-31	<input type="checkbox"/> 2009-12-31	<input type="checkbox"/> 2008-12-31	<input type="checkbox"/> 2007-12-31
<input type="checkbox"/> 2006-12-31	<input type="checkbox"/> 2005-12-31	<input type="checkbox"/> 2004-12-31	<input type="checkbox"/> 2003-12-31
<input type="checkbox"/> 2002-12-31	<input type="checkbox"/> 2001-12-31	<input type="checkbox"/> 2000-12-31	<input type="checkbox"/> 1999-12-31
<input type="checkbox"/> 1998-12-31	<input type="checkbox"/> 1997-12-31	<input type="checkbox"/> 1996-12-31	<input type="checkbox"/> 1995-12-31
<input type="checkbox"/> 1994-12-31			

Parameters

☐ Select All

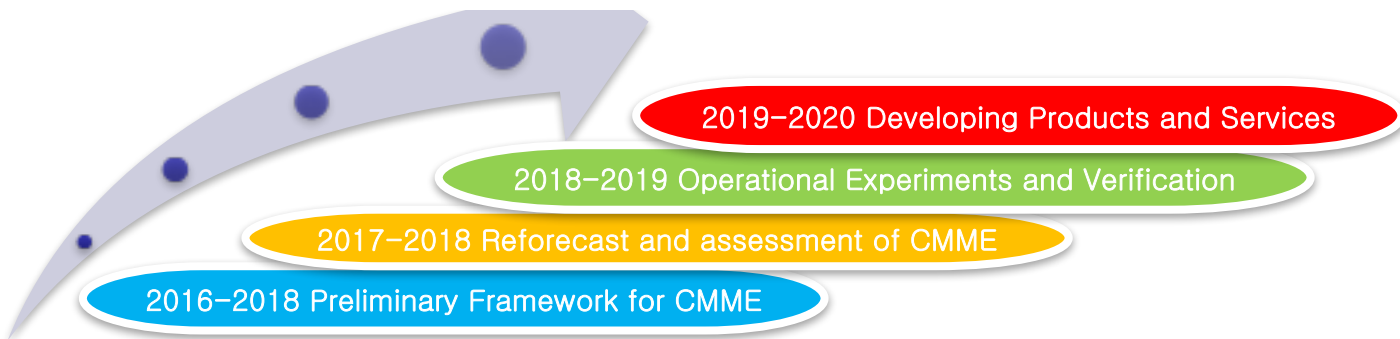
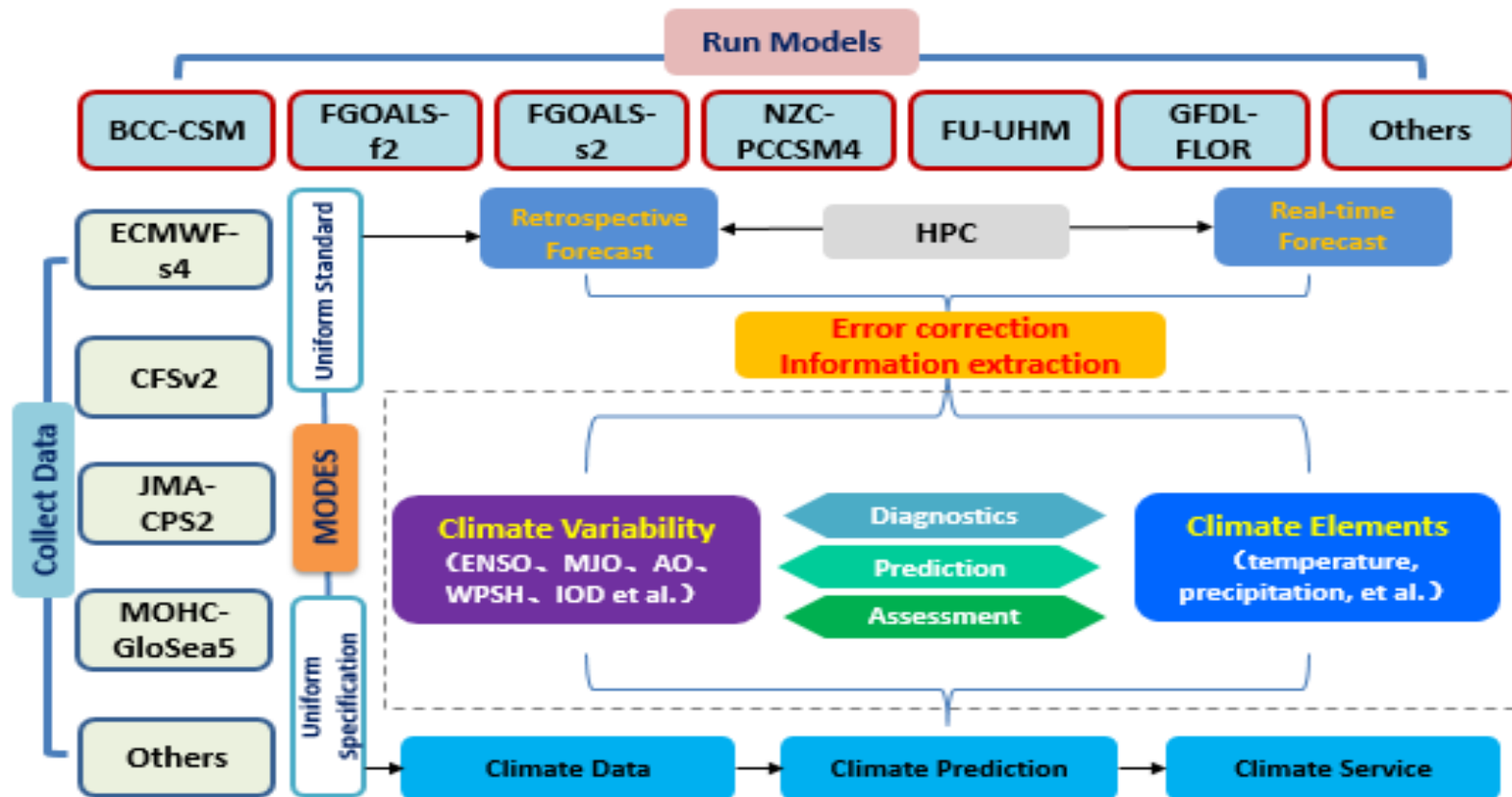
Instantaneous once a day (00Z)

