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Assessment of subseasonal prediction skill of the KMA GloSea5 hindcast experiment

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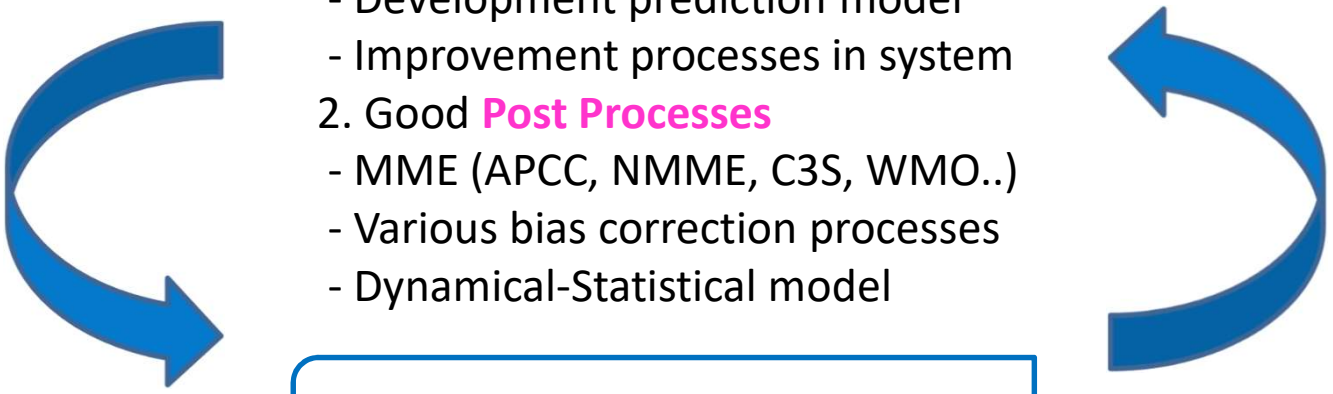
Background

Good (Sub)Seasonal Prediction Skill ☺

1. Good **Individual Model**
 - Development prediction model
 - Improvement processes in system
2. Good **Post Processes**
 - MME (APCC, NMME, C3S, WMO..)
 - Various bias correction processes
 - Dynamical-Statistical model



Background

KMA Operational (sub)seasonal prediction

GloSea5

- Since 2010,
- GloSea4(2013) → GloSea5-GA3(2014) → GloSea5-GC2(2016)
  → **GloSea5-GC2 Upgraded** (current) → GloSea6??

APEC Climate Center)

- Evaluation/Validation of prediction skills for KMA operational climate model
- Systematic error diagnostics
  ➔ To improve the climate prediction model

Data

Model:

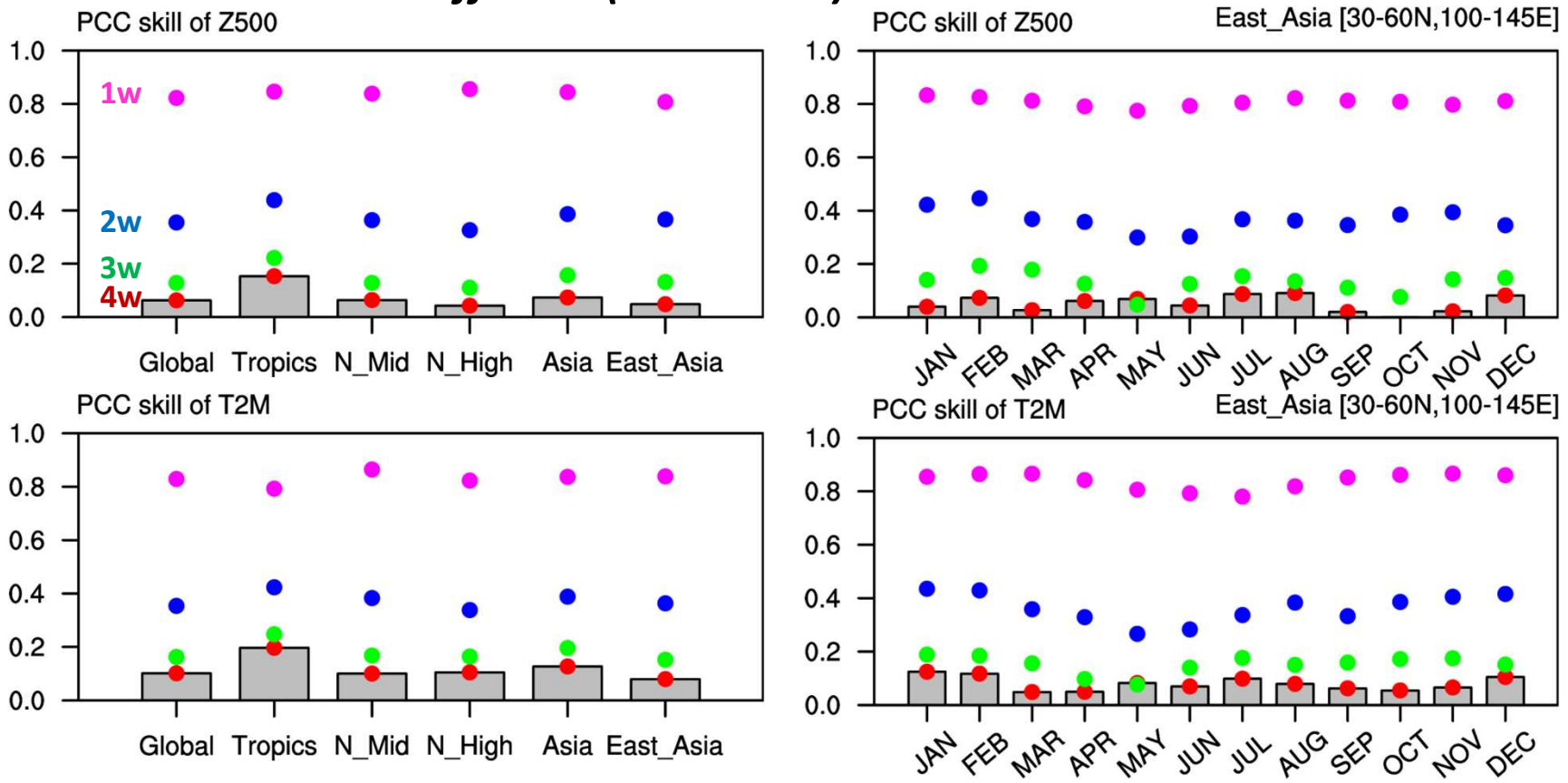
- GloSea5 Hindcast (1991-2010)
- 1, 9, 17, 25 /every month (* 3 ensemble member)

