Introduction to the KMA-Met Office Joint Seasonal Forecasting System and its Evaluation

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Outline

- Backgrounds
- Introduction to the Joint Forecasting System
- Overview of predictability and skill
- Another important feature for Asia region? – Asian Dust
- Summary

WMO Lead Centre – LRFMME
(KMA and NOAA)

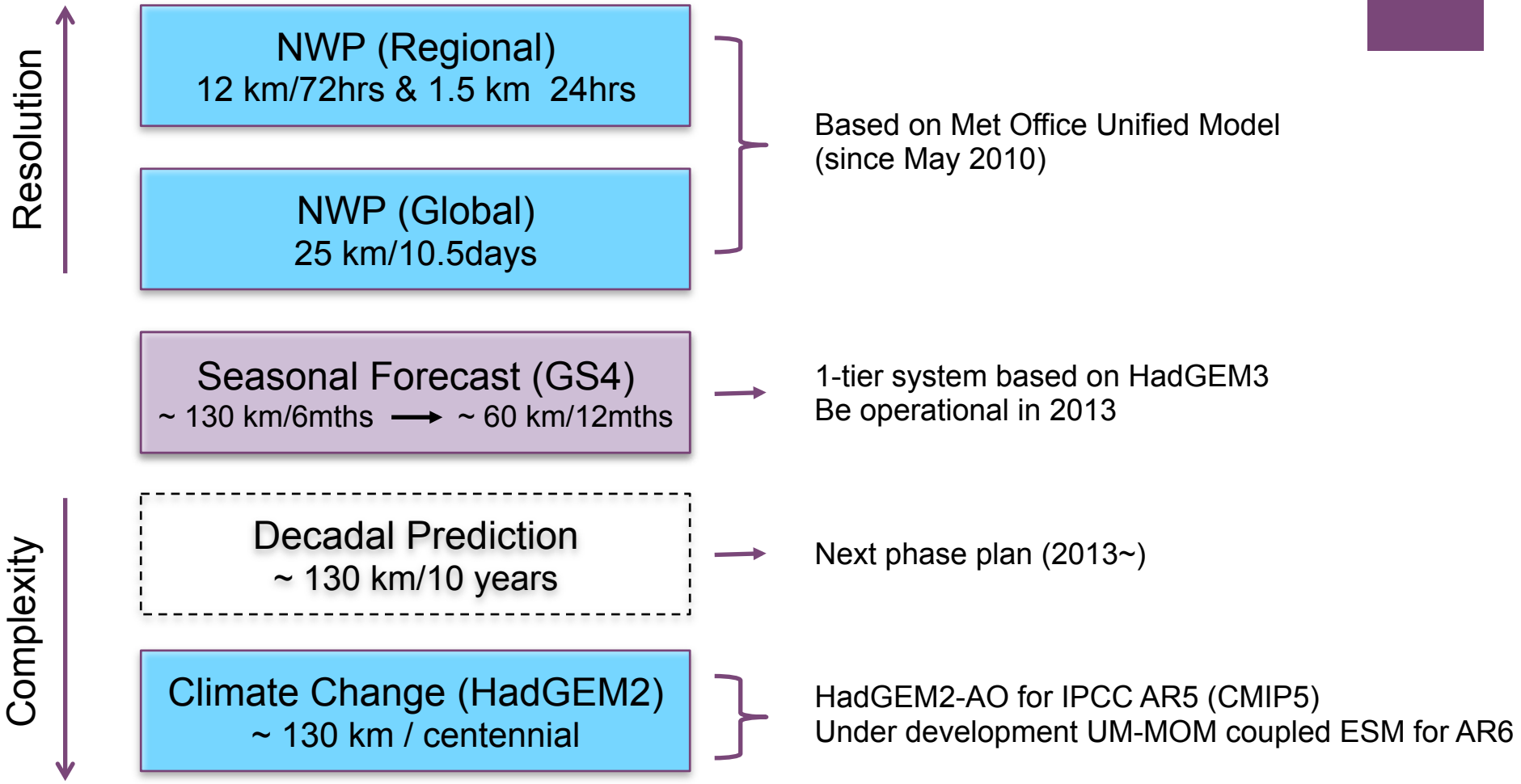
Goal:

To provide a conduit for *sharing the model data for long-term climate predictions* and *develop a well-calibrated MME system* for mitigating the adverse impact of unfavorable, or to maximize the benefit from favorable climate conditions.

- 12 GPCs (operational centers) update their real-time seasonal forecast into the LC-LRFMME (http://www.wmolc.org).
- 1-tier system in 7 Centers (Beijing, ECMWF, Exeter, Melbourne, Tokyo, Toulouse, Washington)
- 2-tier system in 5 Centers (CPTEC, Montreal, Moscow, Pretoria, Seoul)

Seamless Prediction Strategy

from weather to climate projection in KMA

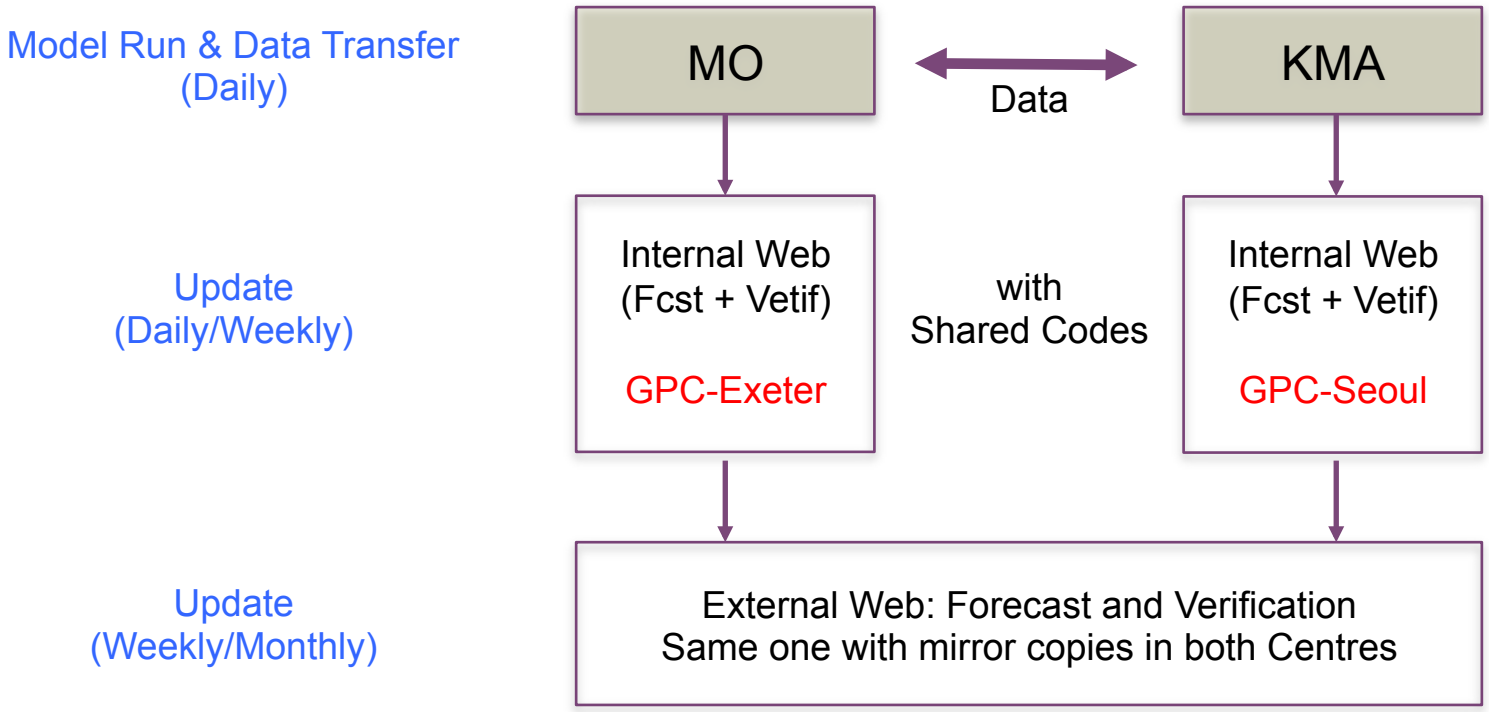


GloSea4

- GloSea4 is the fourth version of the Met Office ensemble prediction system for seasonal forecasting, which has been built based on the latest version of HadGEM3 family.

- Components of the HadGEM3 are:
  - UM (Met Office Unified Model) for Atmosphere,
  - MOSES-II (Met Office Surface Exchange Scheme) for Land Surface,
  - NEMO (Nucleus for European Modeling of the Ocean) for Ocean,
  - CICE (Los Alamos National Laboratory) for Sea-ice, and
  - OASIS (CERFACS) coupling between component models.

KMA – Met Office Joint Forecast System



- This system will be launched by mid-2013. Major advantages are to share ensemble members as many as possible and to save human and computing resources.

