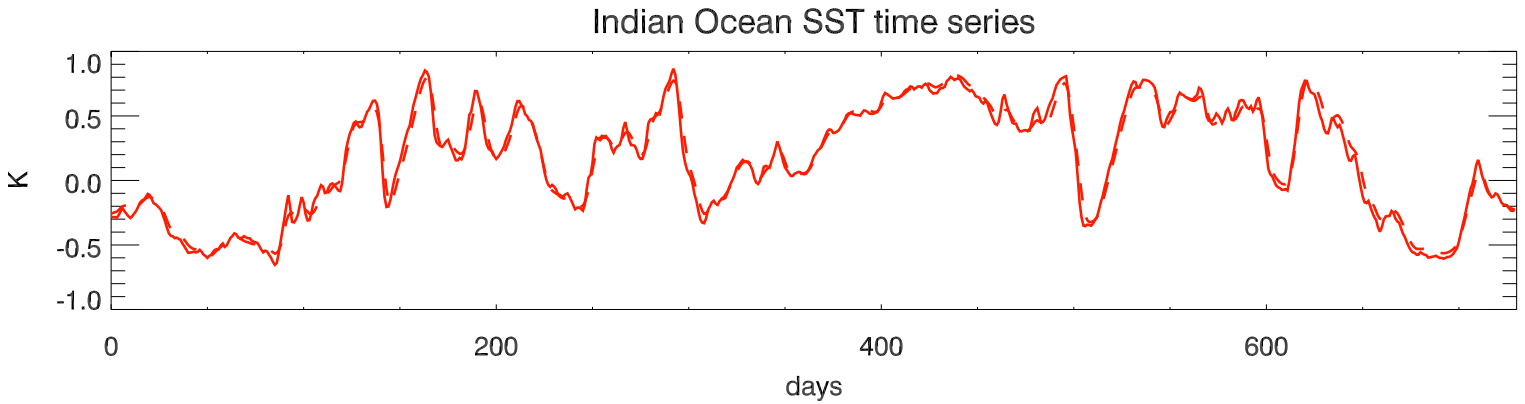
Intraseasonal Variability and Air-Sea Interactions in CMIP5 Models