☐ 10 metre u-velocity ☐ 10 metre v-velocity

☐ Geopotential height ☐ Mean sea-level pressure

Developing framework of CMME in CMA

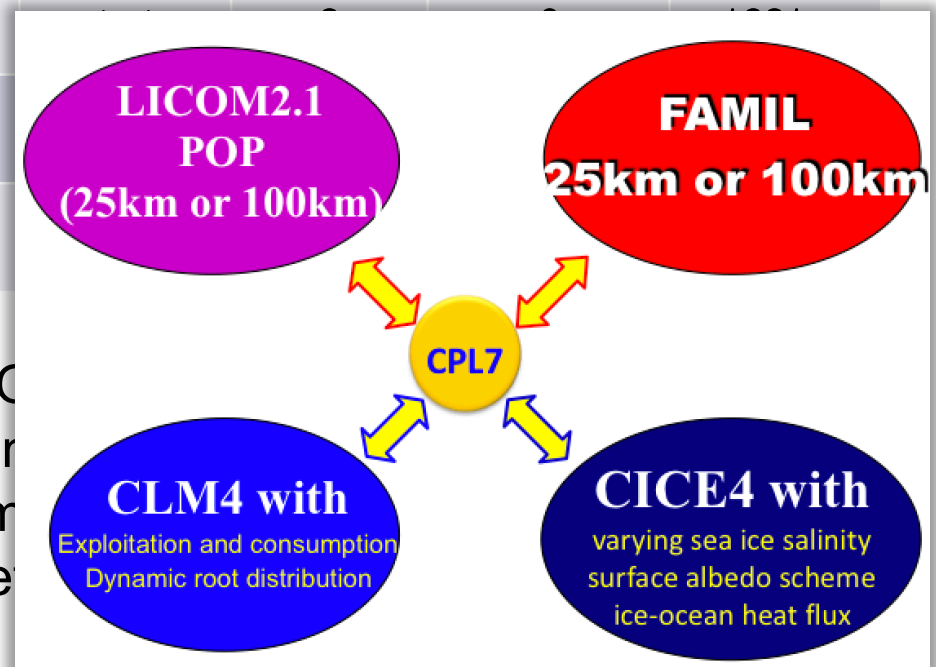
China **M**ulti-**M**odel **E**nsemble System