GloSea4 in KMA

	2011 Implementation	2012 Operational Test (KMA)	2013 Operational Launch
Model	HadGEM3 – GA2.0 N96L85+O1L75 (coupling freq. is 3 hrs)	HadGEM3 – GA3.0 N216L85+O1/4L75 (coupling freq. is 3 hrs)	HadGEM3 – GA? N216L85+O1/4L75 (coupling freq. is 3 hrs)
Real-time Hindcast	• 14 years (1996-2009) • 1st, 9th, 17th, 25th • 12 members/month	• 21 years (1989-2009) • 1st, 9th, 17th, 25th • 12 members/month	• 21 years (1989-2009) • 1st, 9th, 17th, 25th • 12 members/month
Daily Forecast	• 2 members/day • Initialize on every Mon.	• 2 more members/day for monthly forecast • Initialize on every Mon.	• Joint System (28 members/week from each center centers

- Initial condition for atmosphere is from KMA's own, and for ocean and sea-ice are from Met Office.
- Recently join in NEMOVAR development for Ocean Data Assimilation.

Results of the Hindcast Ensemble Runs

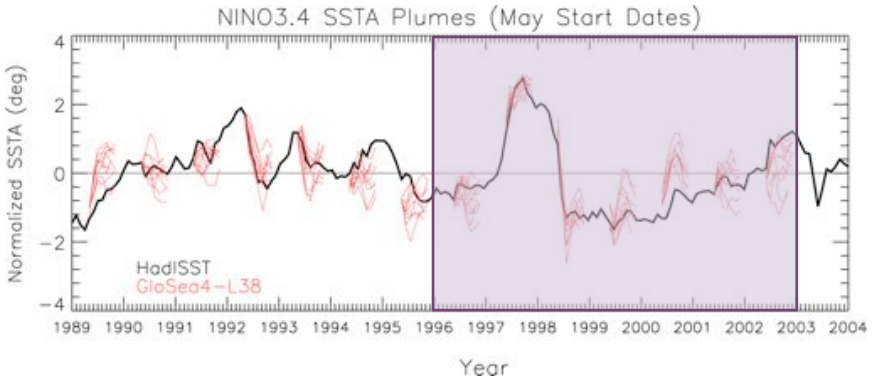
- 14 years (1996-2009)
- ERA-interim on the 1st, 9th, 17th, 25th of each month
- 3 ensemble members with SKEB2

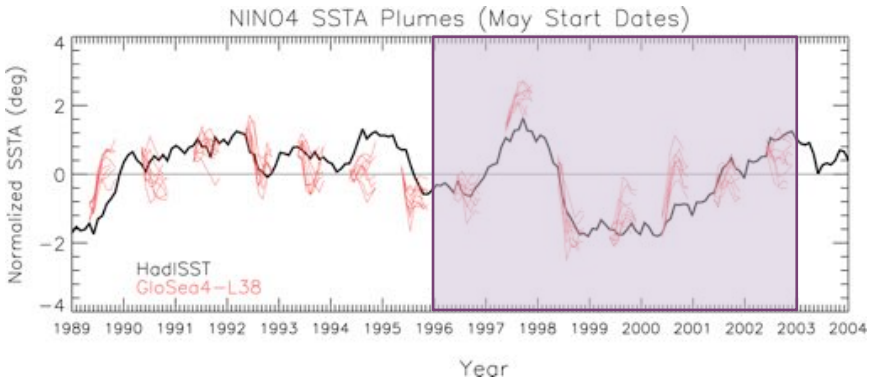
➥ Total number of 7-month-long integrations is 2,016.

- Lead month definition:
  - LEAD_1: 12 ensemble members (4 initial conditions × 3 ensemble members with SKEB2) initialized from one-month before.

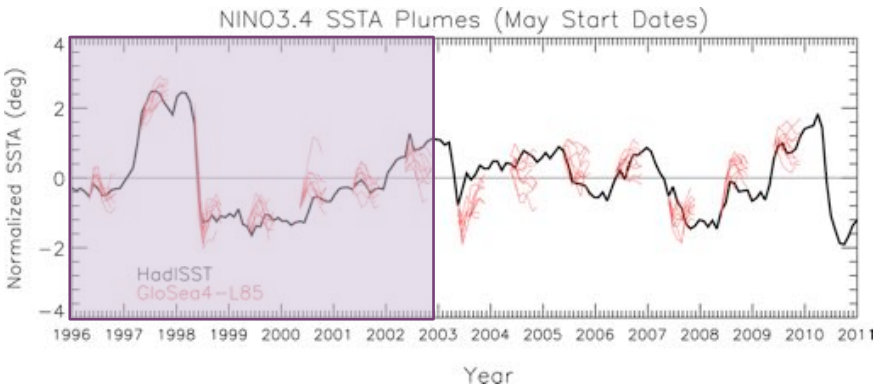
SST Anomaly Plumes

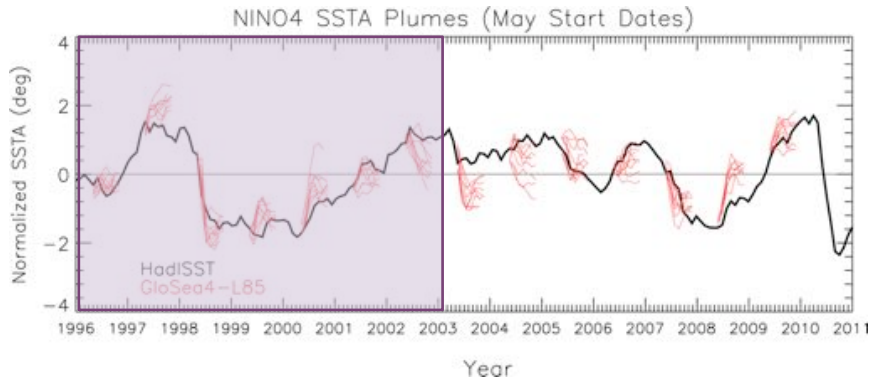
L38 (1989-2002)



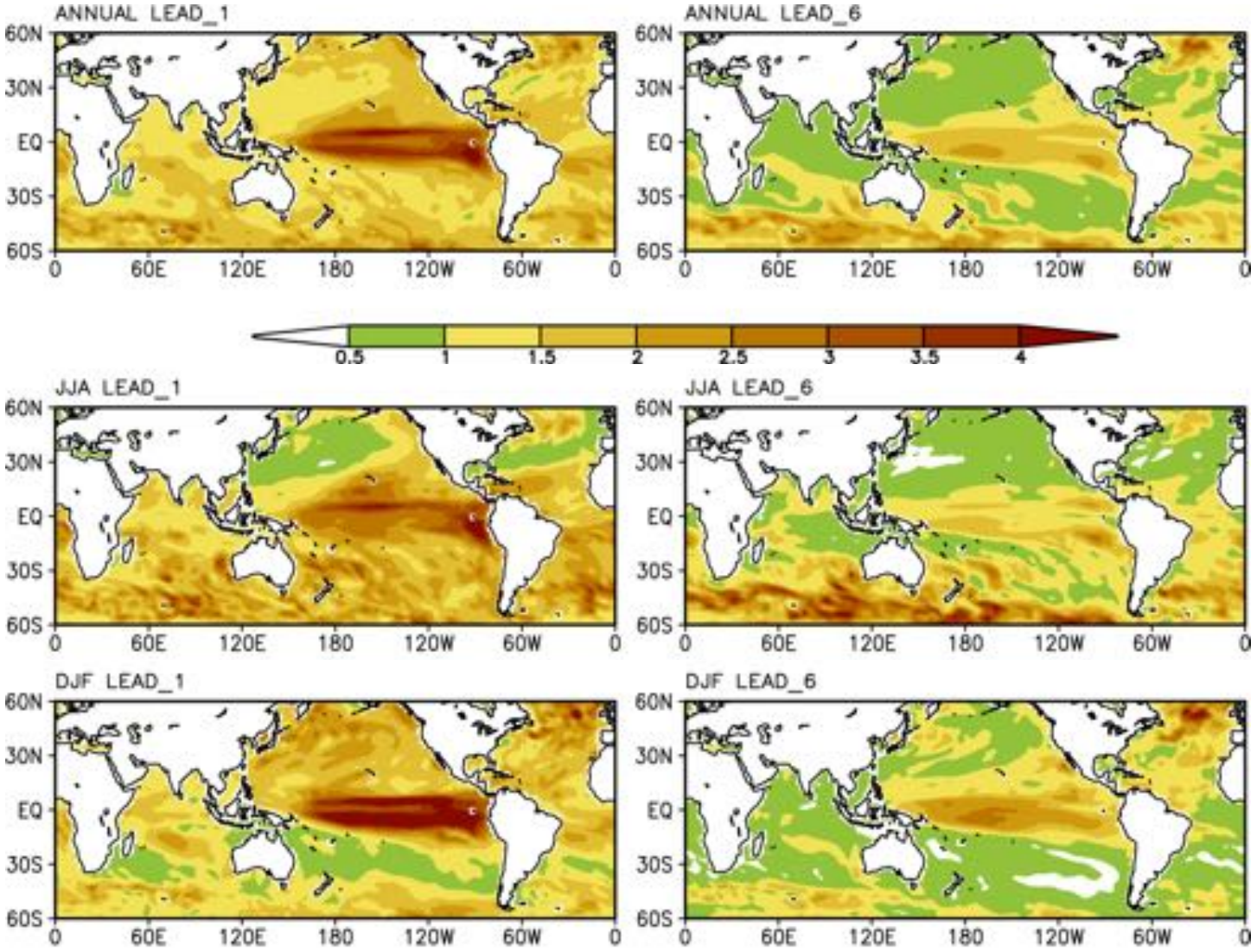


L85 (1996-2009)



