A Project on Regional Climate Change for East Asia and Korean Peninsula
- within the CORDEX Framework -

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Geoscientific
Model Development

WCRP COordinated Regional Downscaling EXperiment (CORDEX): a diagnostic MIP for CMIP6

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CORDEX-CORE Framework

- Coordinated Output for Regional Evaluation (CORE) in part to be responsible to IPCC needs

- For each domain, a matrix of GCM-RCD experiments is designed to cover as much as possible for different dimensions of the uncertainty space (e.g., emissions and GCM spreads)

- As a CMIP endorsed diagnostic MIPs, all outputs should be archived and distributed by ESGF following the CMIP standard format conventions

CORDEX-EA: Phase I vs. Phase II
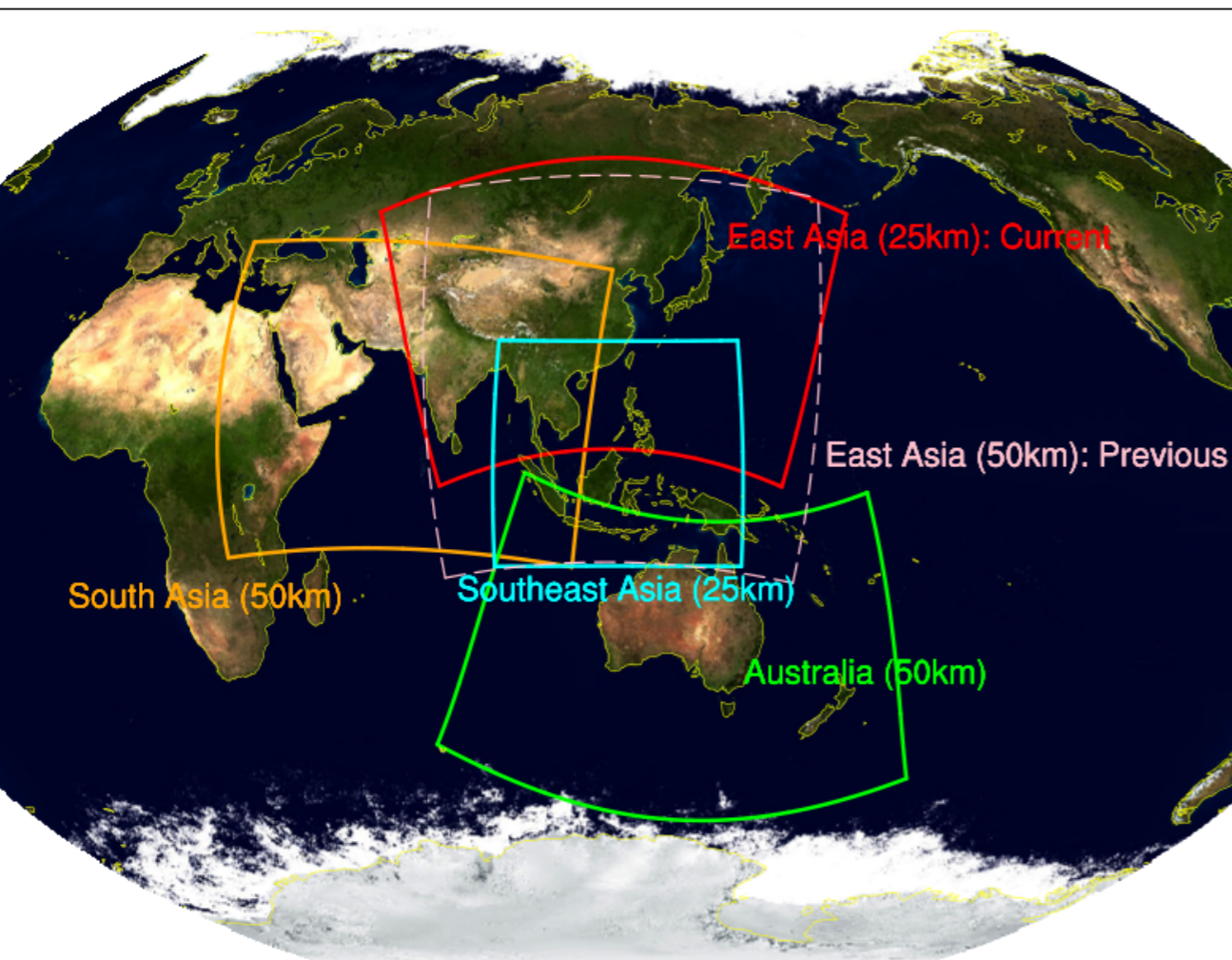
- New domain and resolution, which means…

- Single GCM forcing was the limitation of phase 1. Multi-GCMs are essential for the Phase II.

- More groups in Japan and China joined, particularly ESD-Asia group has been launched by K. Dairaku.

- KMA/APCC will setup and open the ESGF data node next year.

A Regional Downscaling Project coordinated by KMA
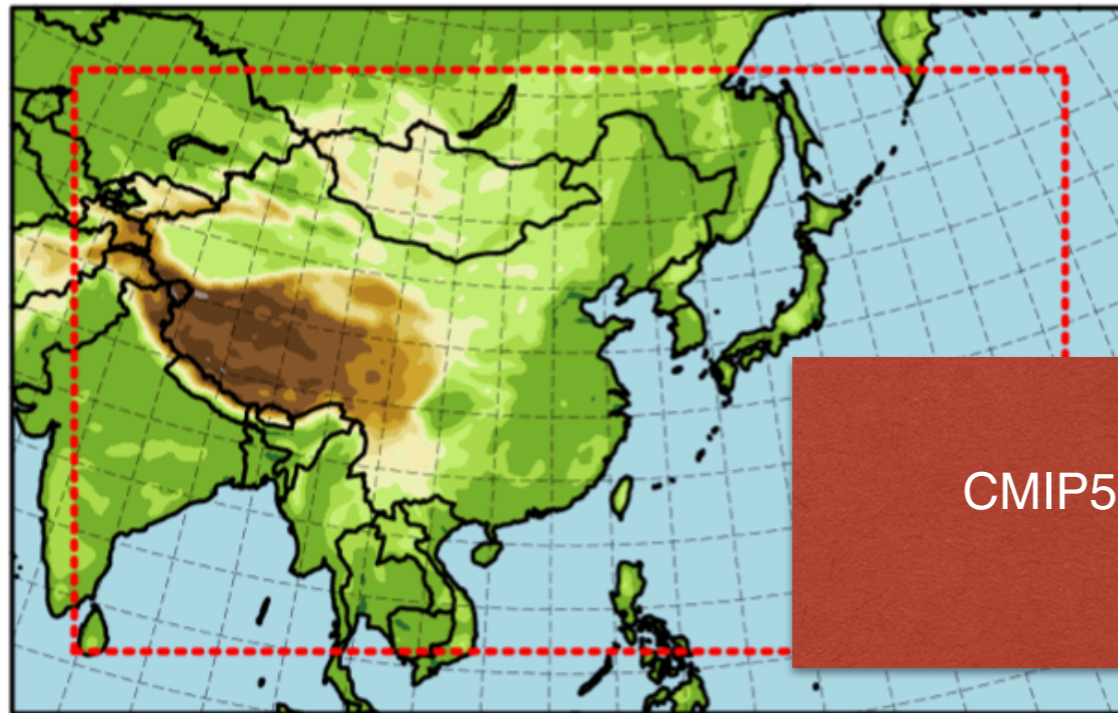
KMA/NIMS
CMIP5 experiment with HadGEM2-AO and provide GCM forcing
Coordinate CORDEX-East Asia
ESGF node for data archiving/distribution

Dynamical Downscaling Group	Statistical Downscaling Group	(Extreme) Analysis Group	Application Group
• Multi-RCMs forced by HadGEM2-AO • Ensemble method • Uncertainty Assessment	• Method Development • High-resolution projection data up to 1 km • Focusing on national scenario	• Evaluation of CORDEX outputs for extreme events • Evaluation of Tropical Cyclones	• Essential factors for administrative districts in *agriculture*, *health*, and *disaster prevention* sectors.

GCM-RCM-ESD matrix
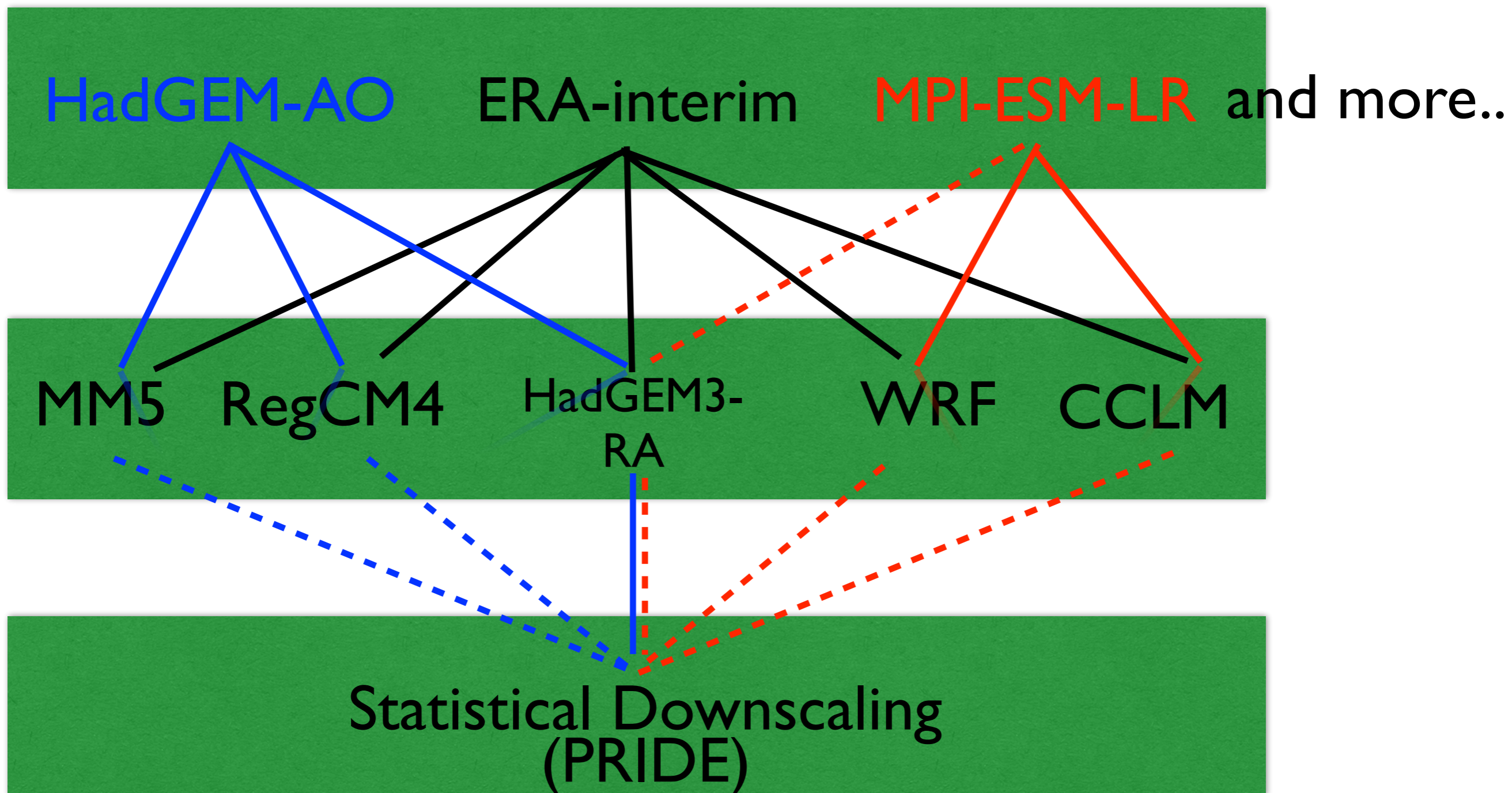
Simulation Results forced by ERA-interim reanalysis