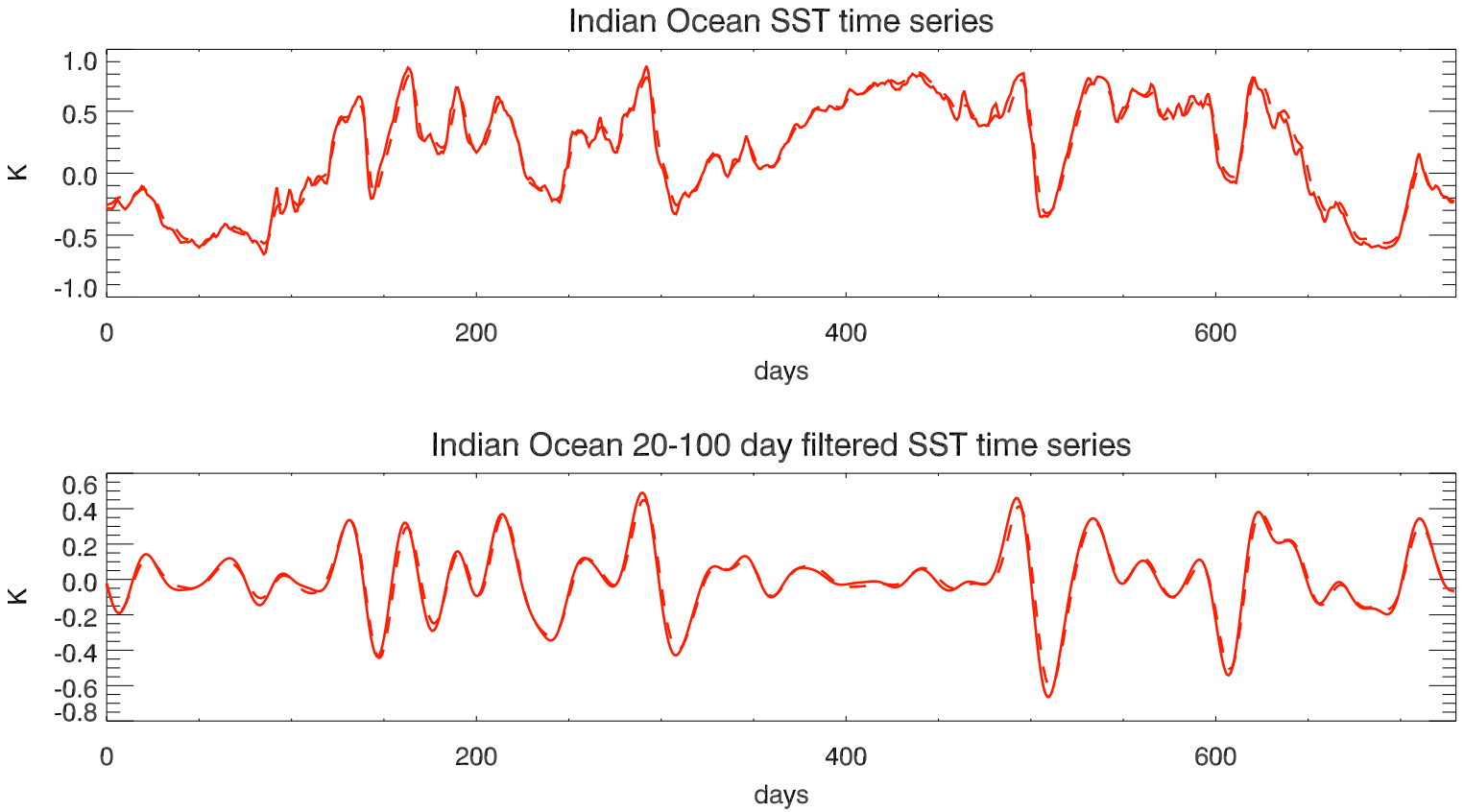
Charlotte DeMott and Mingxuan Chen

first, rainfall-SST relationships in coupled and _5d simulations

Rainfall & SST in Coupled and “5d” simulations



Rainfall & SST in Coupled and "5d" simulations



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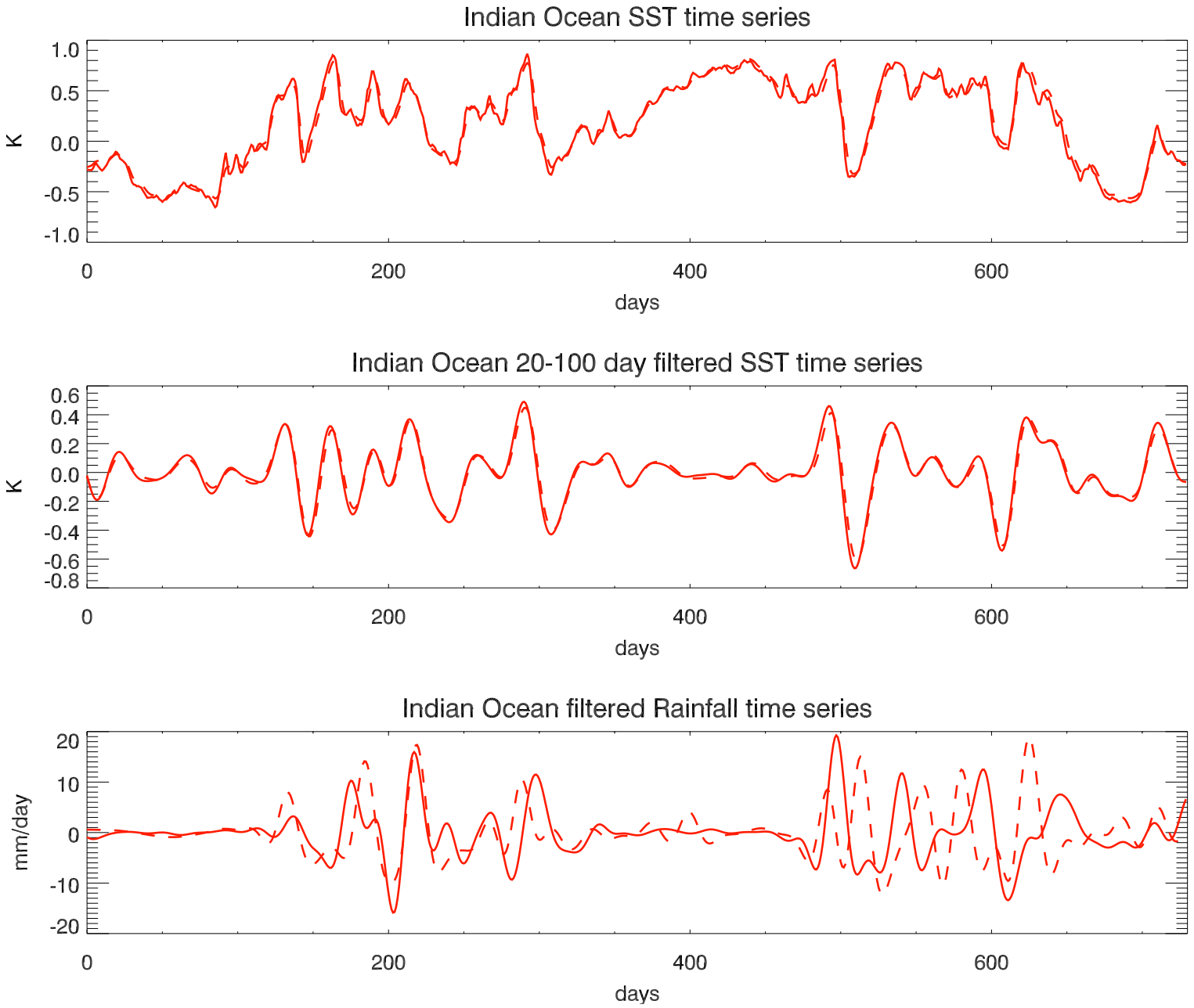


