National Institute of Meteorological Sciences

보다 나은 국립기상과학원

NIMS/KMA Seasonal Forecasting System & Predictability

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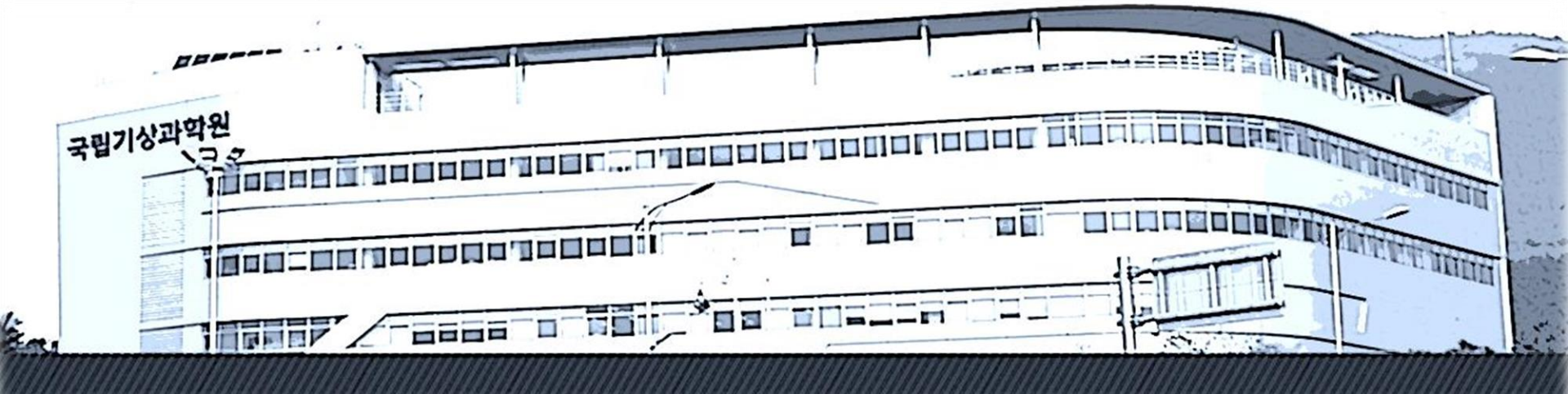
National Institute of Meteorological Sciences (NIMS)



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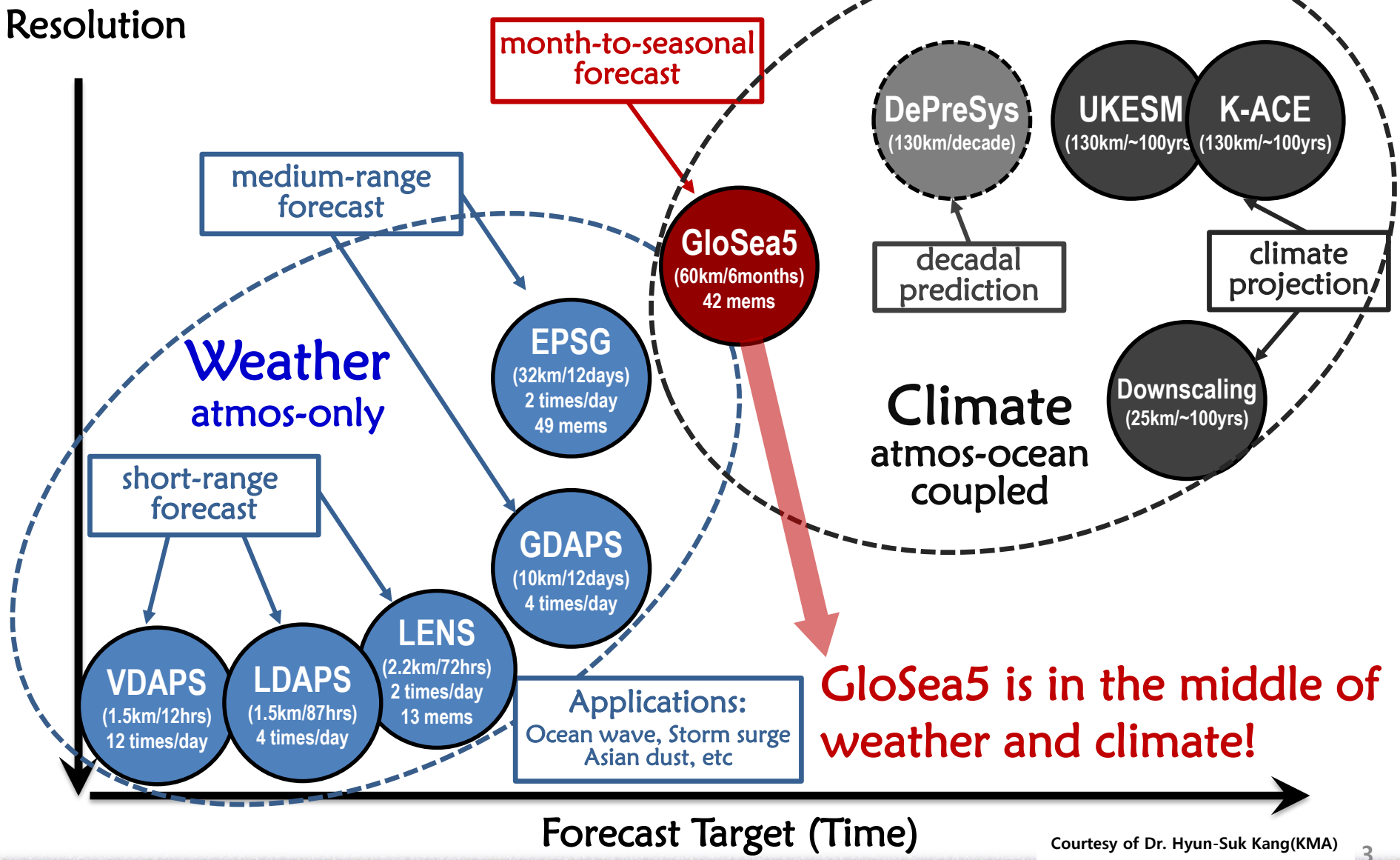
Operational Prediction Systems at KMA



Courtesy of Dr. Hyun-Suk Kang(KMA)

History

2010 June

Joint Seasonal Forecasting System Arrangement with UKMO

2013

GloSea4 op.

2014

GloSea5-GA3 op.
- Core : New Dynamic

2015

2016

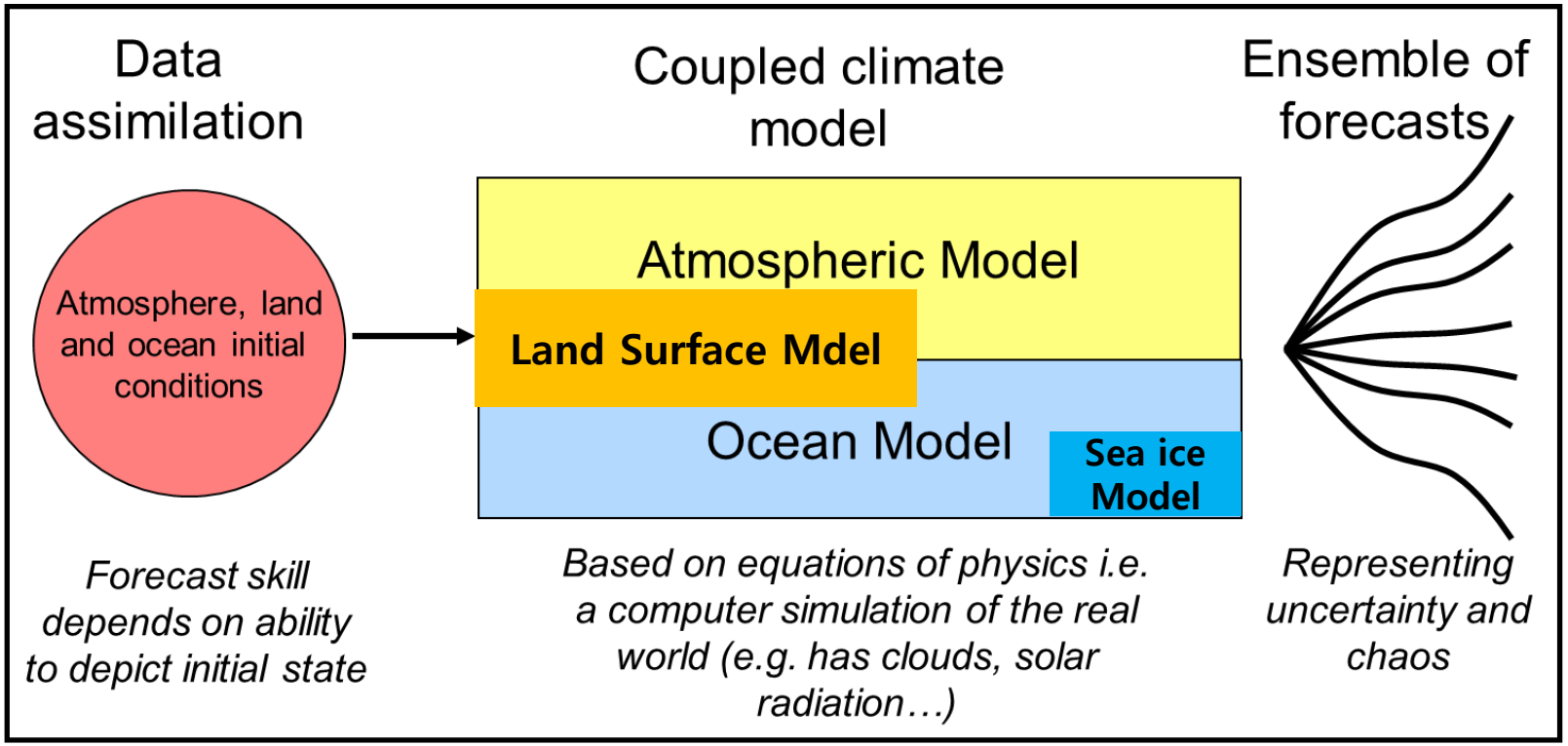
GloSea5-GC2 op.
- Core : ENDGame

2017

2018 ~

GloSea5-GC2 upgrade
- modified soil moisture content & TRIP
- applying for ocean/sea-ice Init. of KMA

