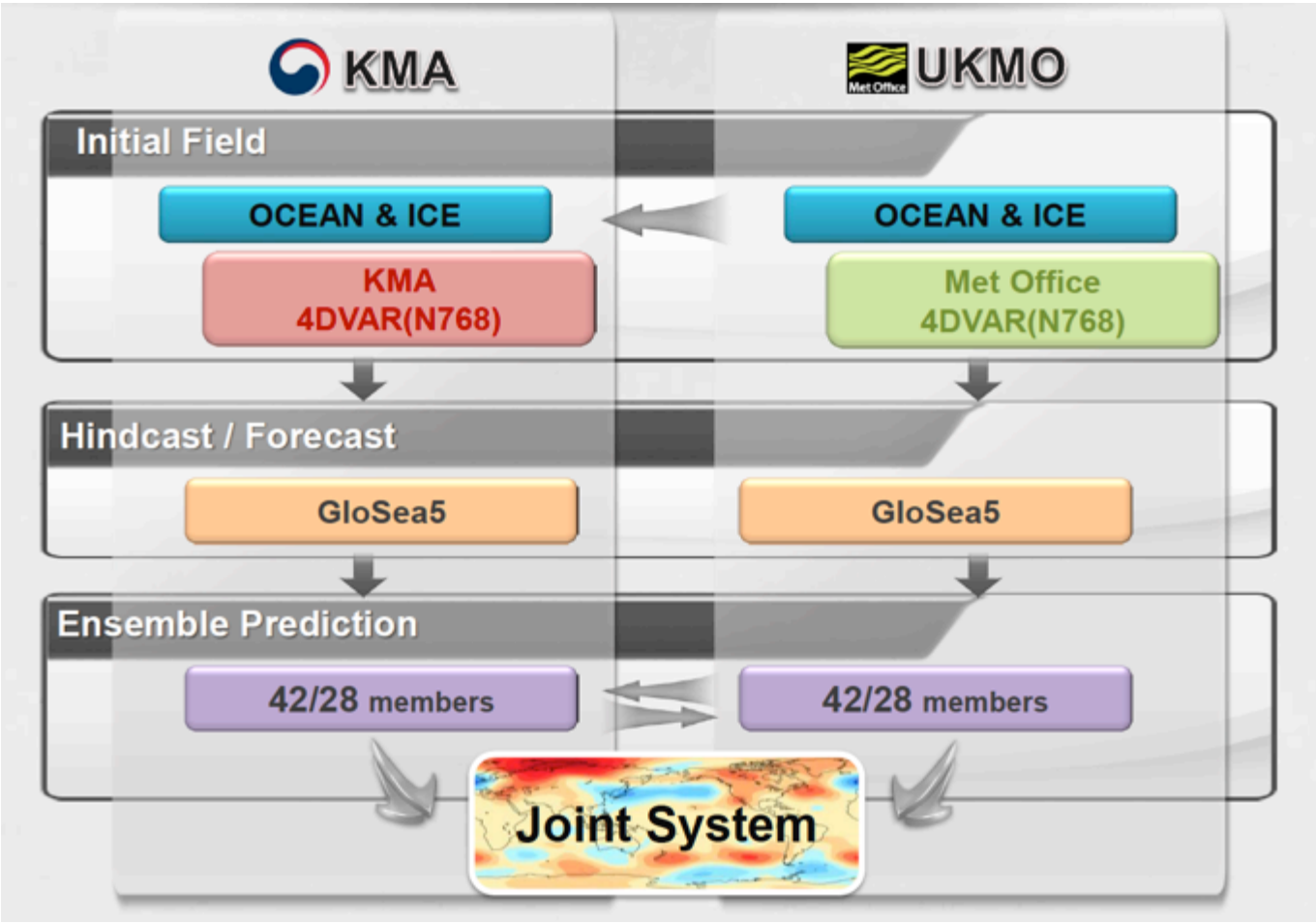
KMA-APCC-CNU updates for dynamical seasonal climate prediction

Jee-Hoon Jeong

Chonnam National University

I. KMA-Met Office Joint Seasonal Forecasting System

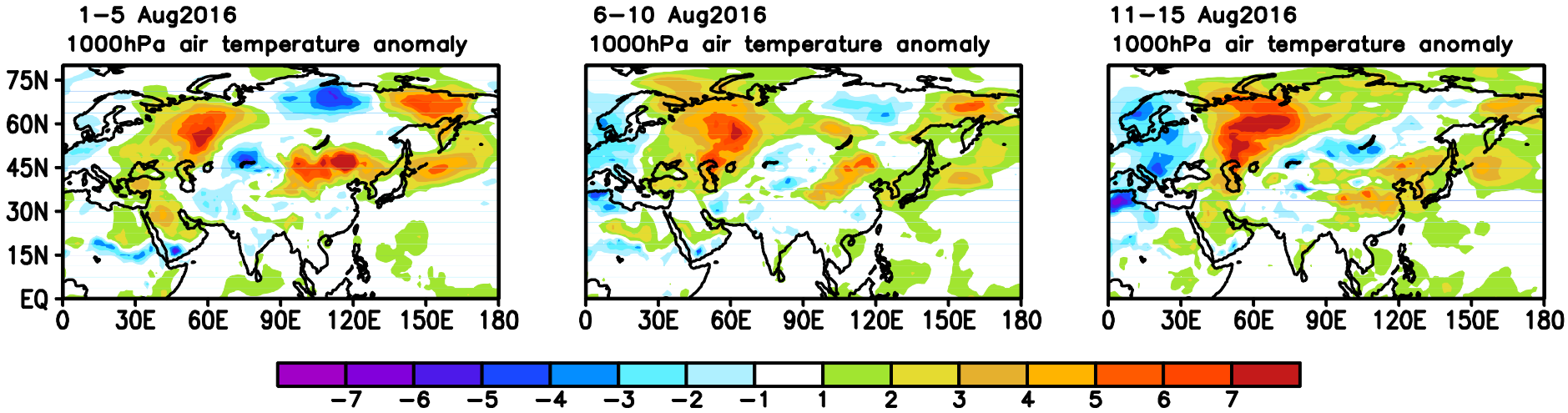


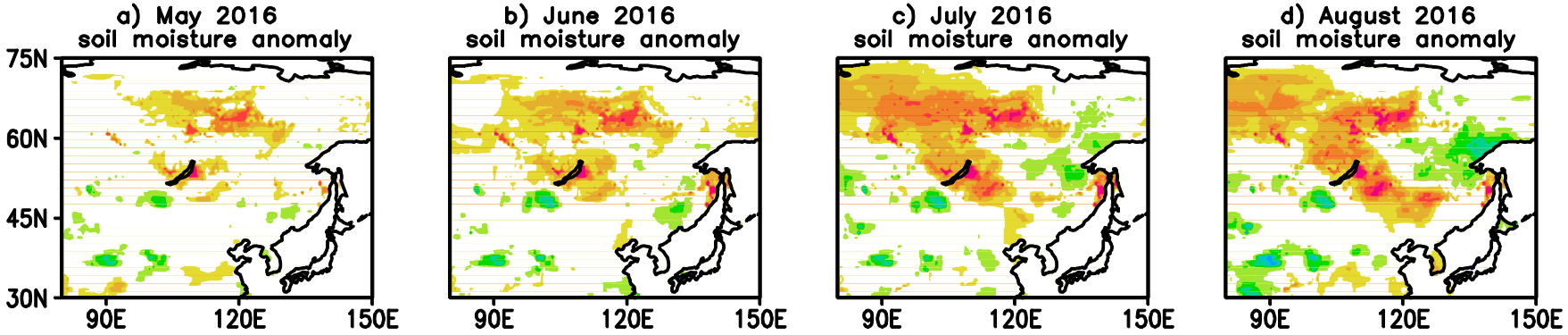
New Initialization schemes for GloSea5-KMA