Observation:

- ERA Interim reanalysis data
- GPCP daily precipitation
- ISCCP radiative fluxes, OAFlux heat fluxes
- GODAS ocean reanalysis data

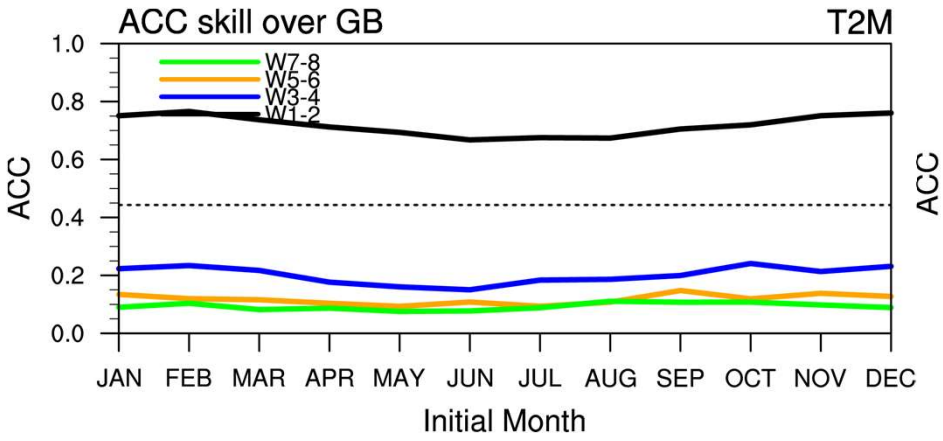
Q. Characteristics of systematic error? : Sub-seasonal prediction skill

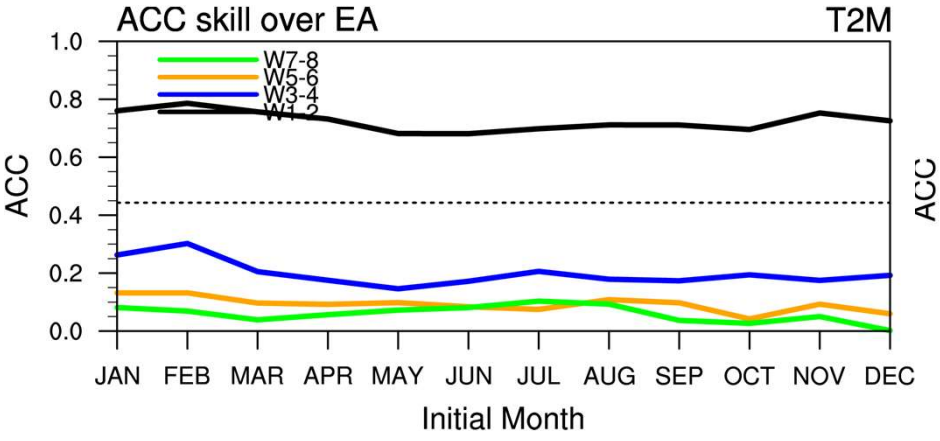
Pattern Correlation Coefficient (1991-2010)



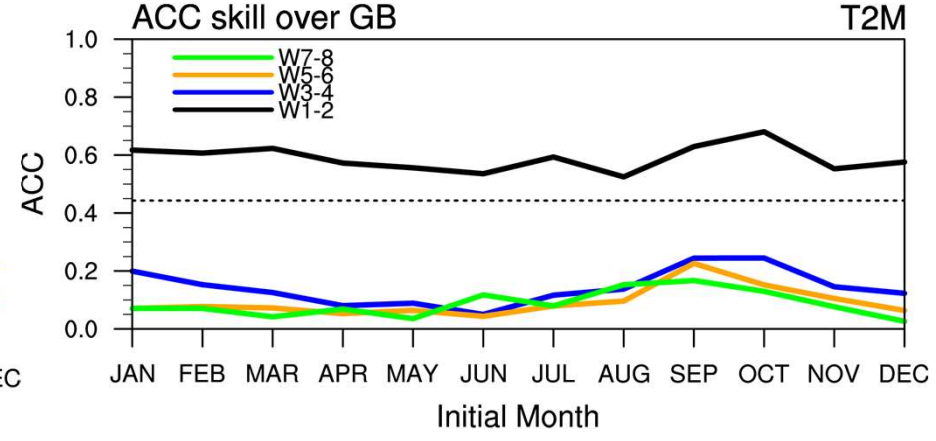
Q. Characteristics of systematic error?
: Sub-seasonal prediction skill

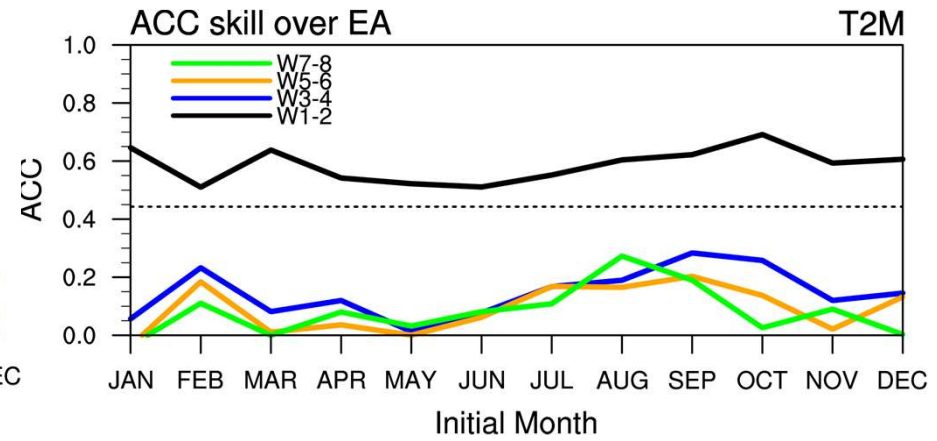
HCST (91-10)