Temperature Bias against w/ APHRODITE (1981-2005)
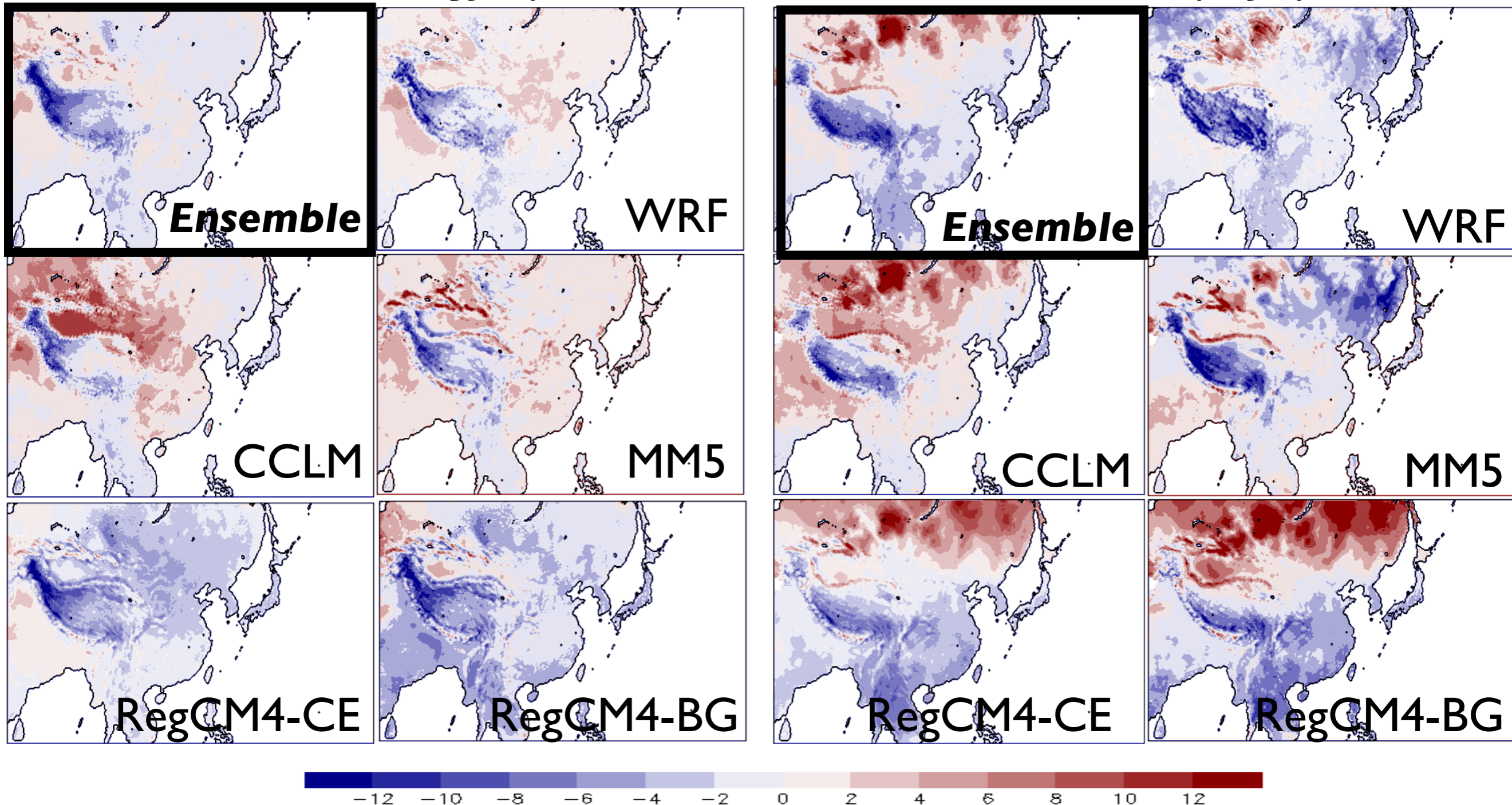
Summer (JJA)

Winter (DJF)

Ensemble · WRF · CCLM · MM5 · RegCM4-CE · RegCM4-BG

−12 −10 −8 −6 −4 −2 0 2 4 6 8 10 12

Precipitation Bias against w/ APHRODITE (1981-2005)

Summer (JJA)

Ensemble | WRF
CCLM | MM5
RegCM4-CE | RegCM4-BG

Winter (DJF)

Ensemble | WRF
CCLM | MM5
RegCM4-CE | RegCM4-BG

East Asia Summer Monsoon
(Area, Intensity, Period)
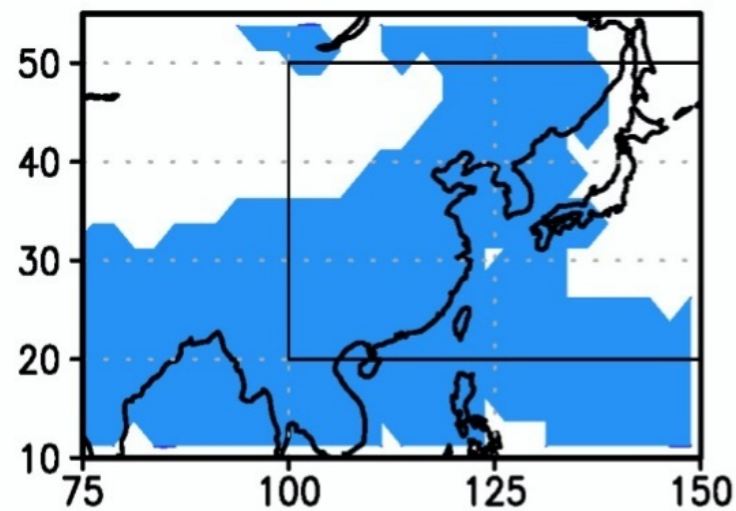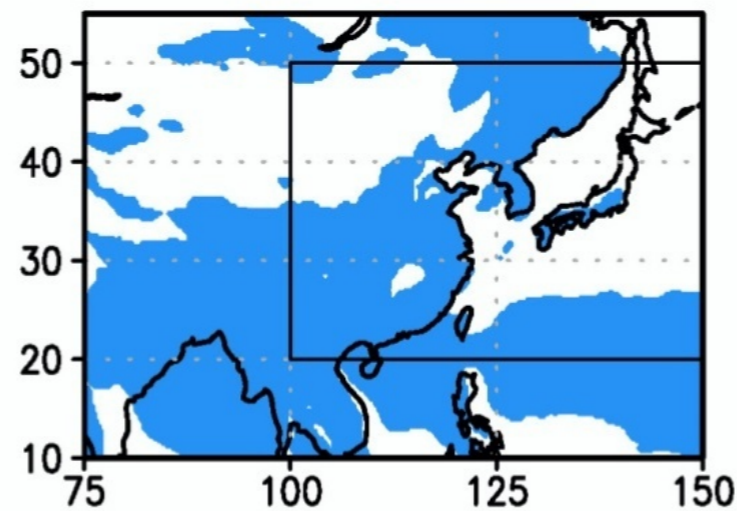
OBS ERA-inteirm CCLM
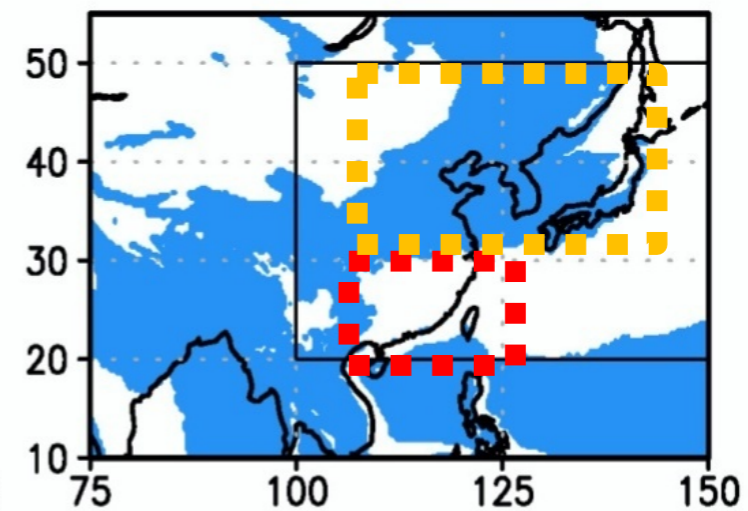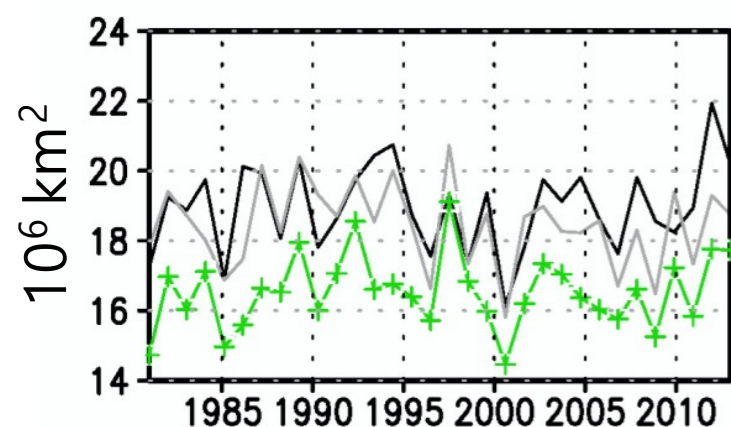
Whole Domain East-Asia
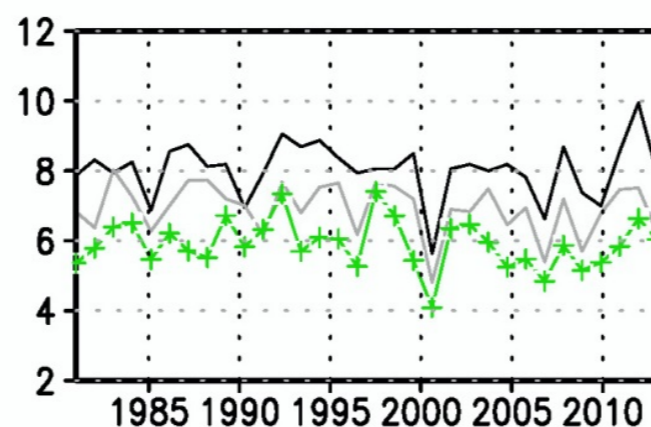
- Underestimation is caused by less monsoon in southern China.