		GloSea5-GC2	
		KMA	UKMO
Initial Field	Atmos	KMA NWP analysis	UKMO NWP analysis
	Land Surf	ECMWF ERA-int ⇒ JULES-JRA55 Near real-time analysis ~2018	ECMWF ERA-int (preparing for JULES-JRA55 based init.)
	Ocean	UKMO NEMOVAR ⇒ KMA NEMOVAR	UKMO NEMOVAR

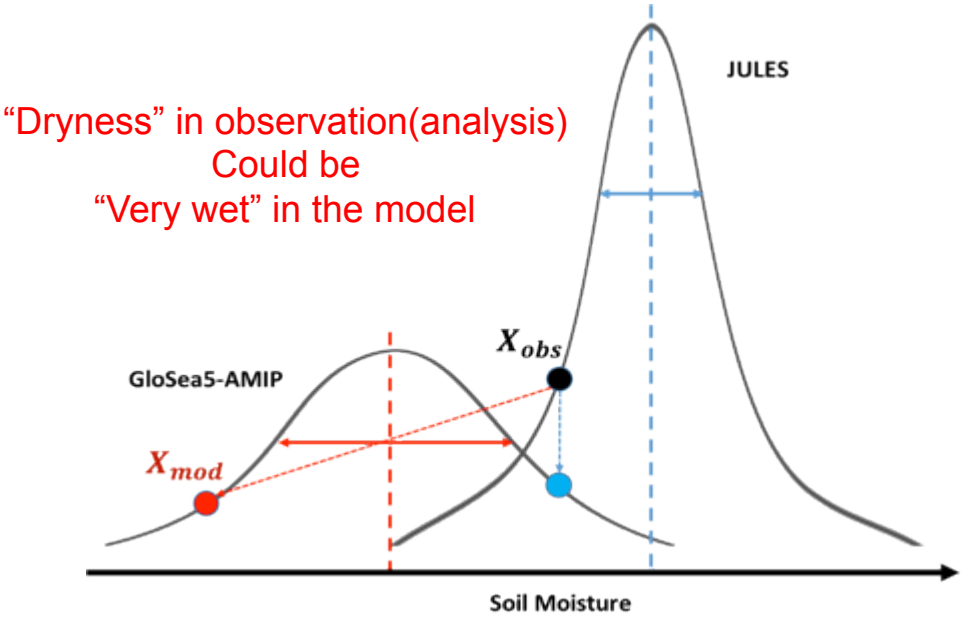
- Offline land surface model, JULES, forced by reanalysis: atmosphere variables + precipitation.

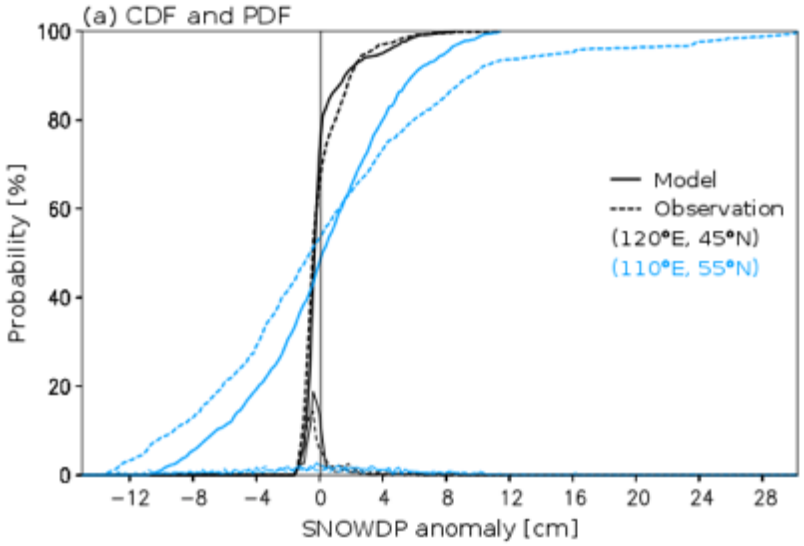
2016 Mega-heatwave in East Asia and Korea, Dry-soil & land-atm interaction seems to contribute…



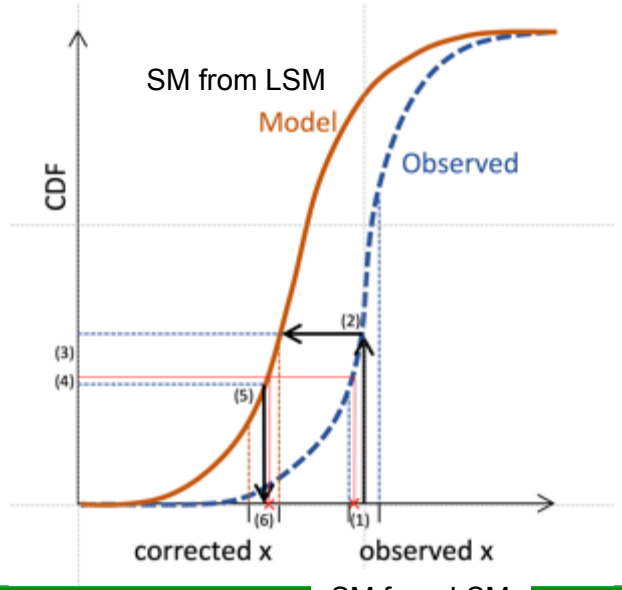


Soil moisture Initialization for GloSea5-KMA





- There is large bias between model and SM estimated, which lead to model's drift which degrade forecasts.
- Soil moisture estimate from the JULES is further modified based on CDF matching technique.