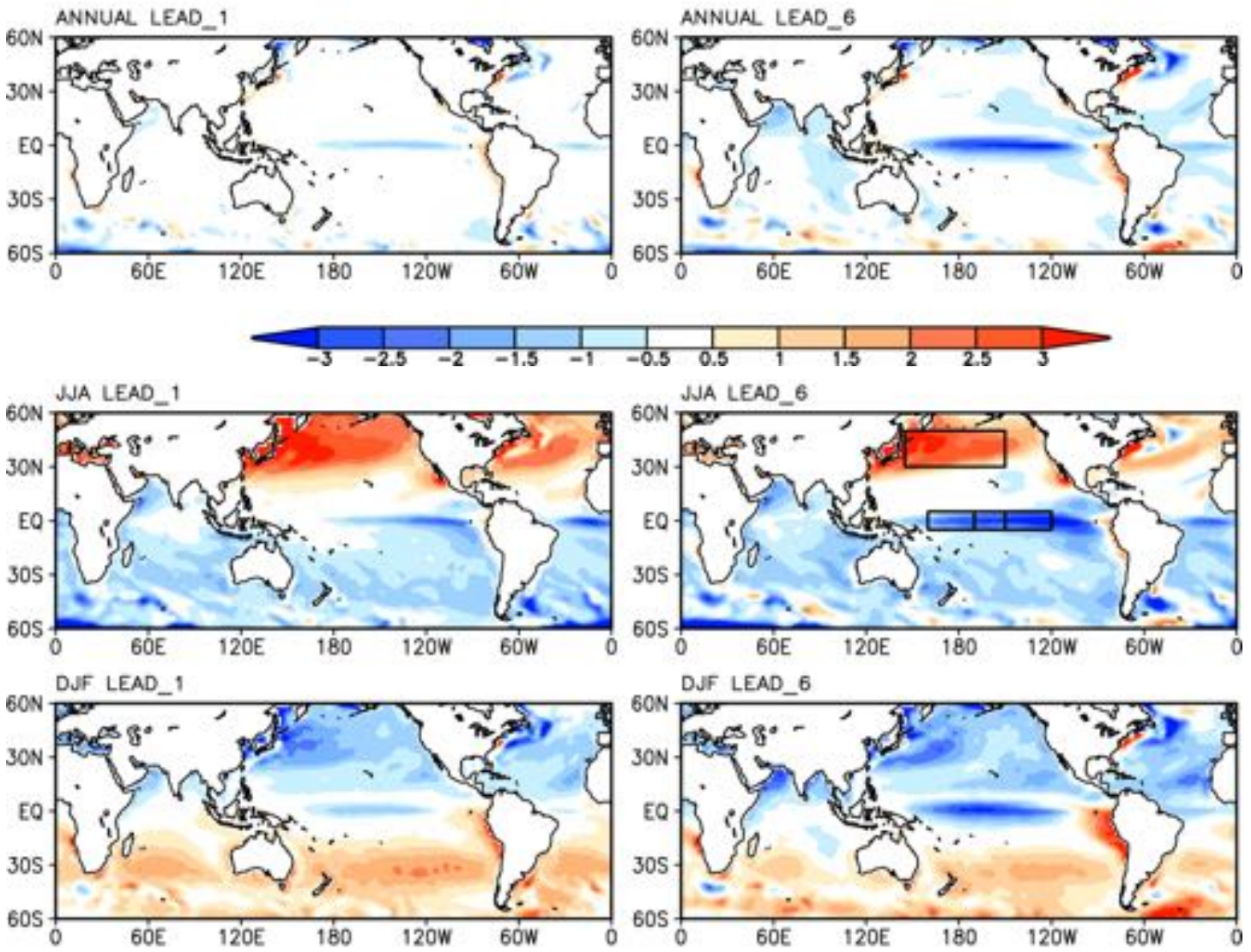


Signal-Noise Ratio (SST)

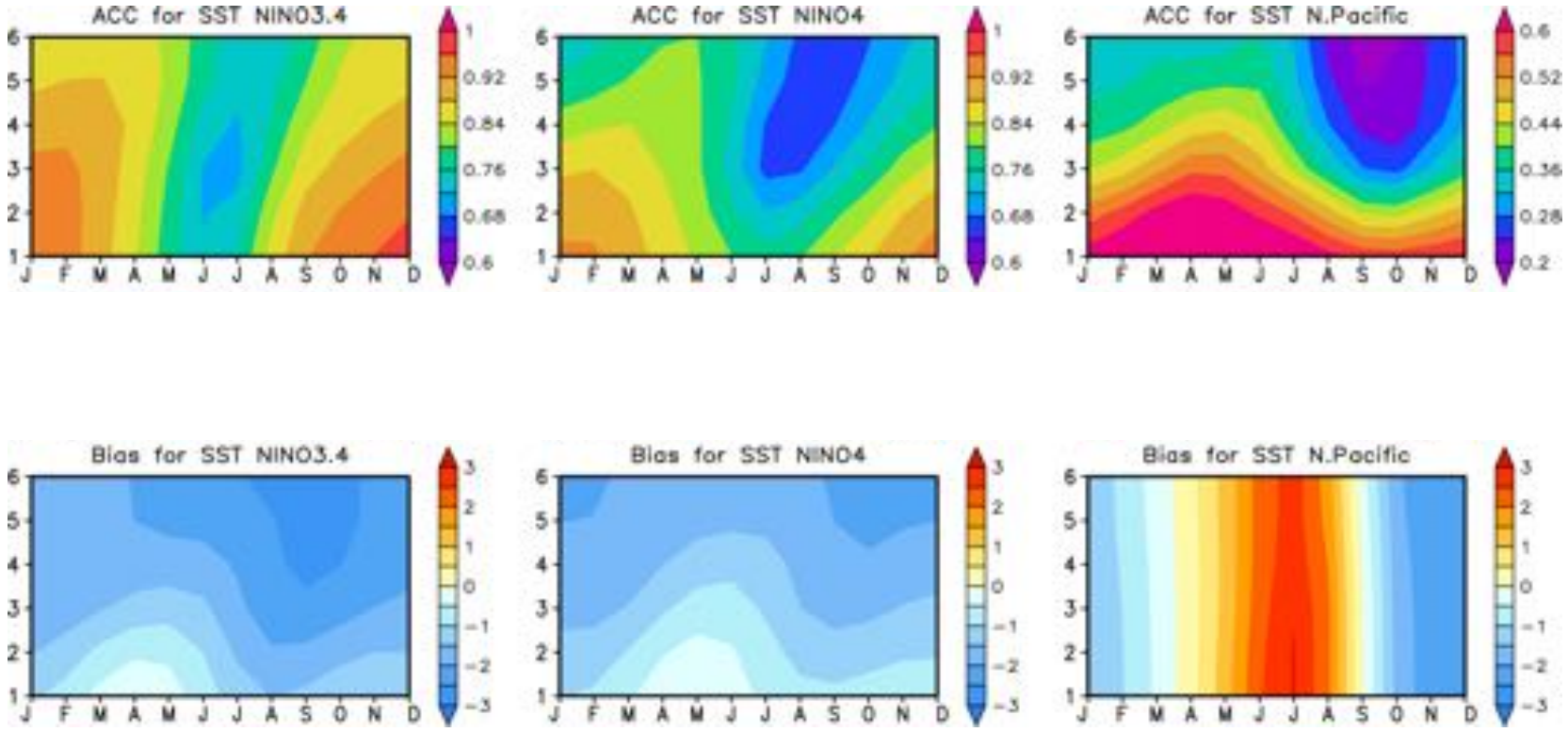


Mean Bias (SST)