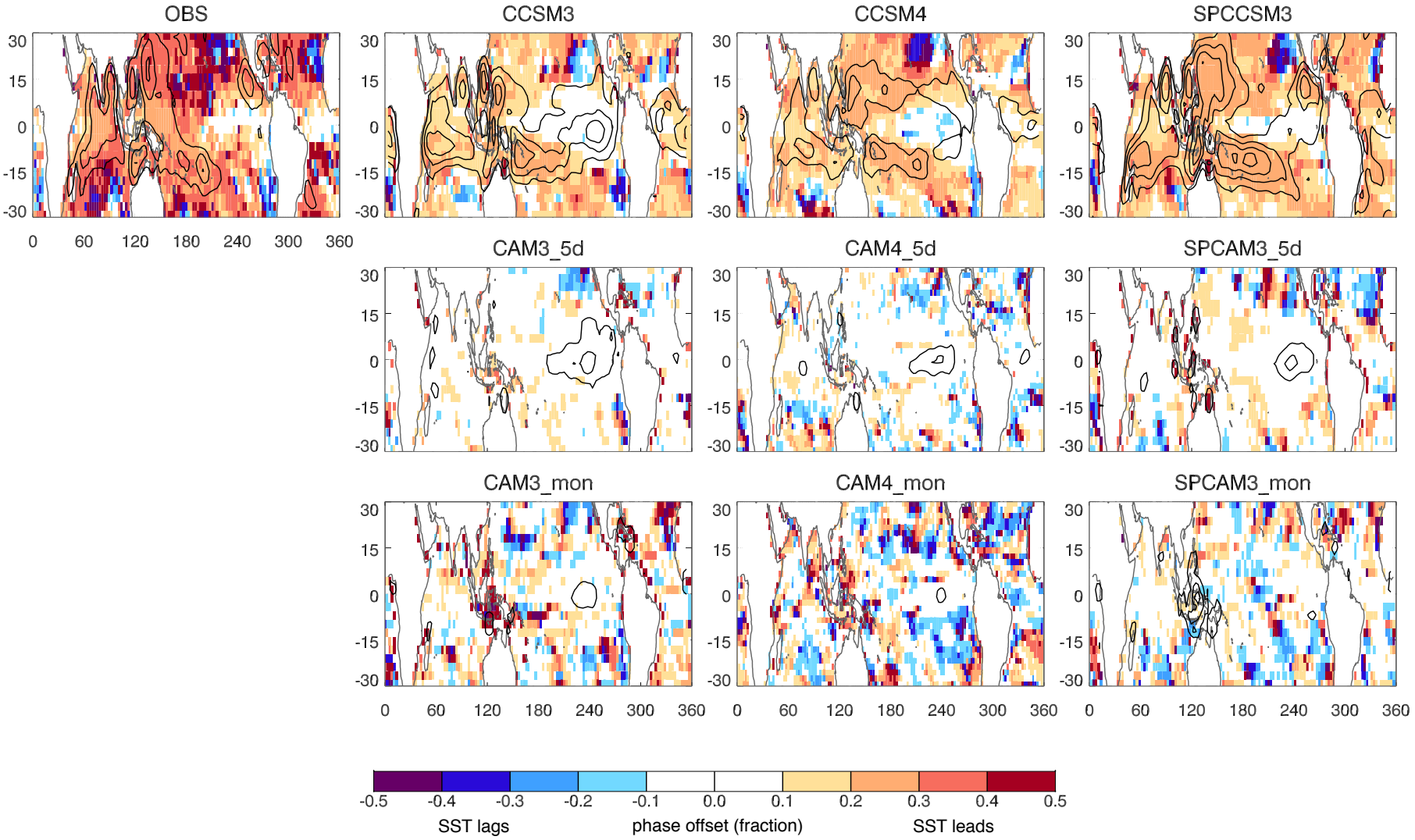
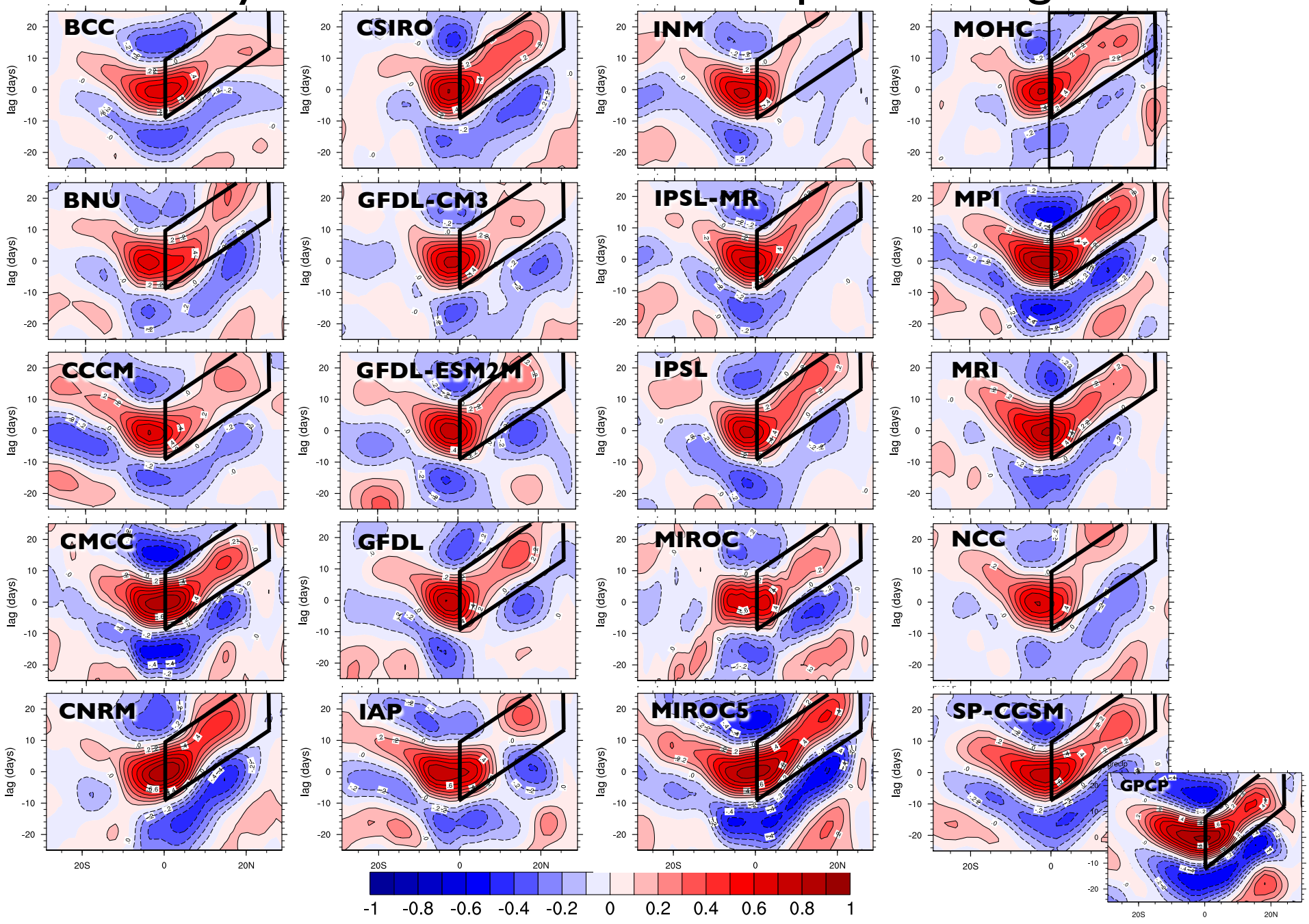


Fig. 5. All-season anomalous rainfall-SST 20-100 day mean phase angle (shaded) and Coh^2 (contour interval 0.1) for TMI and coupled models (top row), atmosphere-only models with SPCCSM3 5-day running mean SSTs (middle row), and atmosphere-only models with SPCCSM3 monthly mean SSTs (interpolated to daily mean values; bottom row).

