KMA's Operational Seasonal Forecasting

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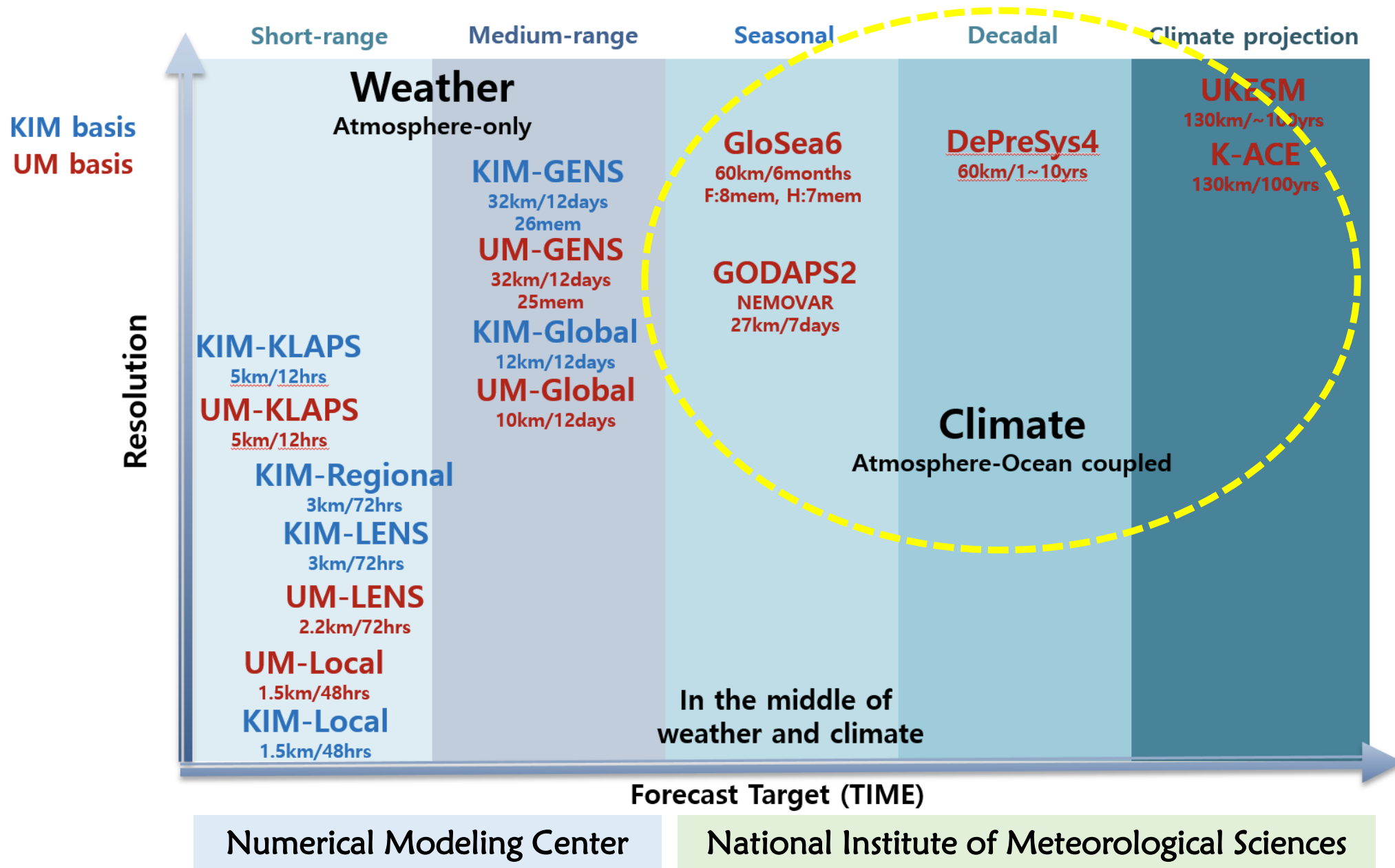
KMA HQ

Seoul
to
Daejeon

(Early 2022)
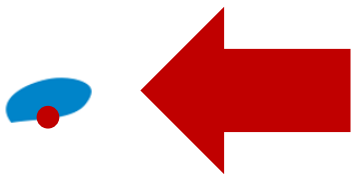
NIMS **N**ational **I**nstitute of **M**eteorological **S**ciences
Jeju Island

Operational Systems @KMA

Resolution (vertical axis)

Forecast Target (TIME) (horizontal axis)