Coupled Ensemble Forecast System

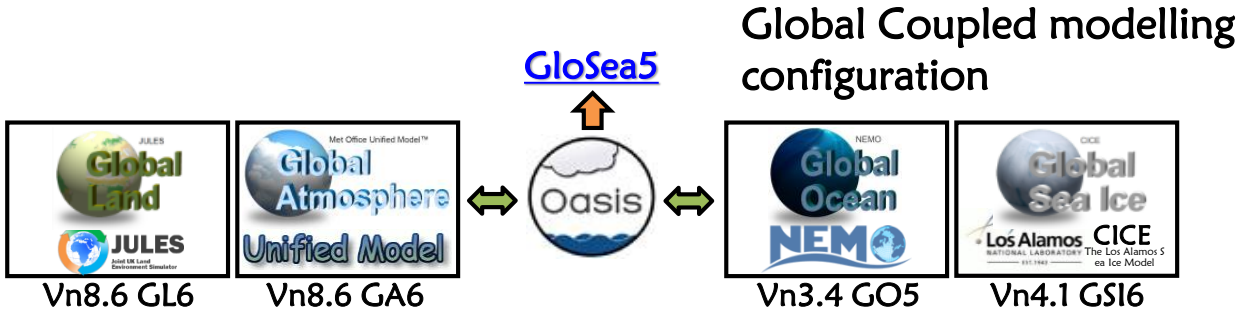


http://poama.bom.gov.au/info/introduction.html

GloSea5-GC2

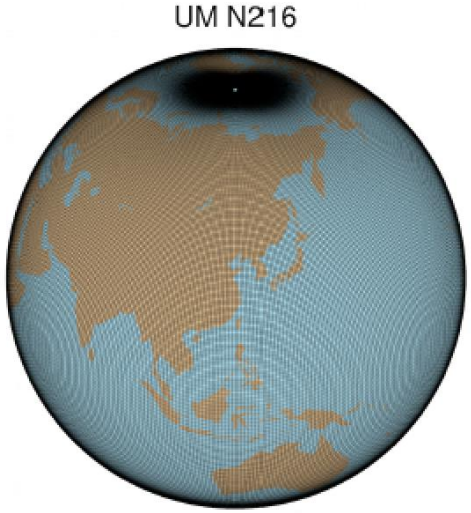
The 5th version of the UK Met Office ensemble prediction system for monthly to seasonal forecasting based on the latest version of the HadGEM3. **It consists of**

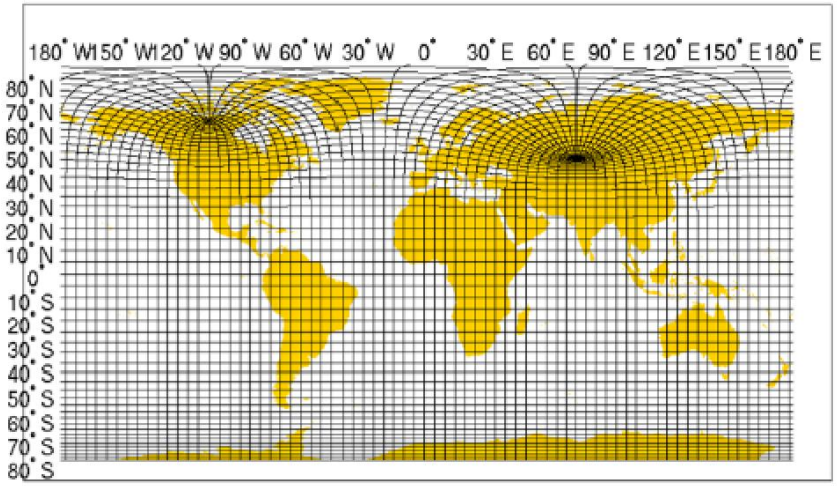
- Atmosphere: UM (Met Office Unified Model)
- Land: JULES (Joint UK Land Environment Simulator)
- Ocean: NEMO (Nucleus for European Modeling of the Ocean)
- Sea-ice: CICE (Los Alamos National Lab.)
- Coupler: OASIS (CERFACS)



Resolution

- Atmosphere: N216L85
  - 0.833*0.555 degrees based on the median latitude in the horizontal
  - 85 levels up to 85 km (50 levels are below 18km) in height, including stratospheric
- Ocean and Sea-ice: ORCA025L75
  - ORCA tri-polar grid with ¼ degrees in the horizontal, and 75 levels (1 meter nearest level to surface) in the vertical





Operation

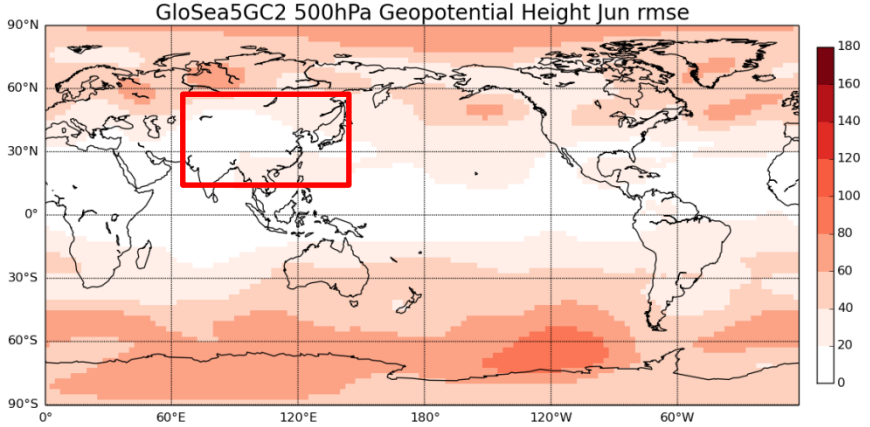
- Hindcast : 255day run, 4mem/day (time-ladged+SKEB2), 20yrs
- Forecast : 240day run, 2mem/day (SKEB2)
  75day run, 2mem/day (SKEB2)

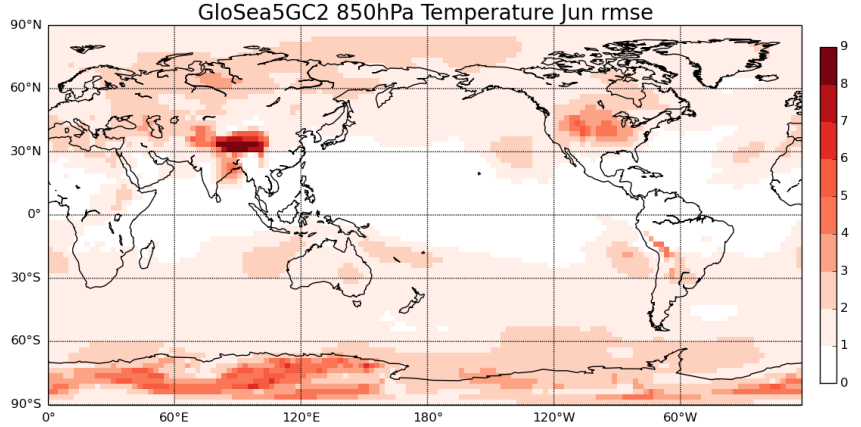
		Hindcast	Forecast
Term		1991 ~ 2010 (20yr)	2016 ~
Initial	Time	00UTC on 1st , 9th , 17th , 25th	00UTC everyday
Ensemble	Mem	Forecast time : 255days 20years X 3mem = 60 Mem (3 Members a year using SKEB2)	Monthly forecast (75days) : 2 Mem Seasonal forecast (240days) : 2 Mem (4 Members using SKEB2)