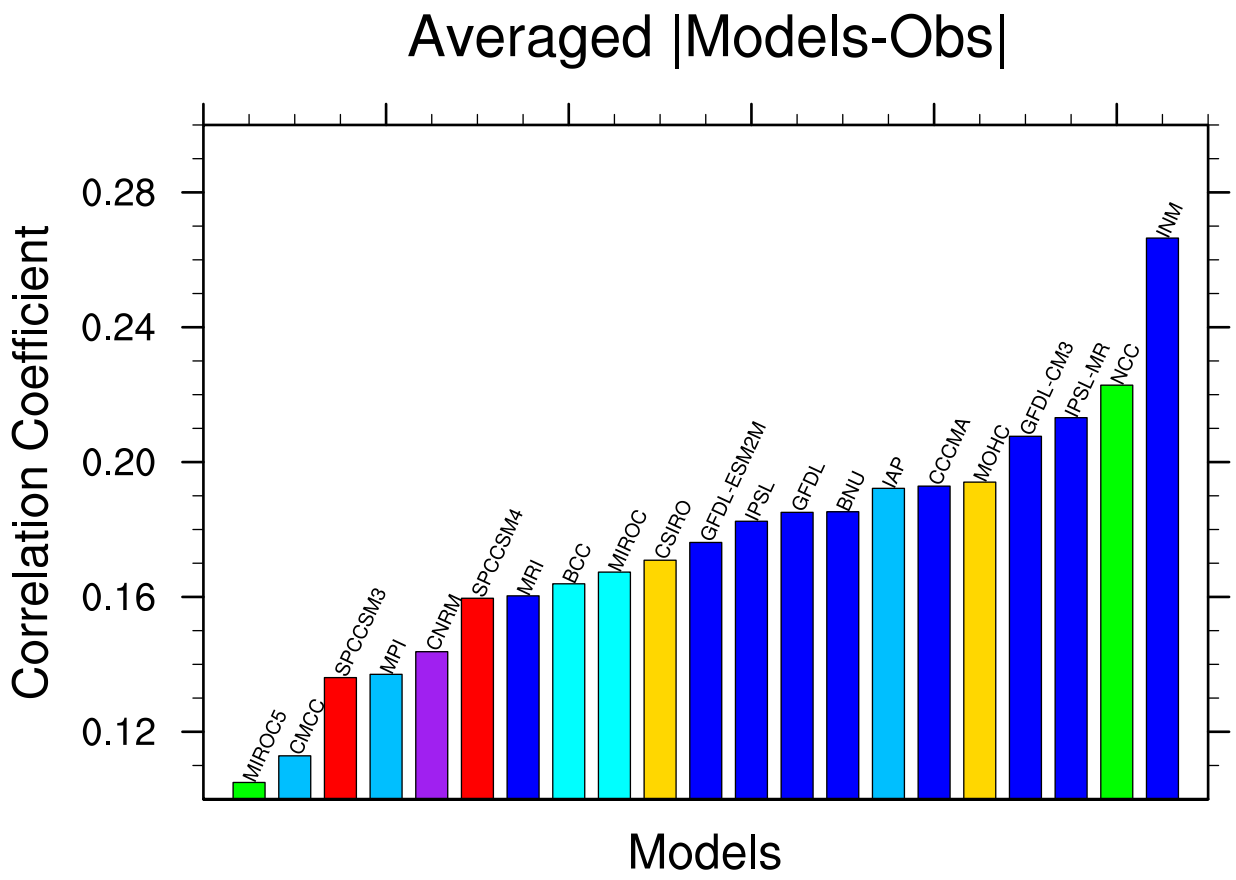
Indian monsoon in CMIP5 models

(all models that provide daily SST output)

CMIP5 May-Oct Indian Ocean Precipitation Lag-correlation



CMIP5 Indian monsoon skill



color	type	models
blue :	cape	(CCCMA, INM, IPSL,IPSL-MR, MRI, BNU, GFDL, GFDL-CM3, GFDL-ESM2M)
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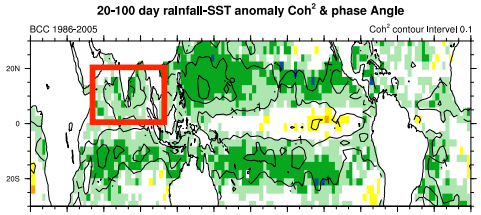
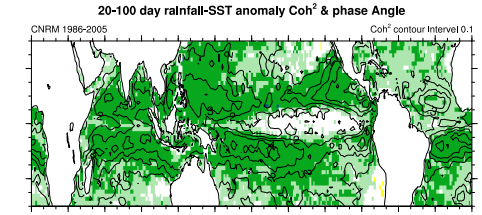
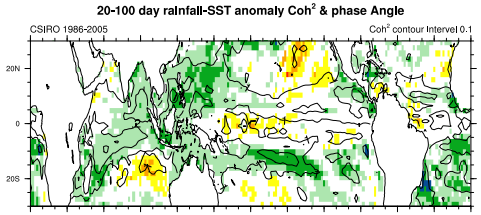
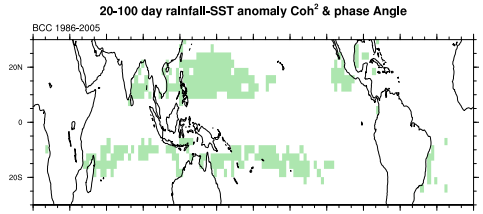
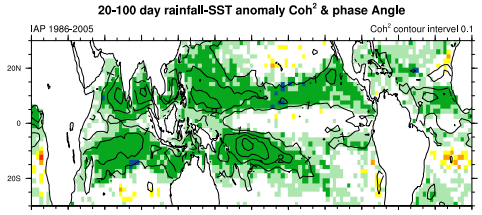
20-100 day mean rainfall-SST phase offset