FCST (2018)





Q. Characteristics of systematic error?
: Sub-seasonal prediction skill

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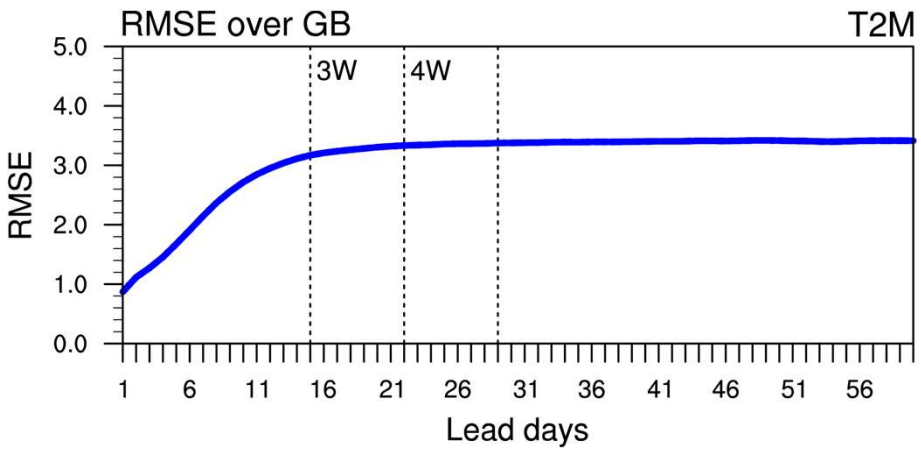

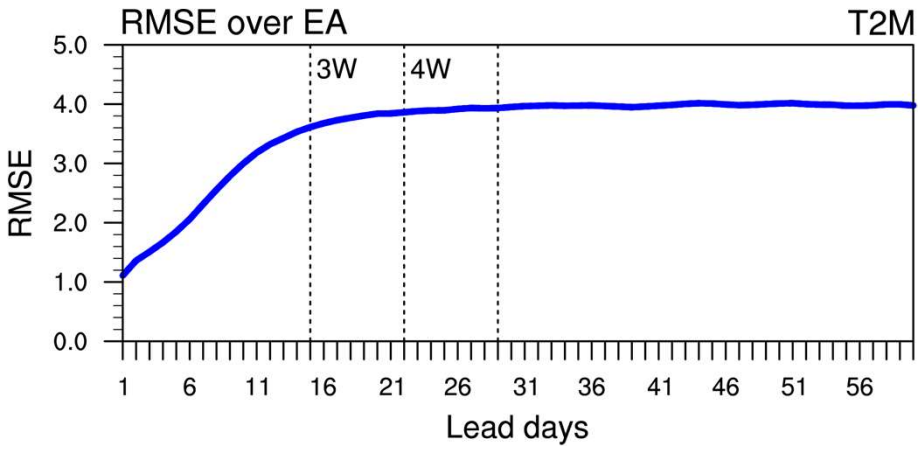

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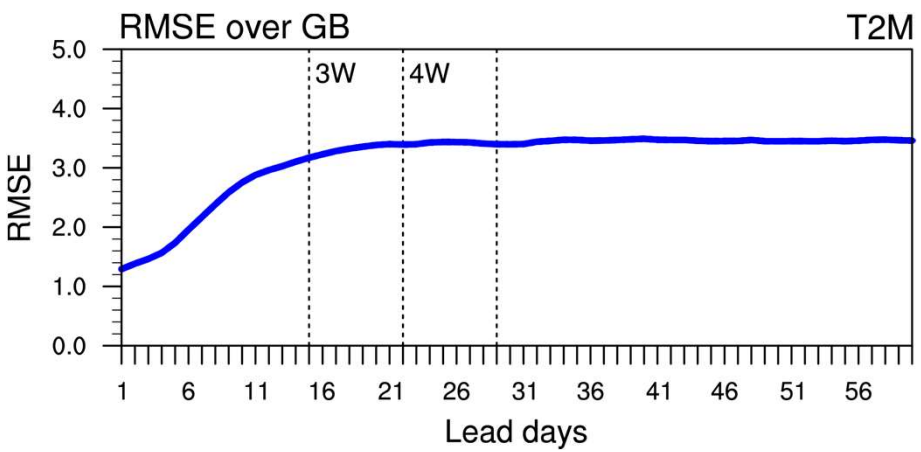
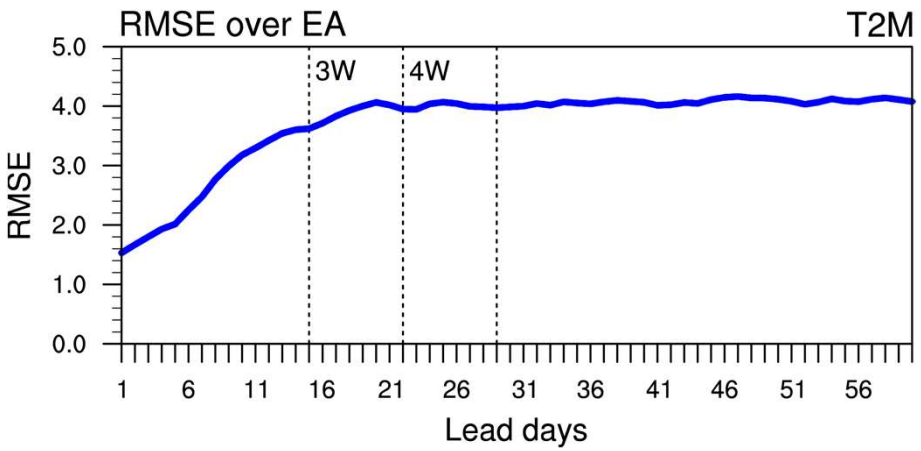
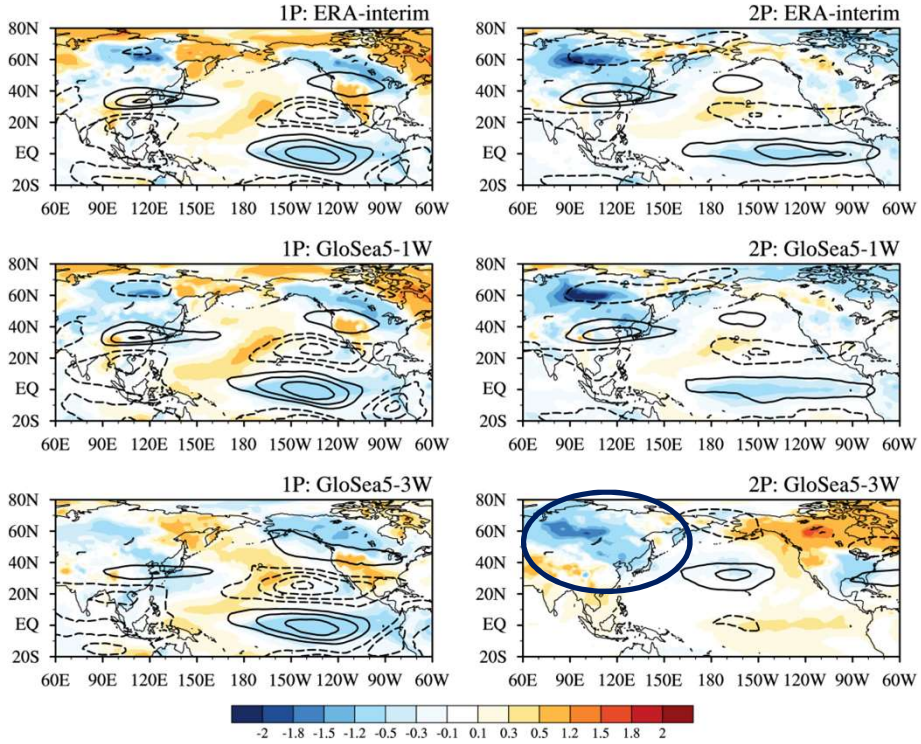