- Features in mid-latitudes look close to observation.

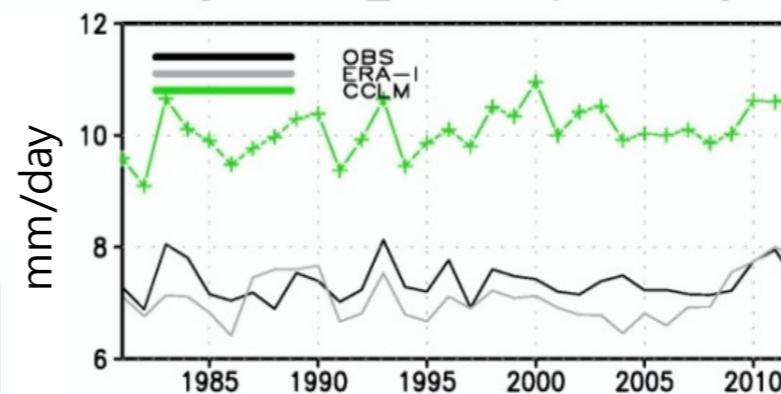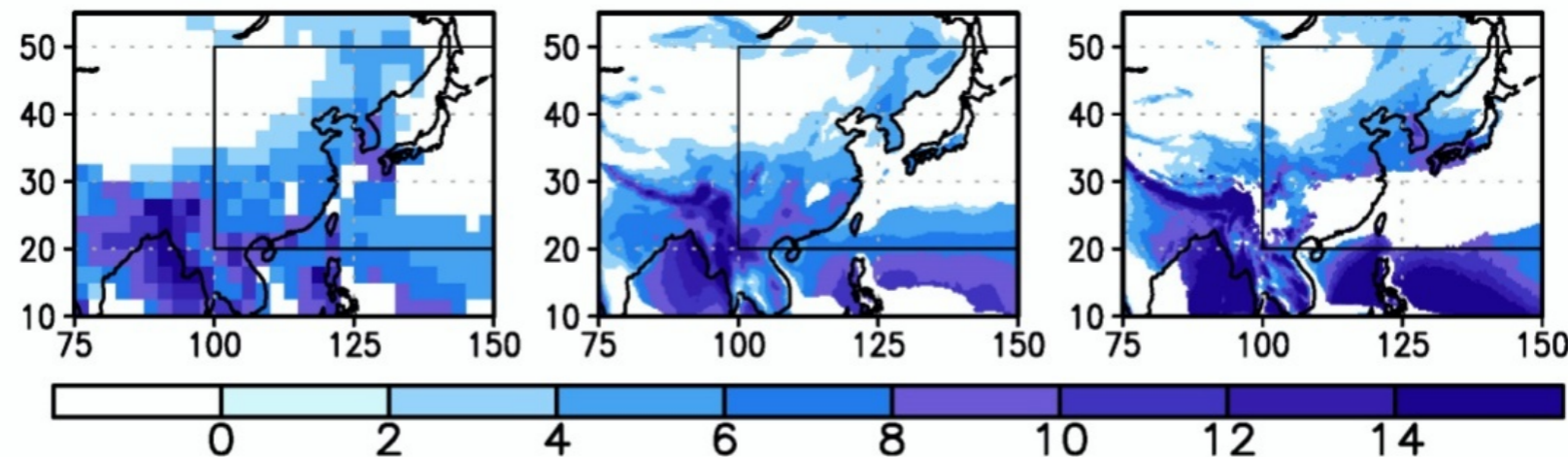# East Asia Summer Monsoon
(Area, Intensity, Period)

EASM Index

Wang et al. (2008)

Correlation: 0.93
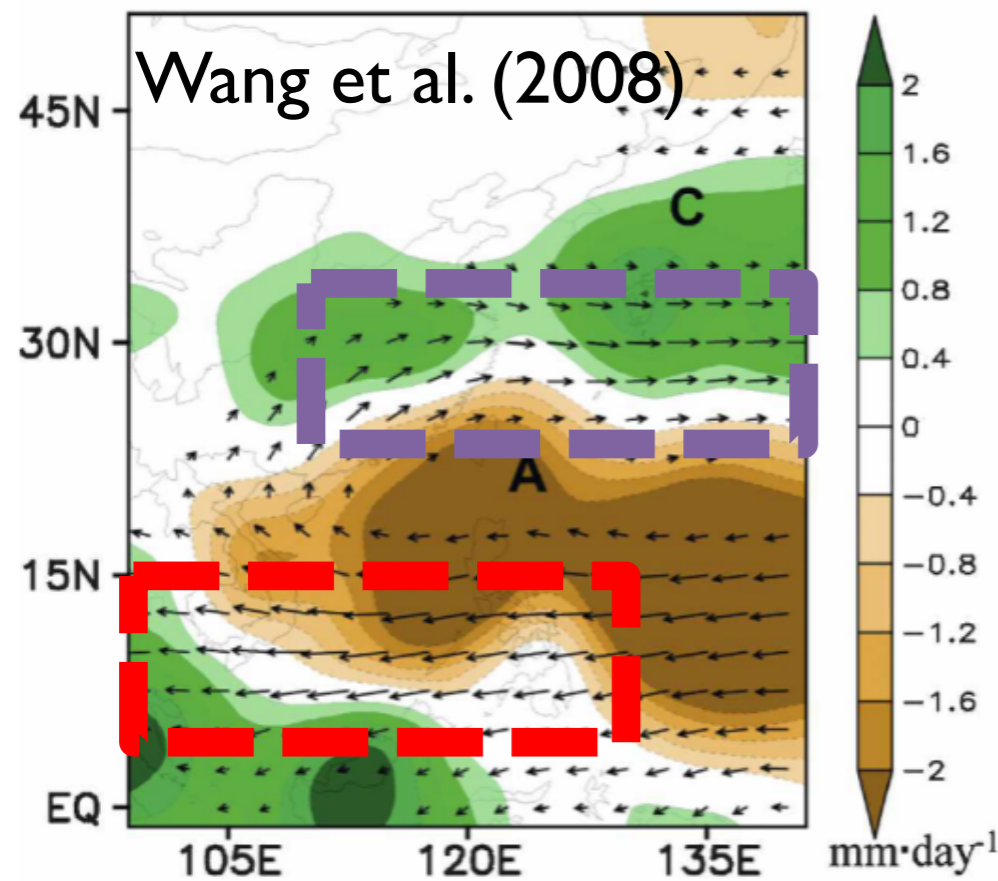
Monsoon Precipitation

OBS   ERA-interim   CCLM
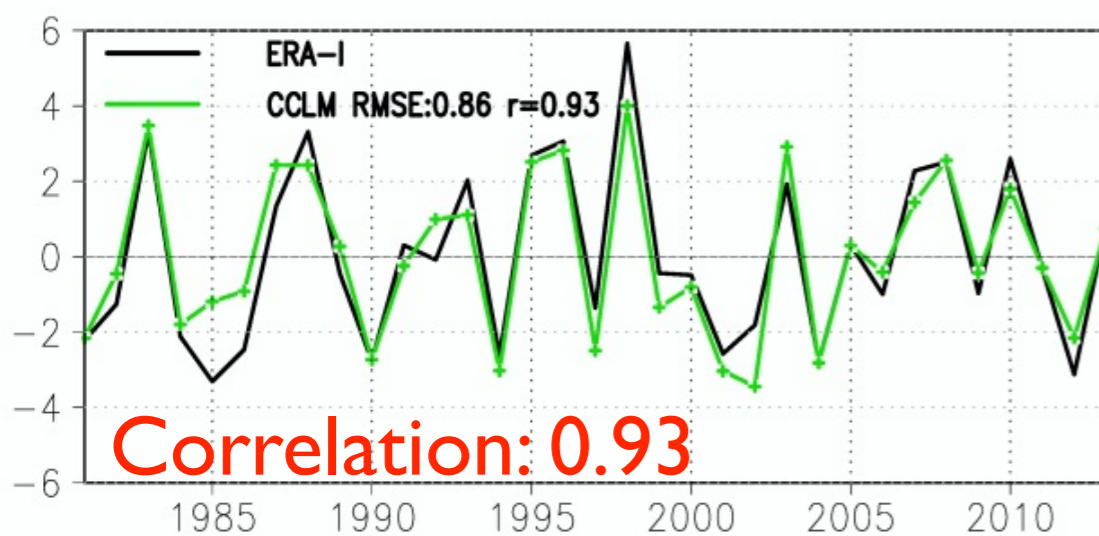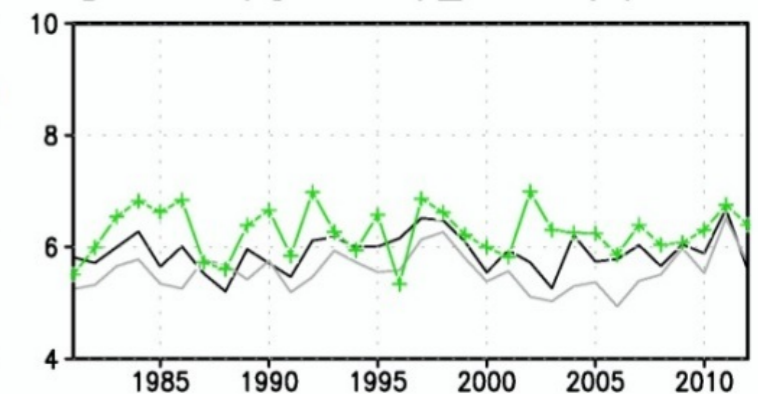
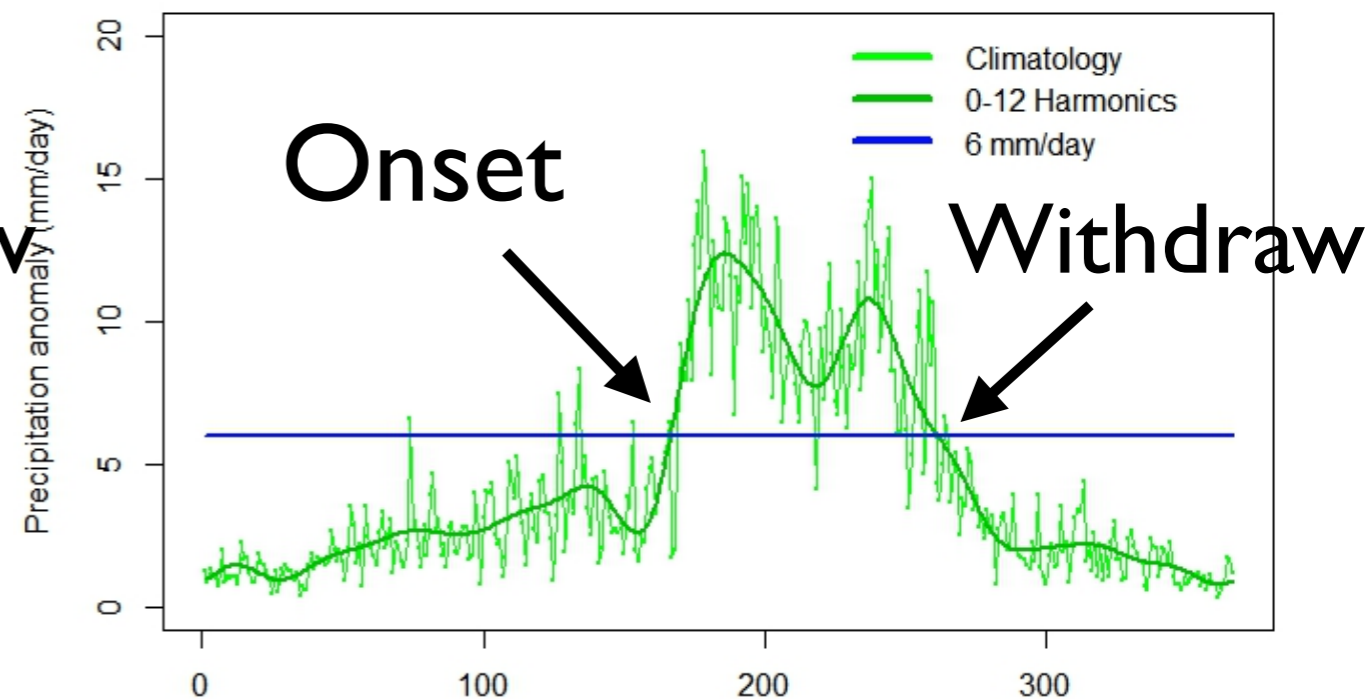Overestimation of monsoon precipitation, but fairly good inter-annual variation in East Asia.