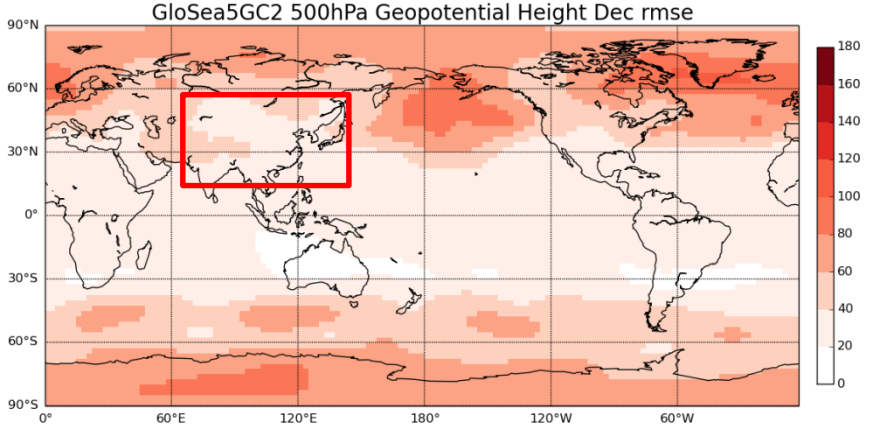
Results of Hindcast Analysis

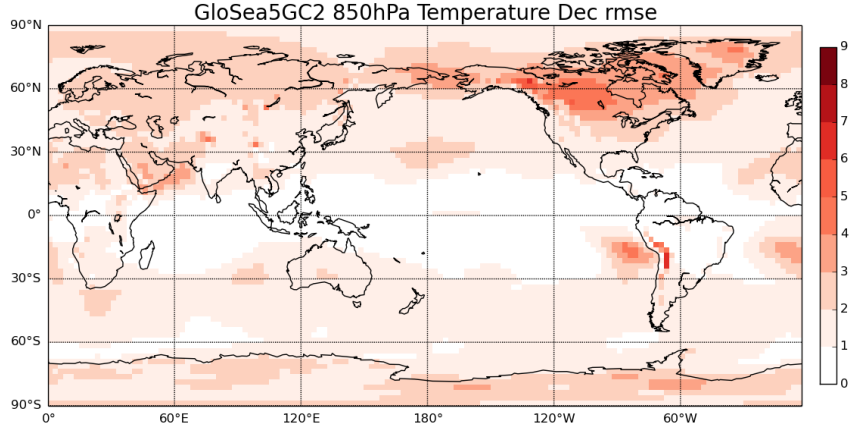
500hPa GPH. & 850hPa Temp. RMSE

Hindcast : +1 month forecast average

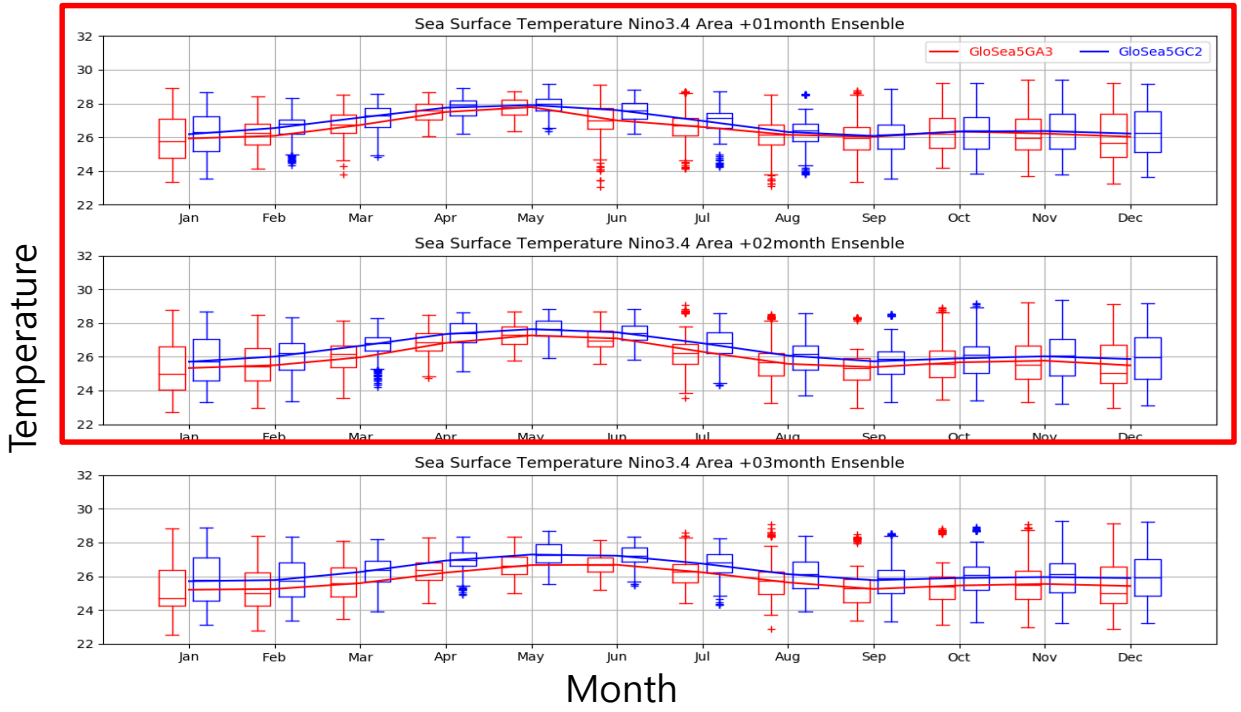








SST Ensemble : Nino3.4 area



ratio of extreme value :
+1 month > +2 month

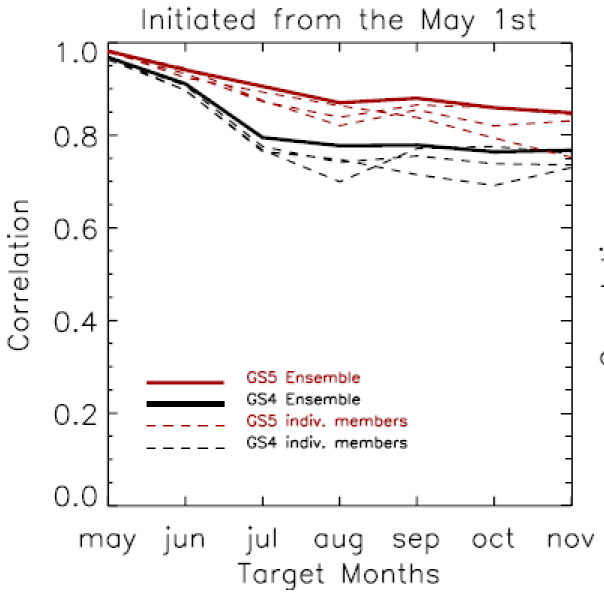
- Signal to Noise ratio(SNR)

	+1month	+2month	+3month	+4month	+5month	+6month
GA3	0.34(1.28)	0.43(1.41)	0.27(1.38)	0.12(1.28)	0.07(1.19)	0.08(1.07)
GC2	0.41(1.04)	0.46(1.26)	0.32(1.27)	0.17(1.20)	0.09(1.14)	0.08(1.08)

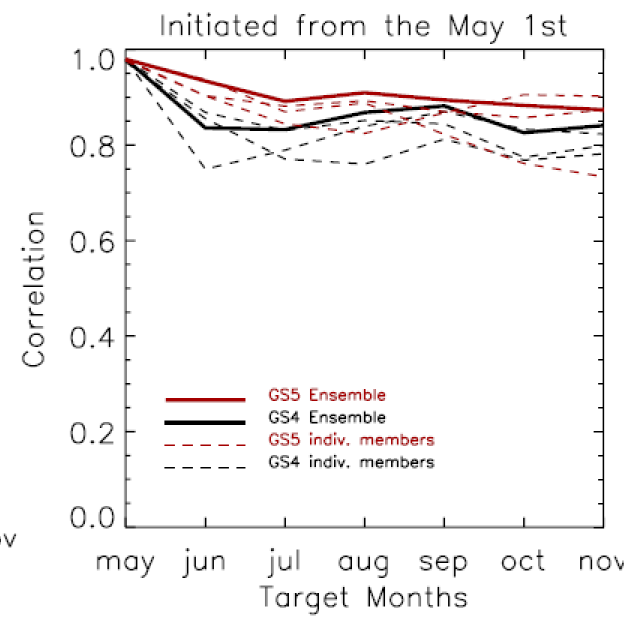
- Because of the difference in the number of members
- GA3 is 42 member/week, GC2 is 60 member/week

SST Correlation

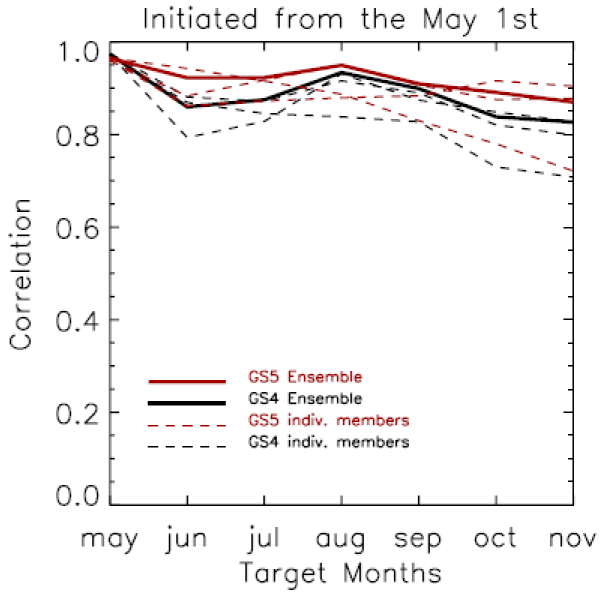
NINO4



NINO3.4



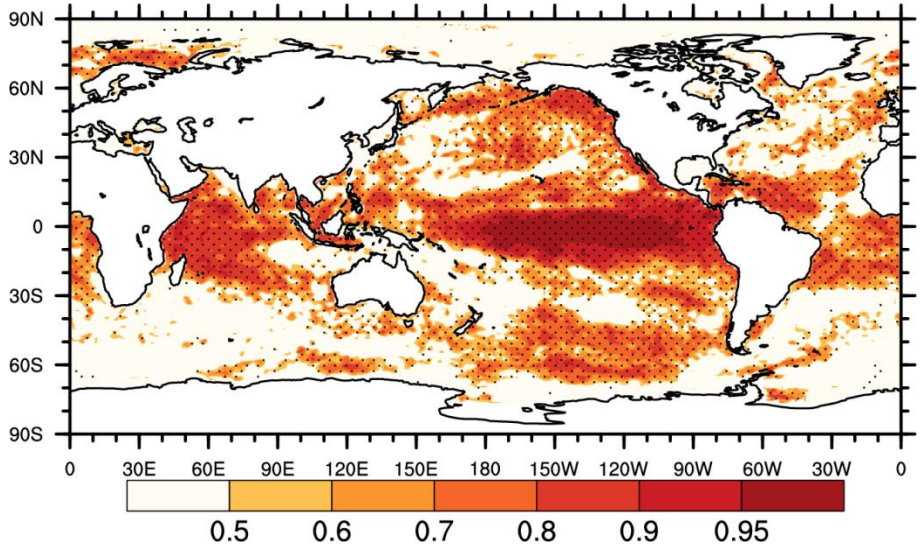
NINO3



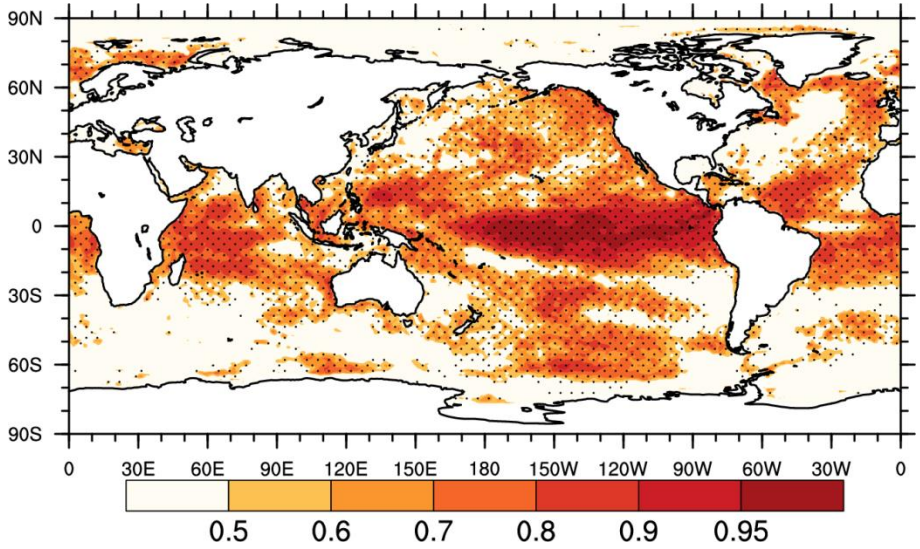
- Overall, it has a high correlation about 0.8~0.9
- ENSO Predictability is over 6 months