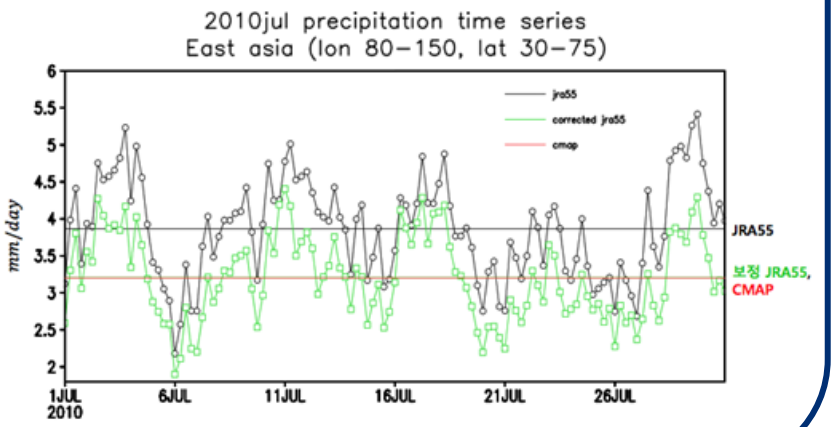


SM from LSM

For further improve soil moisture quality,

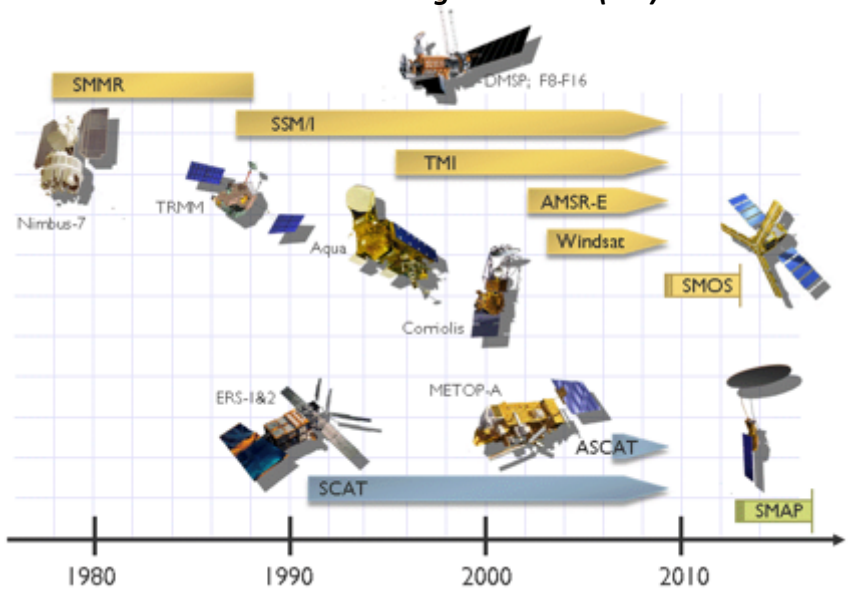
1. Correction of precipitation dataset (forcing to drive LSM) with observation

$$precip_{JRA}^{scaled} = \frac{precip_{CMAP}^{monthly}}{precip_{JRA}^{monthly}} \times precip_{JRA}^{6-hourly}$$



2. Blending satellite dataset into soil moisture derived by LSM

Soil Moisture - ESA Climate Change Initiative (CCI)

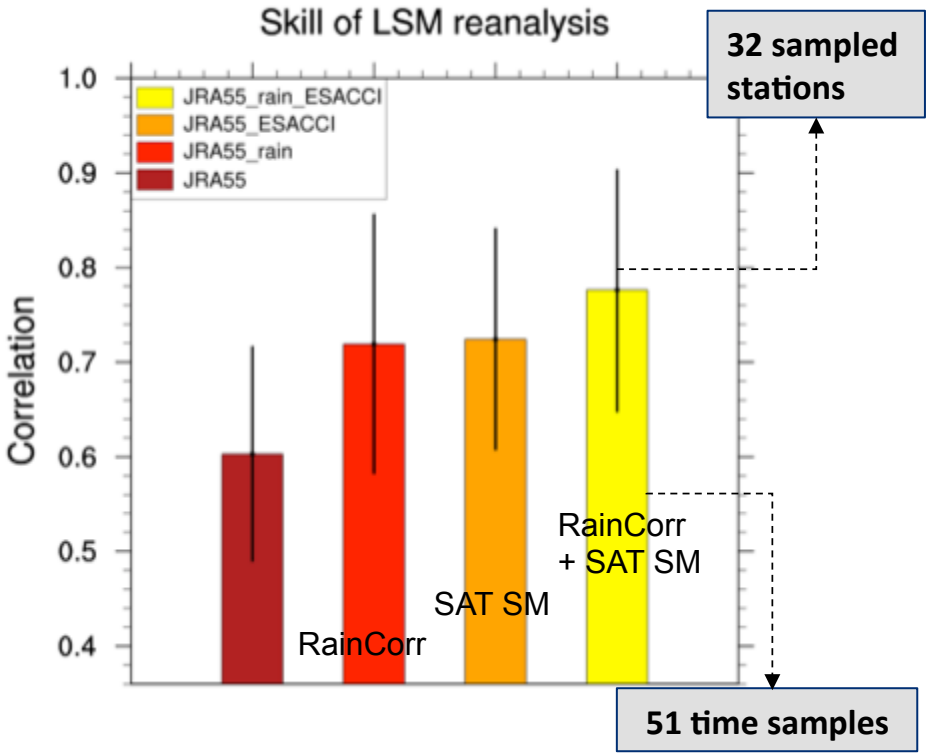


1979~2015 daily 0.25 spatial resolution global dataset

Satellite SM is nudged at the first two soil layers

Improvement of JJA soil moisture quality

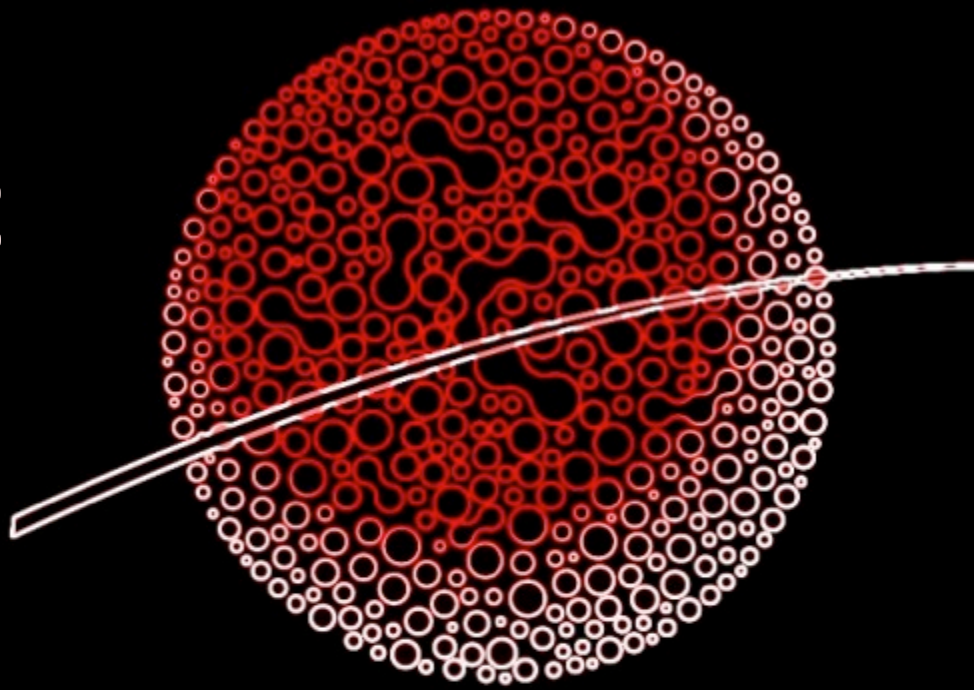
North America (269-274E/33-35N) JJA soil moisture (~10cm)