East Asia Summer Monsoon
(Area, Intensity, Period)

OBS (APHRODITE)

Onset

Withdraw

CCLM

Onset

Withdraw
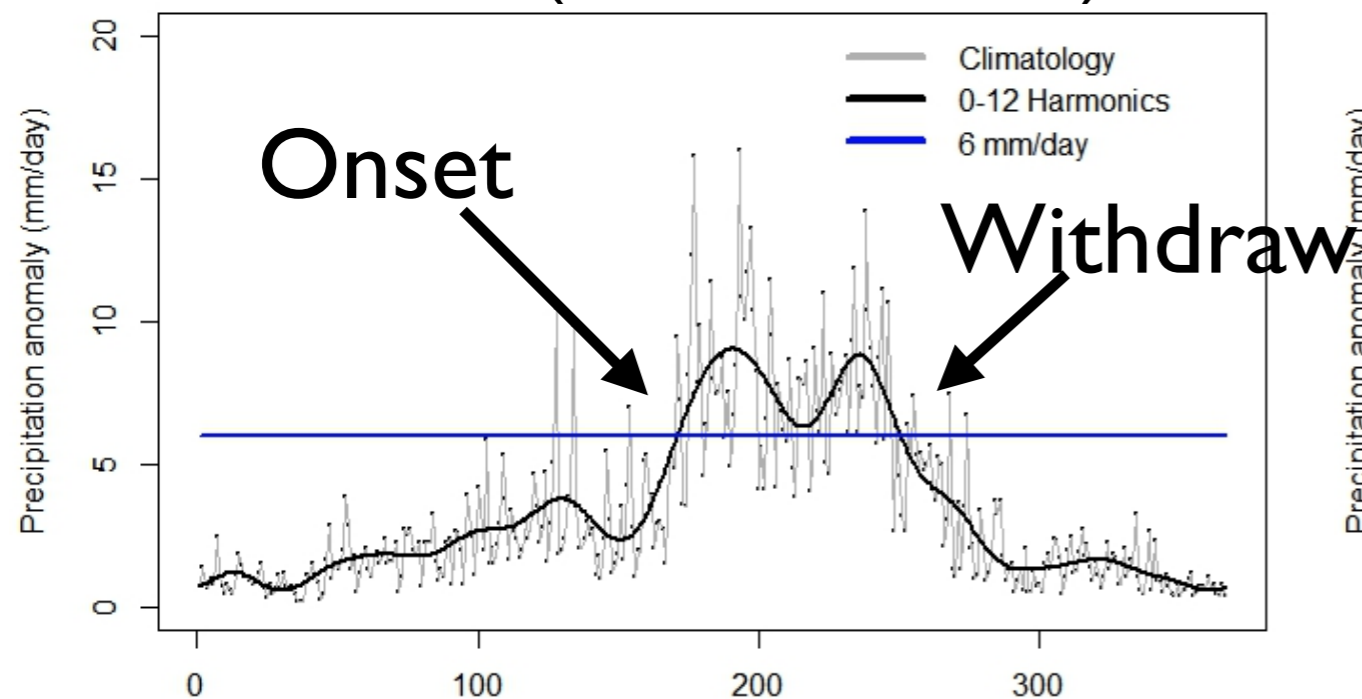
- Definition: Period in which the precipitation from 12 harmonics is above 6 mm/day (Wang and LinHo, 2002).

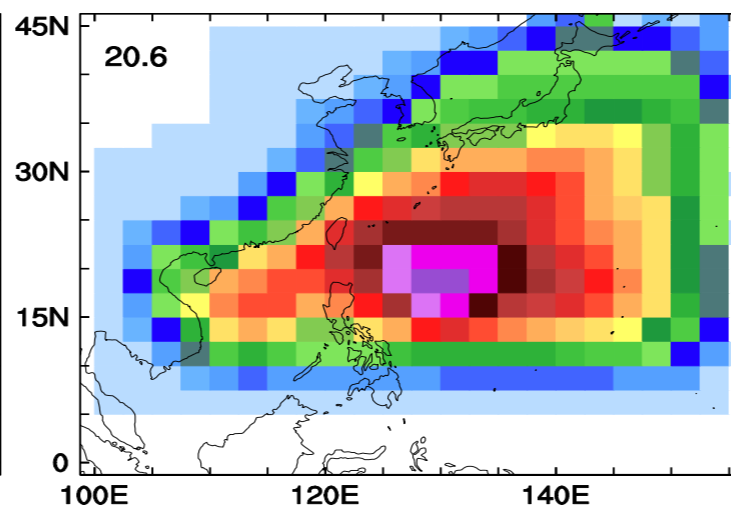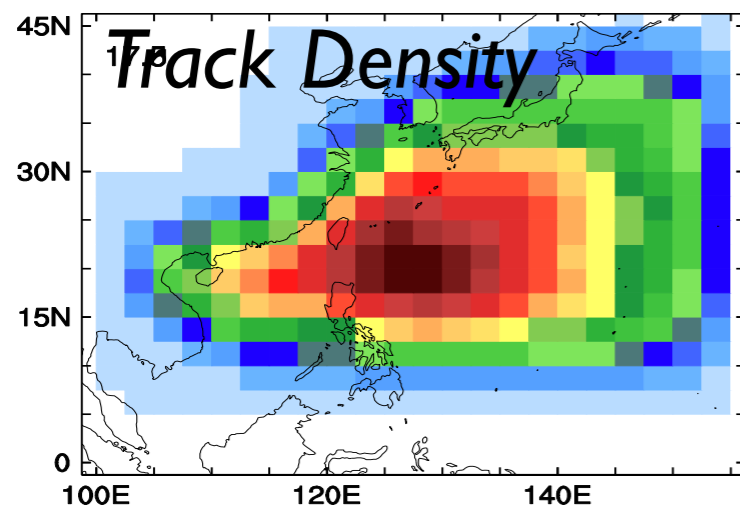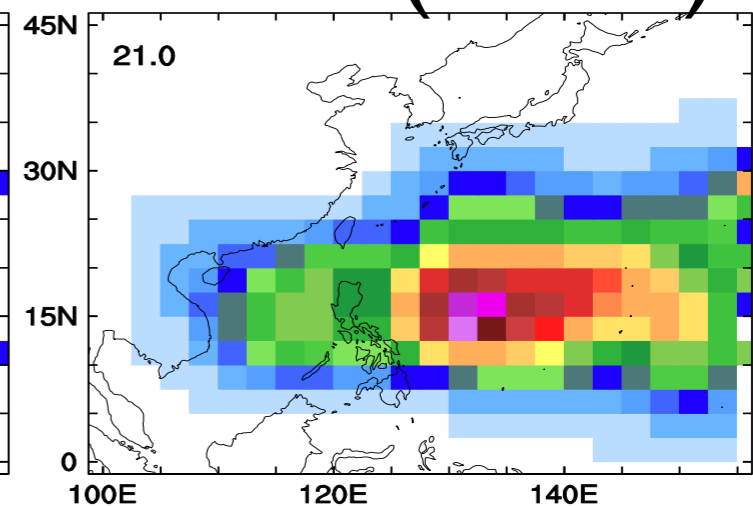- Monsoon in CCLM starts 5 days earlier, and lasts 16 more days.