SST ACC in summer

❖ GA3(1996-2009)



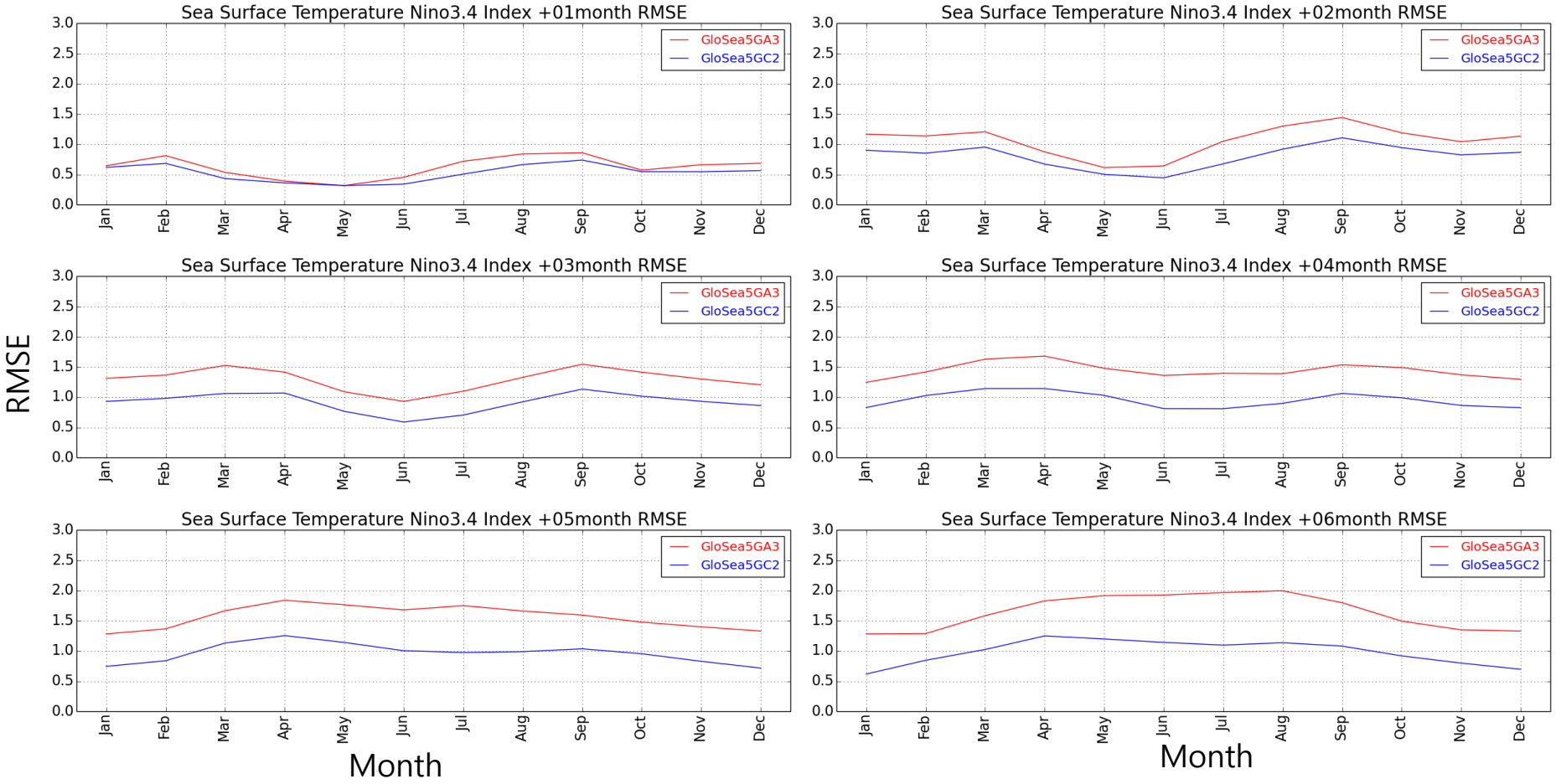
❖ GC2(1991-2010)



ACC	GA3	GC2
Global	0.444	0.453
60S-60N	0.539	0.544
20S-20N	0.707	0.714
20S-20N, 90-300E	0.704	0.719

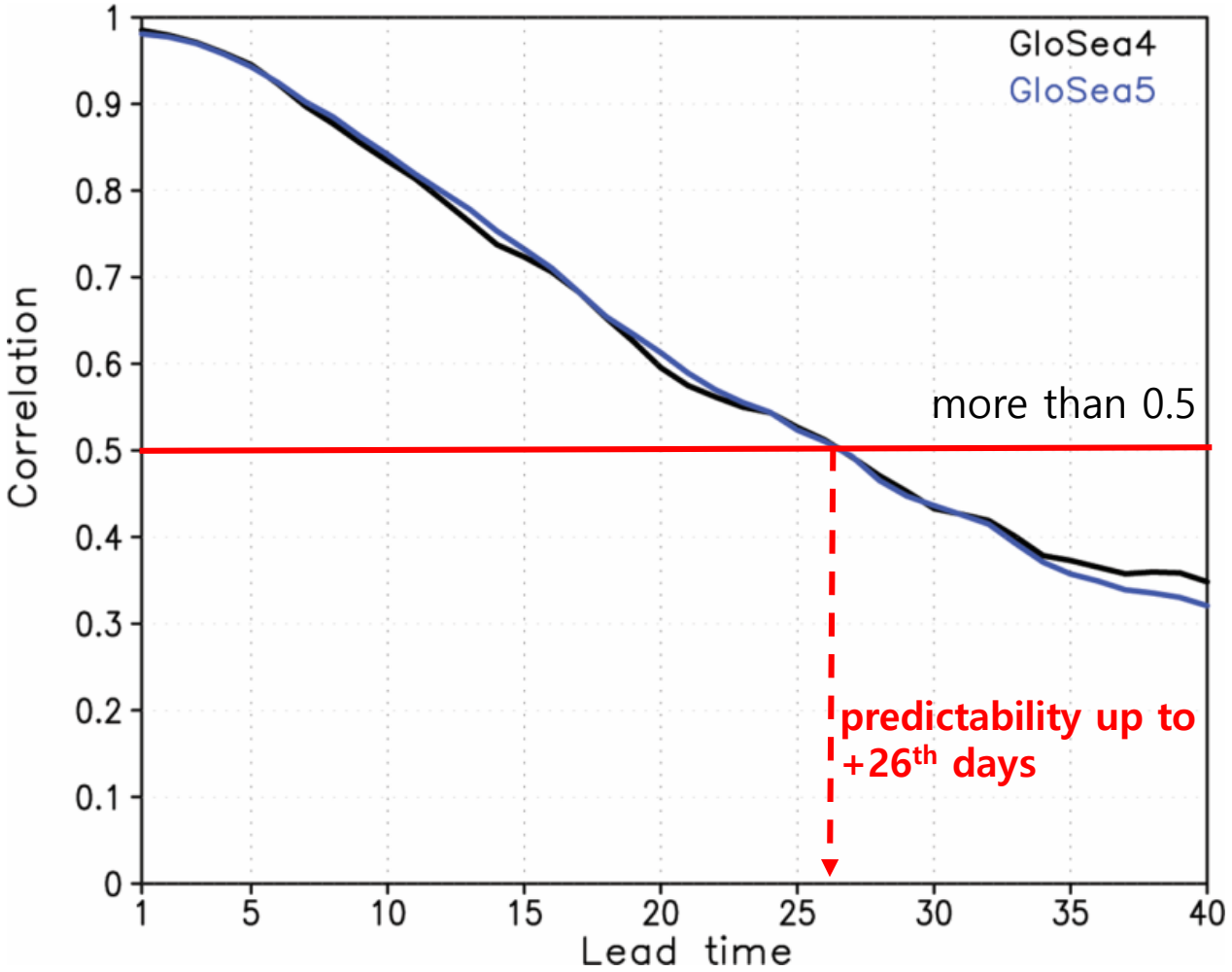
- Equatorial Pacific is highly correlated
- Improved in Eastern & Mid-Pacific