Observation: Hadley SST



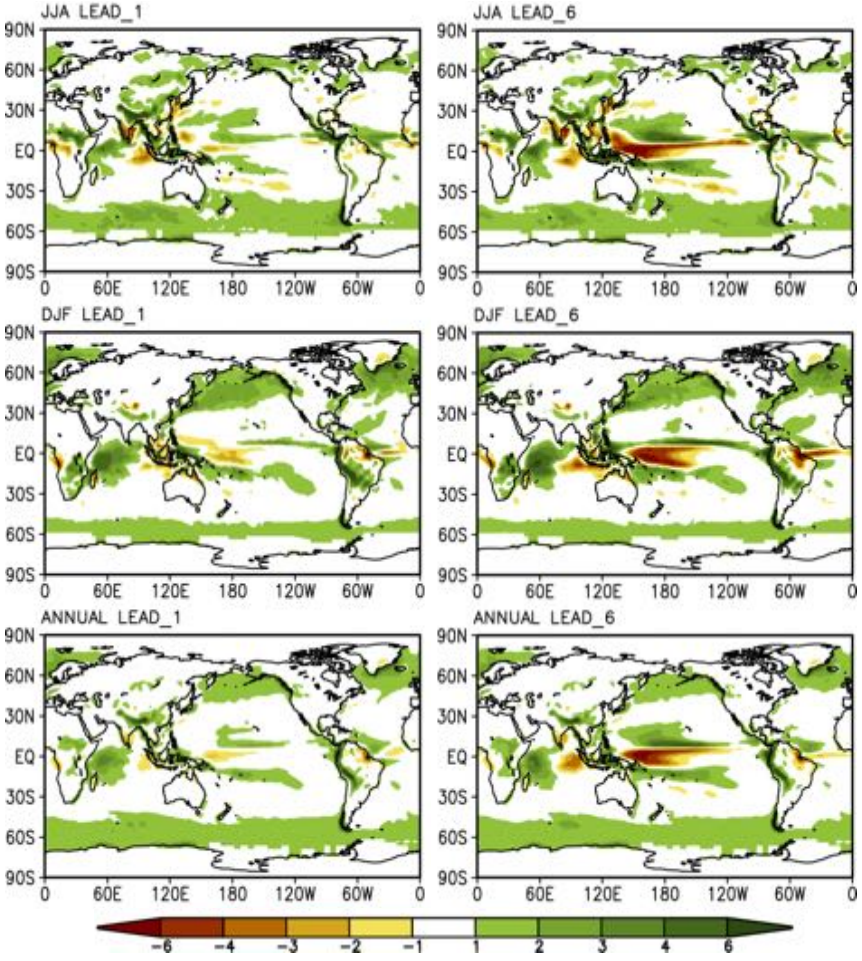
ACC and Bias (SST)



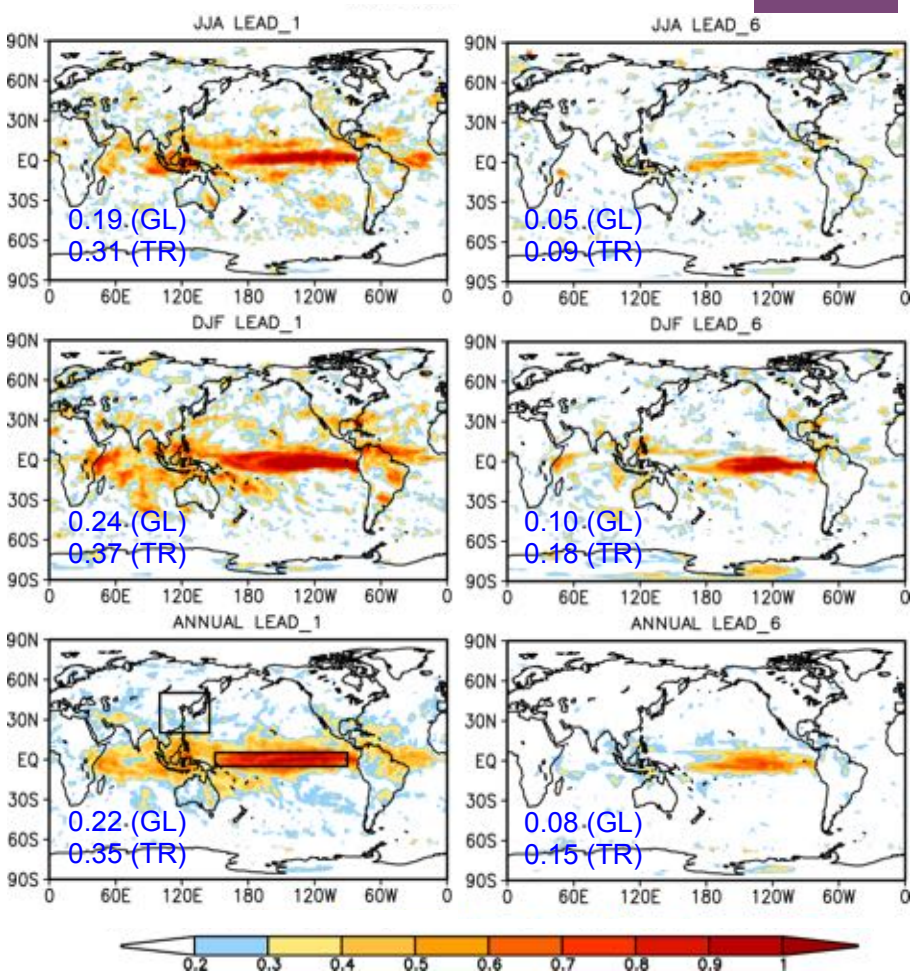
Bias and ACC (Precipitation)

Observation: CMAP

Bias



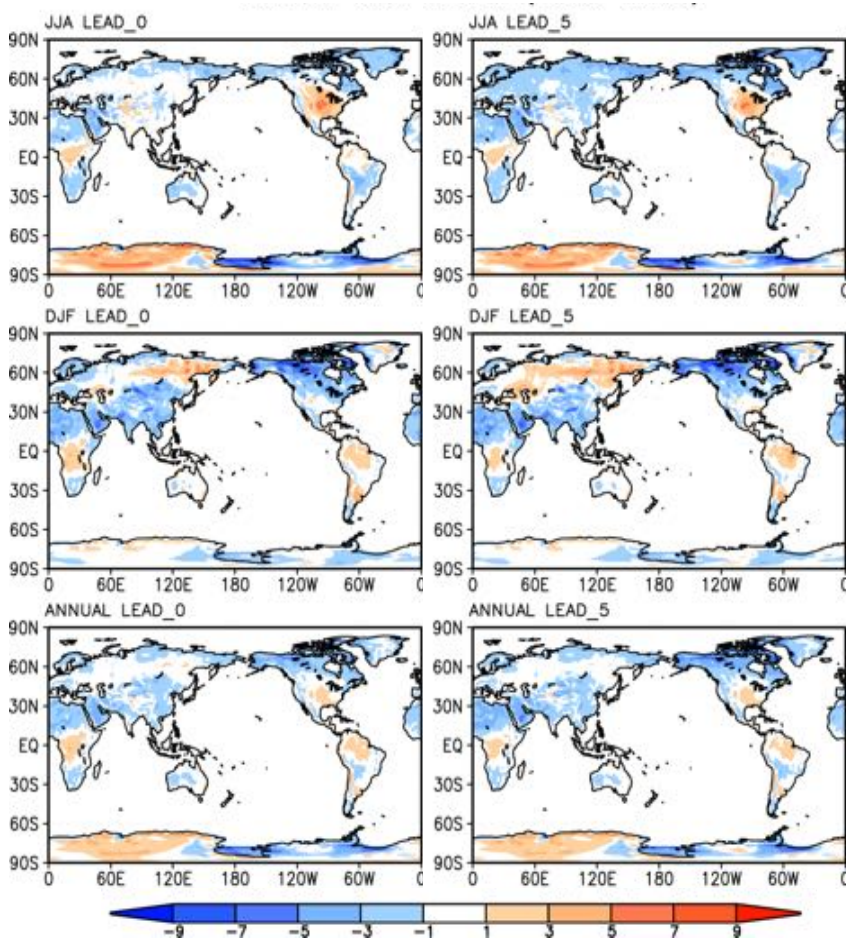
ACC



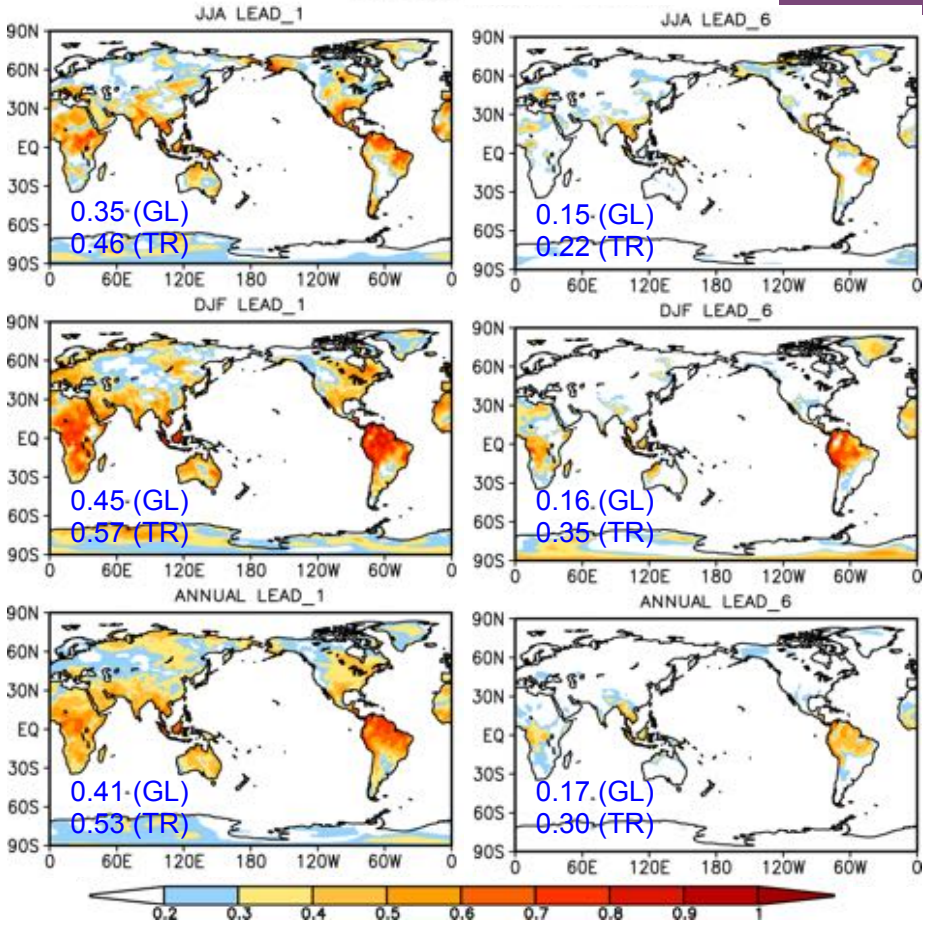
Bias and ACC (Sfc. Temp.)