CMME Version 1.0

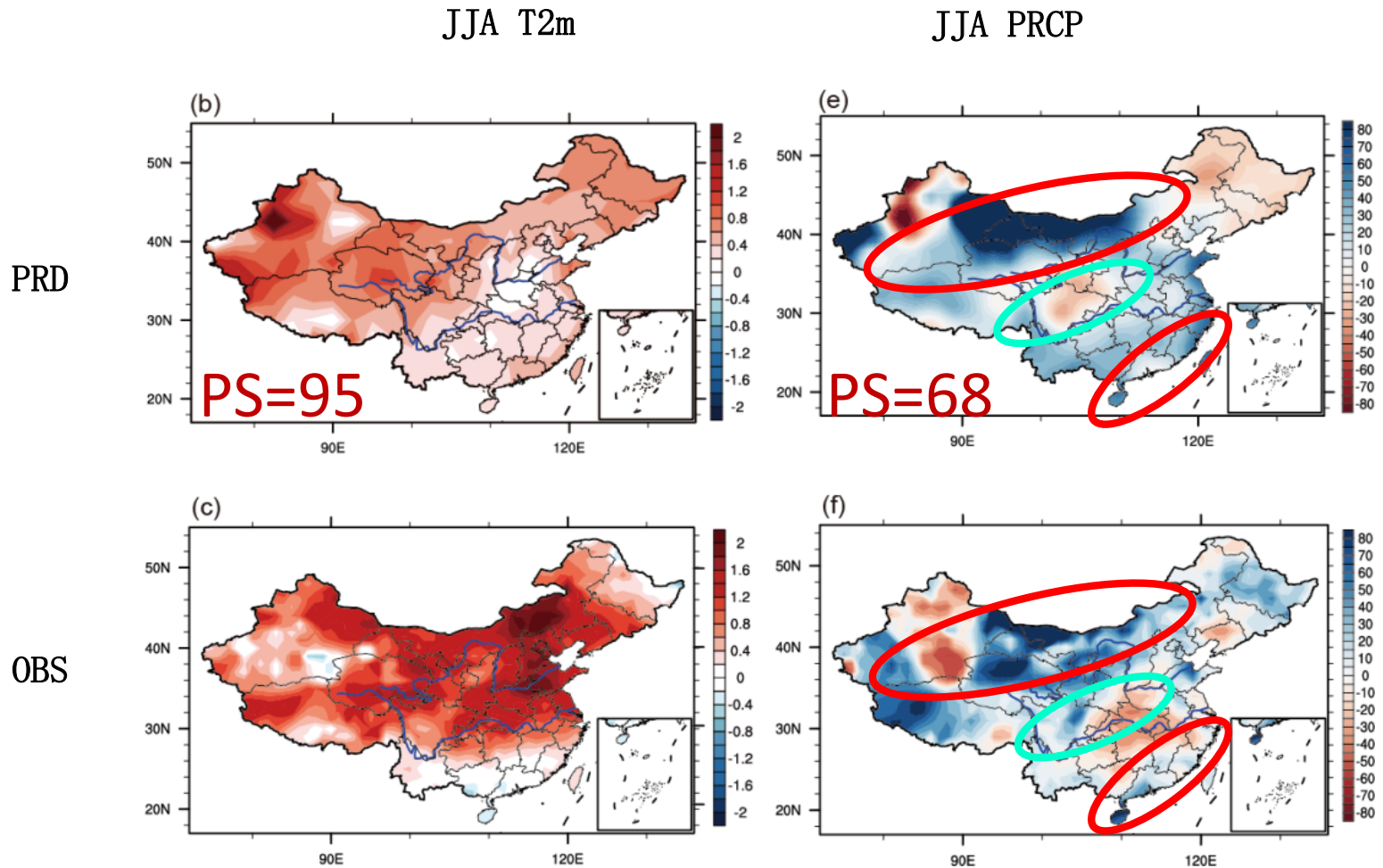
Models	Institution	Atm. Resolution	Ocn. Resolution	Ensemble Size	Lead times (months)	Hindcast /Forecast period
BCC-CSM1.1m	BCC(China)	T106, L26	1×1 L40	24	13	1991–
FGOALS-f2	IAP(China)	100km×100km, L32	1×1 L50	24	6	1981–
FGOALS-s2	IAP(China)	1.66×2.81 L26	1×1 L30	4	6	1981–
NZC-PCCSM4	IAP(China)	2.5×1.9 L26				
ECMWF-SYSTEM4	ECMWF(EURO)	TL255, L91				
NCEP-CFSv2	NCEP(USA)	T126, L64				