Tropical Cyclones
(Numbers, Intensity)
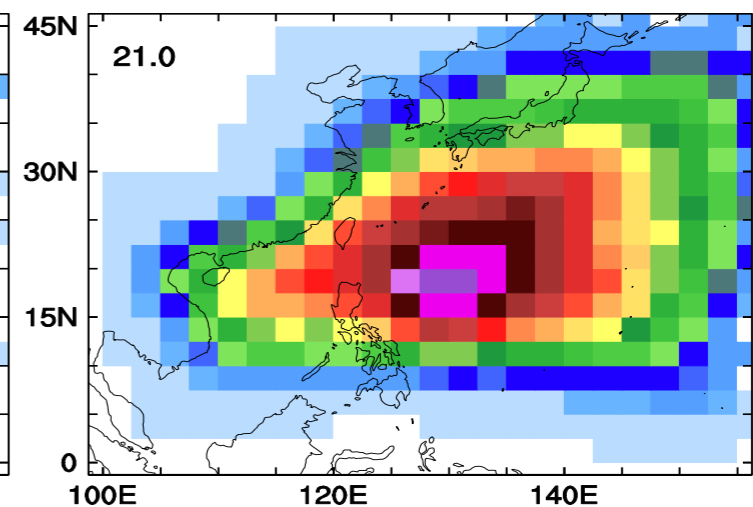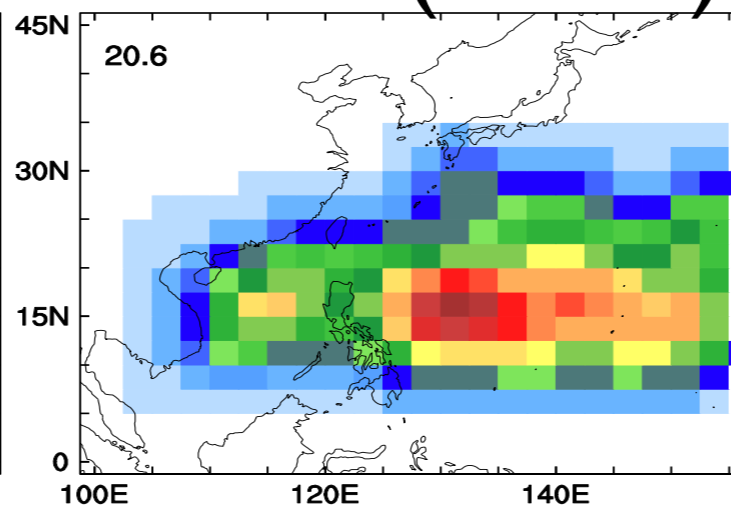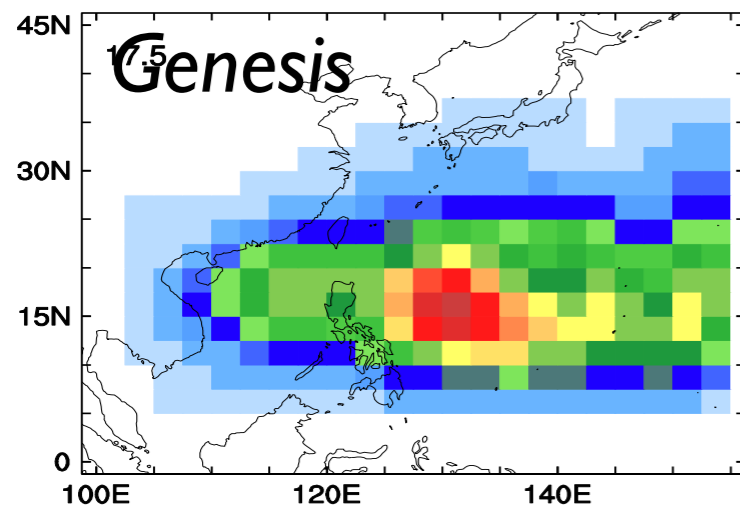
	RSMC	MM5 (50 km)	MM5 (25 km)
Numbers	17.5	20.6	21.0

Tropical Cyclones
(Numbers, Intensity)
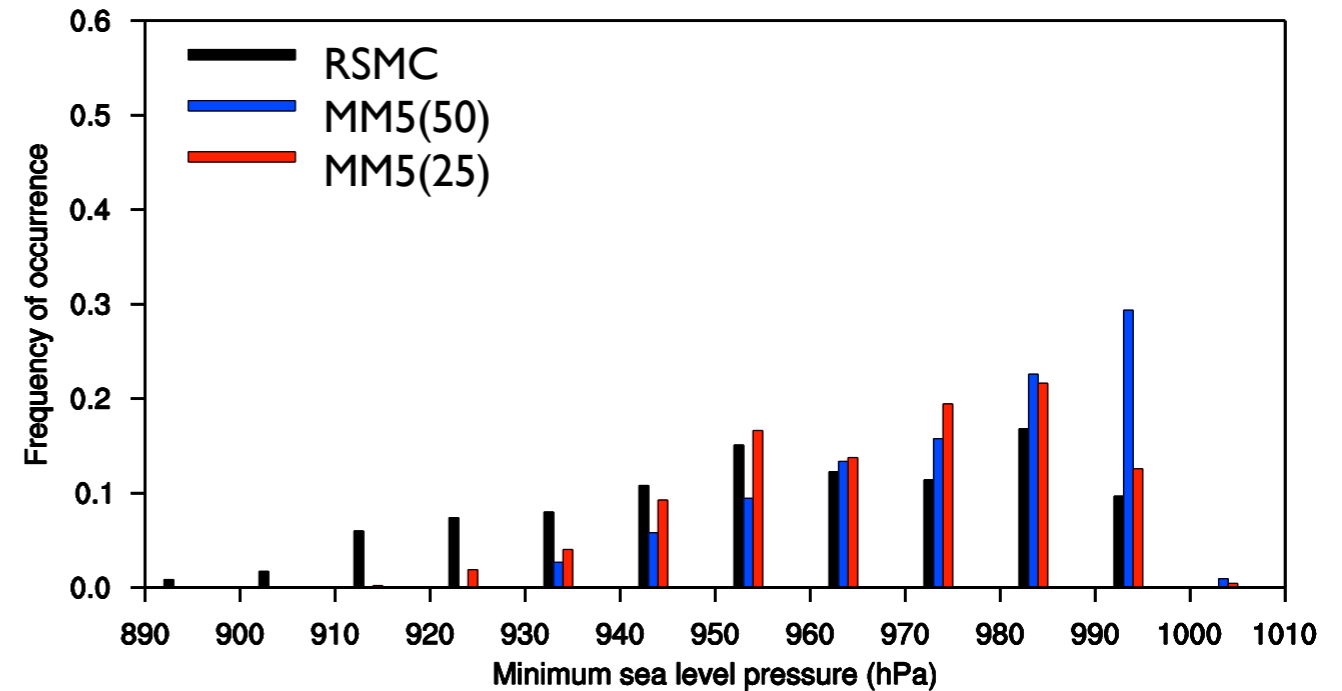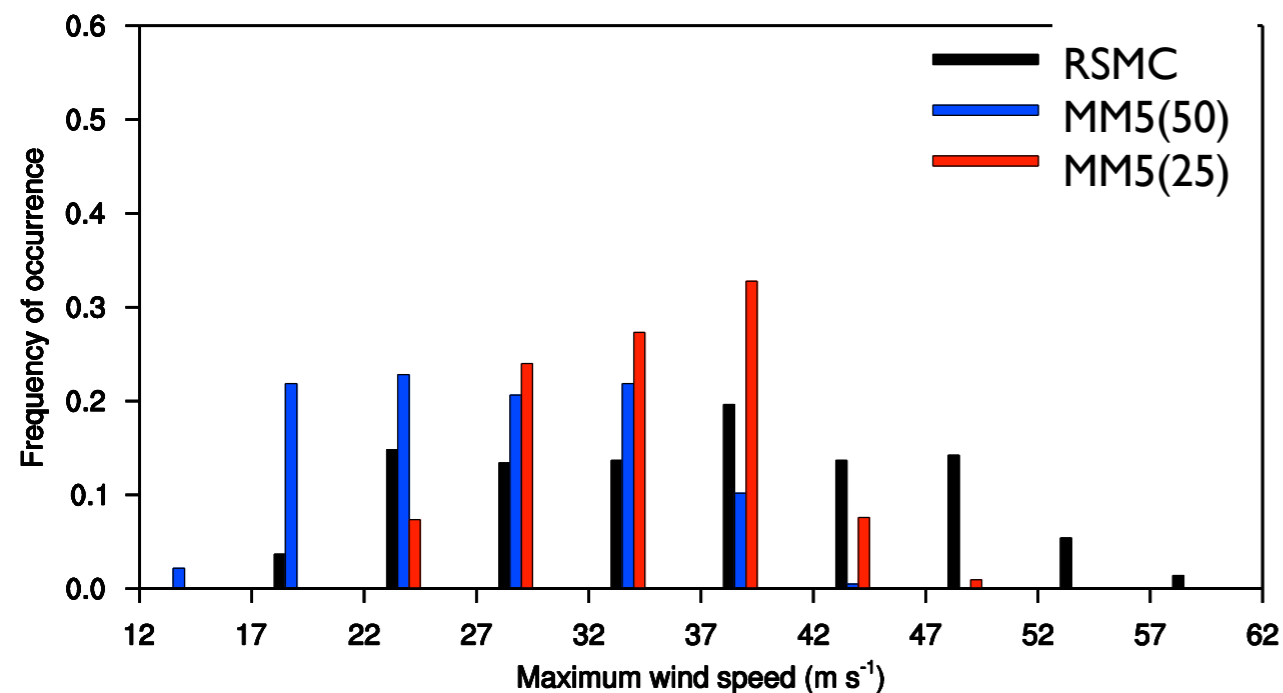
	RSMC		MM5 (50 km)		MM5 (25 km)	
	Mean	Max/Min	Mean	Max/Min	Mean	Max/Min
Max Wind (m/s)	38.0	61.7	27.7	39.9	34.7	47.3
Min Press (hPa)	956.1	890.0	978.6	932.8	970.1	918.2