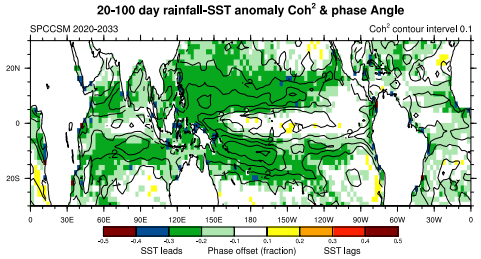


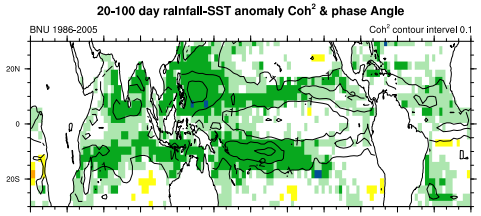


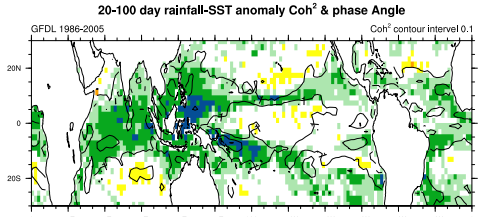


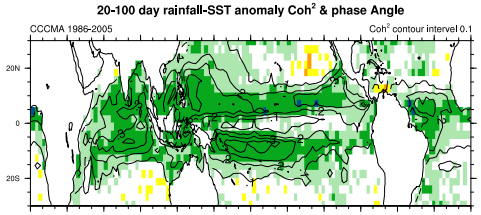


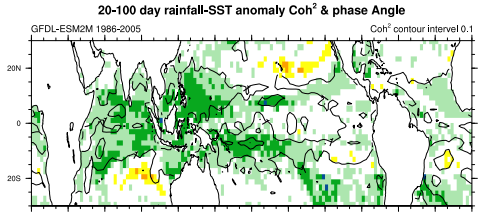


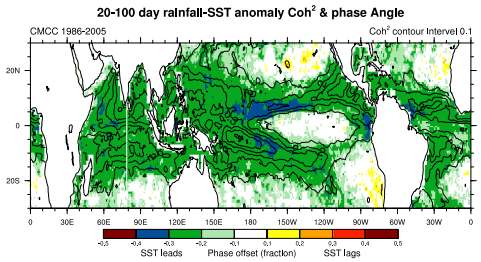


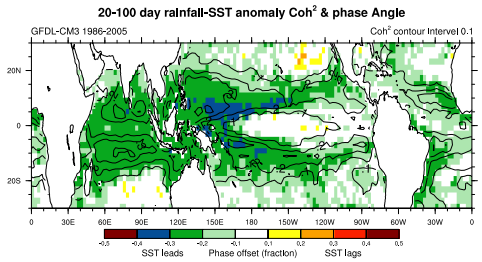


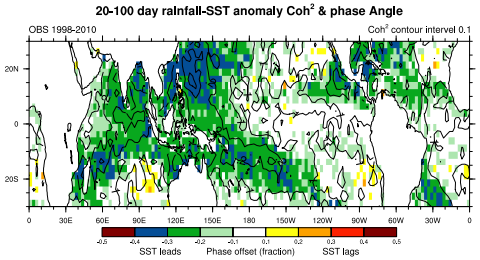




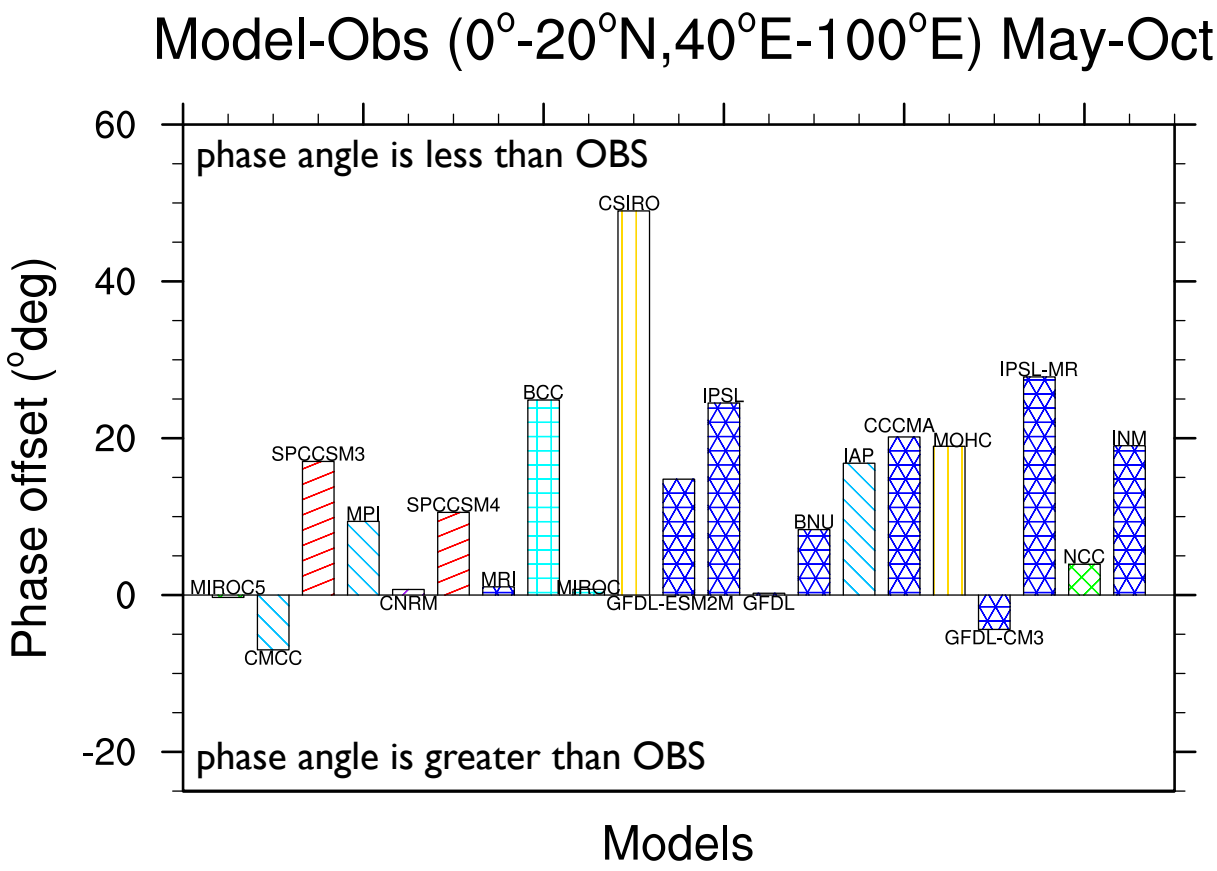








Indian monsoon skill vs. rainfall-SST phase offset



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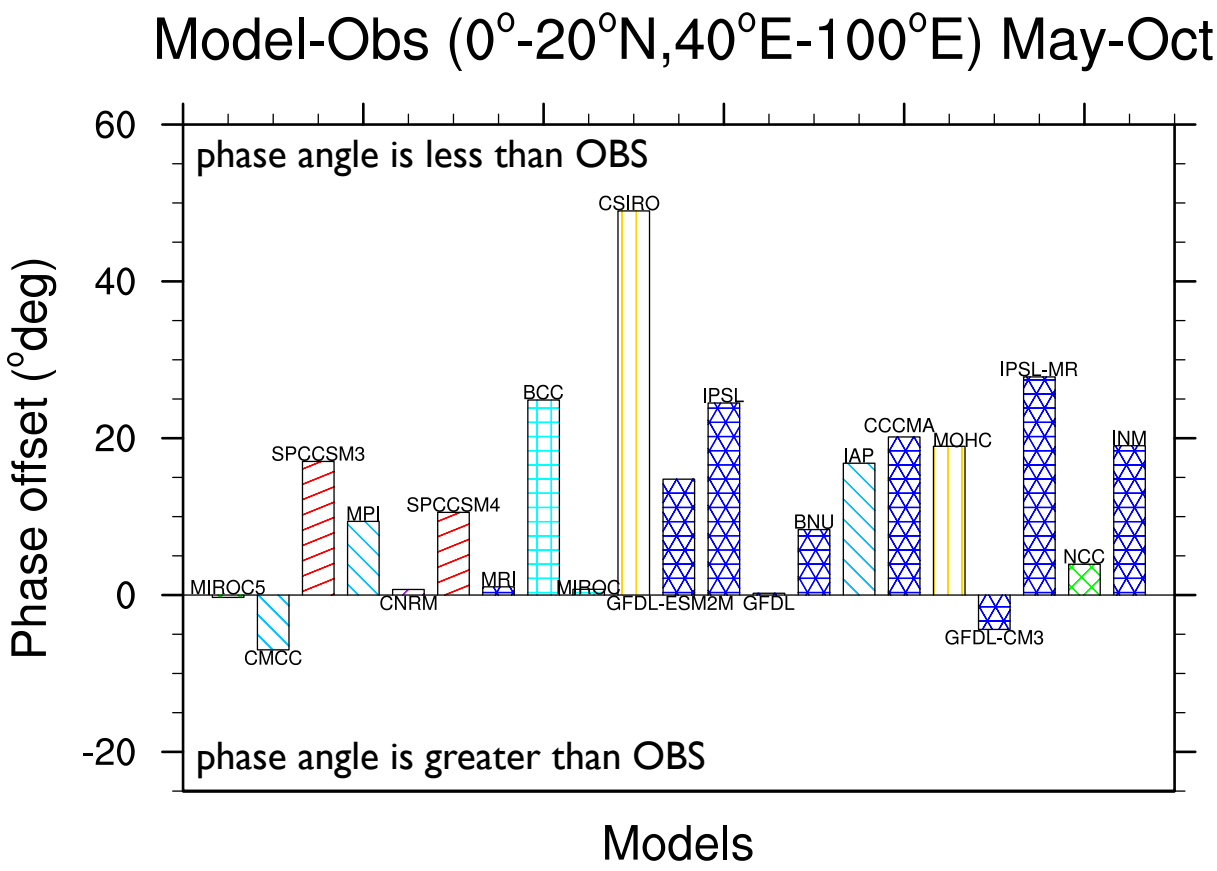