- ◆ CMME hindcast data vs. C
- ◆ Evaluations have been done
- ◆ Measurement: ACC (Anom (Temporal Correlation Coe



CMME: Review of 2018 flood-season predictions

Started from Feb 2018

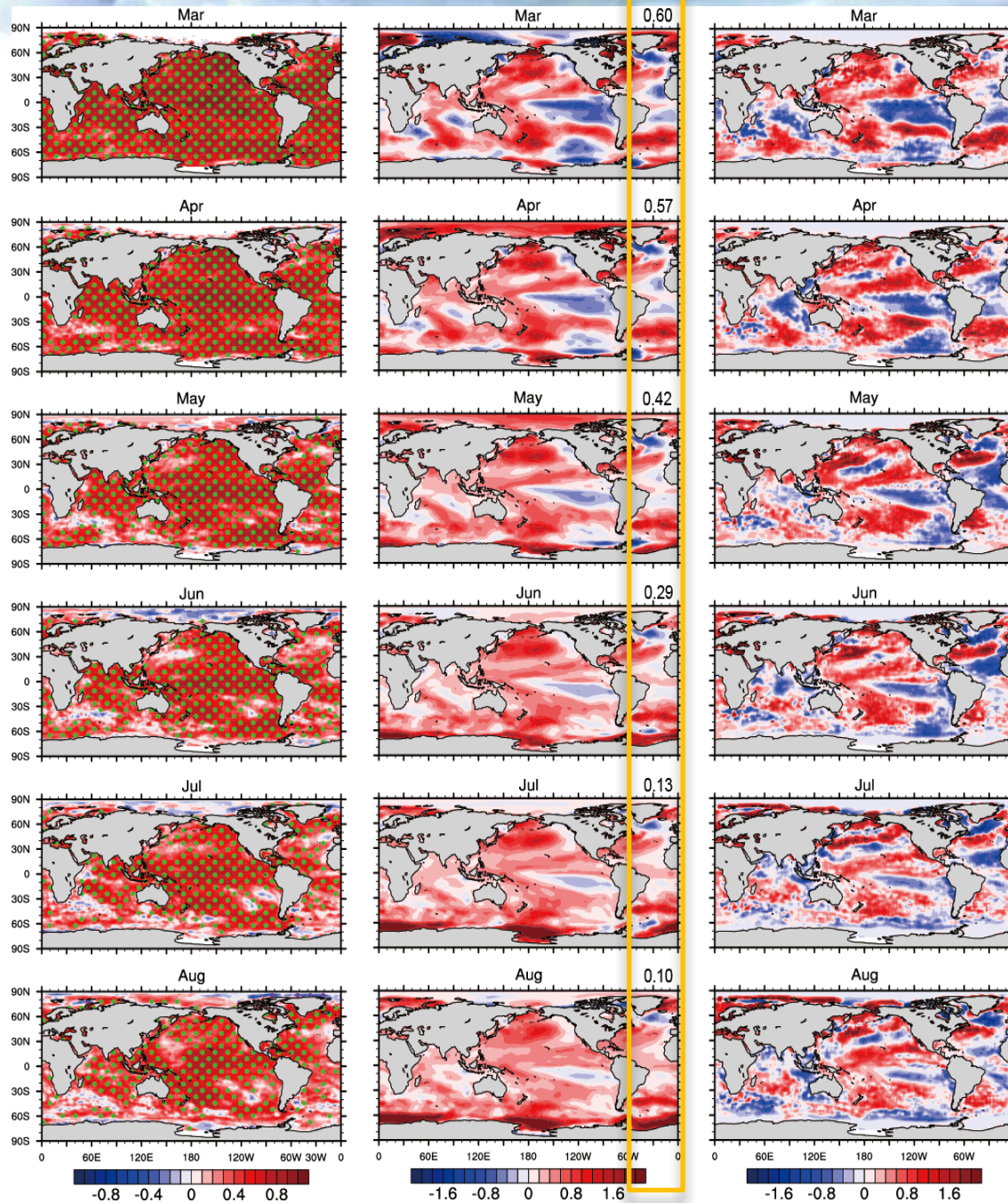