SST RMSE : Nino3.4 area



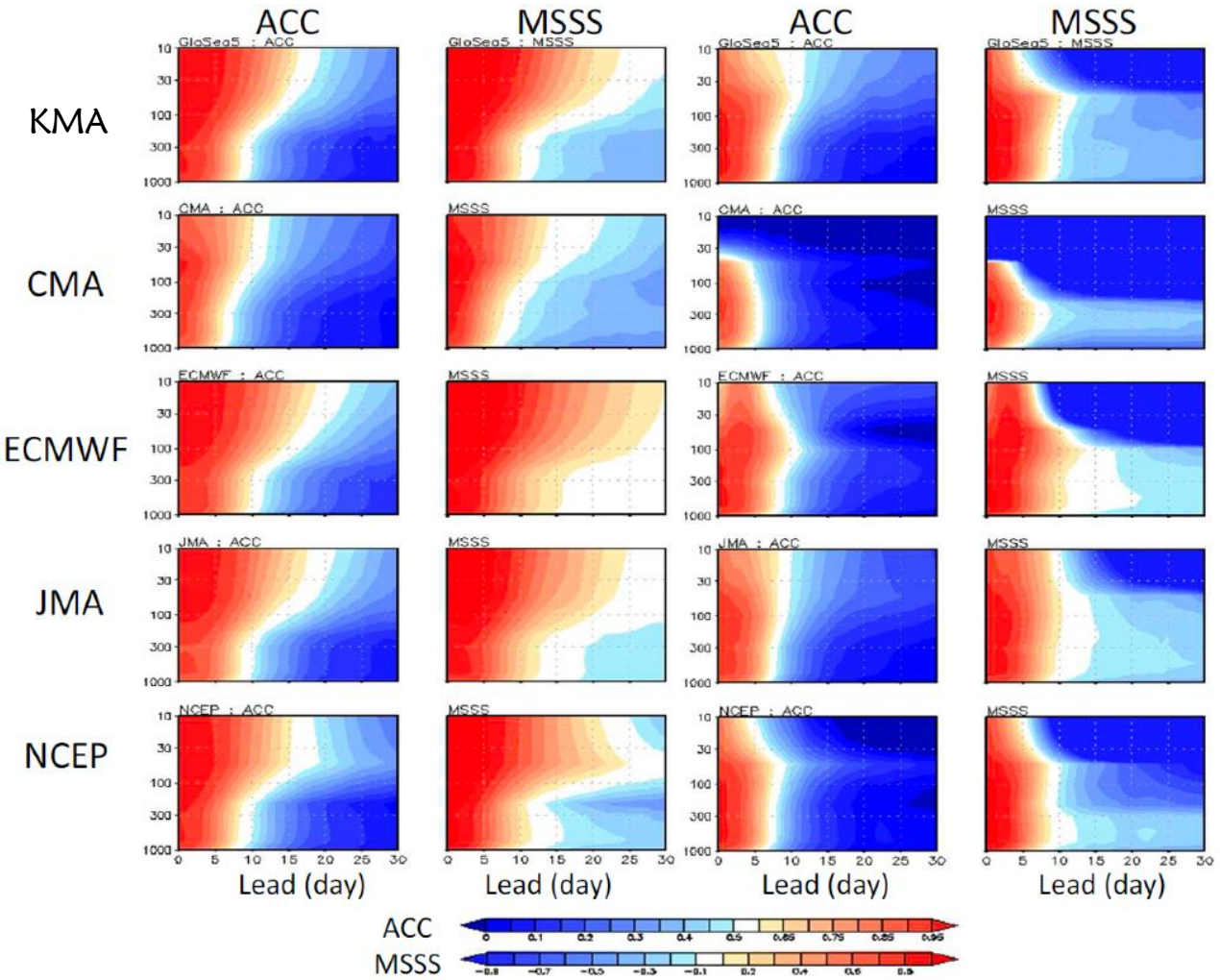
- Even with the extended forecast period, errors are less than 1~1.5º, indicating that errors do not increase significantly

MJO Predictability



Stratospheric Predictability

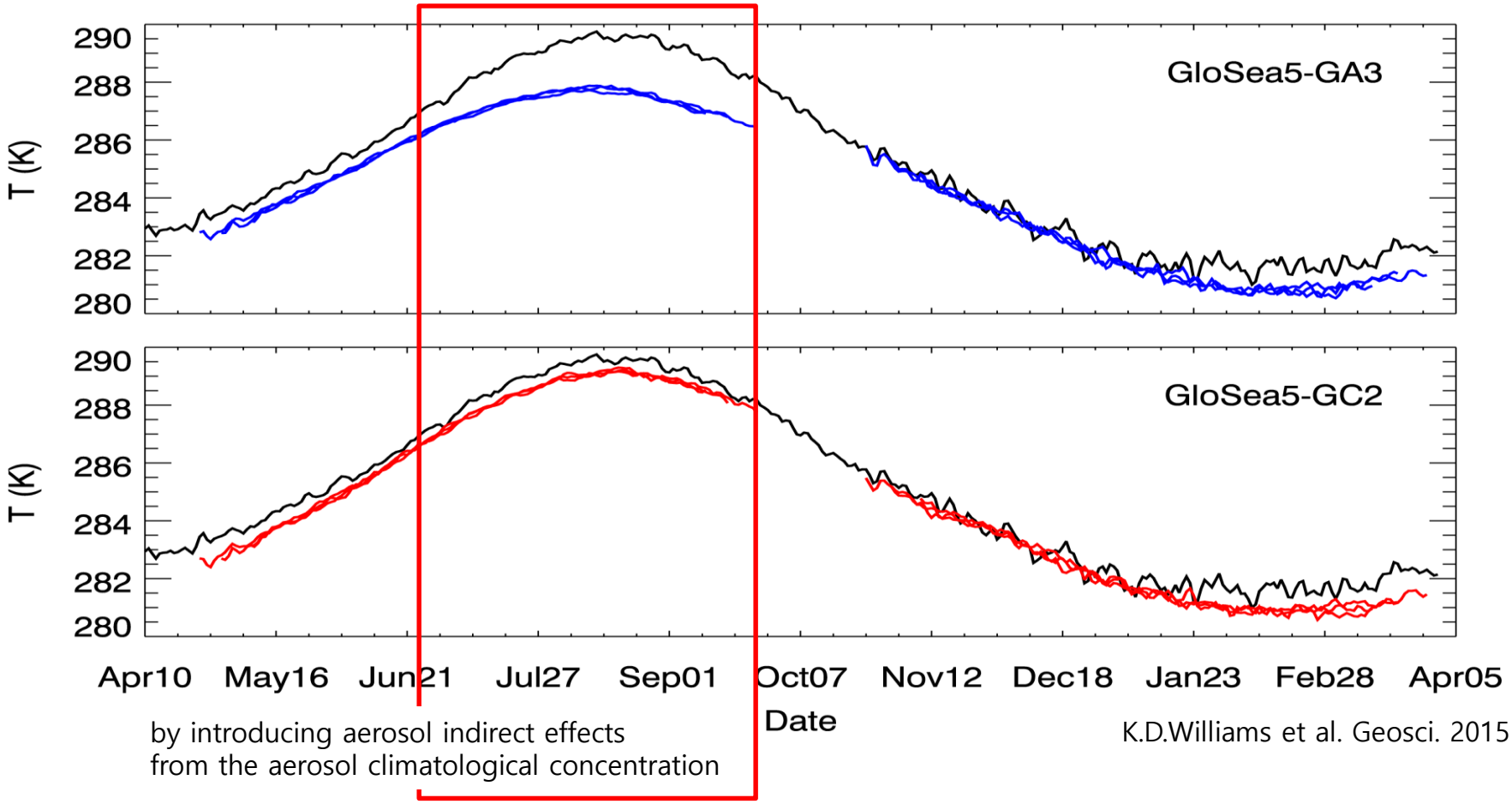
Northern Hemisphere



Predictability
- Troposphere : 10 days
- Stratosphere : 5 ~ 15 days

1.5m Temperature

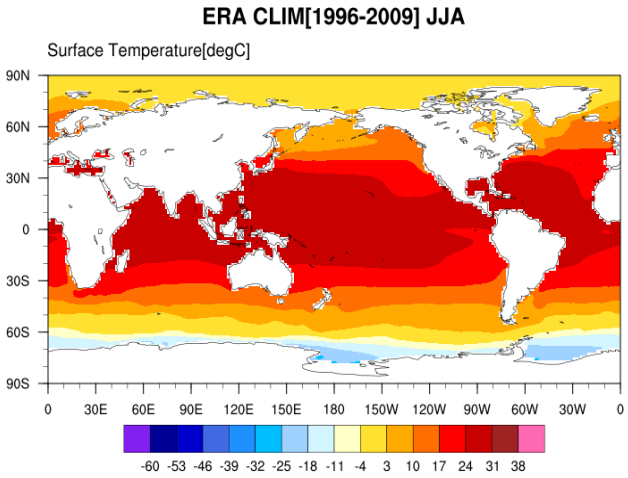
Figure 4. Mean 1.5m temperature over the North Atlantic (10–50W, 40–60 N) for the seasonal hindcasts (colored). ERA-I is shown in black.

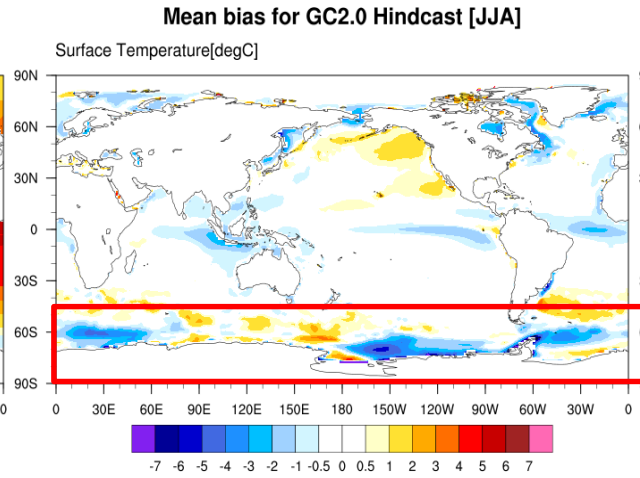


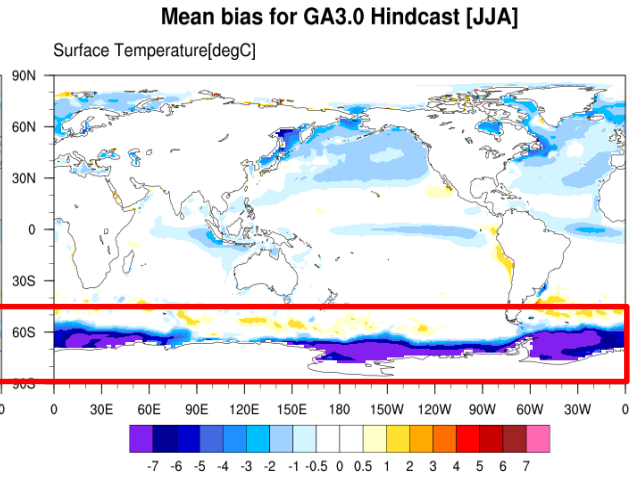
by introducing aerosol indirect effects
from the aerosol climatological concentration