Added-values in higher-resolution
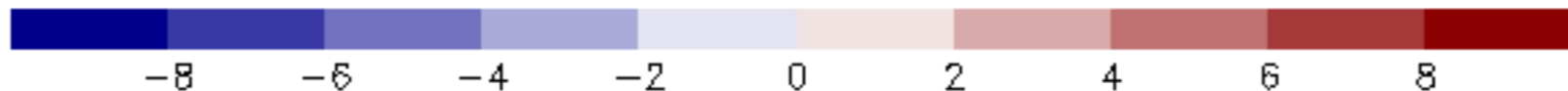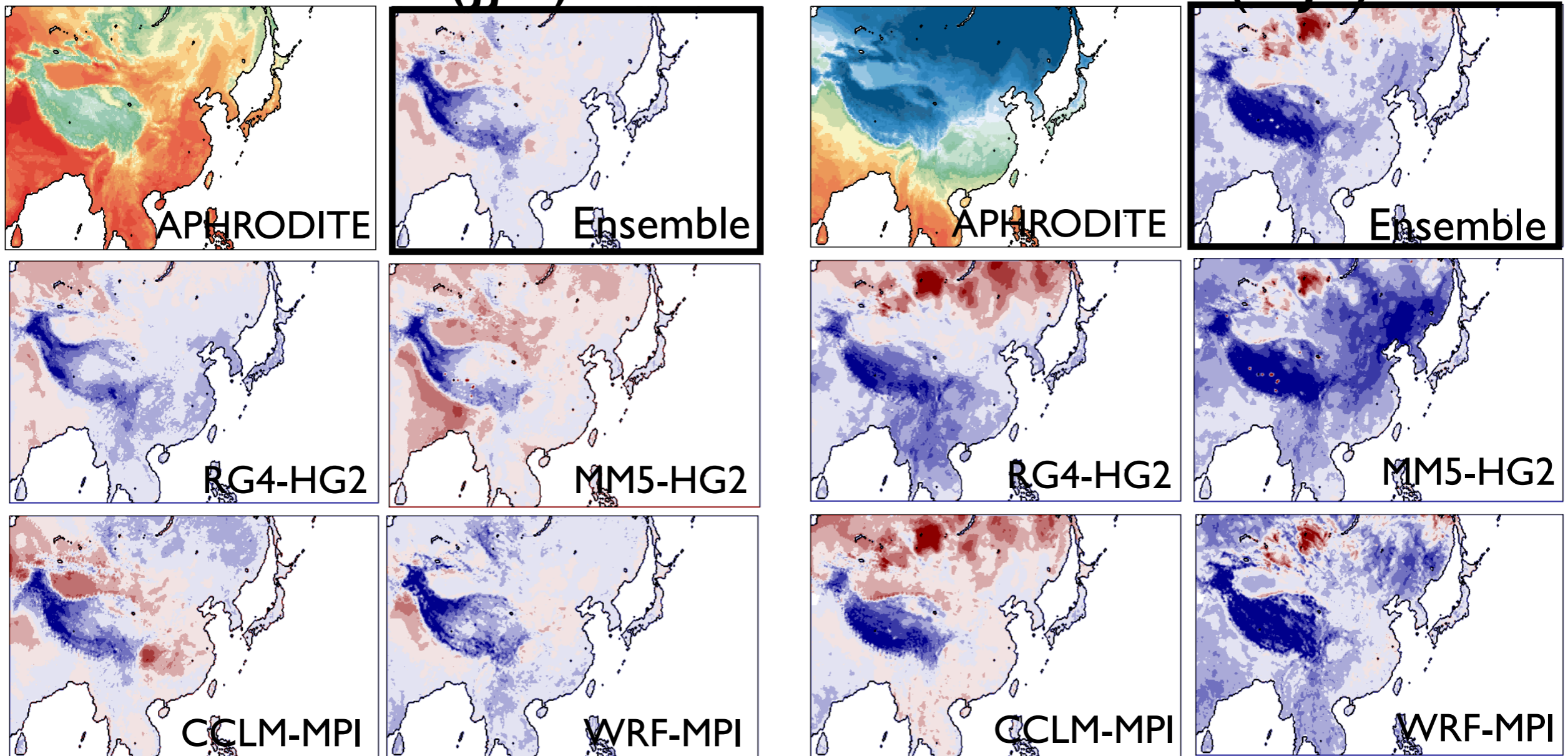## - Precipitation PDF -
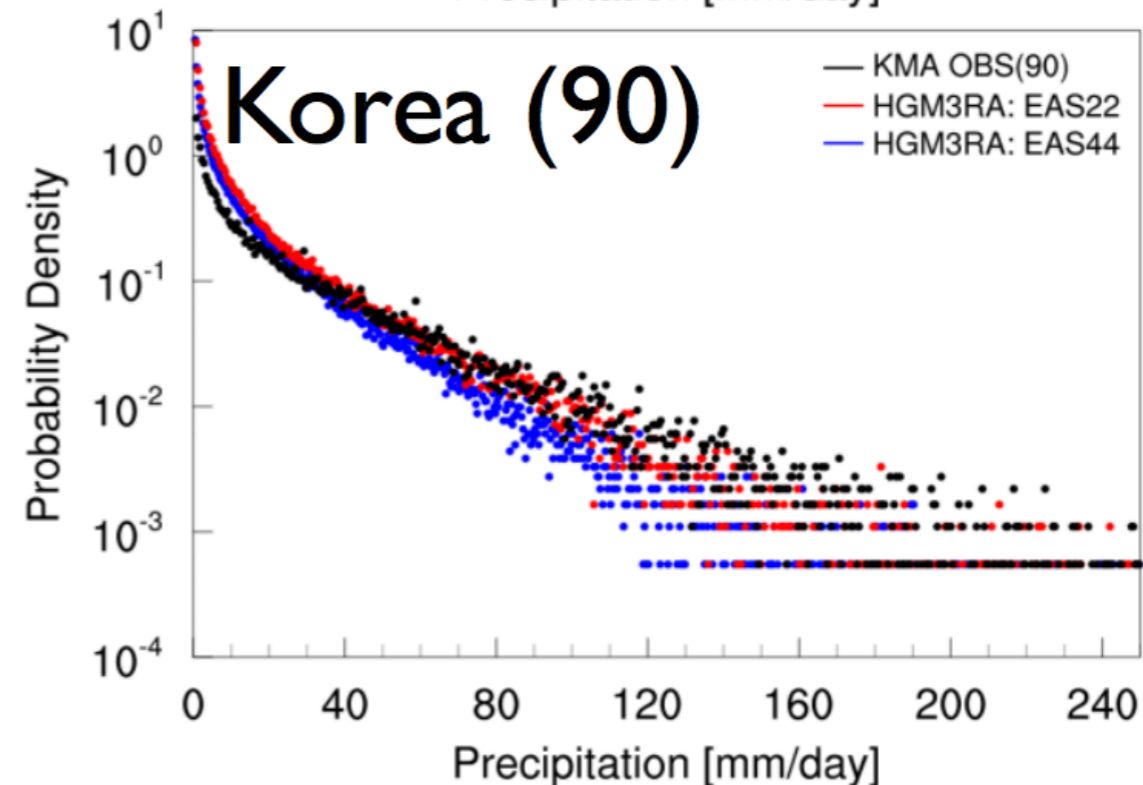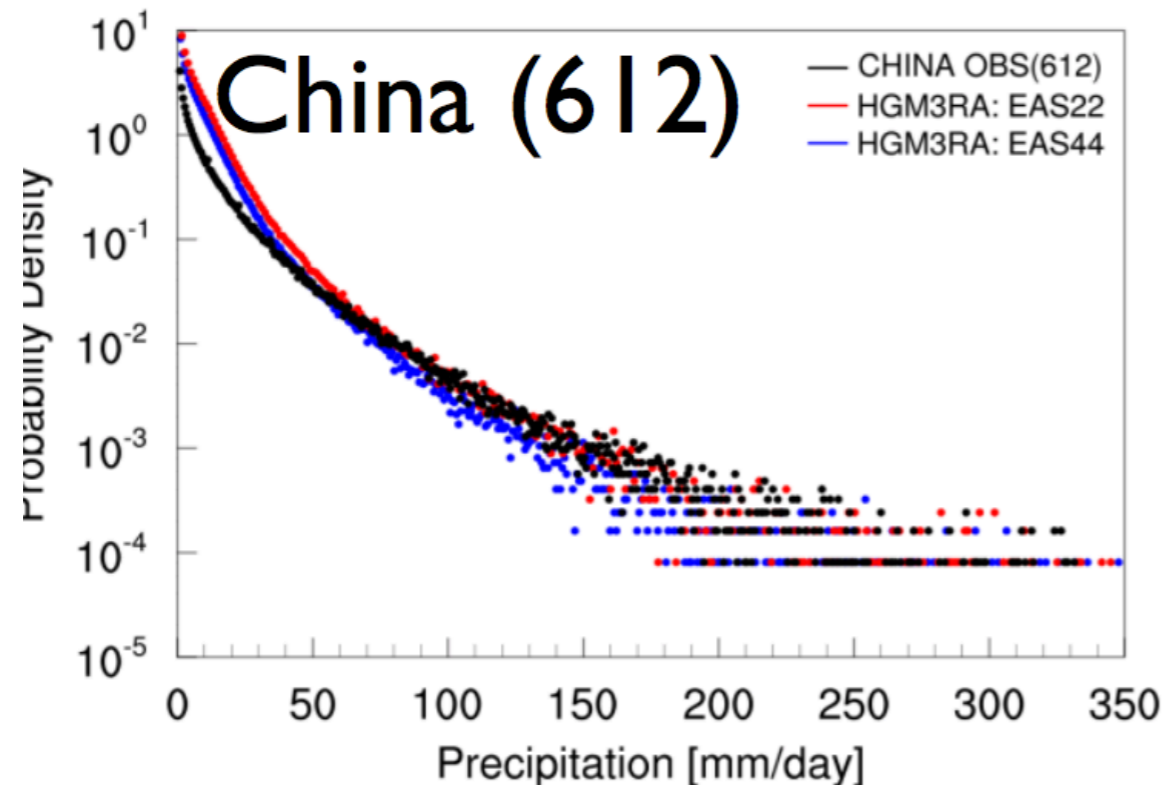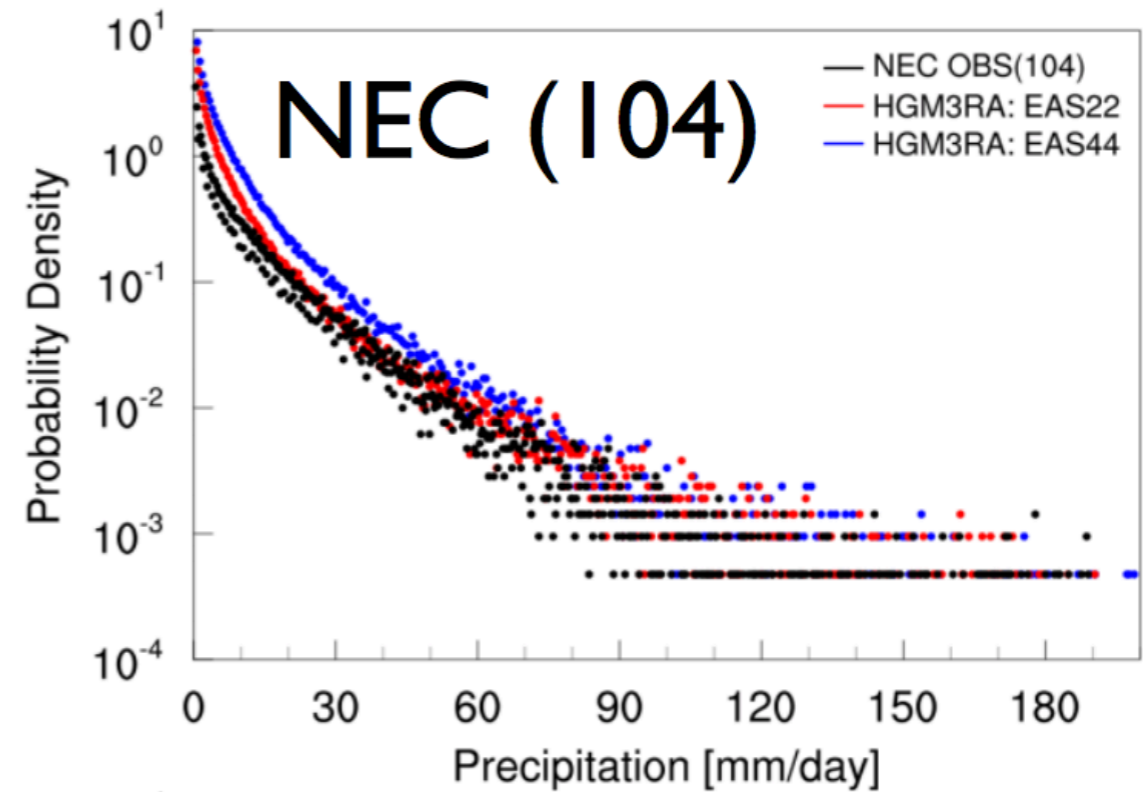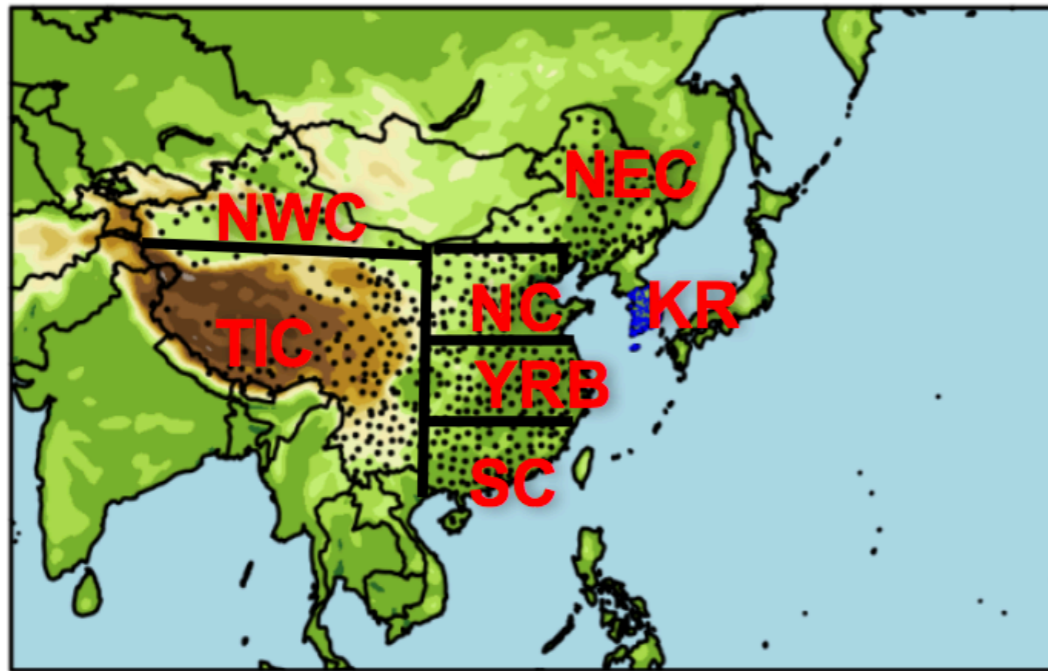
Preliminary Results from HCST simulations with GCM forcing