- Corr are assessed with in-situ SM observation
- Better precipitation data and nudging satellite estimate lead to better SM quality

II. updates for APCC

Jin-Ho Yoo

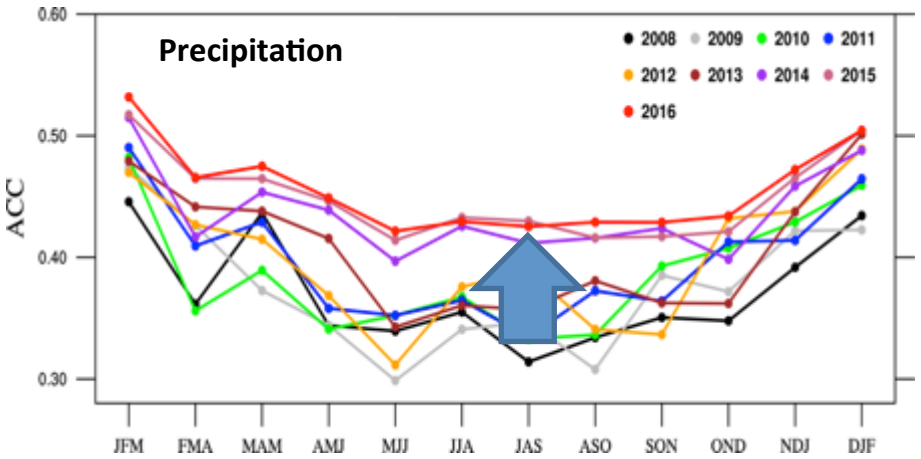


APCC

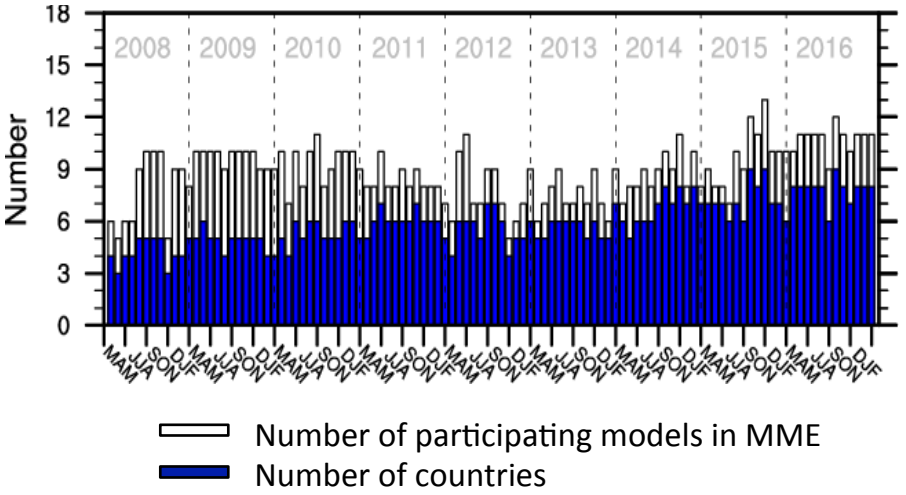
APEC CLIMATE CENTER

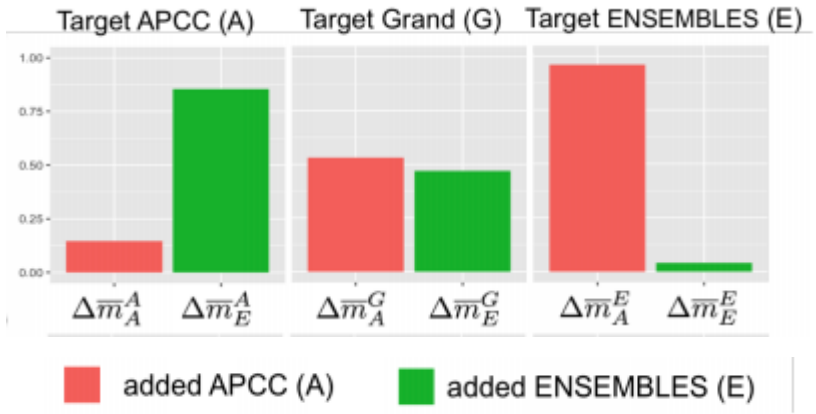
APCC MME skill has been improved, why?

Hindcast Skill of each year's operatinoal MME set



Number of participating models in operational MME





Alessandri et al. (2017) *Clim. Dyn.* "Grand MME
"

Rmm = Rave / sqrt(r) (Yoo et al. 2005)

Increasing skill :
collective impact of individual improvements
+
Increasing diversity?

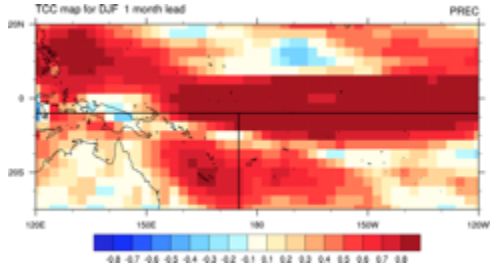
Significant increase of skill of Grand MME when APCC/CliPAS and ENSEMBLES are c ombined.

Enhancing utility of DSP : Post-processing of DSP

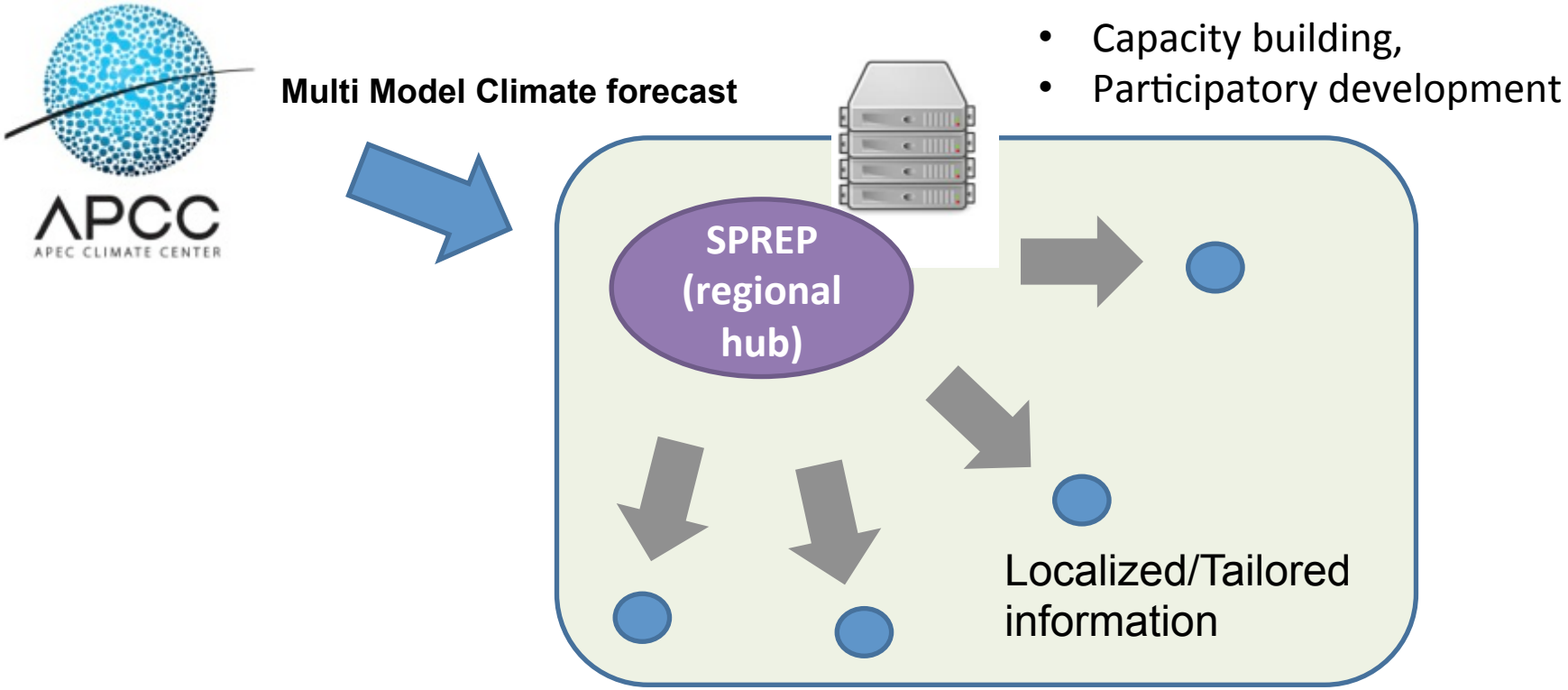
ROK-PI CLIPS (Rep. of Korea – Pacific Islands Climate Prediction Services) project (‘15-’17)