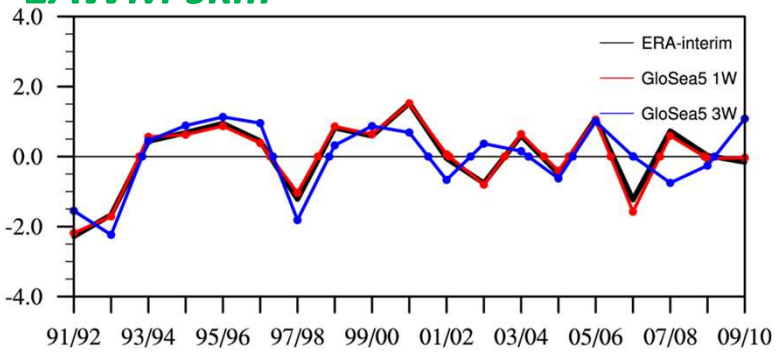
Q. Characteristics of systematic error? : East Asian Winter monsoon

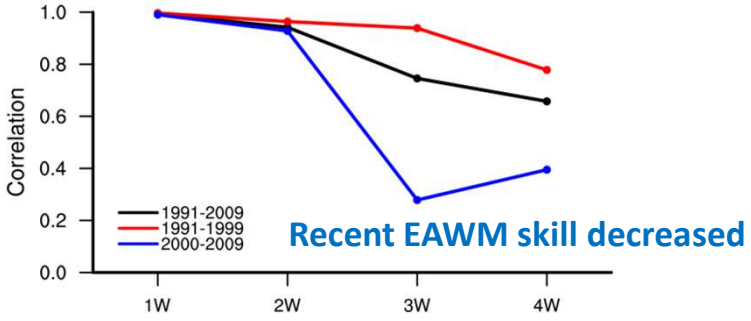
T2M(shaded) & U200(contour) regressed on EAWM index



* **EAWM** *Li and Yang (2010)*
= [2xU200(30-35N,90-160E) –U200(50-60N,70-170E) –U200(5S-10N,90-160E)]/2