- precipitation-SST phase offset is a poor predictor of monsoon skill

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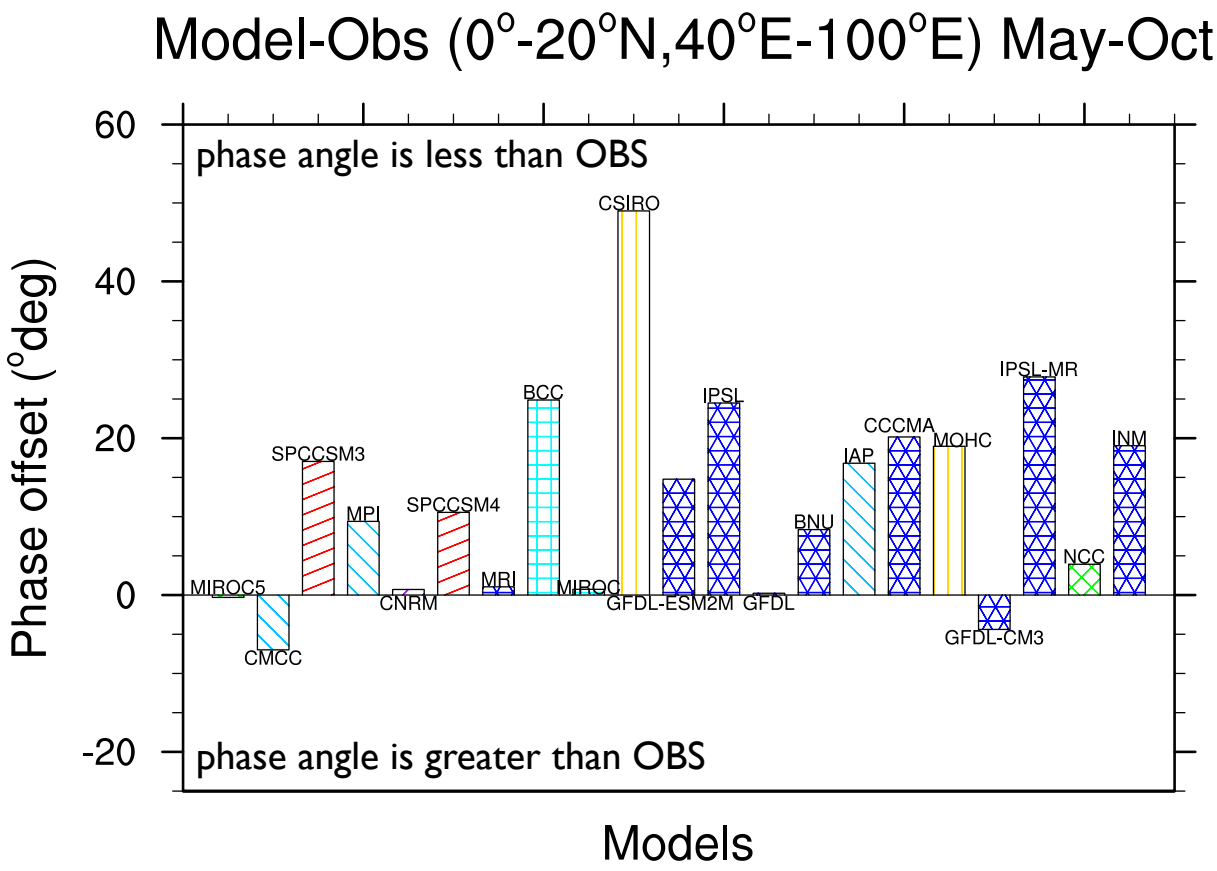
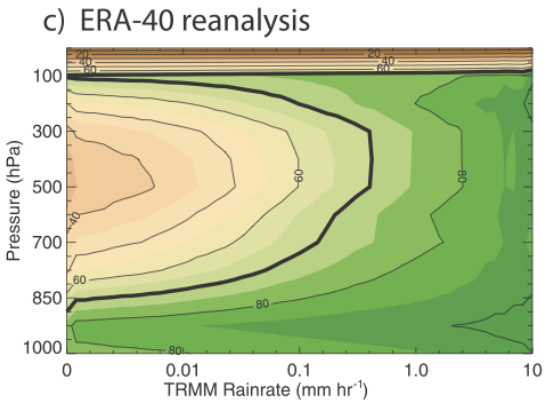
Indian monsoon skill vs. rainfall-SST phase offset



- precipitation-SST phase offset is a poor predictor of monsoon skill
- is precipitation-SST phase angle linked to sensitivity of convection to tropospheric moisture?