Seasonal prediction in Pacific Islands Countries

- Region with the highest potential/actual predictability by DSP
- So far, rely mostly on statistical model (Nino3.4)



“Let’s make the best use of DSP in the region”



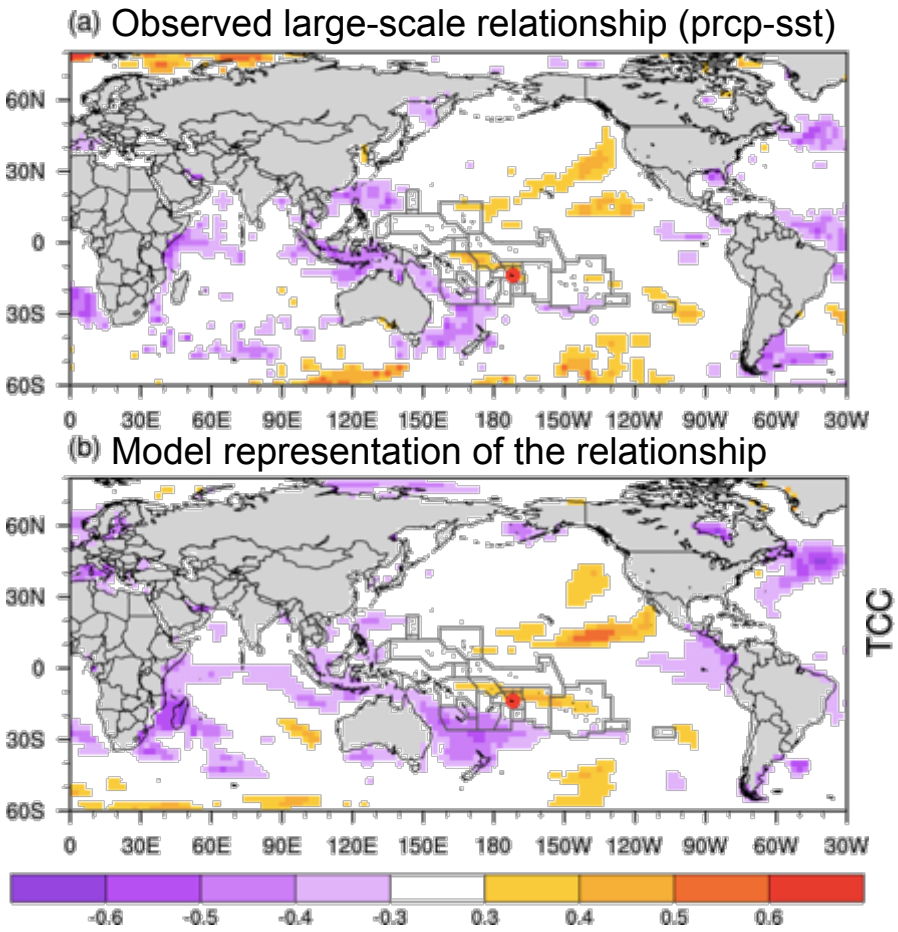
- Capacity building,
- Participatory development

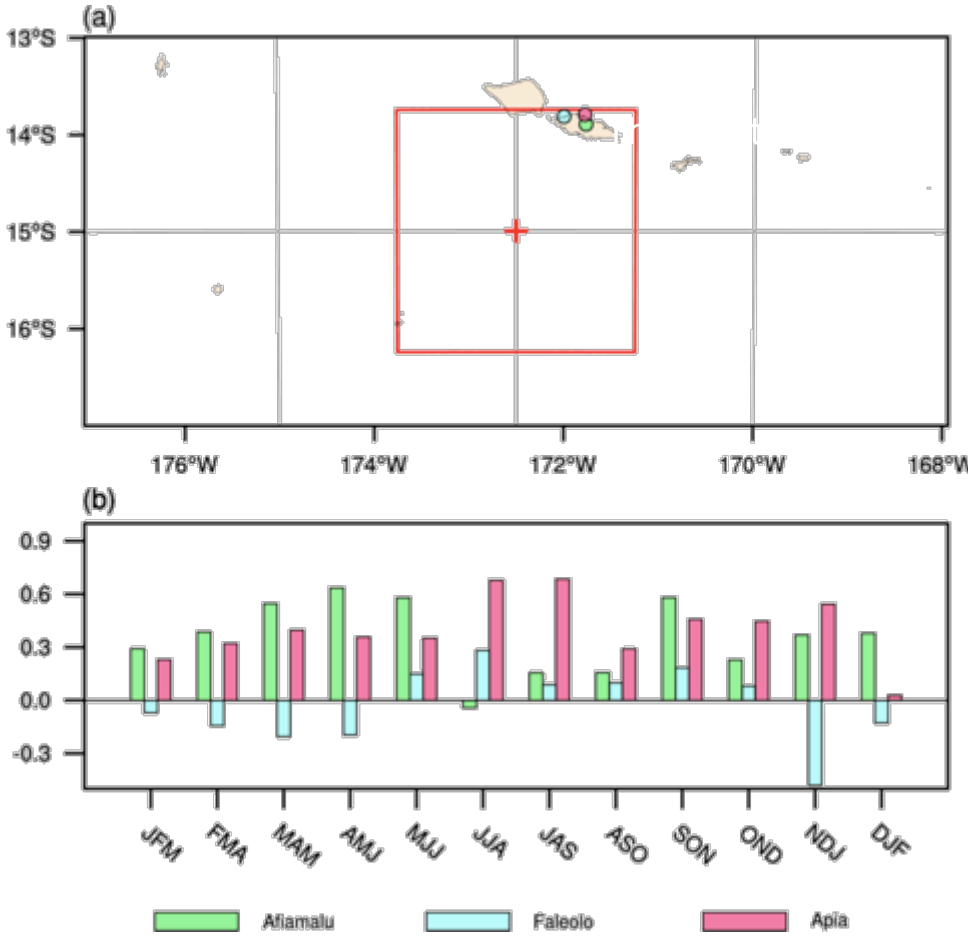
Post-processing of DSP

Statistical Downscaling is possible

Climate model can predict large scale structure related with islands' rainfall variability to some degree (ENSO related and Non-ENSO signal)