Short-range | Medium-range | Seasonal | Decadal | Climate projection

KIM basis
UM basis

Weather
Atmosphere-only

KIM-GENS
32km/12days
26mem

UM-GENS
32km/12days
25mem

KIM-Global
12km/12days

UM-Global
10km/12days

GloSea6
60km/6months
F:8mem, H:7mem

GODAPS2
NEMOVAR
27km/7days

DePreSys4
60km/1~10yrs

UKESM
130km/~100yrs

K-ACE
130km/100yrs

KIM-KLAPS
5km/12hrs

UM-KLAPS
5km/12hrs

KIM-Regional
3km/72hrs

KIM-LENS
3km/72hrs

UM-LENS
2.2km/72hrs

UM-Local
1.5km/48hrs

KIM-Local
1.5km/48hrs

Climate
Atmosphere-Ocean coupled

In the middle of weather and climate

Numerical Modeling Center | National Institute of Meteorological Sciences

History of GloSea @KMA

* GloSea=Global Seasonal Forecasting System

Joint System

KMA — Met Office

KMA Product — Joint Products — UKMO Product

Products sharing
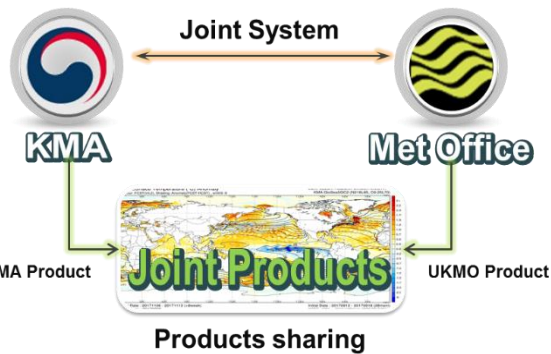
2010 June → **2013** → **2014** → **2015** → **2016**

Joint Seasonal Forecasting System Arrangement

GloSea4 (125km)

GloSea5-GA3 (60km)

GloSea5-GC2 (60km)

2017 → **2018** → **2019** → **2020** → **2021** → **2022** → **2023**

° KMA NEMOVAR Initialization

° Land Initialization
  (JULES-JRA55 soil moisture)

° River discharge

Hindcast ys added (1991-2010→ 1993-2016)

GloSea6-GC3.2 (60km)

Ensembles size increase (HCST 3 → 7 / FCST 4 → 8 mem)

Land Initialization (soil temperature)

2023 Hindcast ACC

from WMO Lead Center for Long Range Forecast (https://wmolc.org/seasonVrfyHindDmmeUI/plot_VrfyHIND_DMME)

- ✓ Season: MAM, JJA, SON, DJF (Leadtime: 1-3months / Collected in the previous mid-month)

- ✓ Common HCST Years: 1993-2009

- ✓ Variables: Precip, MSLP, T2m, T850hPa, 500hPa GPH, SST

- ✓ Centers: 13 GPCs (Exeter(GloSea6), ECMWF(SEAS5), Seoul(GloSea6), Tokyo(JMA/MRI-CPS3), CMCC(CMCC-SPS3.5), Montreal(CanSIPSv2.1), Offenbach(GCFS 2.1), Beijing(CSM1.1m), Washington(CFSv2), Toulouse(System8), Melbourne(ACCESS-S2), Moscow(SL-AV), CPTEC(CPTEC-COLA))

GPC	Institute	System	Res km (atm,ocn)		Coupled	Implementation
Beijing	BCC	CSM1.1m	~110	~30	Yes	2016
CMCC	CMCC	CMCC-SPS3.5	~50	~25	Yes	2020
CPTEC	CPTEC	CPTEC-COLA	~100	-	No	2020
ECMWF	ECMWF	SEAS5	~35	~25	Yes	2017
Exeter	UKMO	GloSea6-GC3.2	~60	~25	Yes	2021
Melbourne	BoM	ACCESS-S2	~60	~25	Yes	2021
Montreal	MSC	CanSIPSv2.1	~180	~100	Yes	2021
Moscow	HMC	SL-AV	~100	-	No	2022
Offenbach	DWD	GCFS 2.1	~100	~40	Yes	2020
Seoul	KMA	GloSea6-GC3.2	~60	~25	Yes	2022
Tokyo	JMA	JMA/MRI-CPS3	~60	~25	Yes	2022
Toulouse	Met France	System8	~35	~25	Yes	2021
Washington	NCEP/CPC	CFSv2	~100	~25	Yes	2011