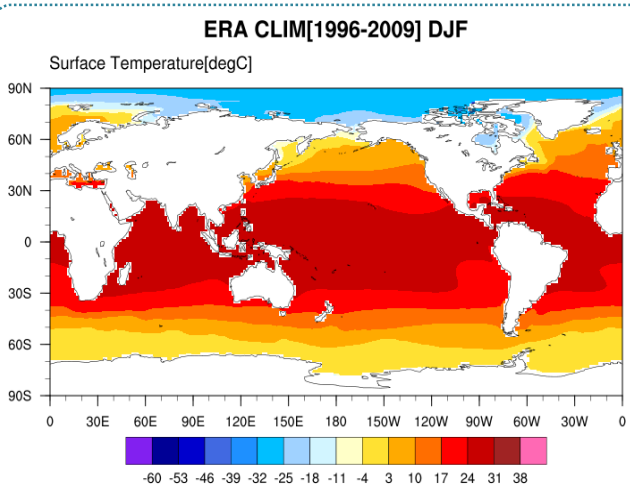
K.D.Williams et al. Geosci. 2015

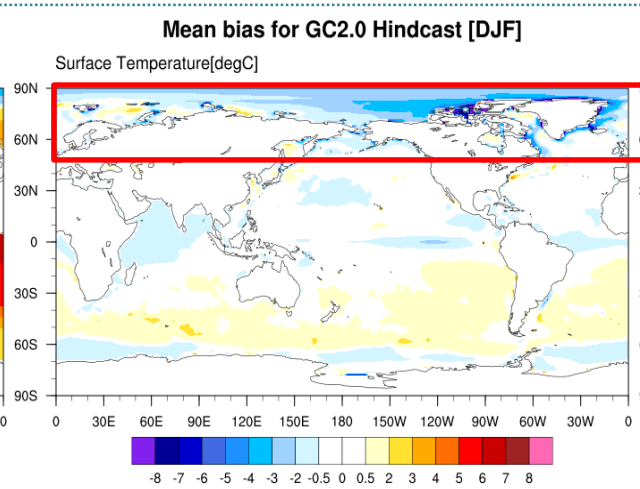
Surface Temperature

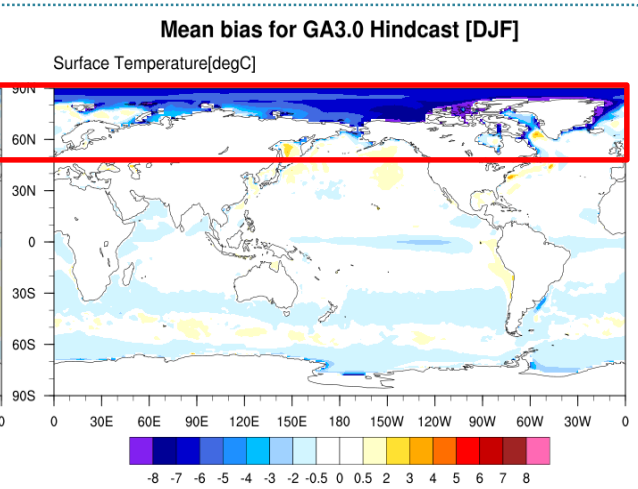








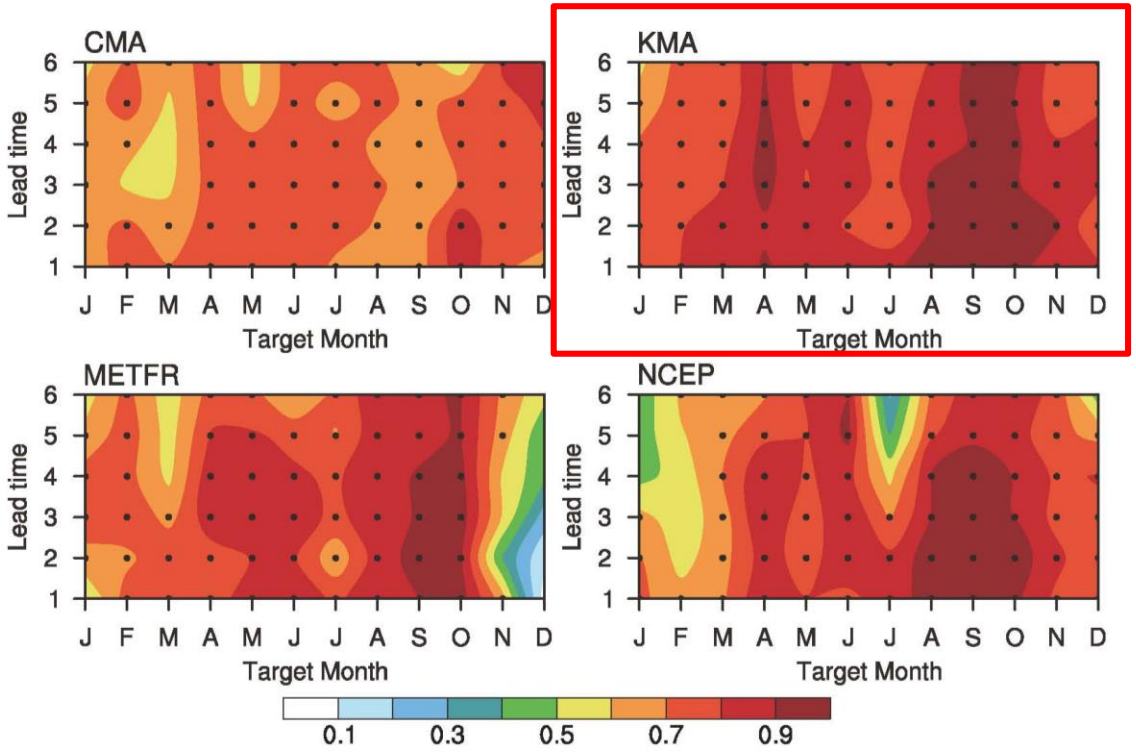


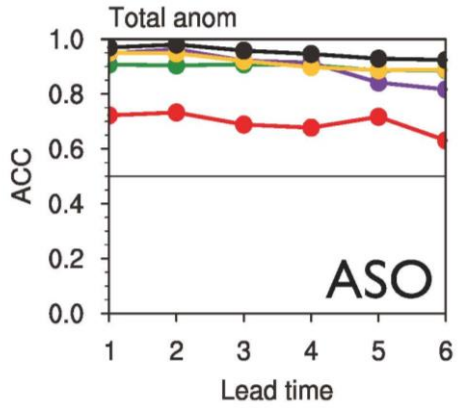


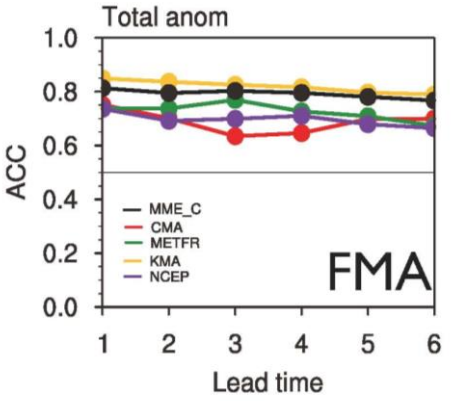
- For GC2, the sea-ice parameter in the model is improved

Arctic Sea-ice Extent

Anomaly Correlation





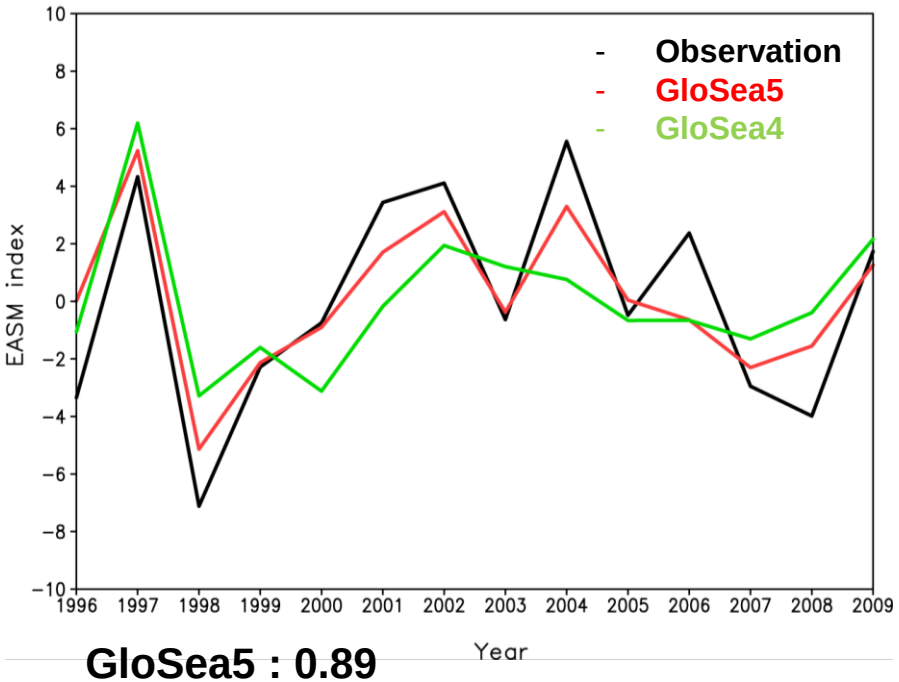


- GloSea5 has a high ACC for the most of the time
- It had a high correlation between August and October
- But it tends to have a high correlation with sea ice extent only