Difference between Individual station's rainfall va riability is partly systematic (due to topography)

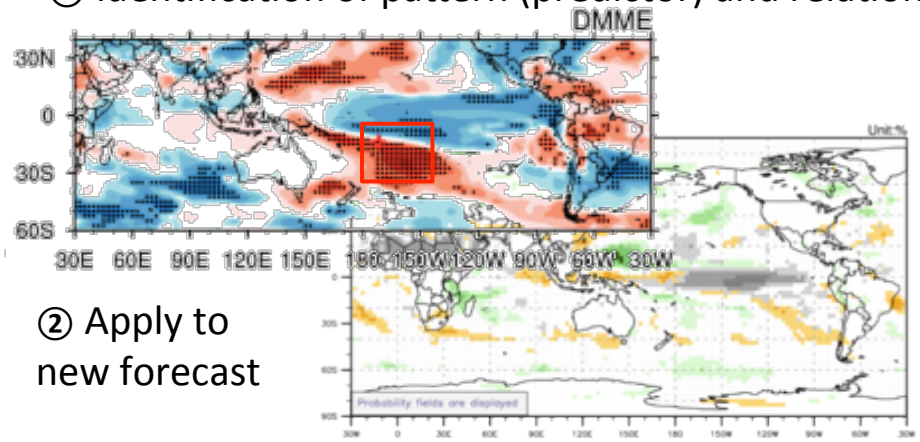




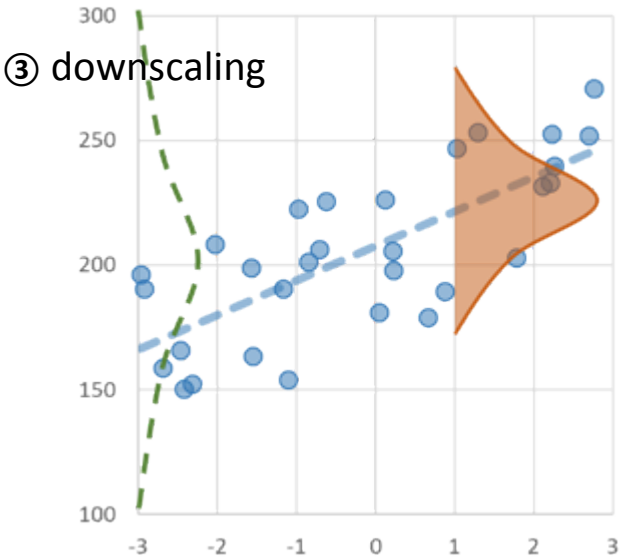
Post-processing of DSP

Local forecast is based on the relationship (Bayesian regression) between large scale pattern (MME) and individual station's seasonal rainfall → Develop a tool for forecaster

① identification of pattern (predictor) and relationship

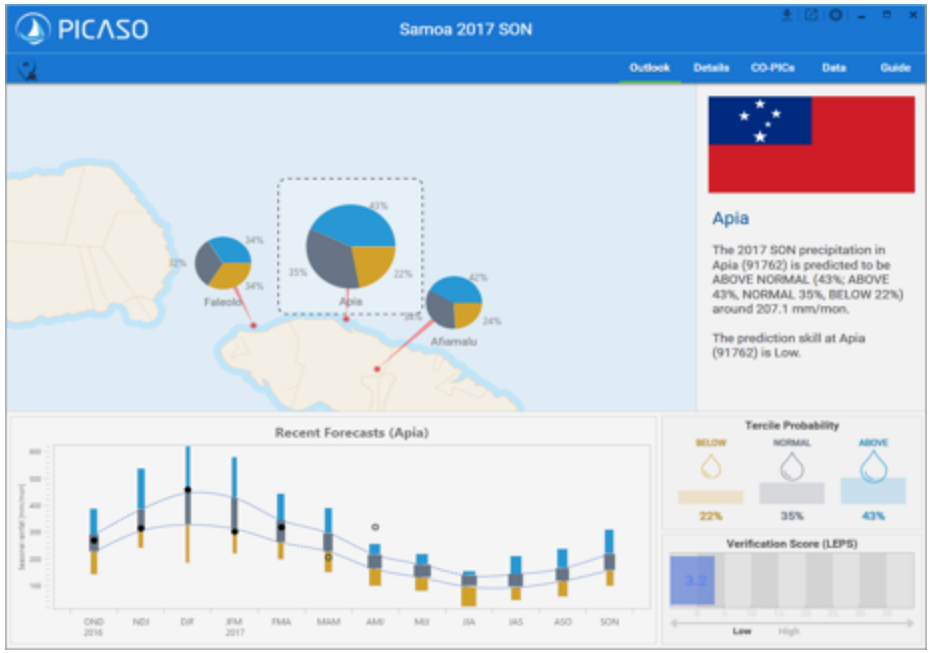


② Apply to new forecast



③ downscaling

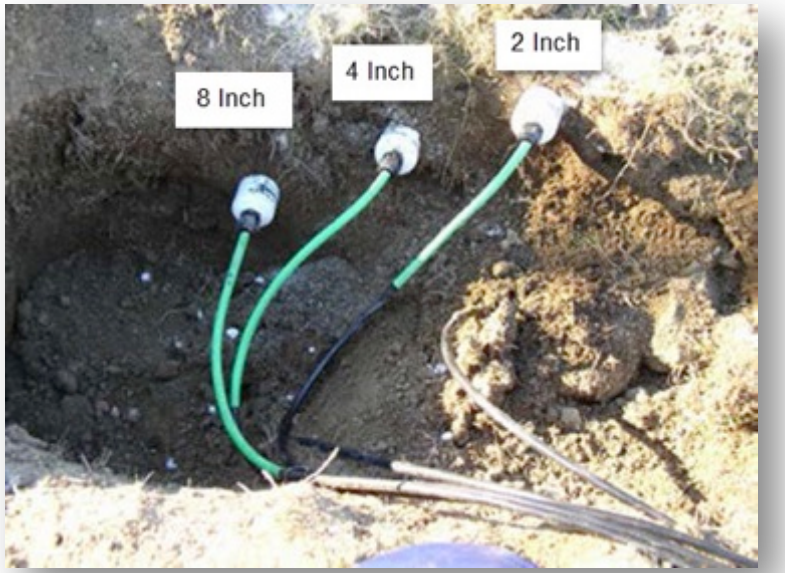
Pacific islands Country
Advanced Seasonal Outlook (PICASO)