Averaged ACC of all 4 seasons and all 6 variables
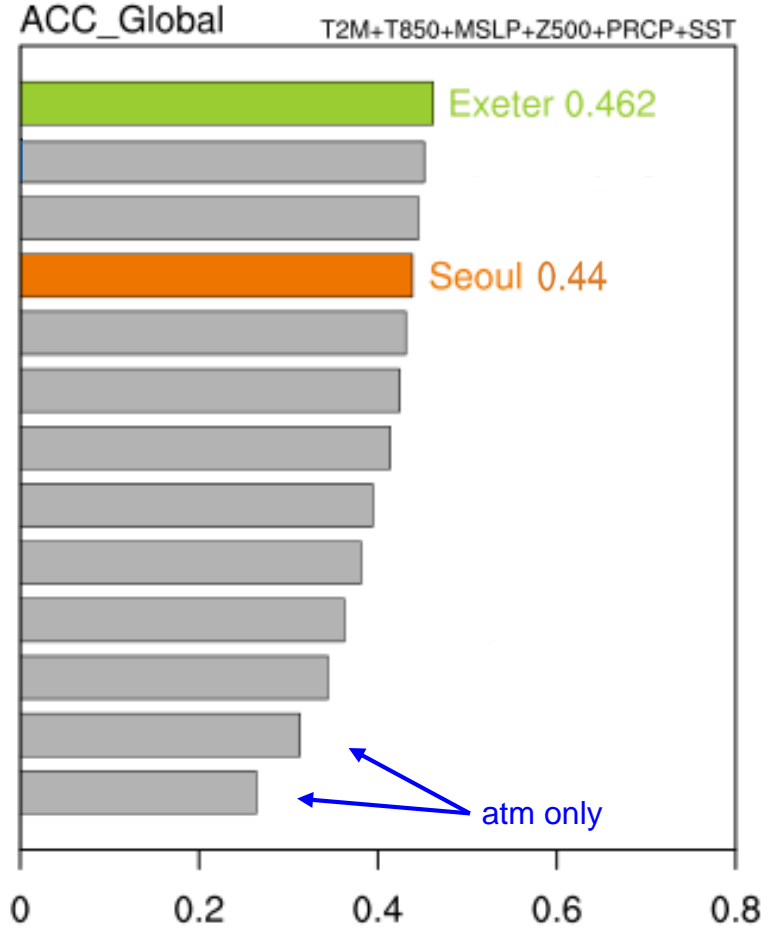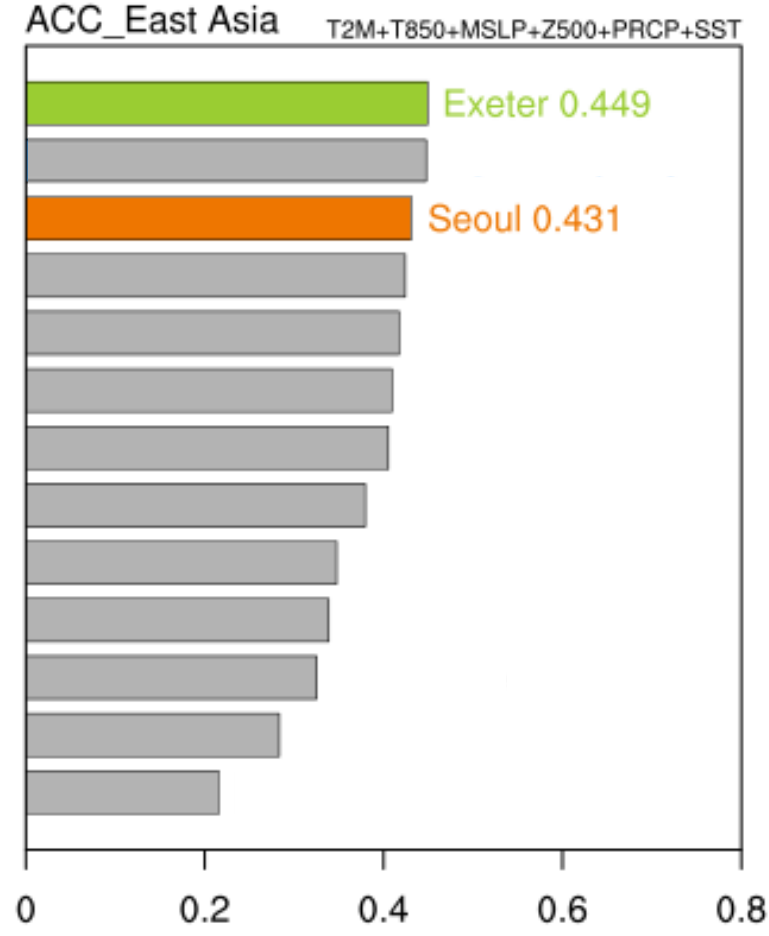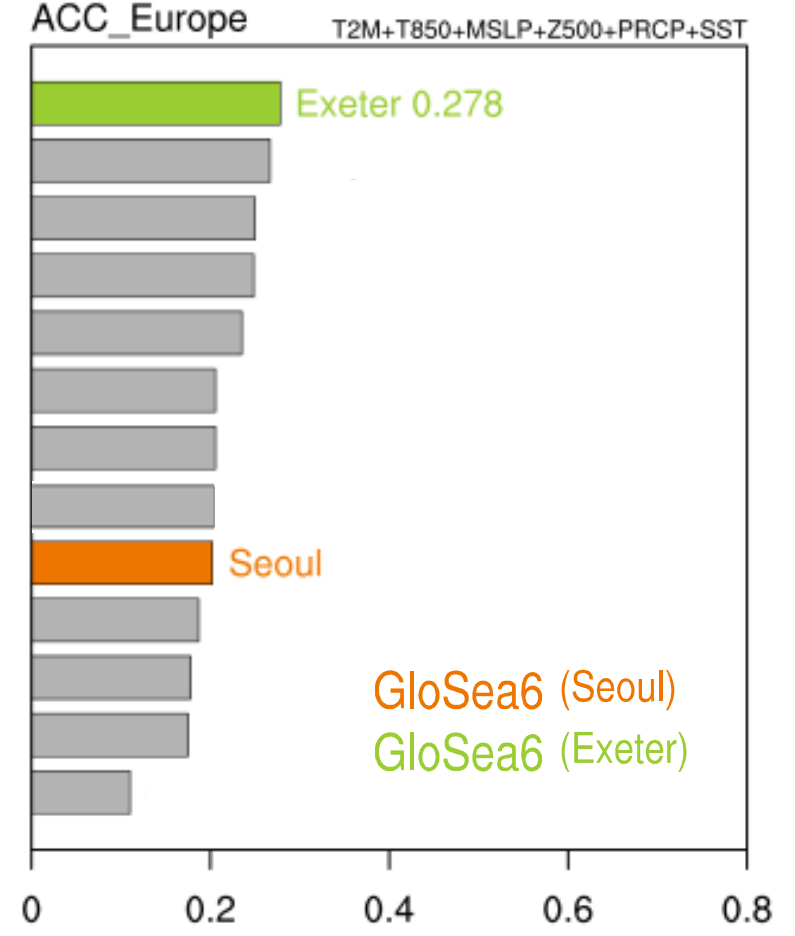