Temperature Bias

against w/ APHRODITE (historical: 1981-2005)
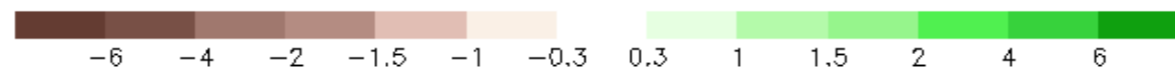
Summer (JJA)

Winter (DJF)

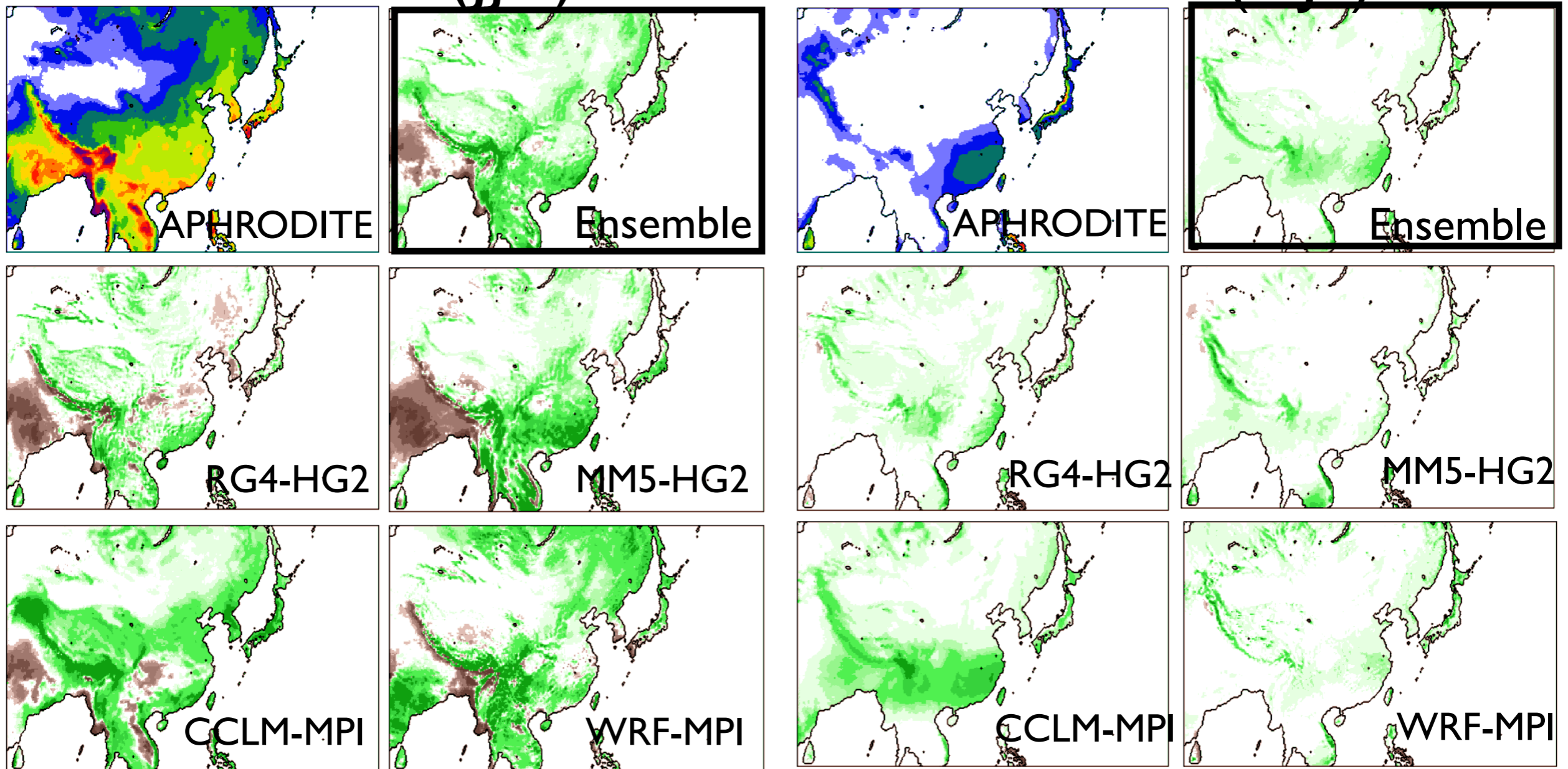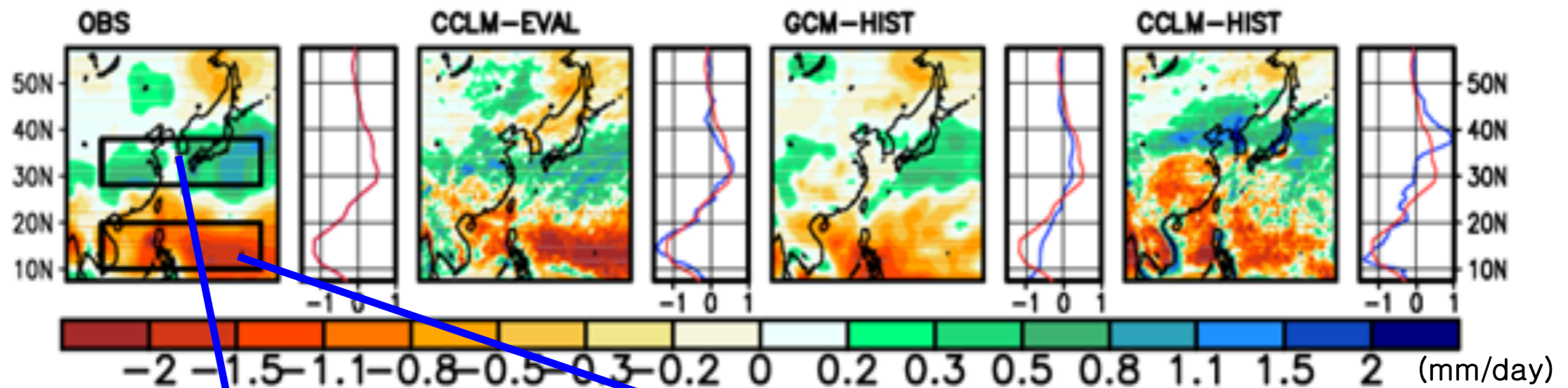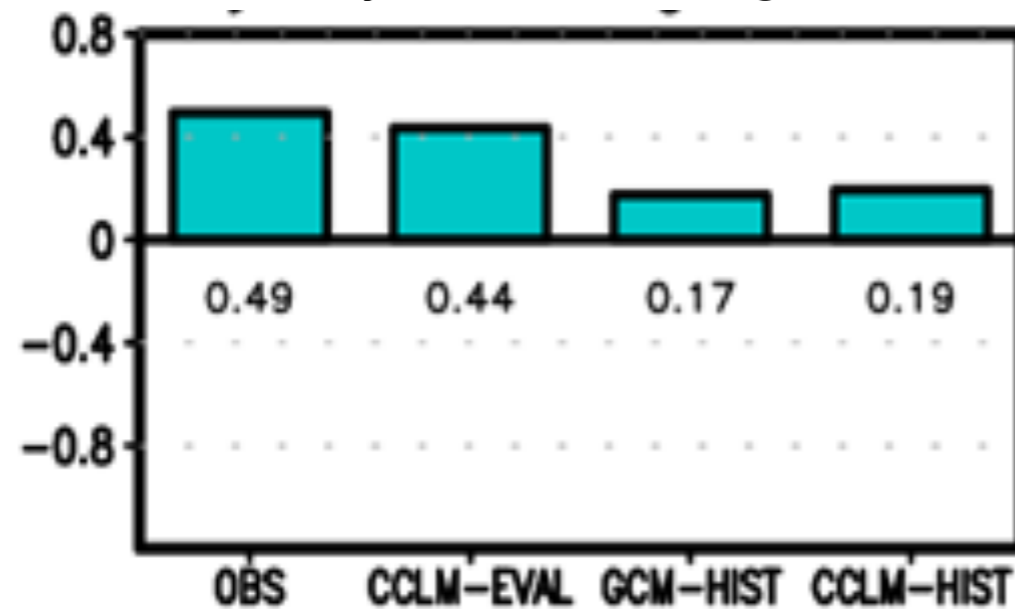Precipitation Bias against w/ APHRODITE (historical: 1981-2005). Summer (JJA) and Winter (DJF) panels: APHRODITE, Ensemble, RG4-HG2, MM5-HG2, CCLM-MPI, WRF-MPI.