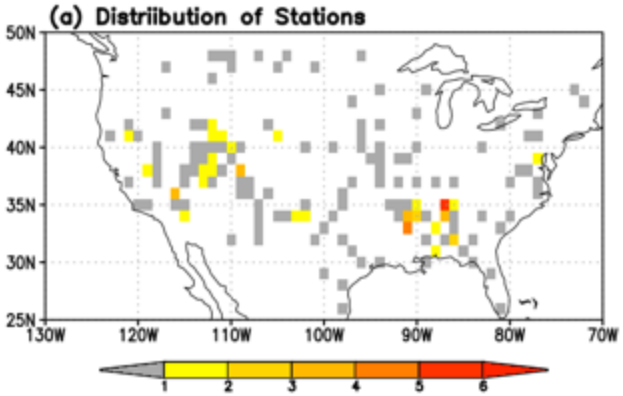


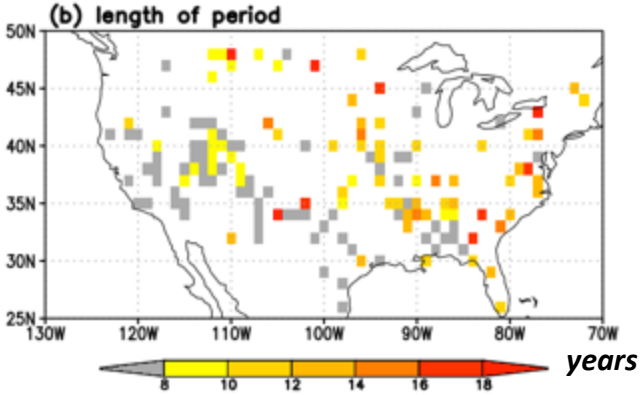
The first operational attempts was made in Pacific I slands Climate Outlook Forum (PICOF, Setp. 2017)

Thanks!

SCAN in-situ soil moisture







We used ground-based soil moisture data from the USDA Soil Climate Analysis Network (SCAN; http://www.wcc.nrcs.usda.gov).

LSM experiment design

	Exp1	Exp2	Exp3	Exp4
Precipitation correction	X	O	X	O
Blending Satellite dat aset	X	X	O	O

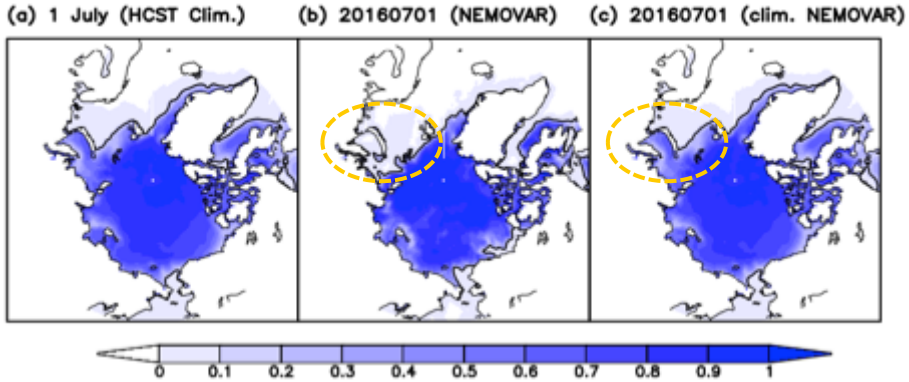
- Monthly CMAP data is used to correct the climatological difference between JRA-55 forcing, but sub-monthly variation is adopted by JRA-55.
- Long-term merged soil moisture satellite date (*ESA-CCI*) provides surface (~5cm) volumetric soil moisture for 1979~2015.
- The soil moisture data is nudged about a half of top-level (~10cm) soil moisture derived by JULES offline simulation.

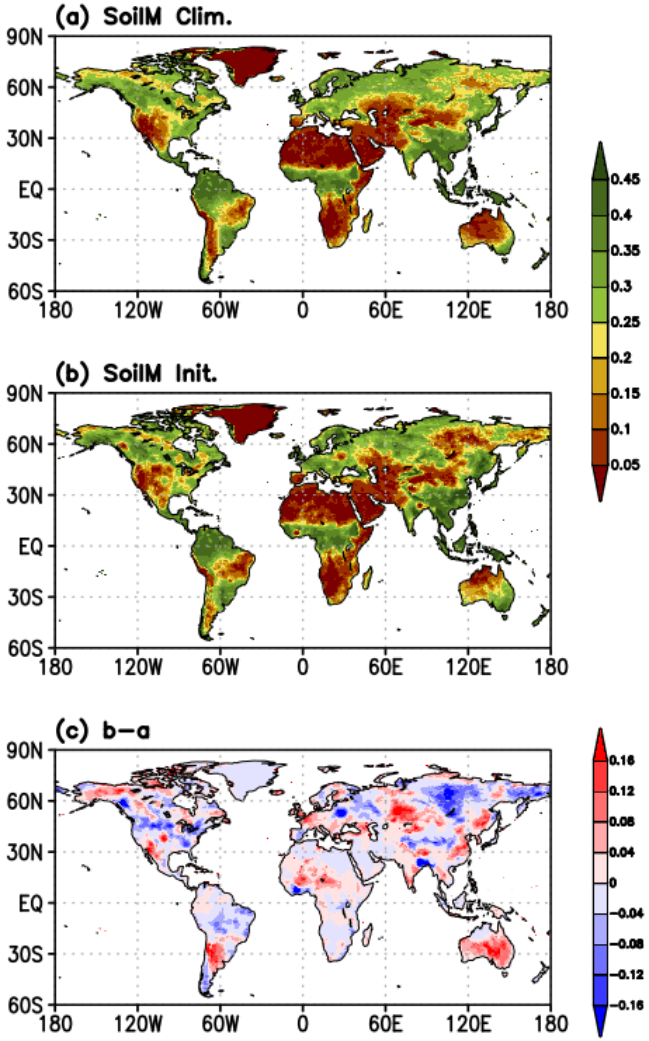
$$SoilM'_{diag} = \alpha \times SoilM_{diag} + \beta \times SoilM_{satellite} \quad [\alpha=0.5, \beta=0.5]$$

Experiment design (2016 heat wave)

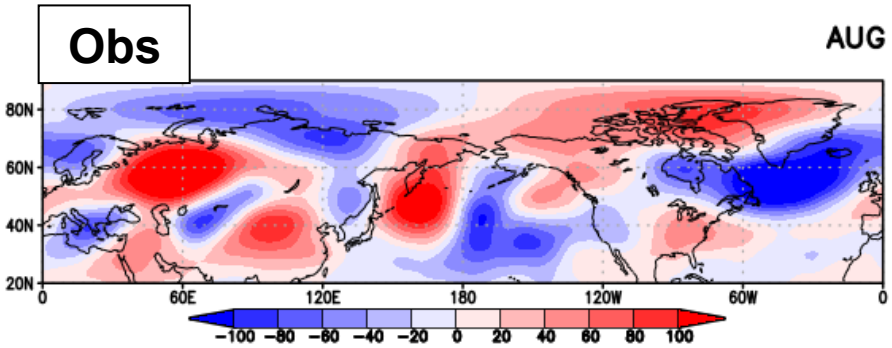
	Exp1	Exp2	Exp3	Exp4
Ocean/sea-ice initialization	Climatology	O	Climatology	O
Soil moisture initialization	Climatology	Climatology	O	O