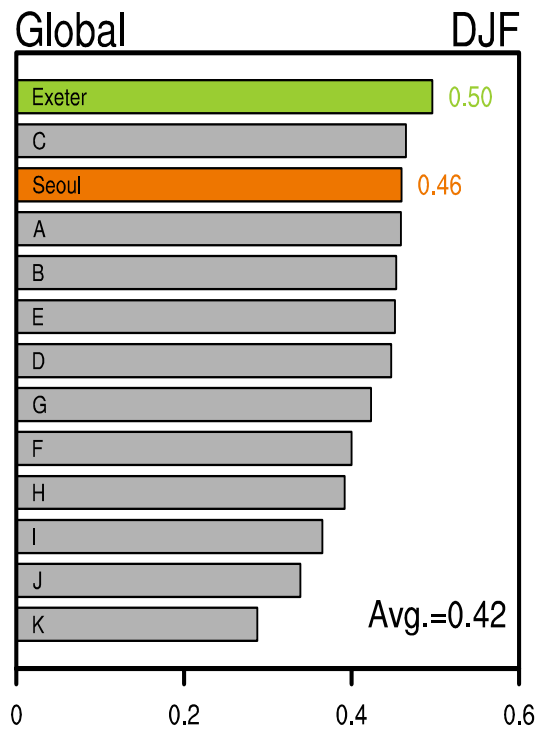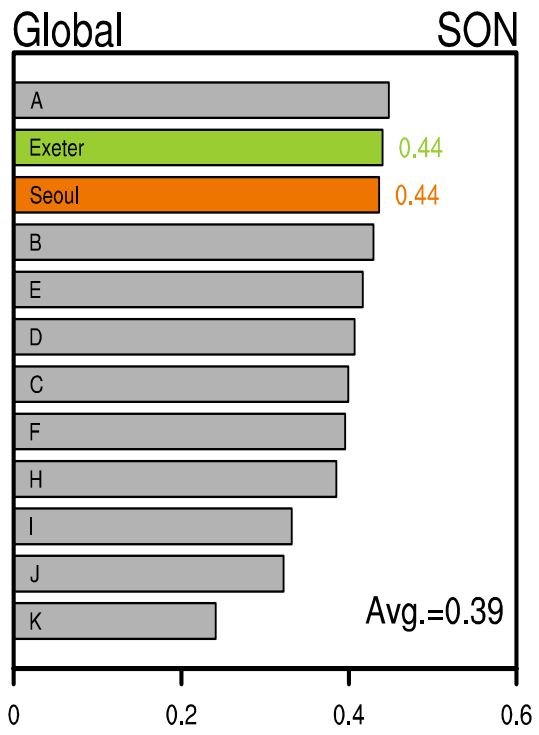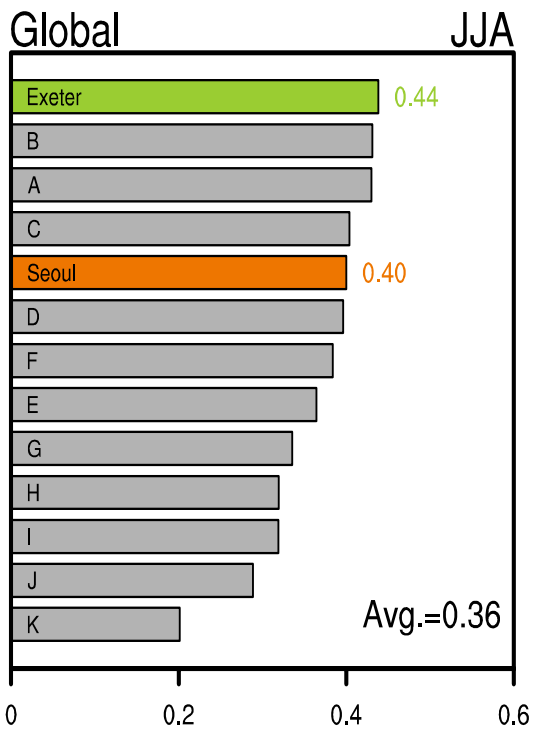