SSTA

TCC Skill

CMME

OISST



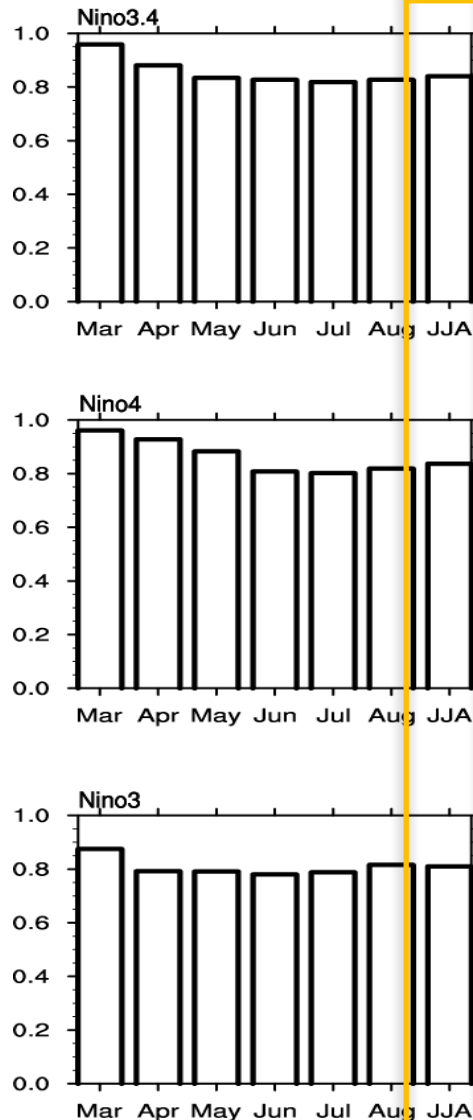
ENSO indices

TCC Skill

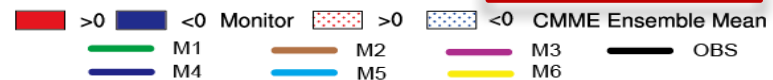
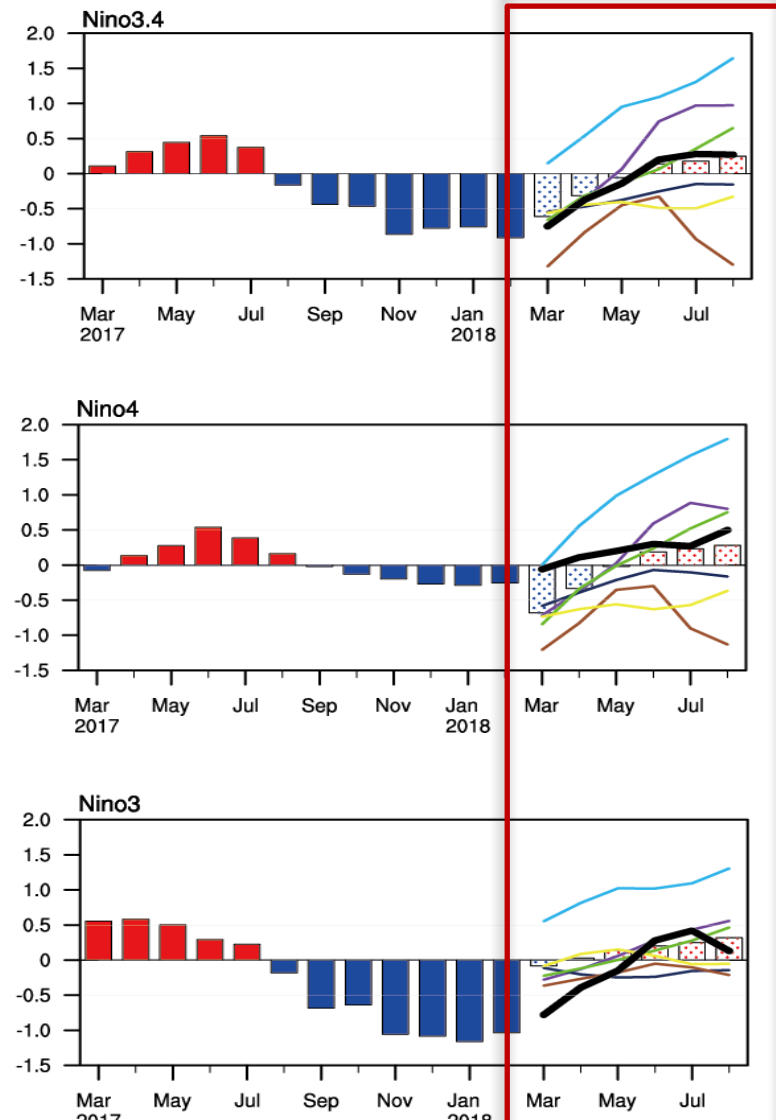
OISST