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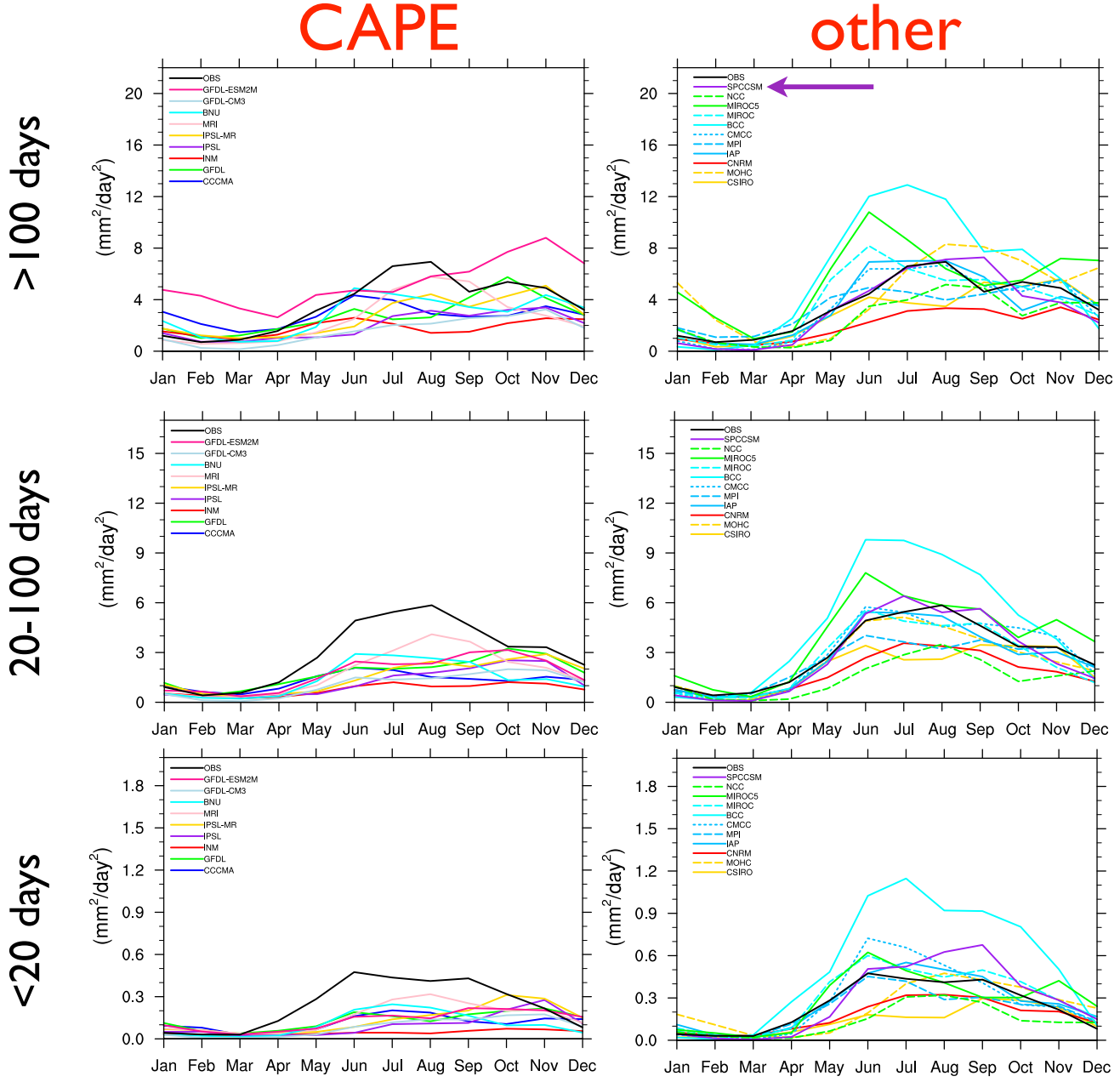
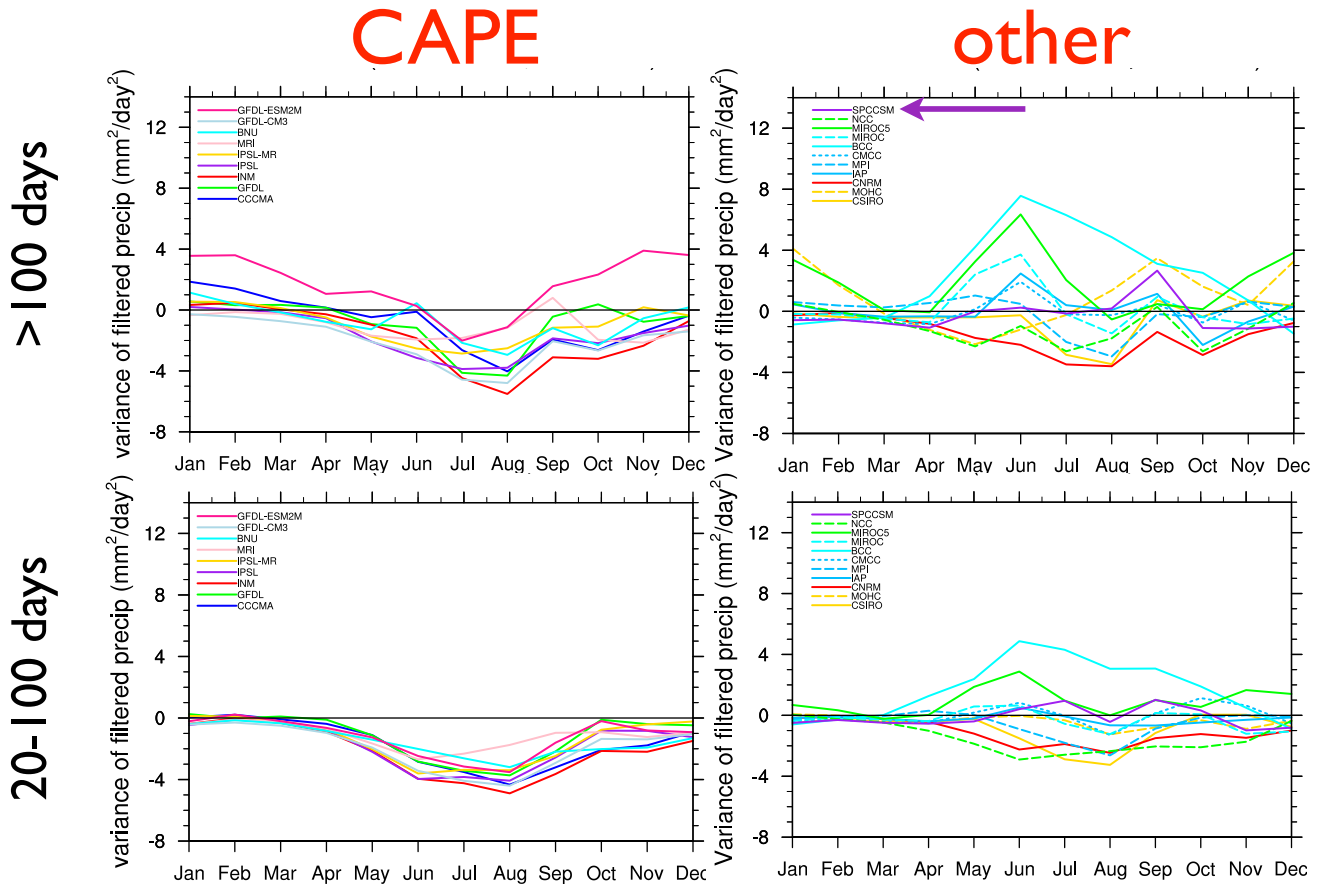
how does cumulus parameterization impact monsoon skill?