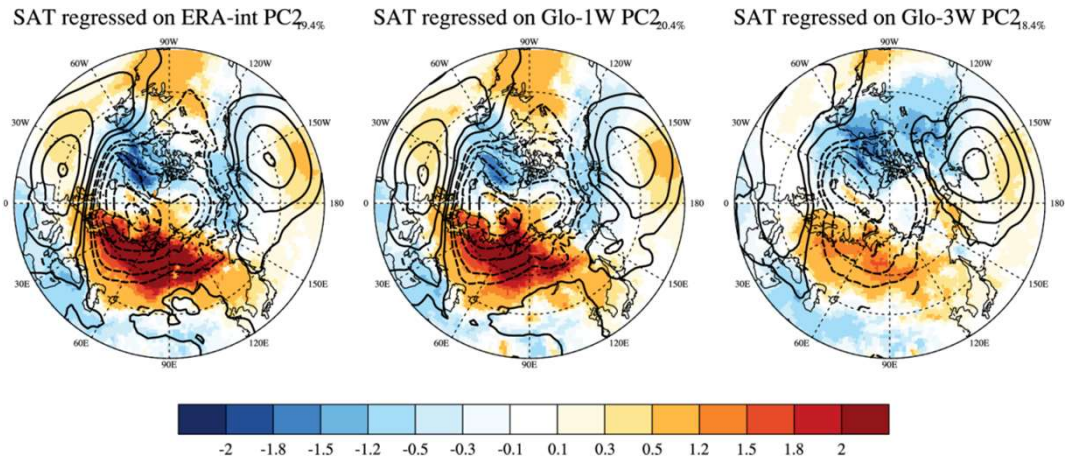
EAWM skill





Recent EAWM skill decreased

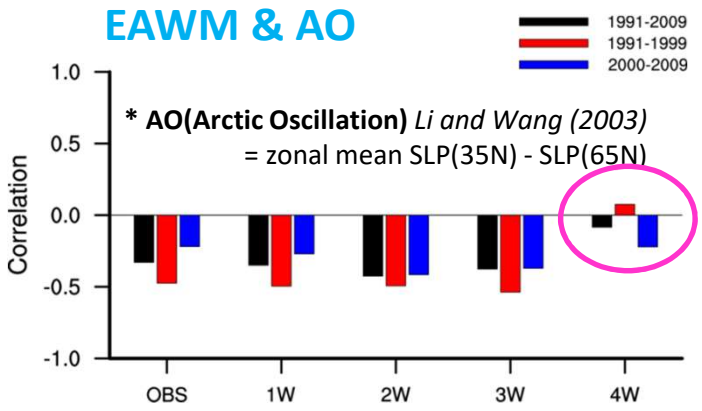
EAWM ~ Arctic (AO)

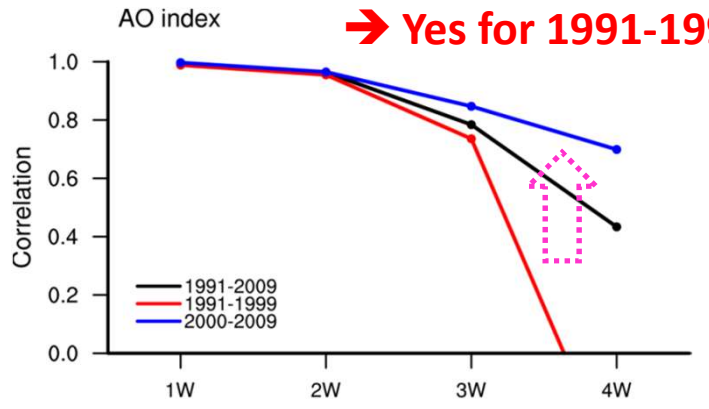


PC2_SAT vs AO
: 3W, weak pattern!!!

EAWM vs AO
: 4W, opposite relation (1991-1999)!!!

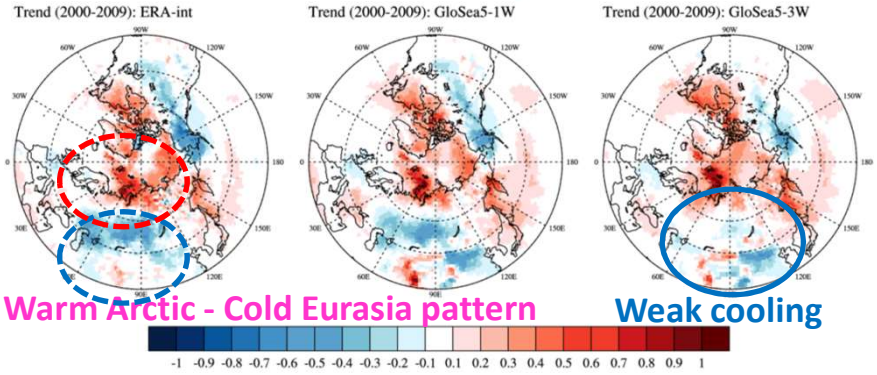
➔ **Bad AO representation issue?**





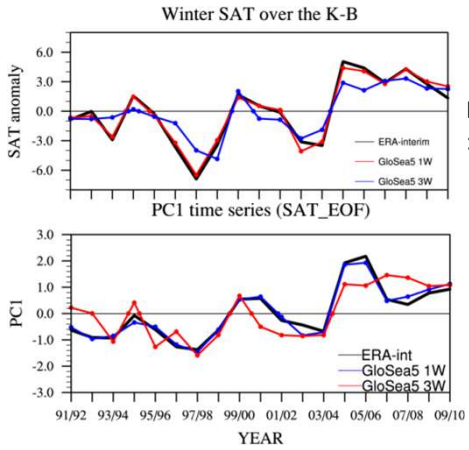
EAWM ~ Cryosphere (WACC)

SAT Trend and Arctic temperature



Warm Arctic - Cold Eurasia pattern

Weak cooling



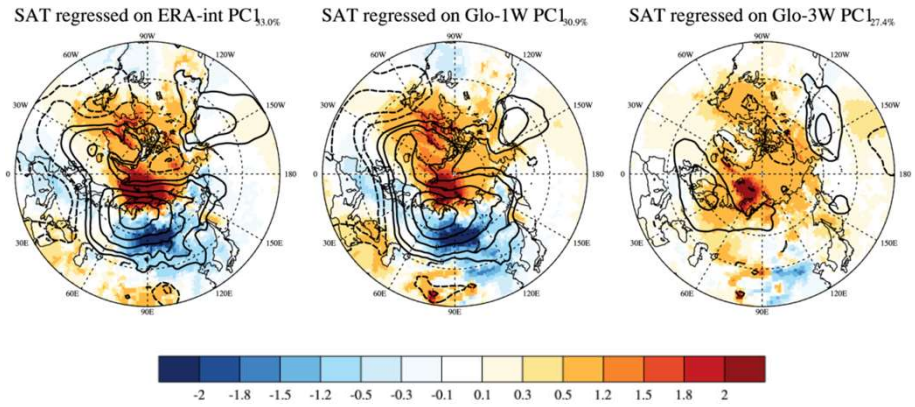
Kara – Barents Sea (K-B)
: 30 – 70E, 70 – 80N

Linear trend in the arctic temperature for the periods 1982-1996 and 1998-2012

- In earlier epoch the Arctic was actually **cooling slightly** whereas in the later epoch it was **warming.**
- Many recent studies have suggested that **recent cold winters in northern continents are related to Arctic warming**

* When the Arctic temperature gets warmer over the K-B region, East Asia experiences cold winters