Observation: ERA-interim

Bias



ACC



Precipitation–SST Relation

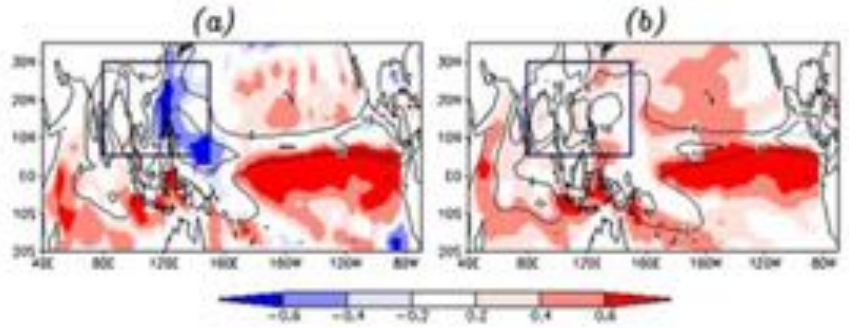
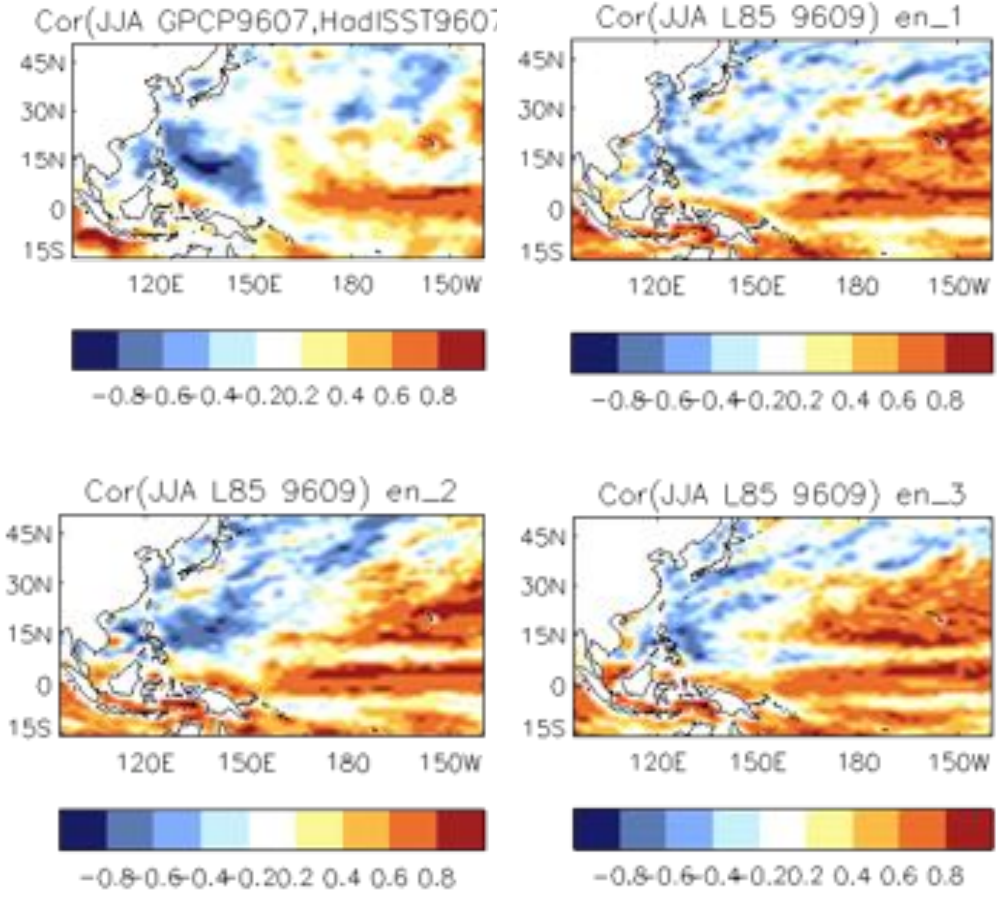


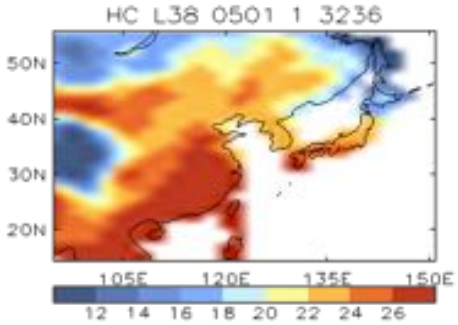
Figure 3. (a) Observed and (b) simulated correlation coefficients between the June–August SST and precipitation anomalies (the color shadings). The contours denote the climatological June–August mean rainfall rate (in units of mm day^{-1}). The observed correlations were computed using 20 years of data (1982–2001) derived from CMAP rainfall and Reynolds SST. The simulated results were made by 5 AGCM's multi-model ensemble simulation.

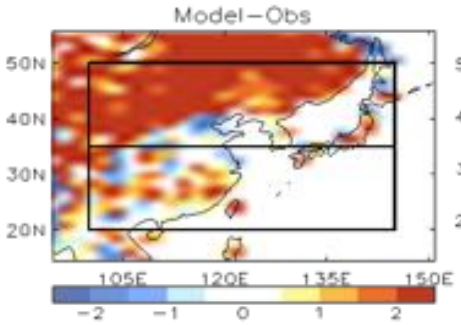


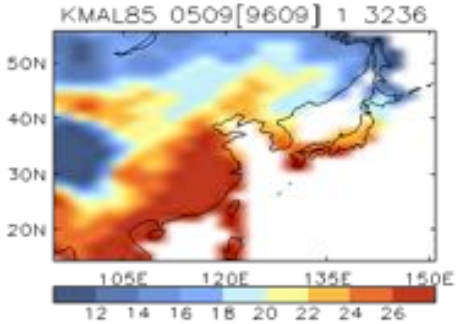
(Wang et al., JGR, 2005)

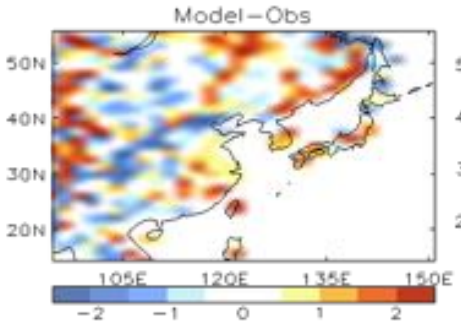
Bias over East Asia

Sfc. Air Temperature (JJA)

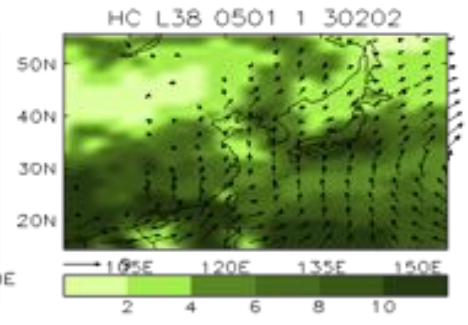


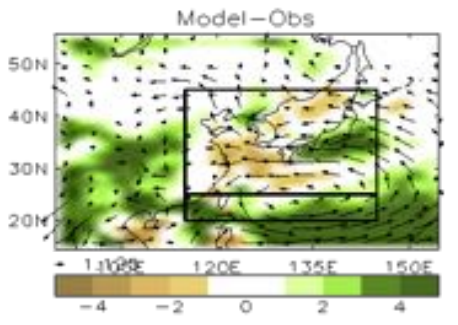


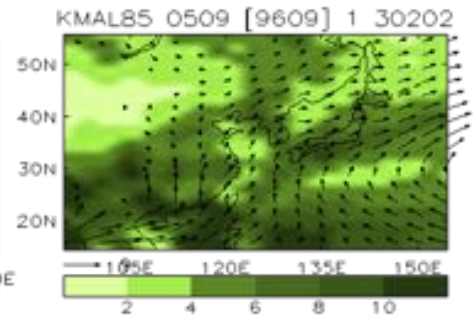


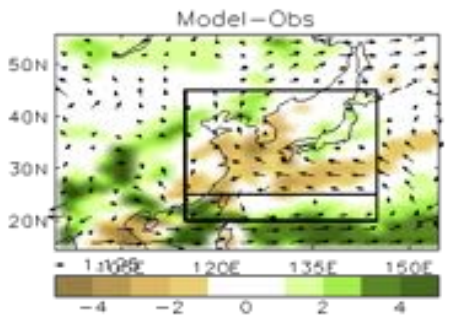


Precipitation (JJA)