Monsoon Precipitation

(regressed coefficients responding to WF index from CCLM)
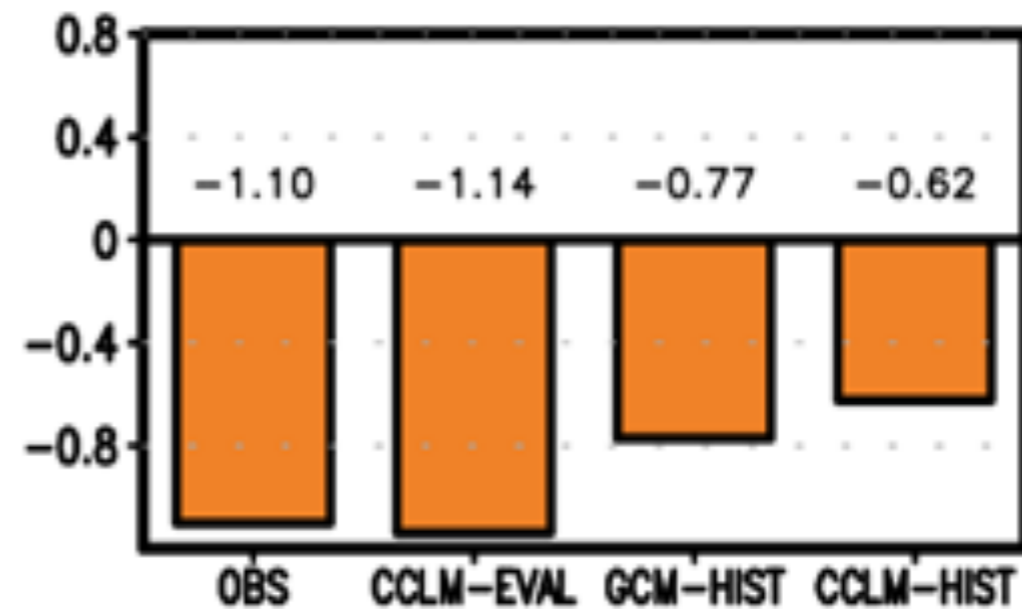
Monsoon Onset/Withdraw
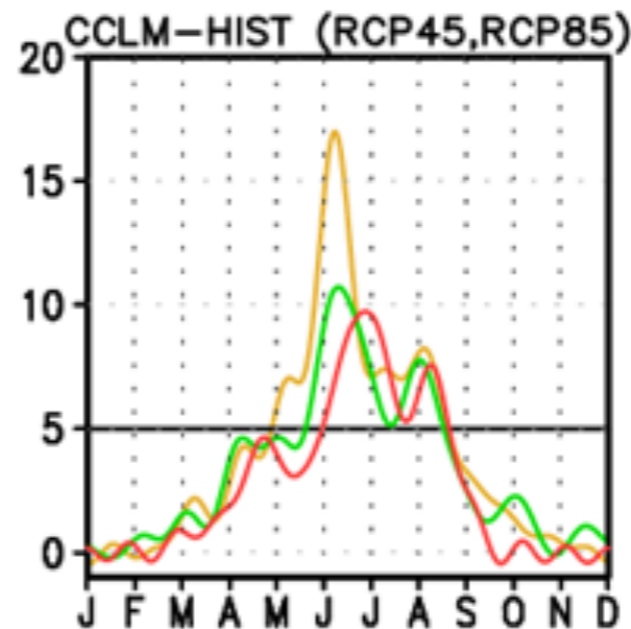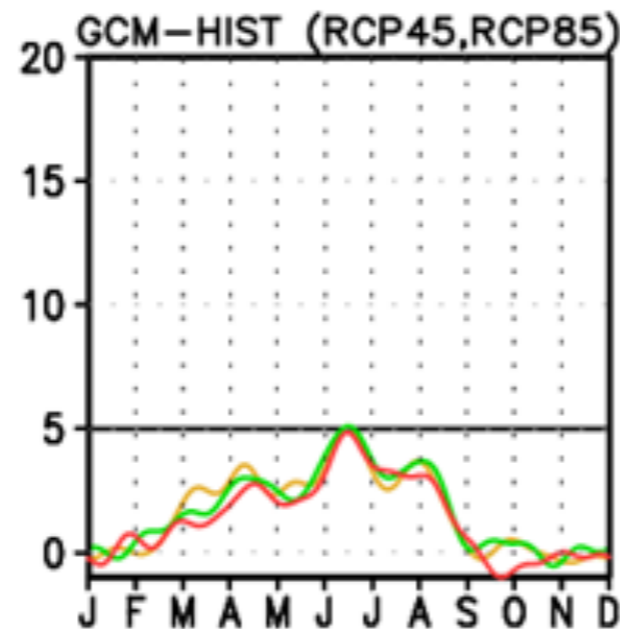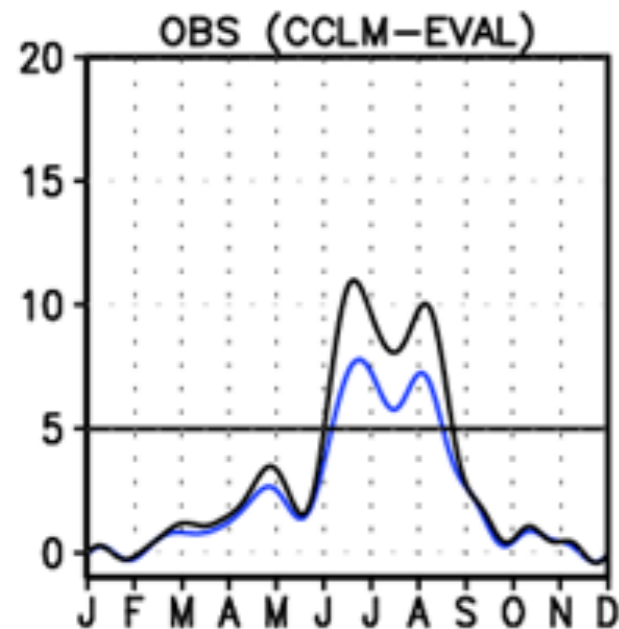
Observation
CCLM-Evaluation
Historical (1981-2005)
RCP45 (2006-2050)
RCM85 (2006-2050)

Monsoon Date	OBS	CCLM-E	Historical		RCP45		RCP85	
			GCM	CCLM	GCM	CCLM	GCM	CCLM
Onset	22. JUN	16. JUN	01. JUL	11.MAY	29.JUN	03. JUN	x	15. JUN
Withdraw	06. SEP	13. SEP	02. JUL	09.SEP	05.JUL	06. SEP	x	10. SEP
Duration	77 days	90 days	2 days	122 days	7 days	96 days	No days	88 days

Extreme Indices
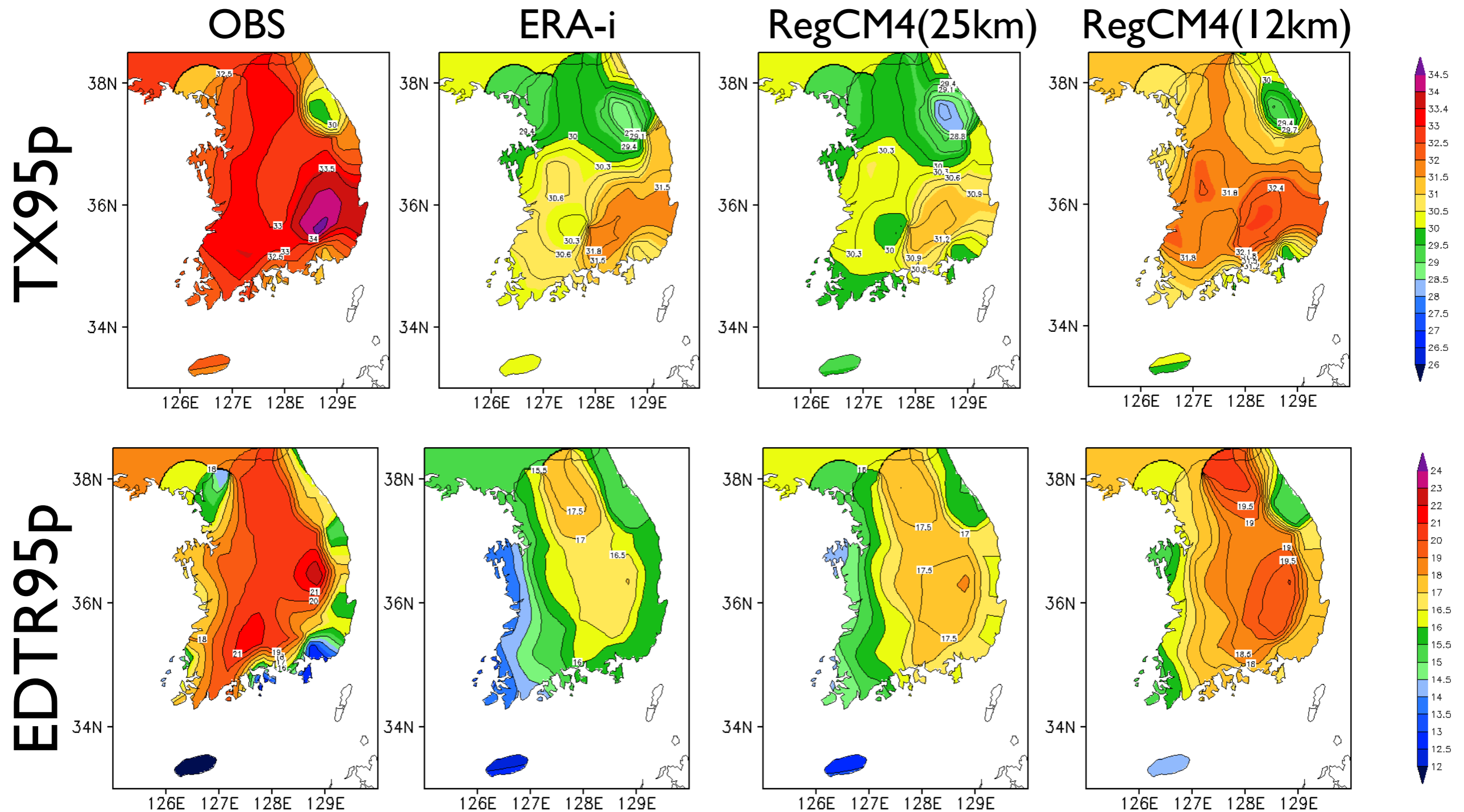
Summary

- For the new domain of CORDEX-EA new domain, evaluation and historical simulations have been finished, and scenario runs are on-going.

- From the individual model results, we found some added value in high-resolution simulations - needs more robust analysis with model ensemble.

- Simulations with additional GCM forcing will be designed soon.

- Welcome to share outputs with other groups in Japan, China, and others for collaboration.

Some Issues

- We need to setup GCM-RCD matrix for CORDEX-CORE: 5 RCMs and 3 GCMs at least.

- As a diagnostic MIP of CMIP6, DECK simulations (entry card) are essential. What about CORDEX-CORE?

- ESGF node for data exchange - APCC and KMA will setup next year.

- Fast-track to share outputs within East-Asia and Asia communities for publications to meet AR6 timeline.

- How ESD group can contribute to CORDEX and CORDEX-CORE in the context of common framework (e.g., domain, resolution, period, forcing, and etc.)

Thanks for your Attention!