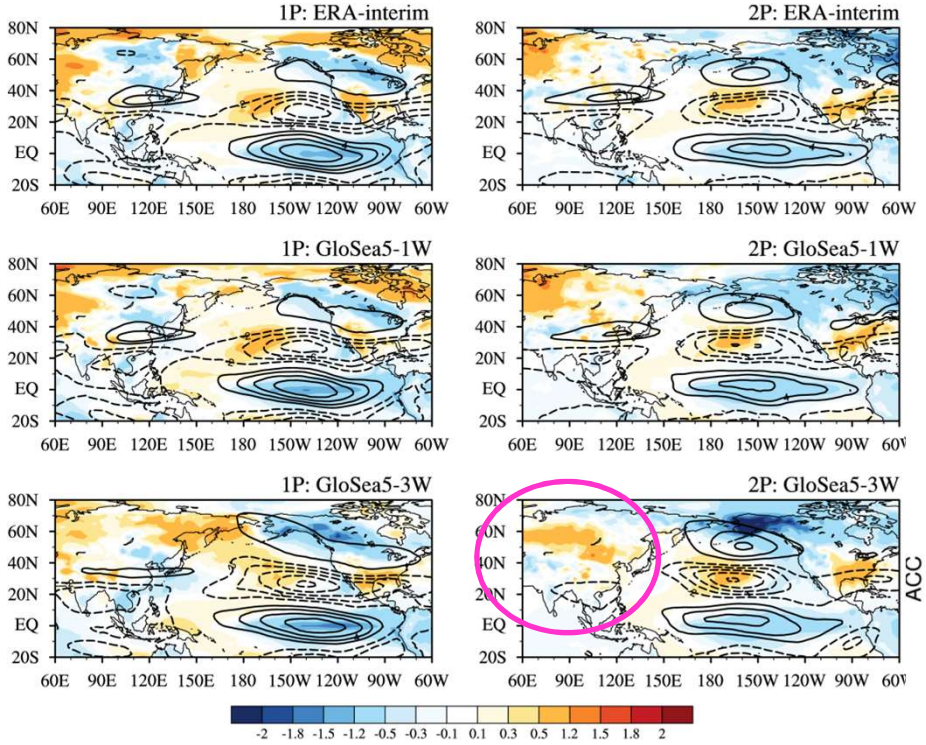
➔**Warm Arctic-Cold Continent pattern**



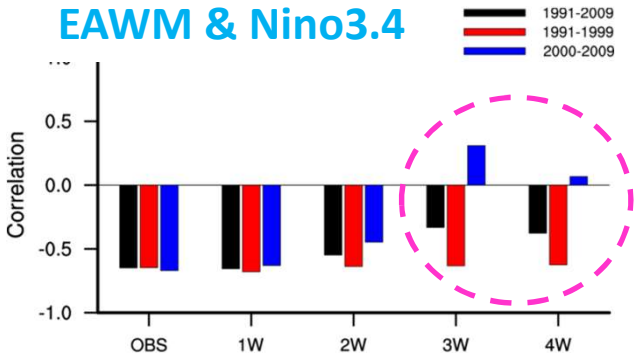
3W: Weak Eurasia cooling & Weak SLP pattern

EAWM ~ Ocean (ENSO)

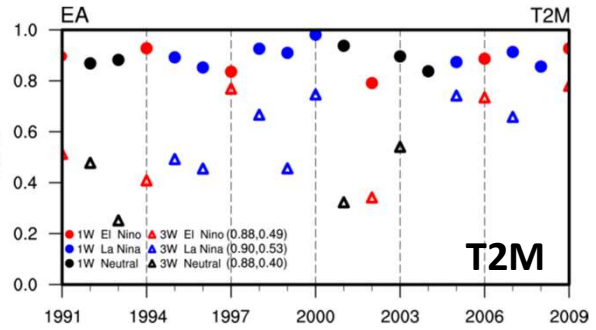
T2M(shaded) & U200(contour) regressed on NINO3.4 index

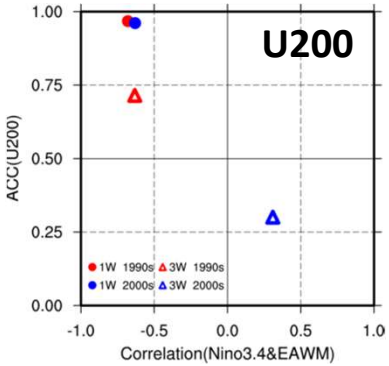


EAWM & Nino3.4



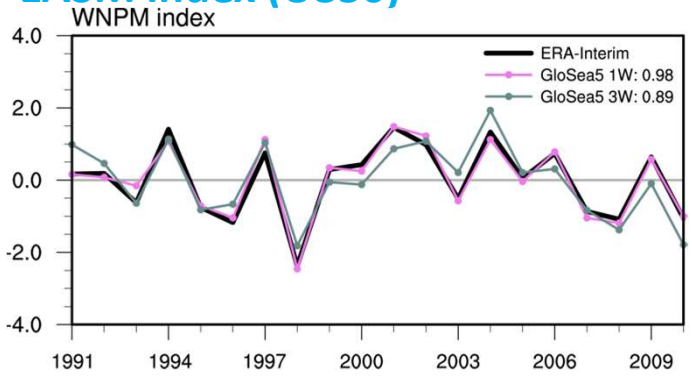
➔ **Recent relationship between EAWM & Nino3.4?**
Opposite sign!