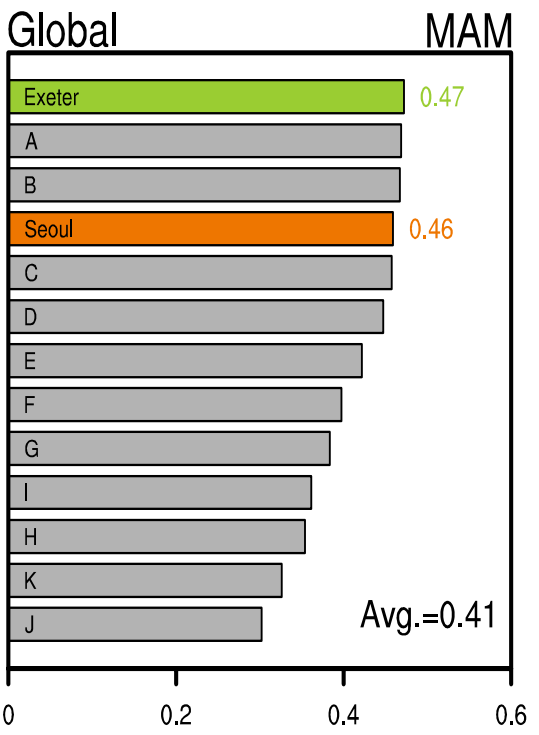# Each Variables of all 6 variables
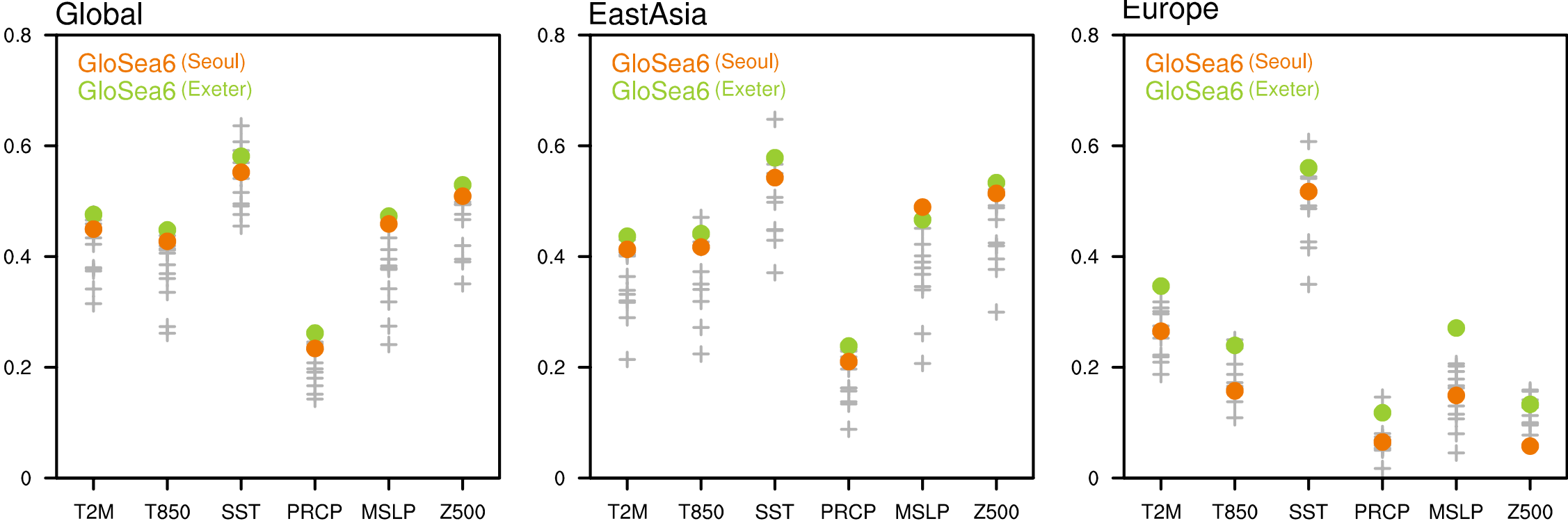
Global Skill   SST > Z500 > MSLP, T2m, T850 > PRCP