CMME

ENSO Index: CMME Skill

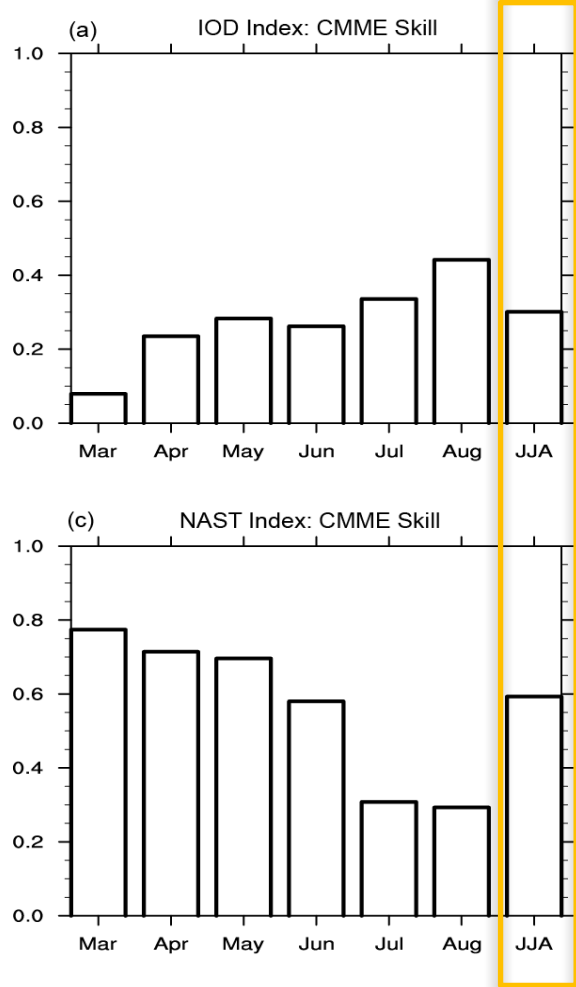


ENSO Index: CMME Forecast



IOD

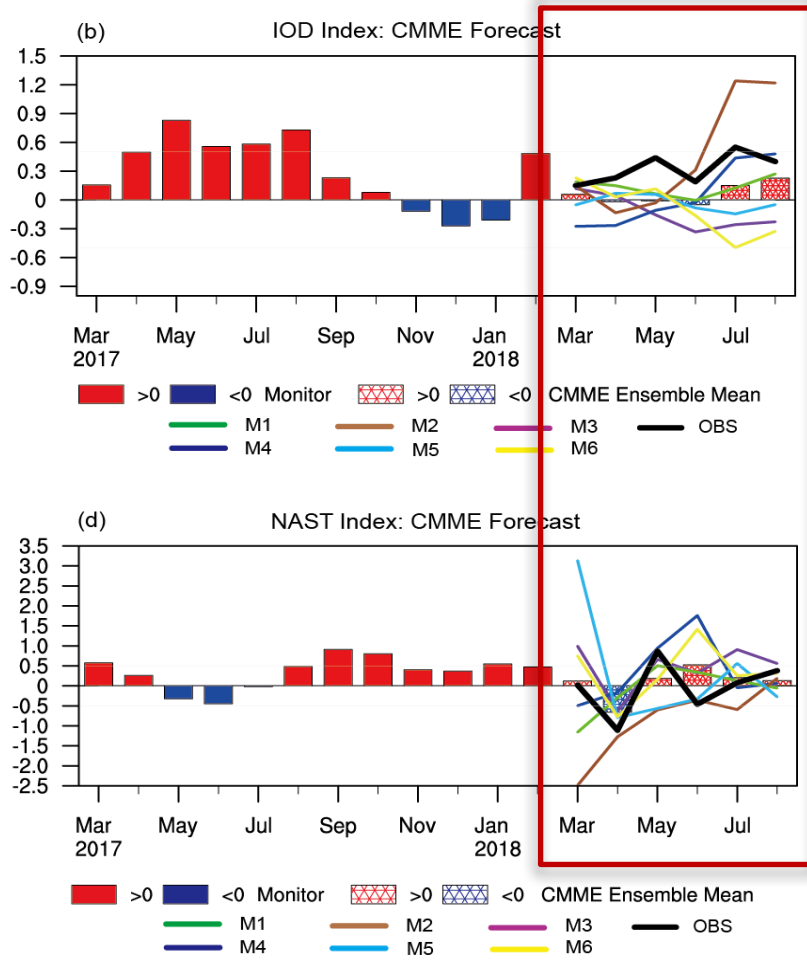
TCC Skill



NAST

OISST

CMME