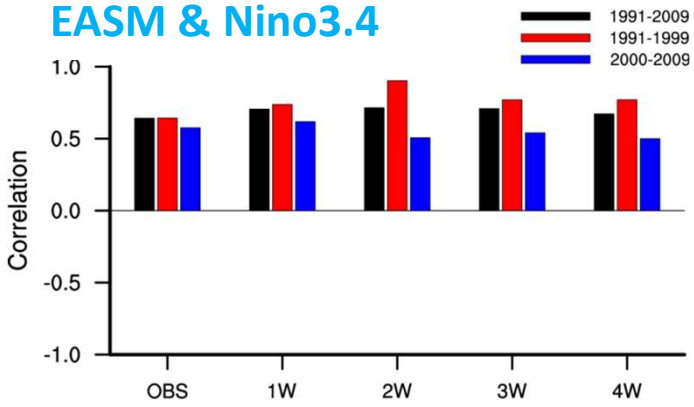


Q. Characteristics of systematic error?
: East Asian Summer monsoon

EASM index (U850)

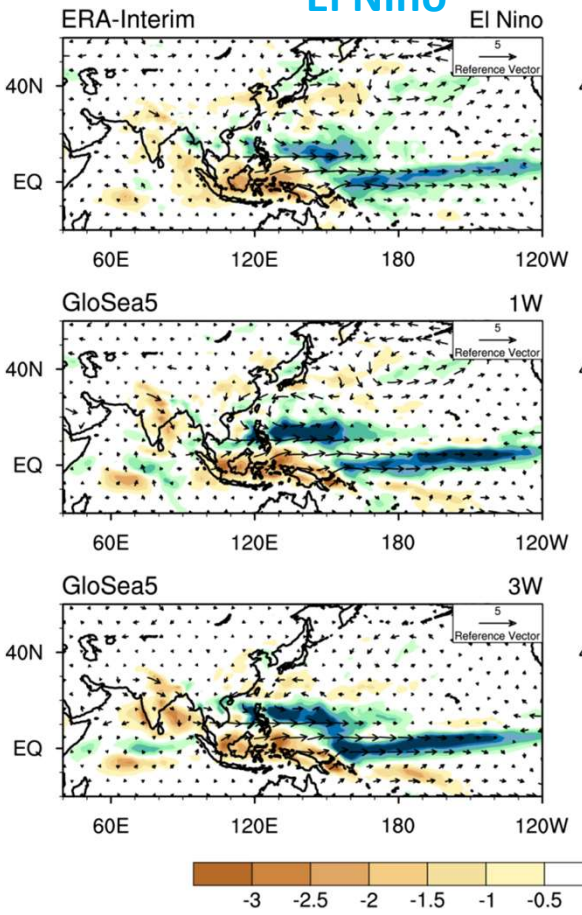


EASM & Nino3.4

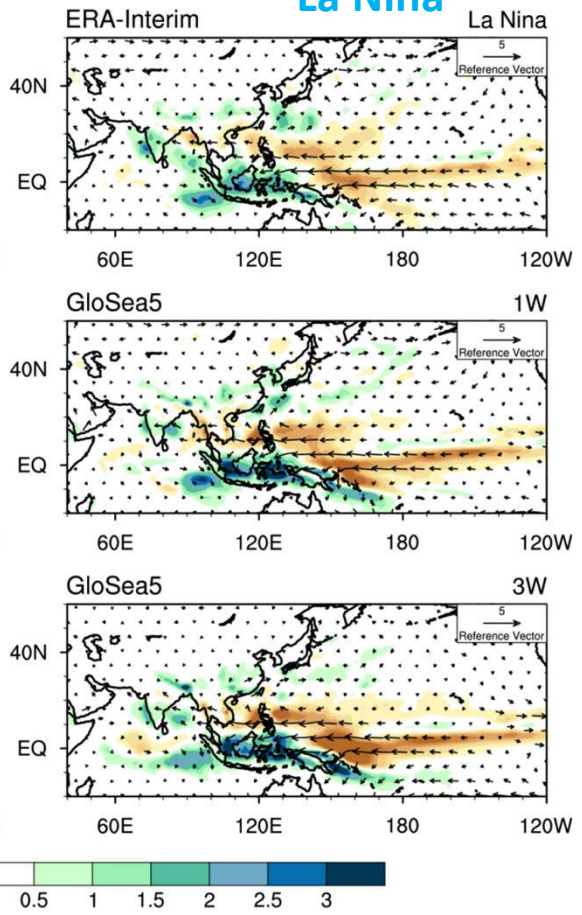


➔ **EASM & Nino3.4: Good!**

El Nino



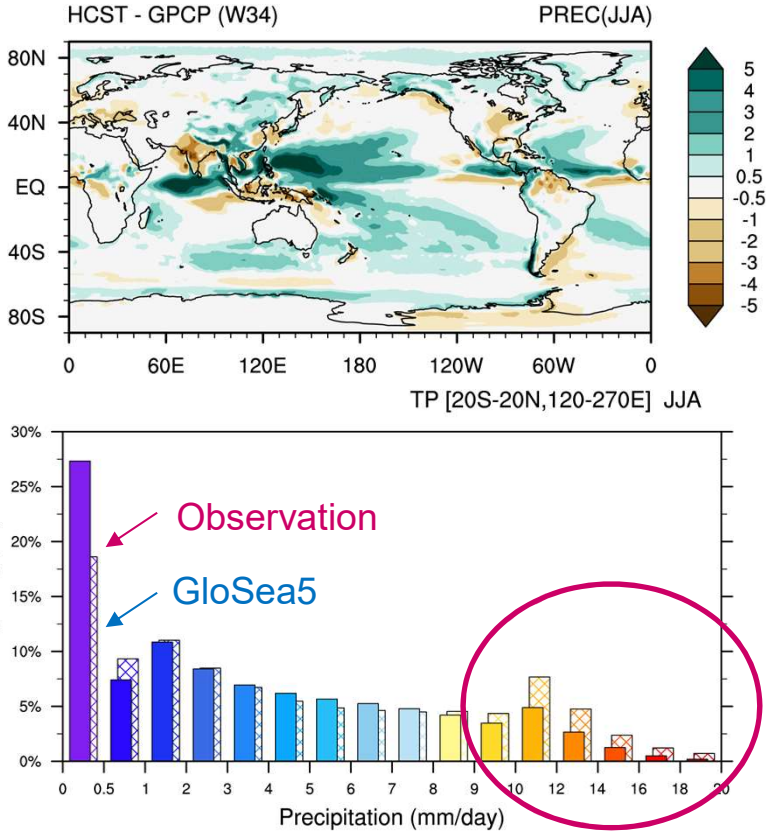
La Nina



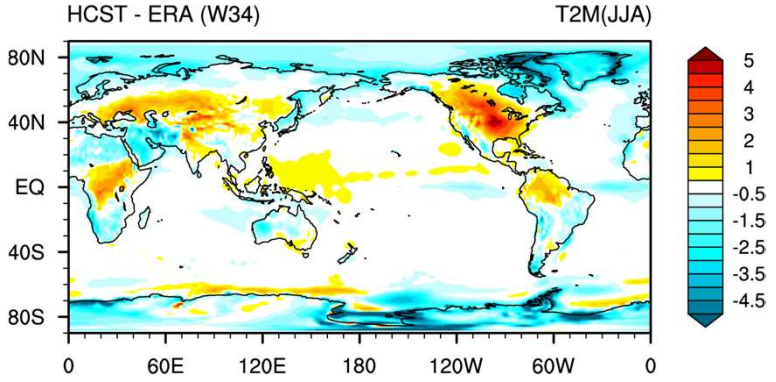
Q. Characteristics of systematic error?
: JJA Precipitation/Temperature

JJA Systematic Biases:

Precipitation



Temperature

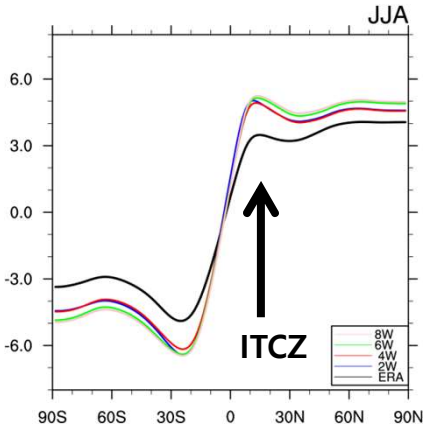


- Strong Convection
- Wet Biases
- Cold(Warm) Biases: Eastern (Western) Pacific

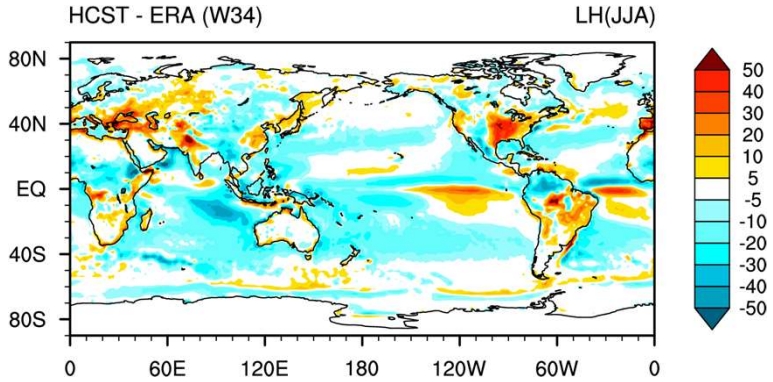
Q. Characteristics of systematic error?
: JJA Precipitation/Temperature