- Good skills of GloSea6 about the Pressure Height, T850 and Precipitation

- The SST Skill in Europe is not low comparing to other regions. However, SST does not seem to significantly impact performance in Europe

Each Season (averaged ACC of all 6 variables)

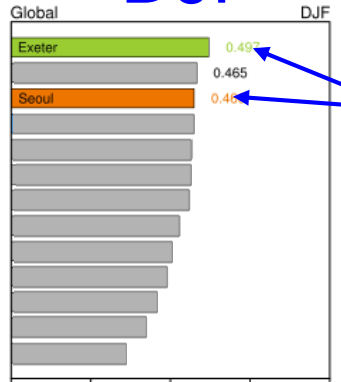GloSea6 (Seoul)
GloSea6 (Exeter)

Global   **MAM**

Exeter	0.47
A	
B	
Seoul	0.46
C	
D	
E	
F	
G	
I	
H	
K	
J	

Avg.=0.41

Global   **JJA**

Exeter	0.44
B	
A	
C	
Seoul	0.40
D	
F	
E	
G	
H	
I	
J	
K	

Avg.=0.36

Global   **SON**

A	
Exeter	0.44
Seoul	0.44
B	
E	
D	
C	
F	
H	
I	
J	
K	

Avg.=0.39

Global   **DJF**

Exeter	0.50
C	
Seoul	0.46
A	
B	
E	
D	
G	
F	
H	
I	
J	
K	

Avg.=0.42
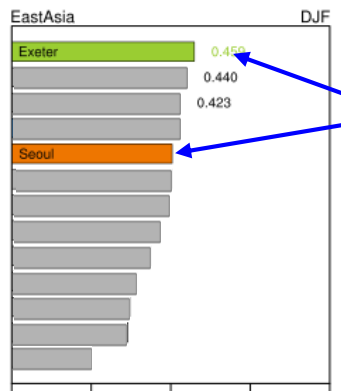
Where are these differences coming from?
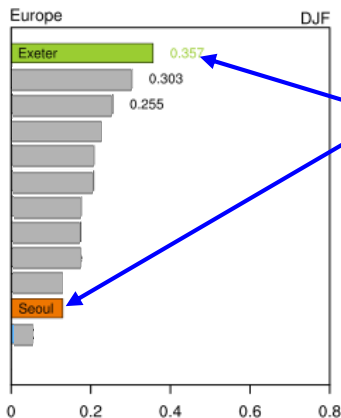
(averaged ACC of all 6 variables)

DJF

Global

East Asia

Europe

Only differences are

1) Land Initialization (SM vs SM+ST+Snow)

2) O3 forcing (CMIP6 annually monthly varying vs monthly Clim)
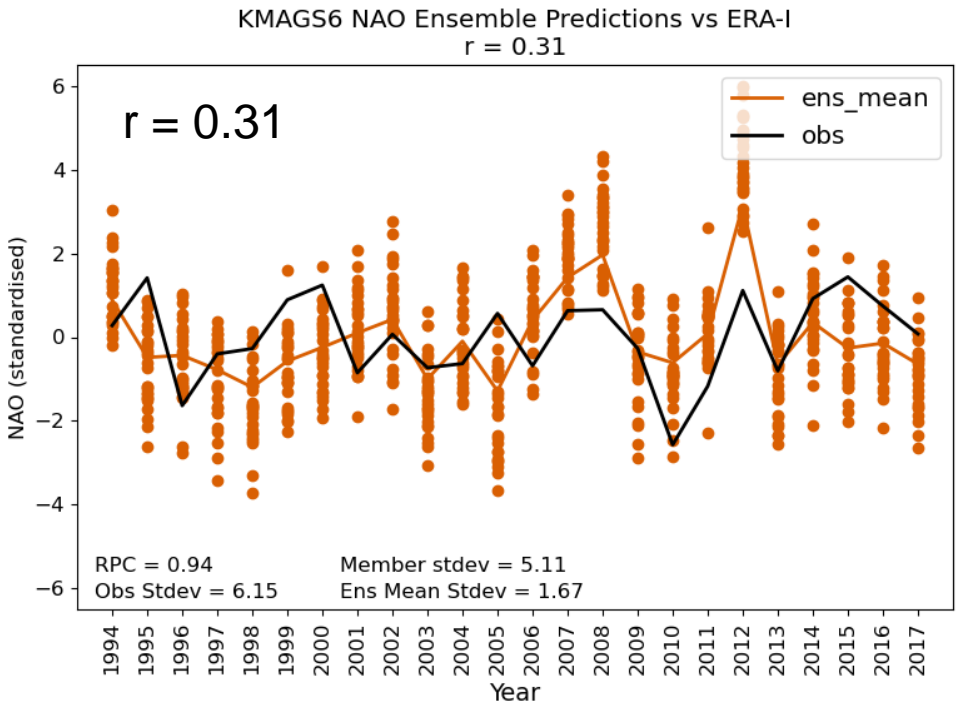
3) UM version (11.5 vs 11.9)   * It seems like the difference will be small due to the minor version change.
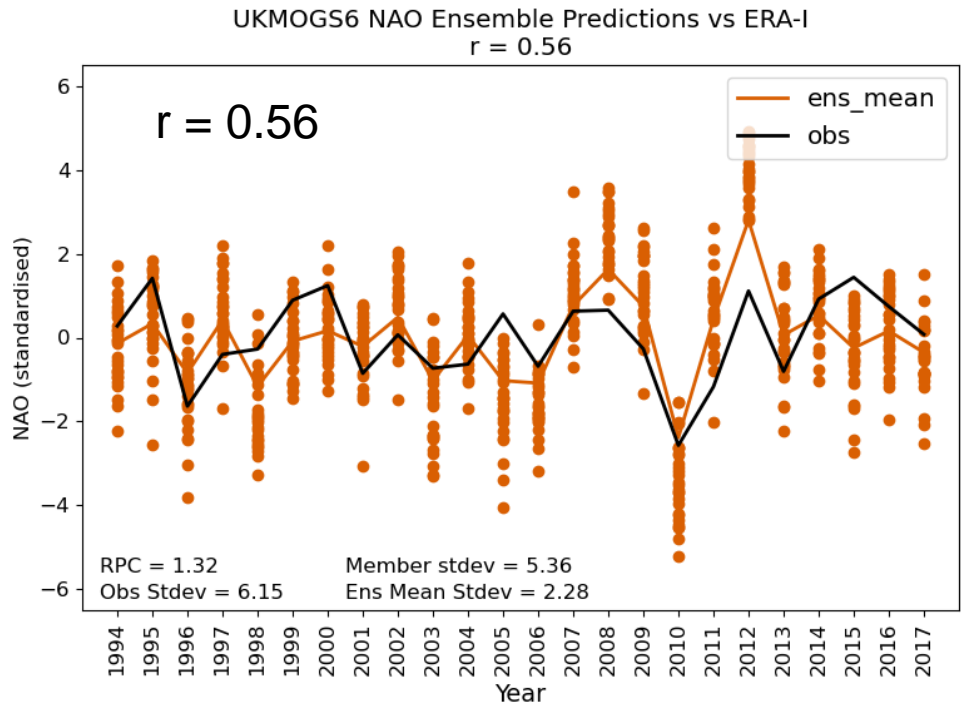
4) HPC environment   * There's nothing I can do about it