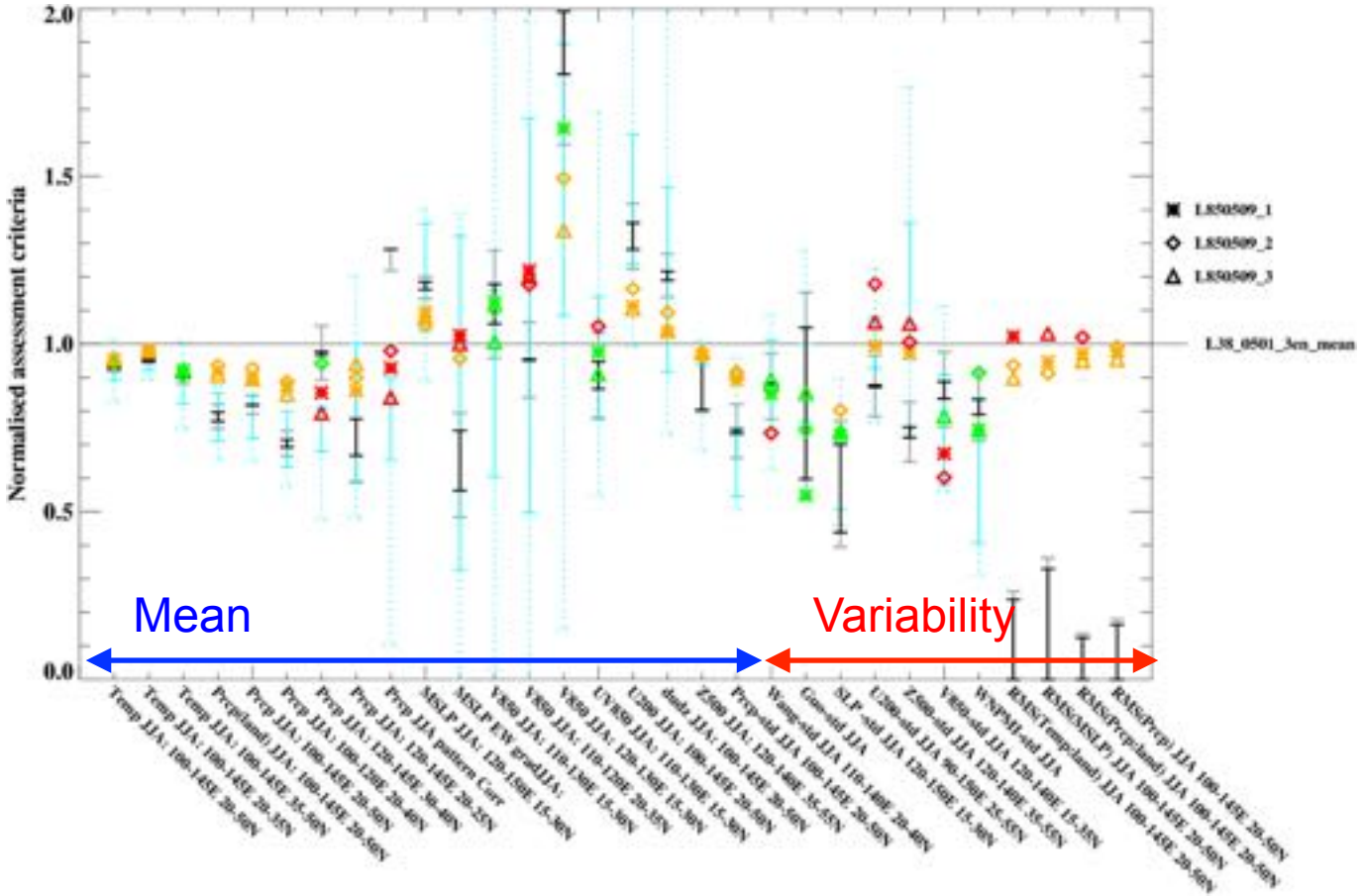






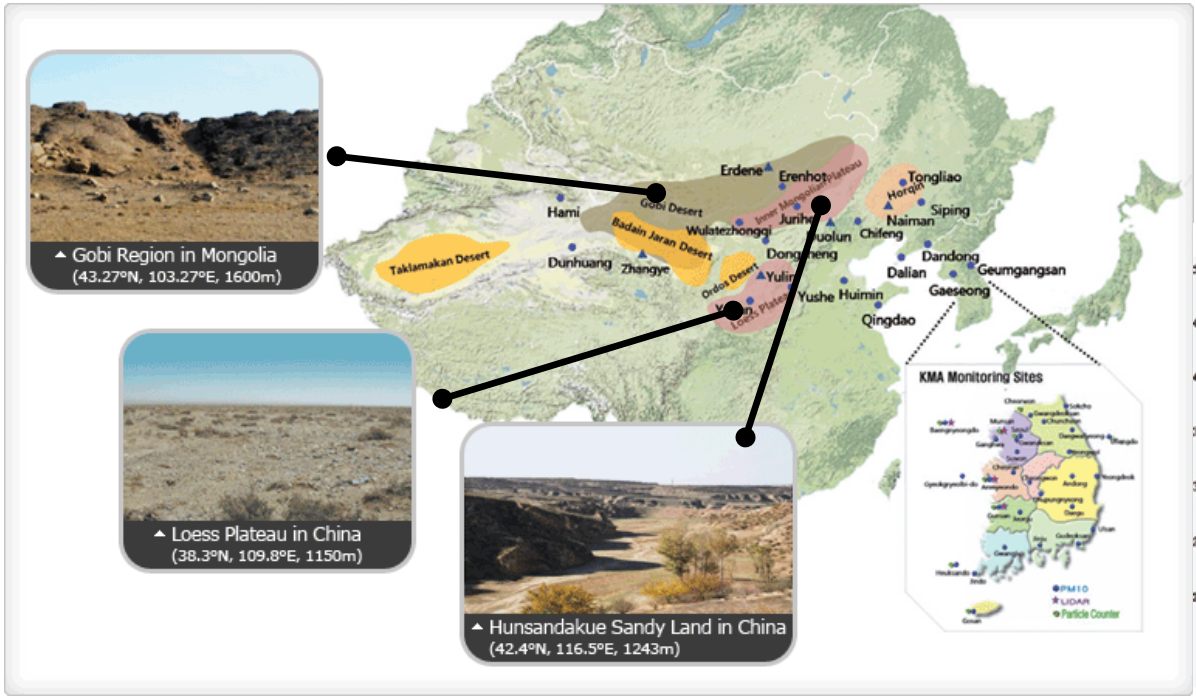
Diagnostic Metrics for East ASia

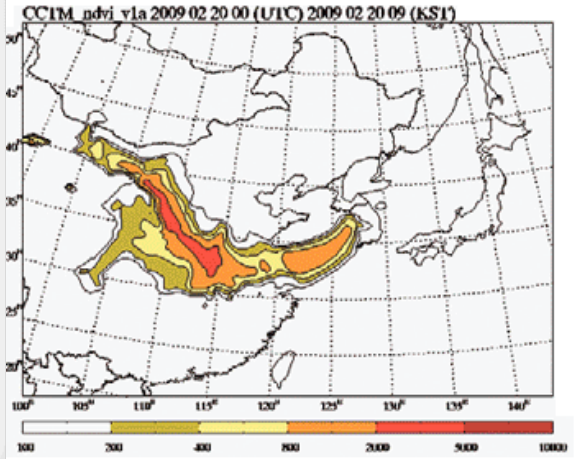
- 3 ensemble members started on 9th May
- Reference line: GS4-L38
- Worse, Better, within observational uncertainty



Asian Dust

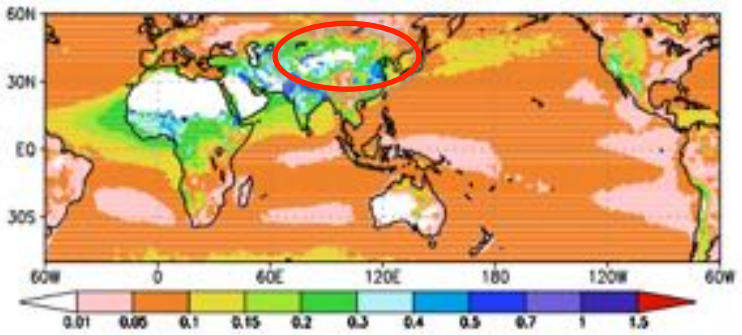
- Dust storms in arid and/or semi-arid areas over northern China and Mongolia.
- High frequency in spring, Mar-Apr-May.
- Serious impacts on weather and climate.