JJA Systematic Biases:

Zm_PV (Hadley Cir.)

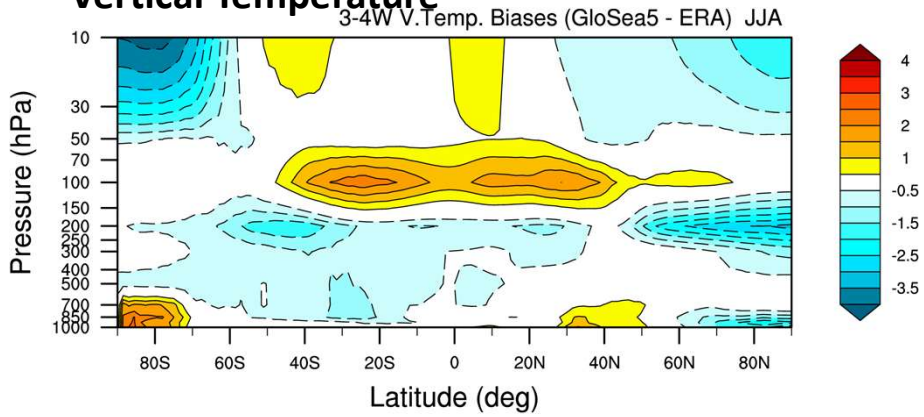


Latent Heat Biases

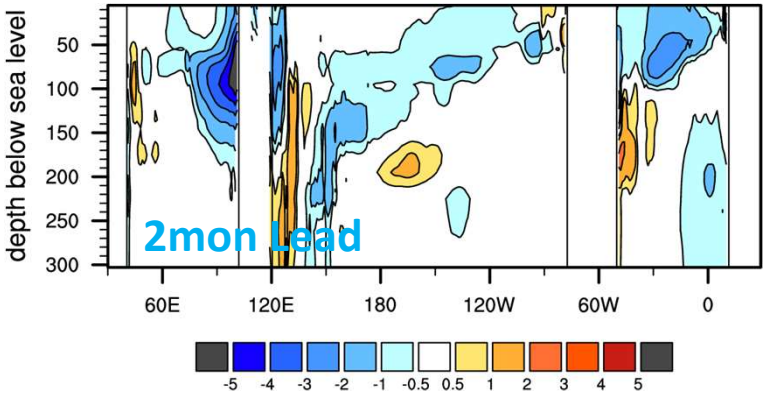


Wet (Strong Convection) Biases
- ➔ Intensified evaporation
- ➔ Increased cloud
- ➔ Surface cooling due to radiation-cloud interaction

Vertical Temperature



-10~10Lat., Cold subsurface temperature, Deep OML



Summary

GloSea5

1) Diagnostics systematic errors

- Wet/Cool biases ➔ Strong convection!

2) East Asian Monsoon system

- Recent EAWM prediction skill is decreased
  → EAWM-ENSO relationship: opposite sign! (due to the **upper level wind biases**)
- Warm Arctic-Cold Continent: From lead week 3, weak signal → not good simulation of SLP