East Asia Summer Monsoon Index

Long-term variability

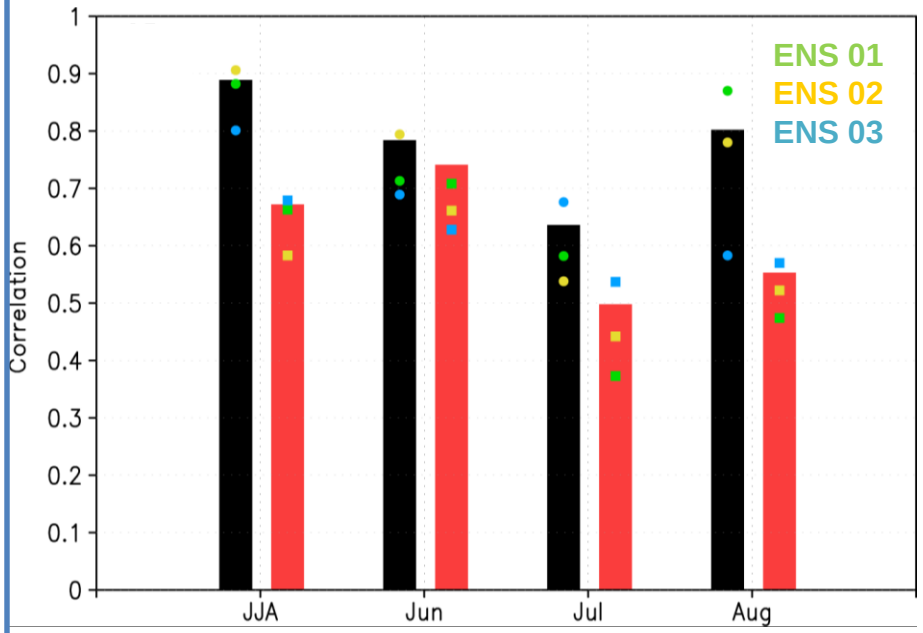
GloSea5 JJA mean



GloSea5 : 0.89

Predictability Improvement

EASMI Prediction skill

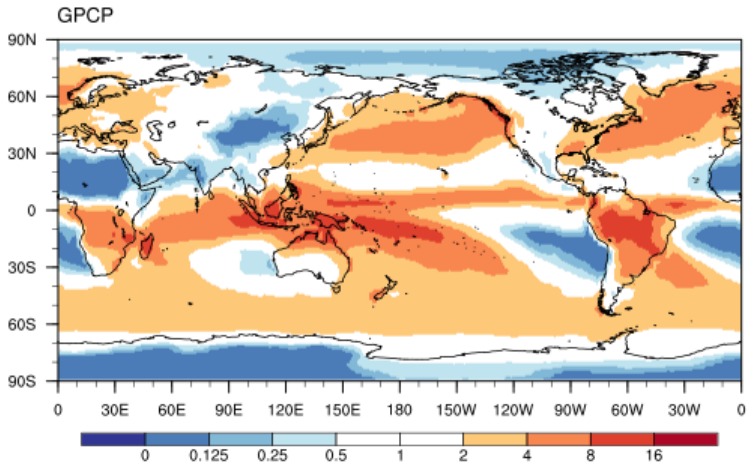


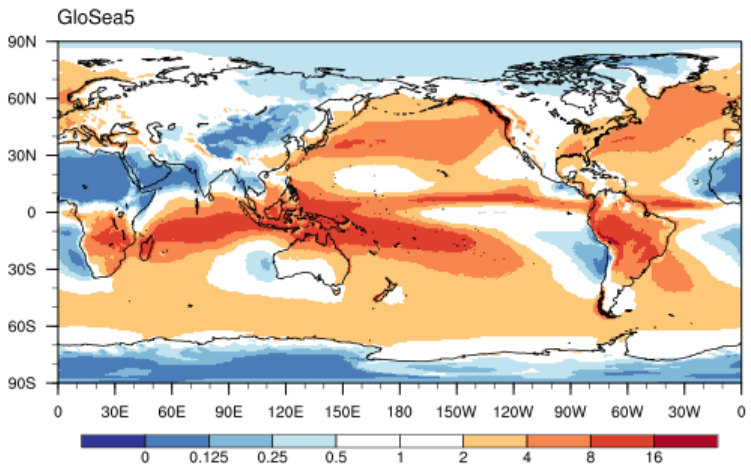
GloSea5 **GloSea4**

- GloSea5 simulates the variability of observations.

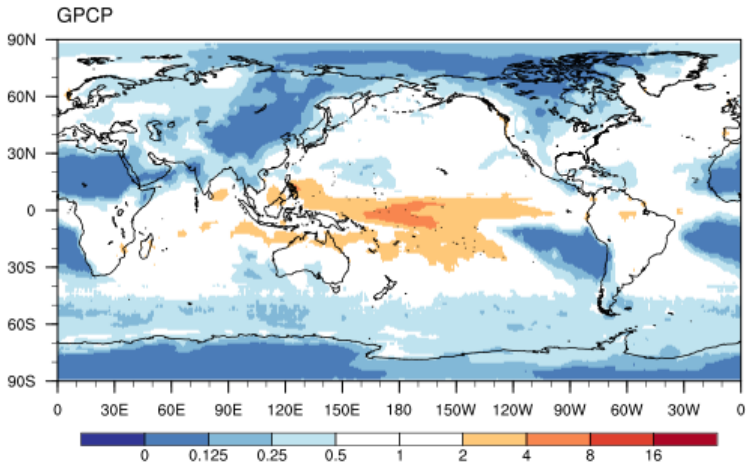
Seasonal Rainfall

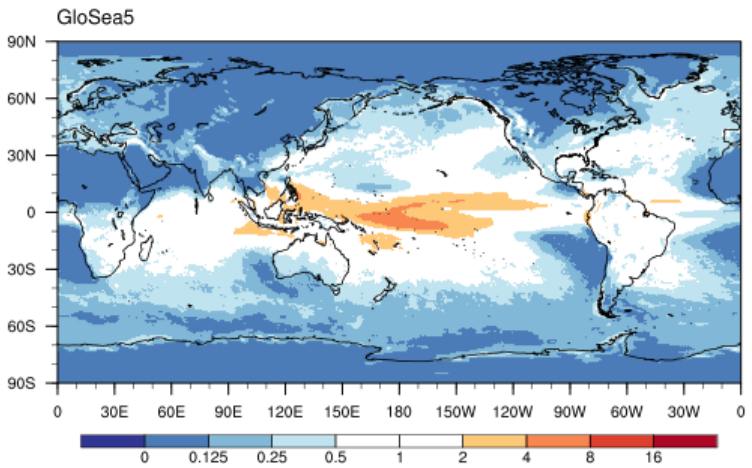
Seasonal Mean Climatological Rainfall



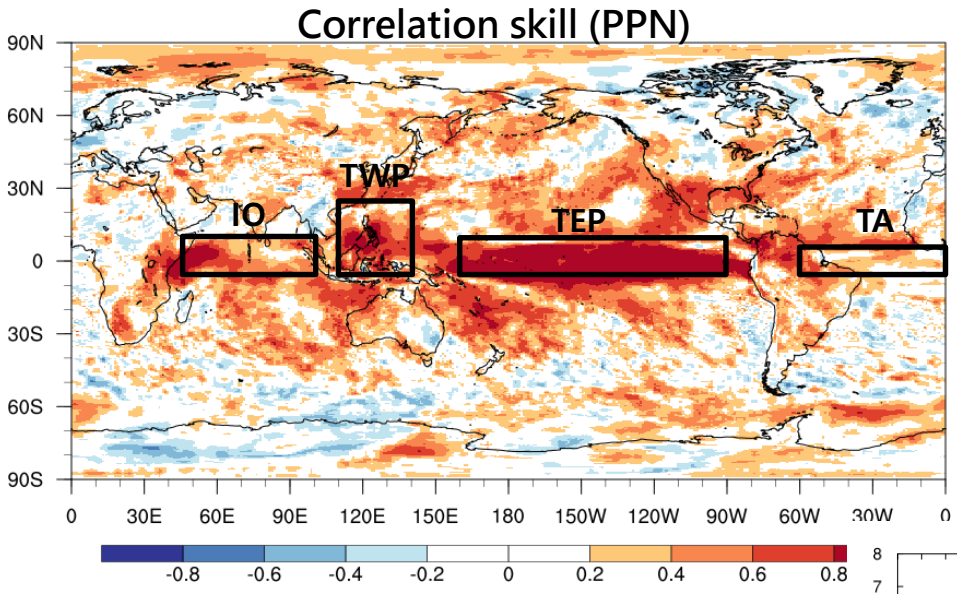


Inter-annual variability



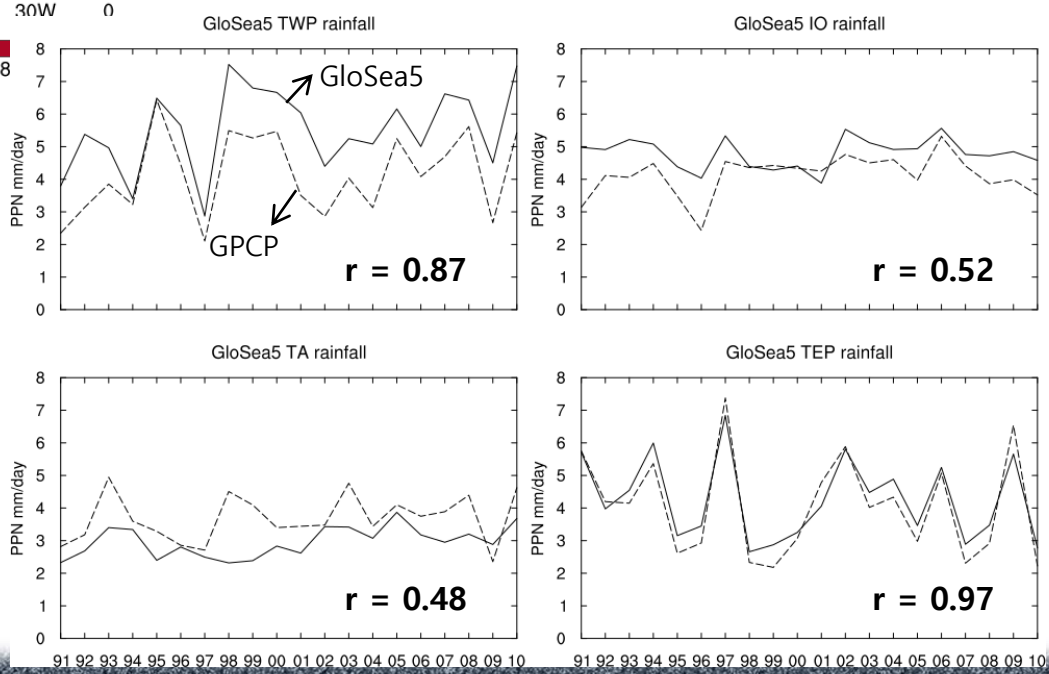


Analysis of Tropical rainfall



- GPCP v2.3 Combined Precipitation Data
- 1991/1992~2010/2011 DJF
- Initialised from lagged start dates (25 October, 1 and 9 November)