- **Initial date: 1~5, July 2016**
  (each starting date has 4 member ensemble simulations)
- **Each experiment has 20 member ensembles**

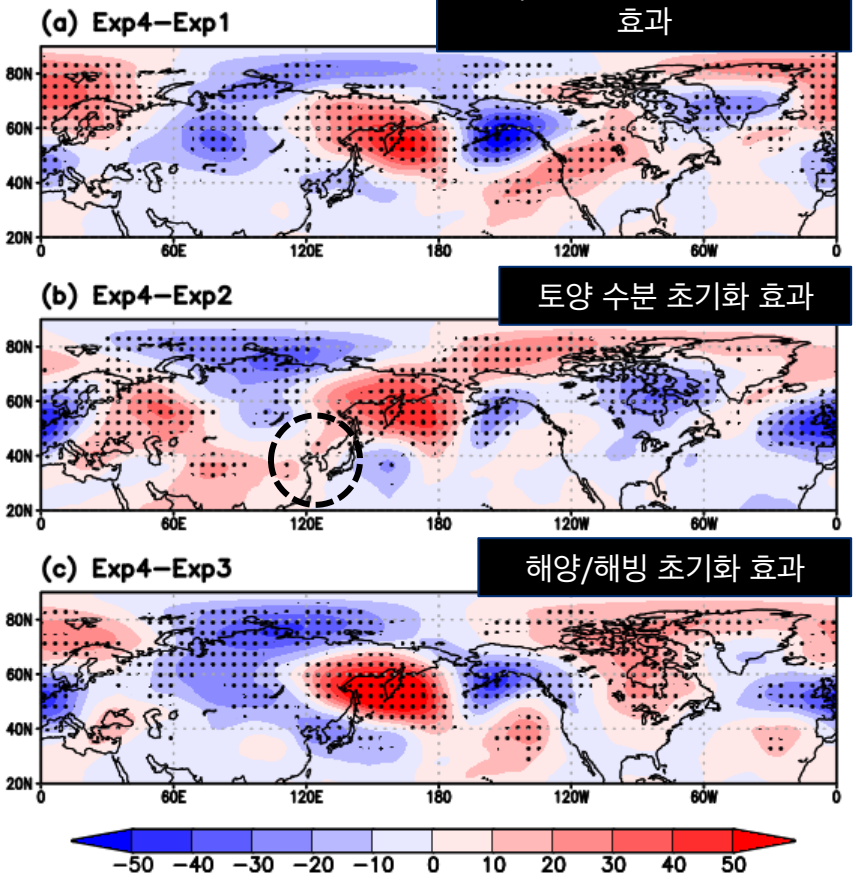




2016 East Asia heat wave (H300 - eddy)

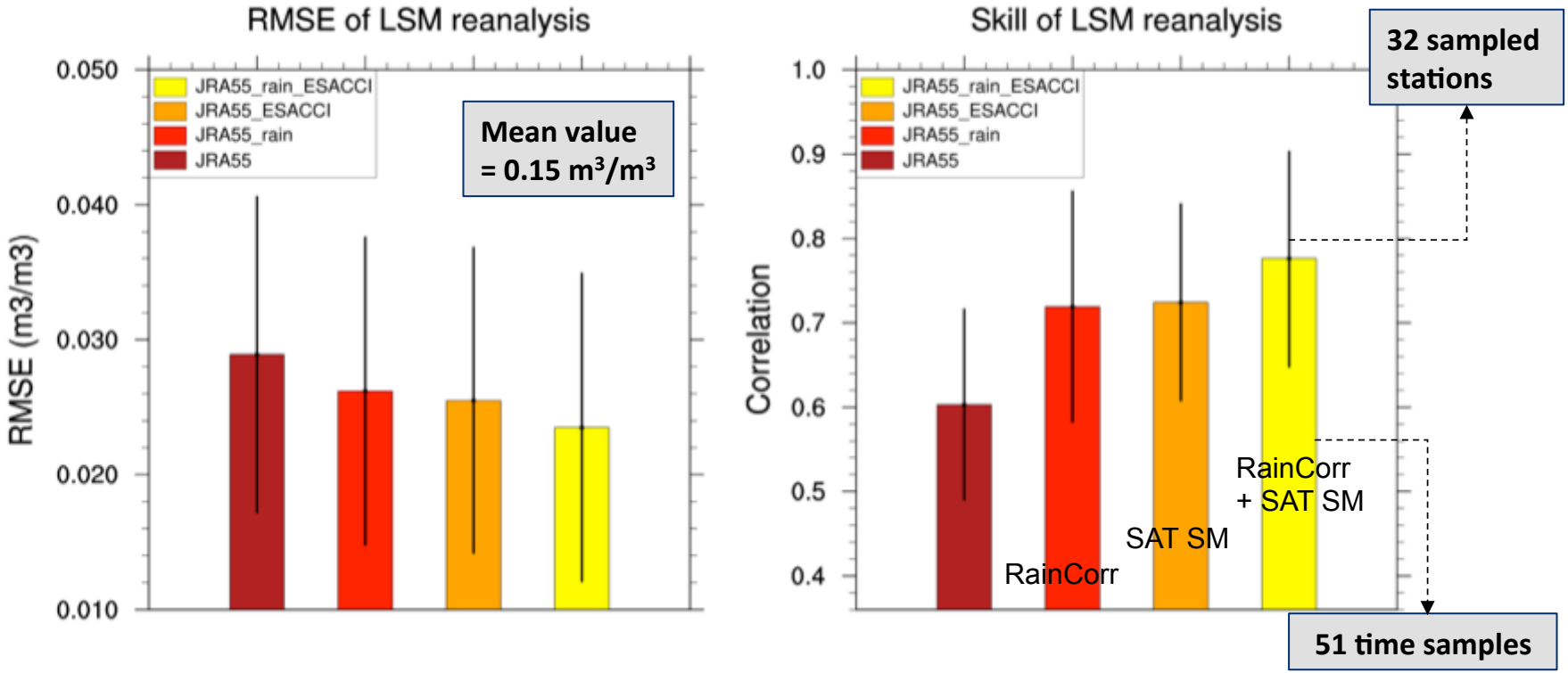


- 토양수분 영향이 다소 동아시아 폭염 발생하는 데에 기여함. (c.f. Exp4-Exp2)
- 해양/해빙 초기화 영향으로 캄차카 반도 high가 유도되지만, Eurasia에서는 Low가 유도됨. (c.f. Exp4-Exp3)
- Exp4-Exp# 에서 각 앙상블 별로 h300 zonal eddy depart ure 값이 ±20 인 앙상블이 10개가 넘는 경우 dotted.



Improvement of JJA soil moisture quality

North America (269-274E/33-35N) JJA soil moisture (~10cm)



- RMSE and Corr are assessed with in-situ SM observation
- Better precipitation data and nudging satellite estimate lead to better SM quality