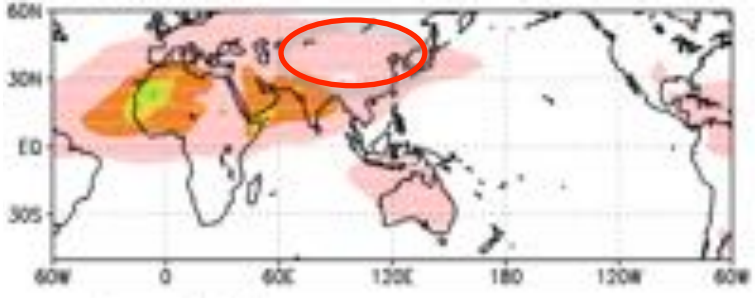


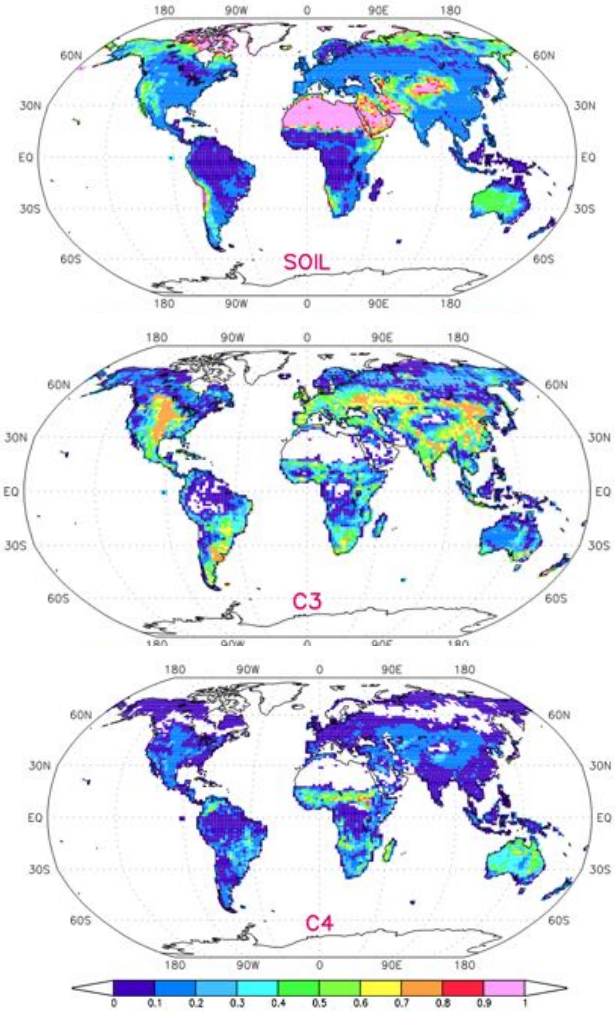
Backgrounds to Modify Dust Scheme

Coarse Mode AOD in MODIS (ANNUAL)

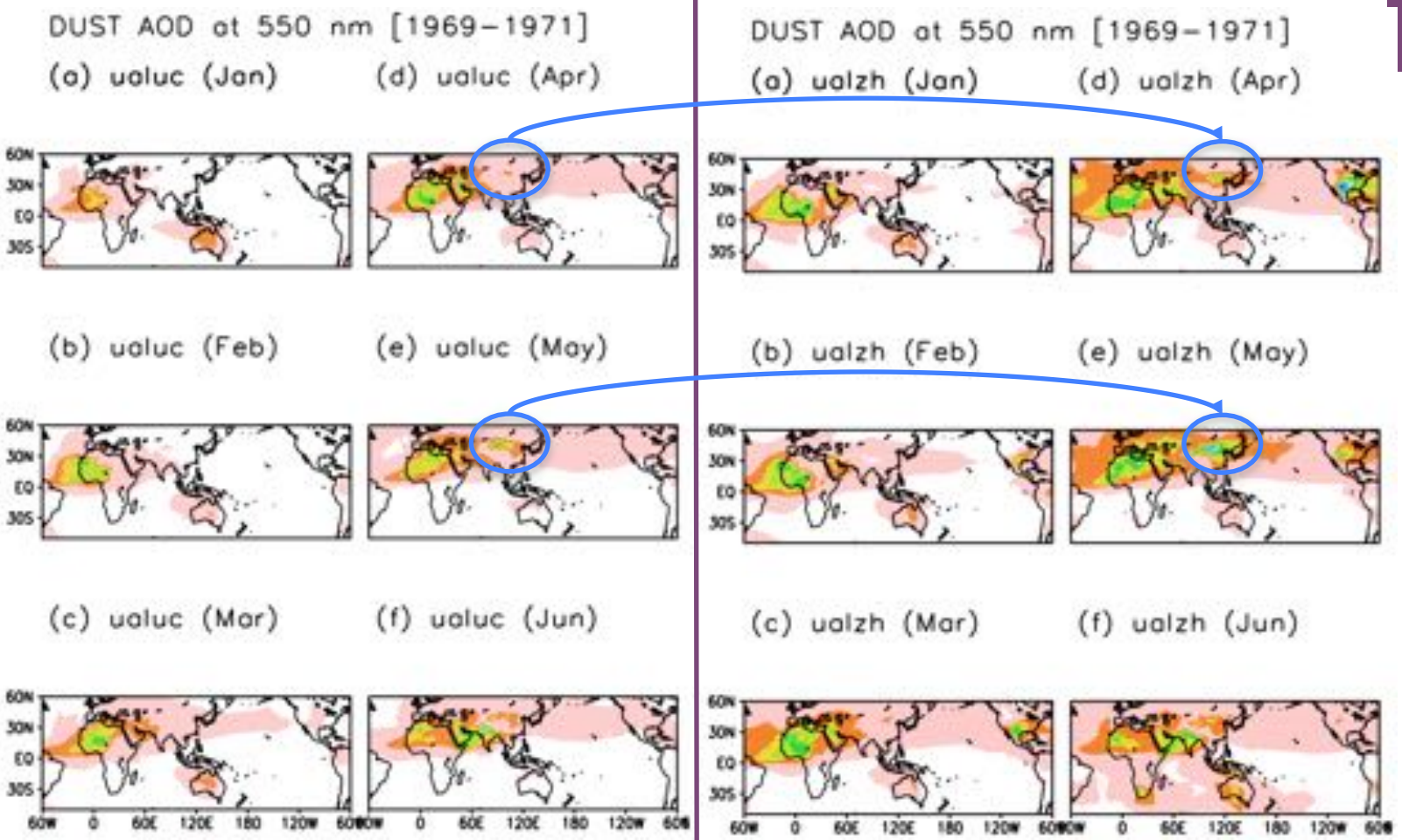


Dust AOD in the Model (ANNUAL)





Monthly Dust AOD



Original Scheme

Modified Scheme

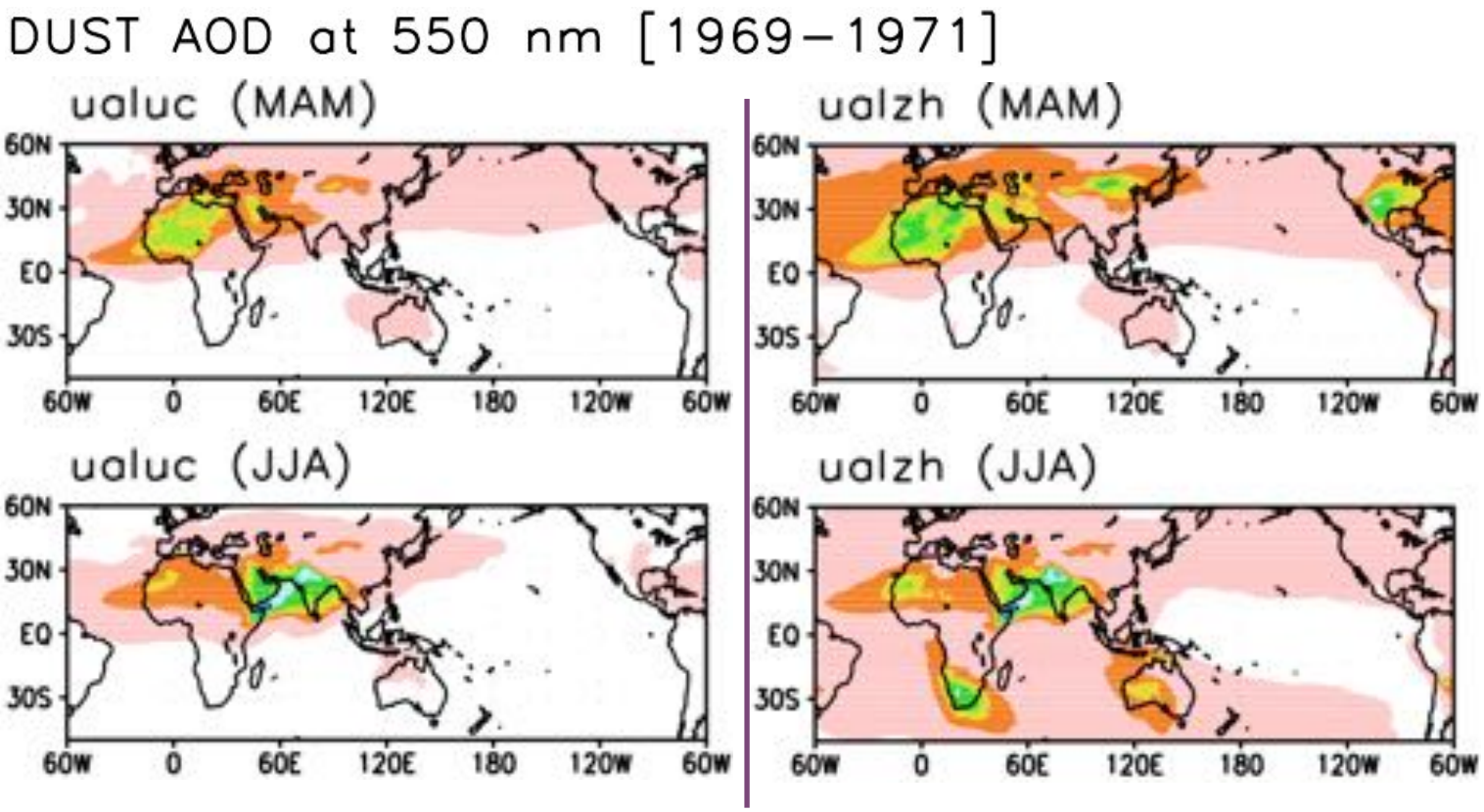
Summary

- Glosea4 with the low resolution (N96L85-O1L75) has been successfully implemented at KMA for preparation of Joint Seasonal Forecast System.
- Predictability and skill scores in the retrospective forecast of the GloSea4 are similar to other coupled models. Robust investigation on climate variability (e.g., ENSO, AO, MJO, etc.) should be further investigated.
- Dust aerosol scheme has been modified to improve the simulation (prediction) of Asian Dust. This scheme will be implemented in the next version of the HadGEM3.
- Operational test with the GloSea4 (N216L85-O1/4L75) will be started in mid-2012.
- Operational launch of the KMA-Met Office Joint Seasonal Forecasting System is expected in mid-2013.