NAO (DJF)

Init Nov 1st 9th 17th 25th (7×4=28 mem)

Oper (Seoul)

Oper (Exeter)

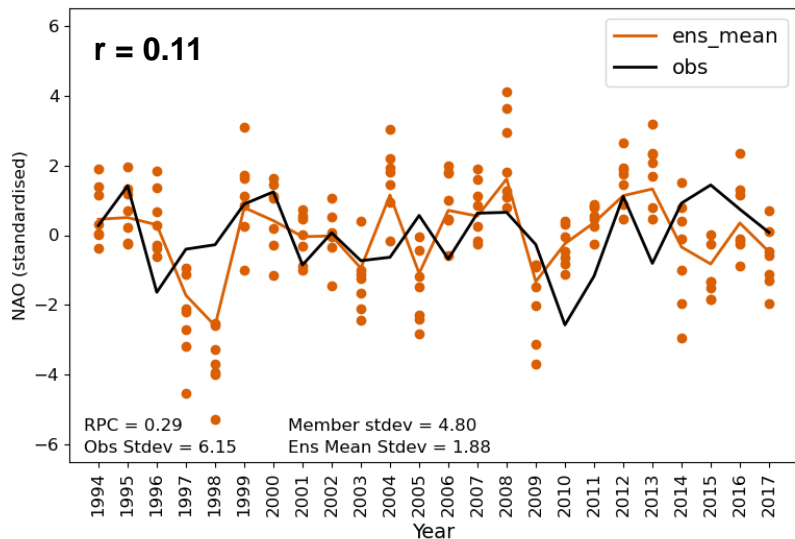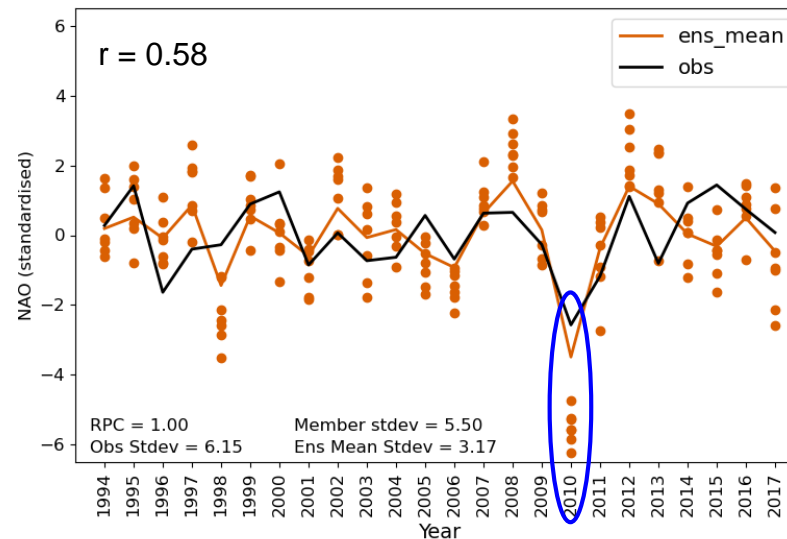**KMAGS6 NAO Ensemble Predictions vs ERA-I**
r = 0.31

r = 0.31

ens_mean
obs

NAO (standardised)

RPC = 0.94   Member stdev = 5.11
Obs Stdev = 6.15   Ens Mean Stdev = 1.67

Year

UKMOGS6 NAO Ensemble Predictions vs ERA-I
r = 0.56

r = 0.56

ens_mean
obs

NAO (standardised)

RPC = 1.32   Member stdev = 5.36
Obs Stdev = 6.15   Ens Mean Stdev = 2.28

Year

NAO (DJF)

Init Nov 1ˢᵗ (7mem)

Hyun et al. (2024) accepted

(a) Oper (**Seoul**)

KMAGS6 NAO Ensemble Predictions vs ERA-I
r = 0.11

r = 0.11

RPC = 0.29   Member stdev = 4.80
Obs Stdev = 6.15   Ens Mean Stdev = 1.88

(b) Oper (Exeter)

UKMOGS6 NAO Ensemble Predictions vs ERA-I
r = 0.58

r = 0.58

RPC = 1.00   Member stdev = 5.50
Obs Stdev = 6.15   Ens Mean Stdev = 3.17

need snow initialization, too?