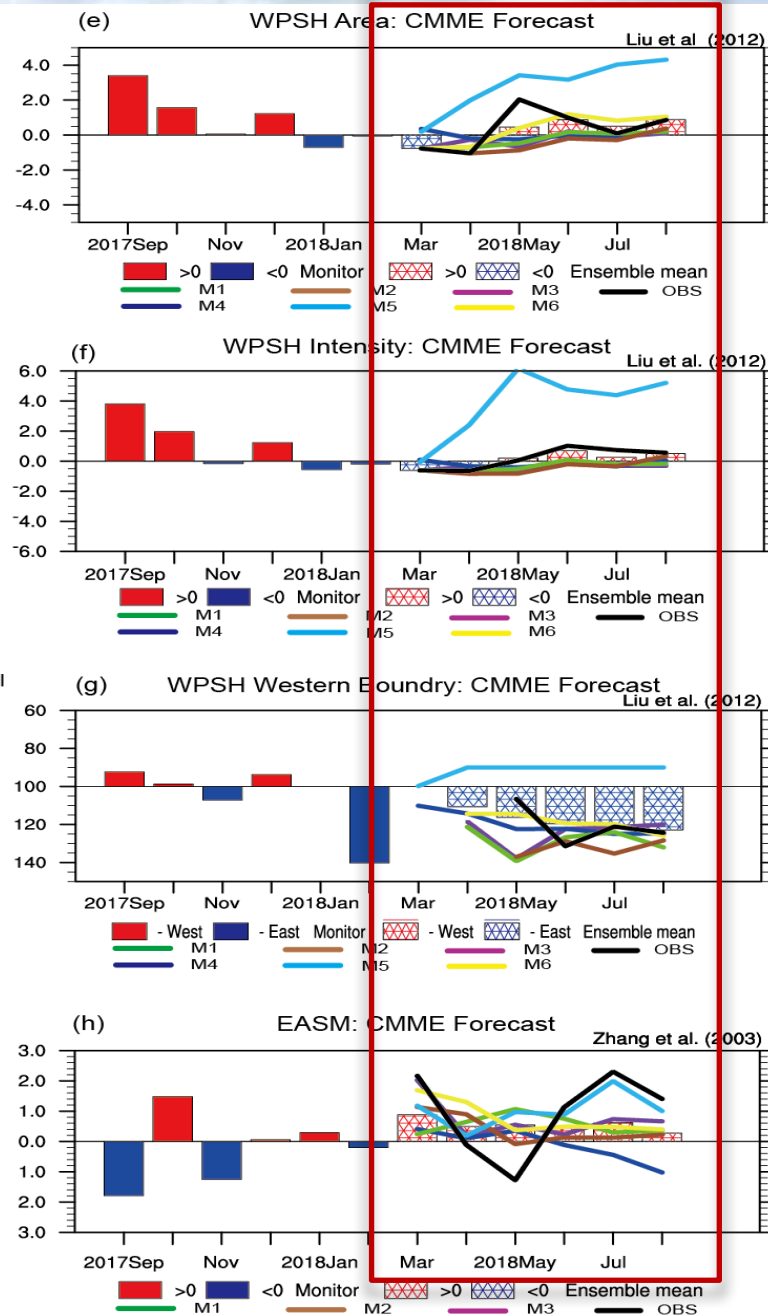
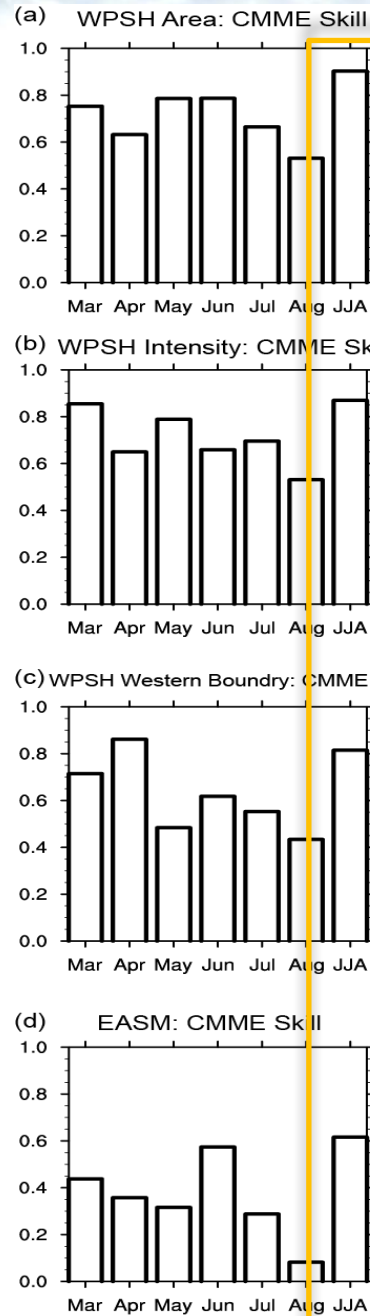
TCC Skill

OBS

CMME

WPSH indices

EASMI



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