- TWP (Tropical West Pacific)
- IO (Tropical Indian Ocean)
- TA (Tropical Atlantic)
- TEP (Tropical East Pacific)

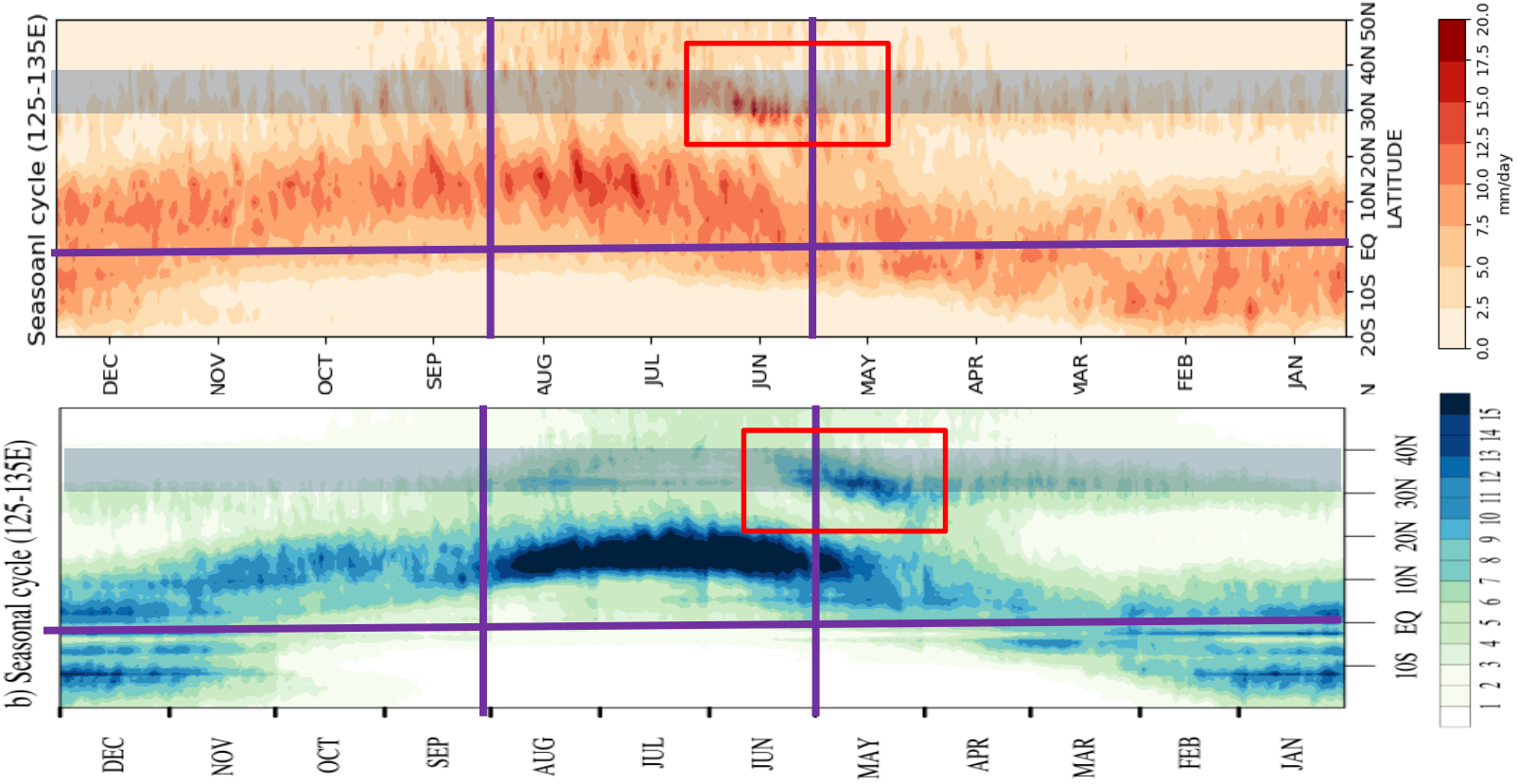


Monsoon

Climatological daily precipitation variability

Reanalysis

GloSea5

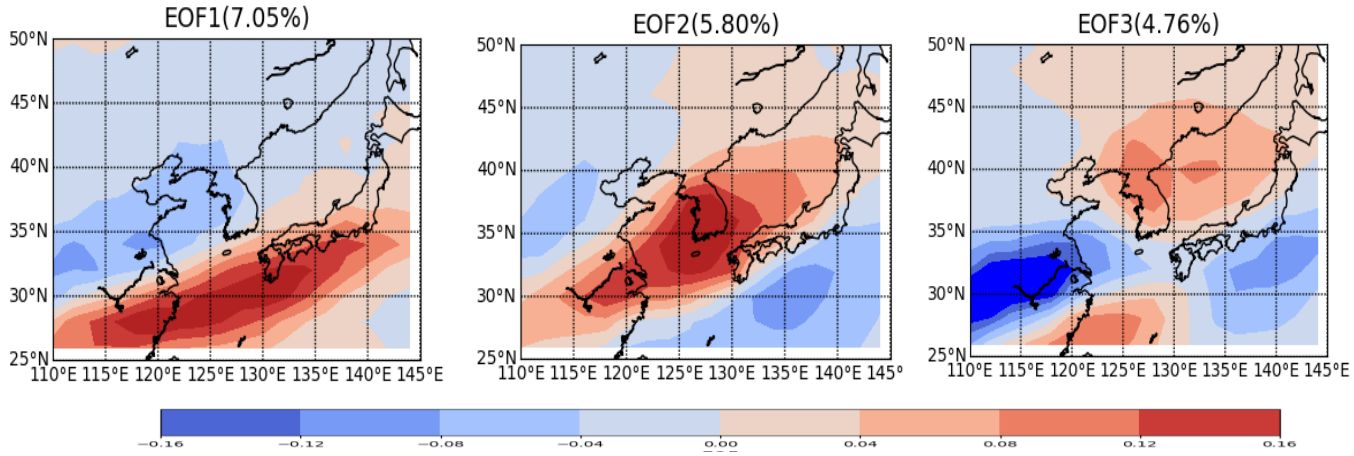


- It is well simulate in low-latitude precipitation
- In Korea, it simulated the precipitation, although there are some time differences.

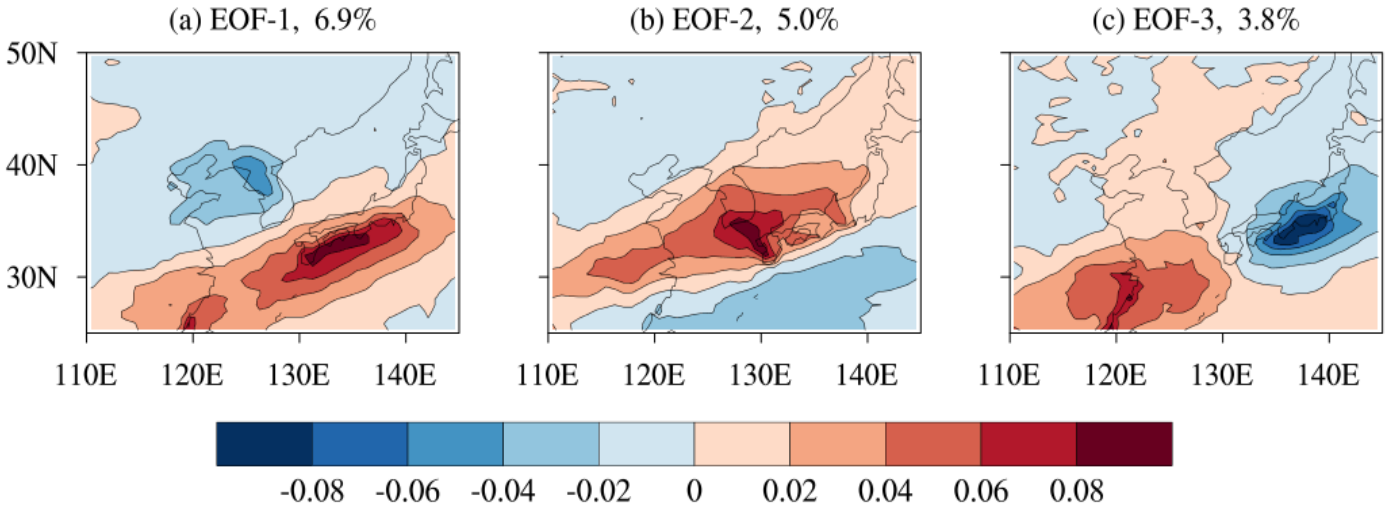
EOF analysis of Precipitation

EOFs of daily precipitation anomalies for 1991-2010 during JJA

20*92day



Reanalysis



Glosea5

- Upgrading to the GC2 version improved the predictability of GloSea5
- ENSO predictability lasts for more than 6 months
- MJO predictability lasts about 4 weeks
- Improved predictability by Sea-ice parameter improvement & applying Aerosol indirect effect
- Predictability in Northern Hemisphere
  - Troposphere : 10 days
  - Stratosphere : 5(summer) ~ 15(winter) days

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Thank you