O3 impact seems to be larger

adding the two, does not always make the cumulative effect

(c) Soil T initialization (**Seoul**)

KMAGS6 NAO Ensemble Predictions vs ERA-I
r = 0.29

Soil T (Seoul) r = 0.29

RPC = 0.68   Member stdev = 5.15
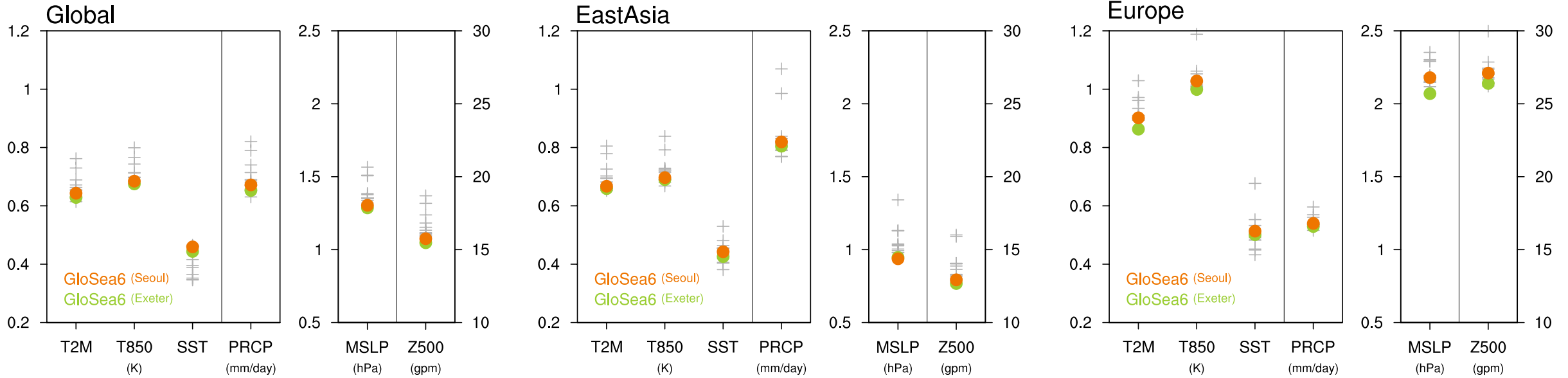Obs Stdev = 6.15   Ens Mean Stdev = 2.23

(d) O3 Climatology (**Seoul**)

KMAGS6OZ NAO Ensemble Predictions vs ERA-I
r = 0.40

O3 clim (Seoul) r = 0.40

RPC = 1.02   Member stdev = 4.99
Obs Stdev = 6.15   Ens Mean Stdev = 1.93

(e) SoilT+O3 (**Seoul**)

KMAGS6OZ NAO Ensemble Predictions vs ERA-I
r = 0.39

Soil T+O3 clim (Seoul) r = 0.39

RPC = 0.75   Member stdev = 5.37
Obs Stdev = 6.15   Ens Mean Stdev = 2.81
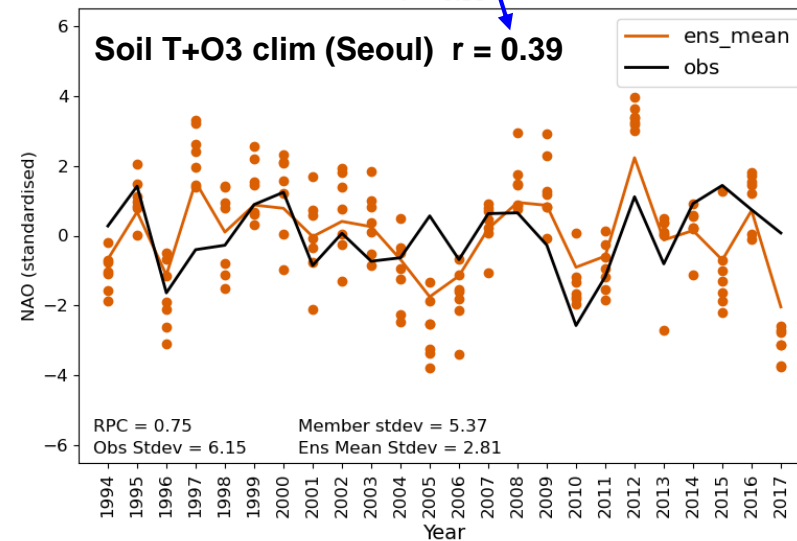
RMSE

For T850, MSLP and Z500,
GloSea6-exeter the lowest RMSE

While Centres that ranked high in ACC also tended to
show good RMSE,
there was no direct relation that
the best ACC performance necessarily resulted in the
smallest RMSE

The diffs of RMSEs among mid-range systems are very very small enough to
suggest there are no differences

In Europe,
GloSea6-exeter also shows the top & top-ranked
performance in RMSE
(except for SST)

Thank you.

National Institute of
Meteorological Sciences