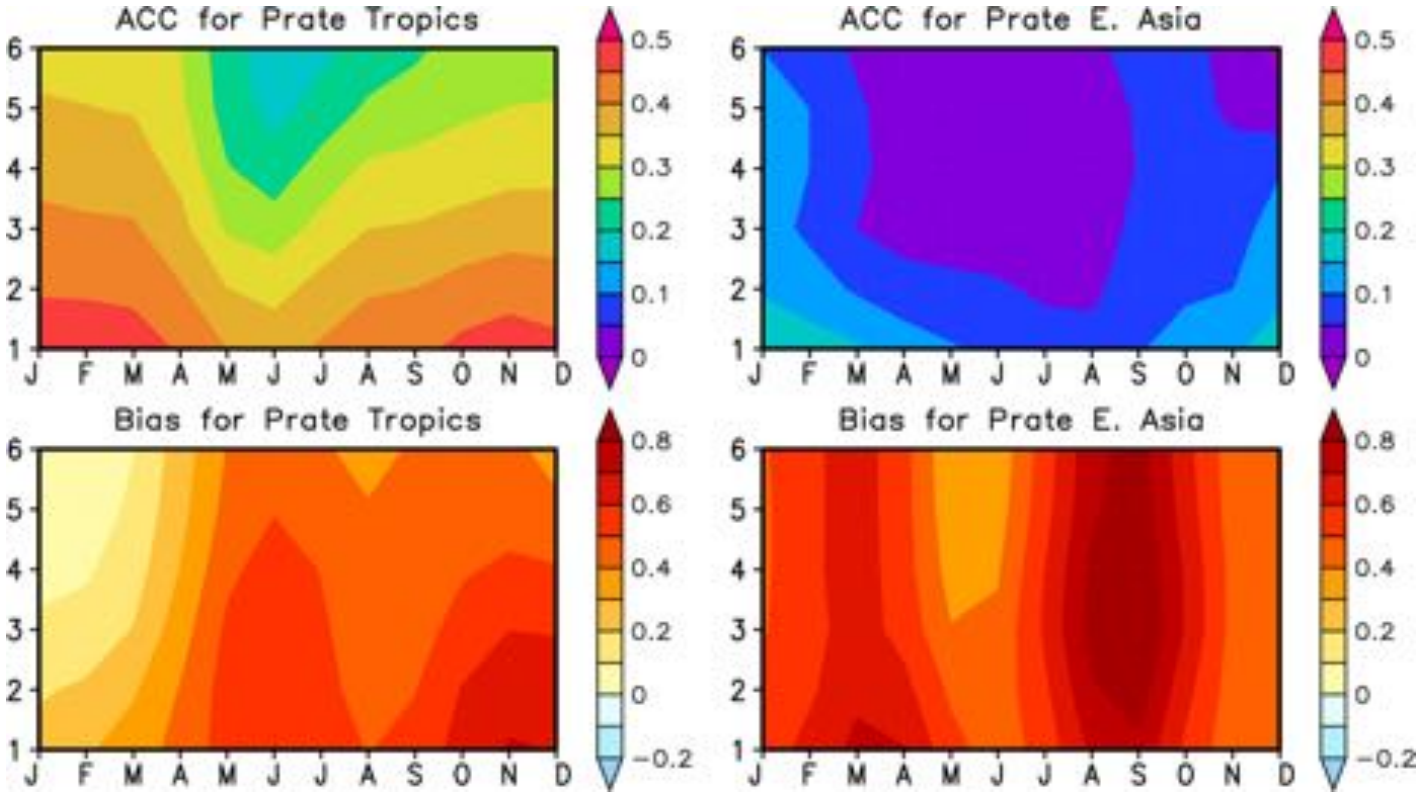
Thanks for your Attention!

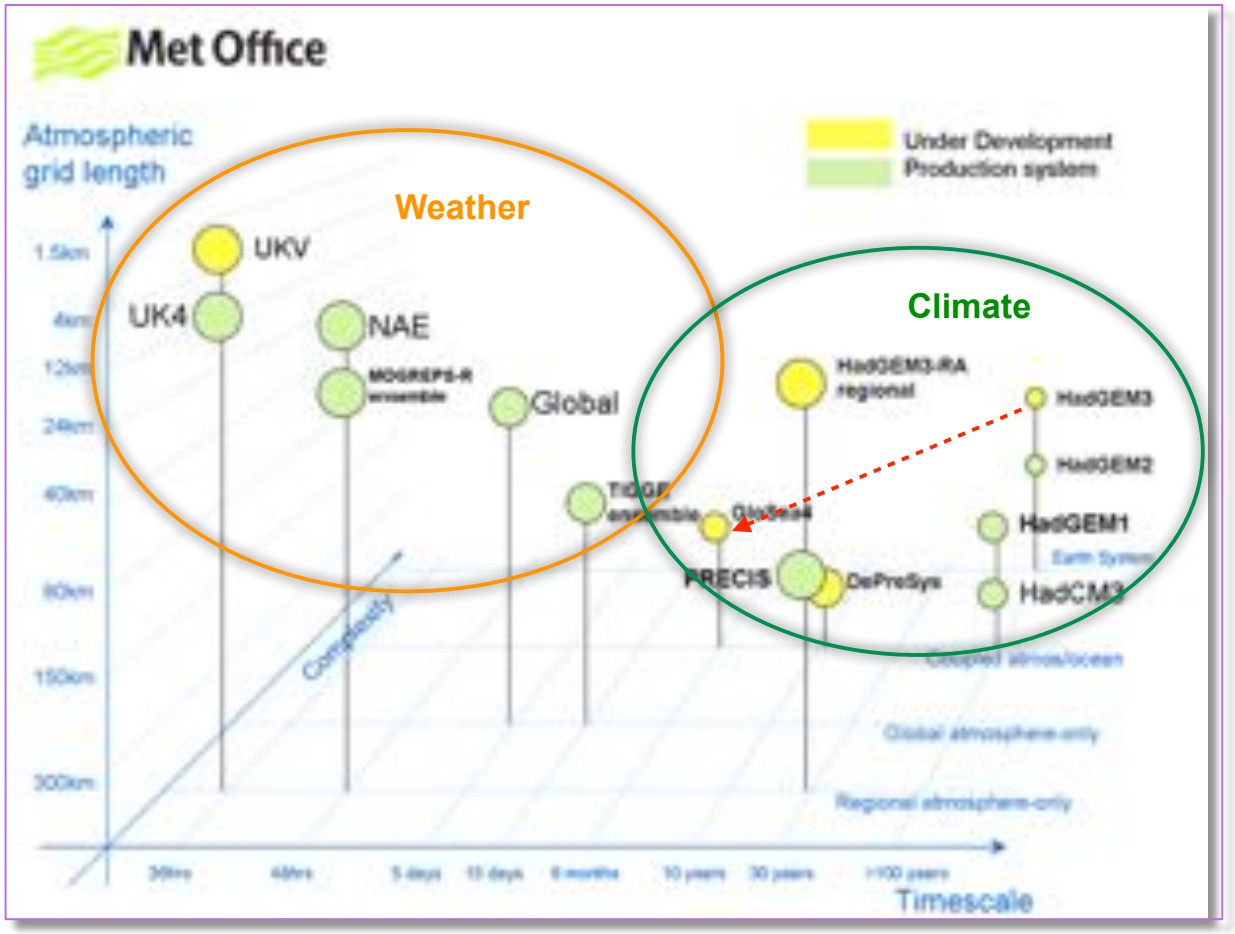
Questions?

Seasonal Dust AOD



Bias and ACC (Precipitation)




Met Office
Atmospheric grid length
Under Development
Production system
Weather
Climate
UKV
UK4
NAE
MOGREPS-R
Global
HadGEM3-RA regional
HadGEM3
HadGEM2
HadGEM1
PRECIS
DePreSys
HadCM3
Complexity
Timescale