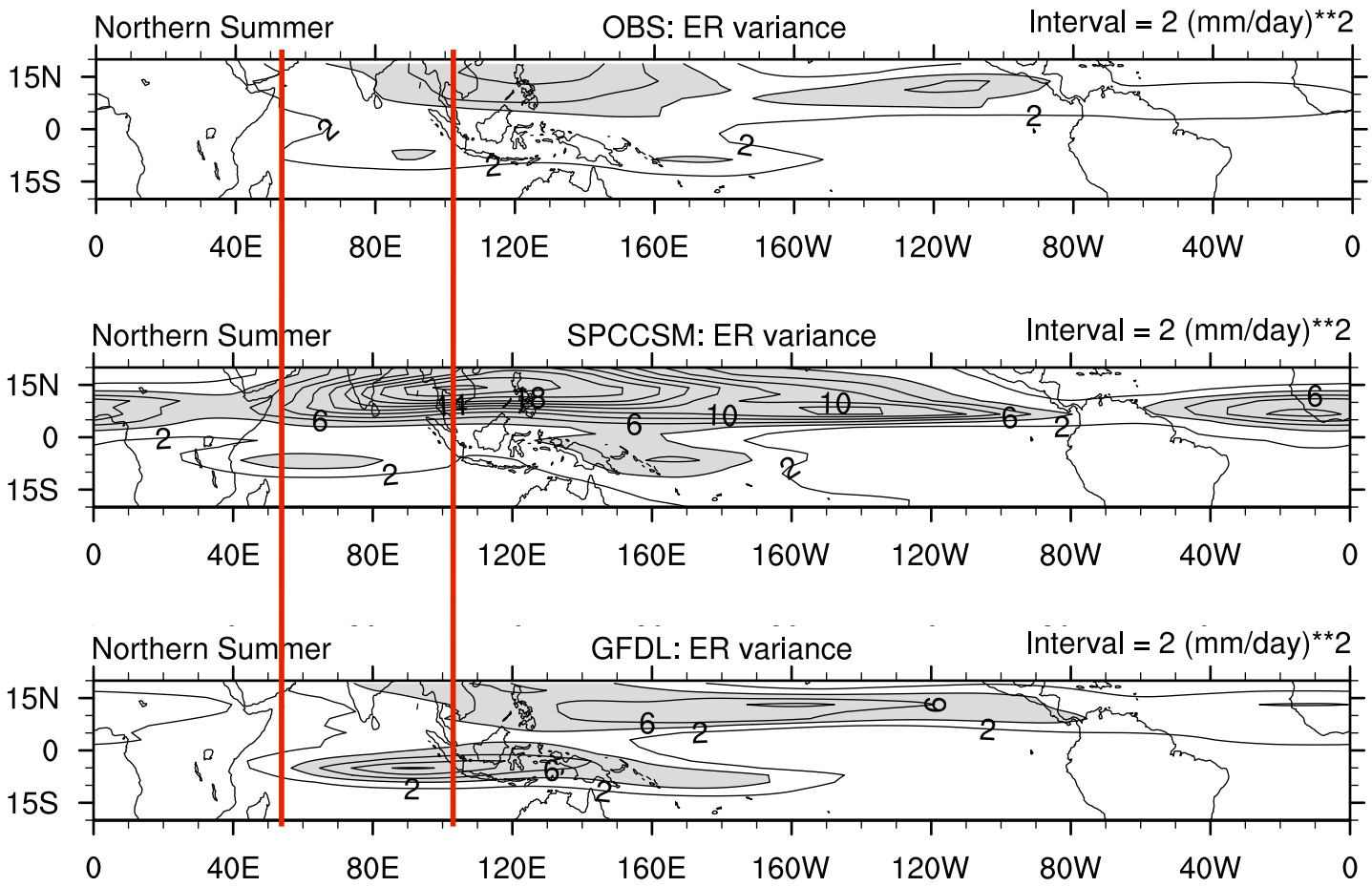
Precipitation Variance Seasonal Cycle, Indian Ocean



Precipitation Variance Bias Seasonal Cycle, Indian Ocean



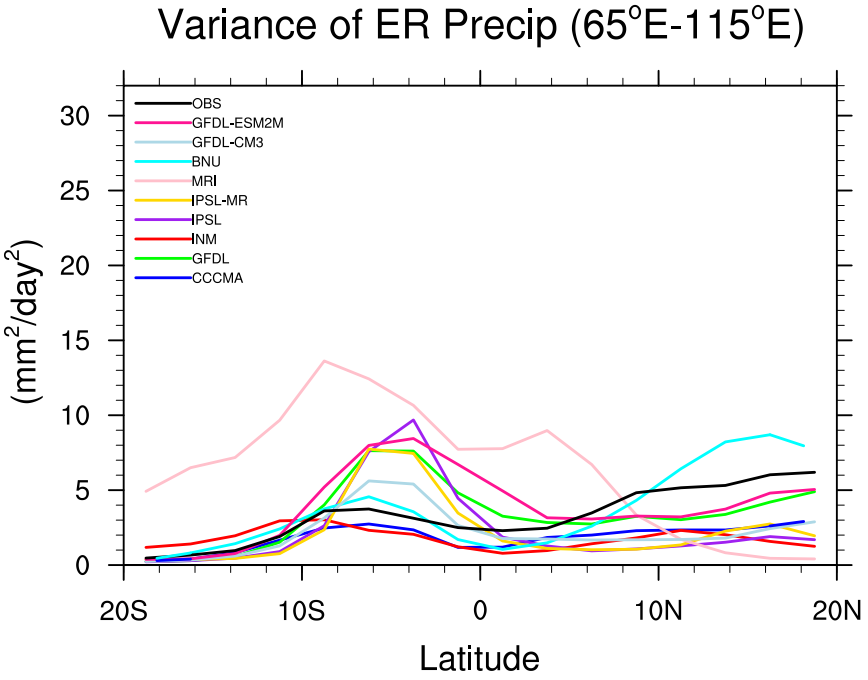
examples of ER wave variance, Indian Ocean



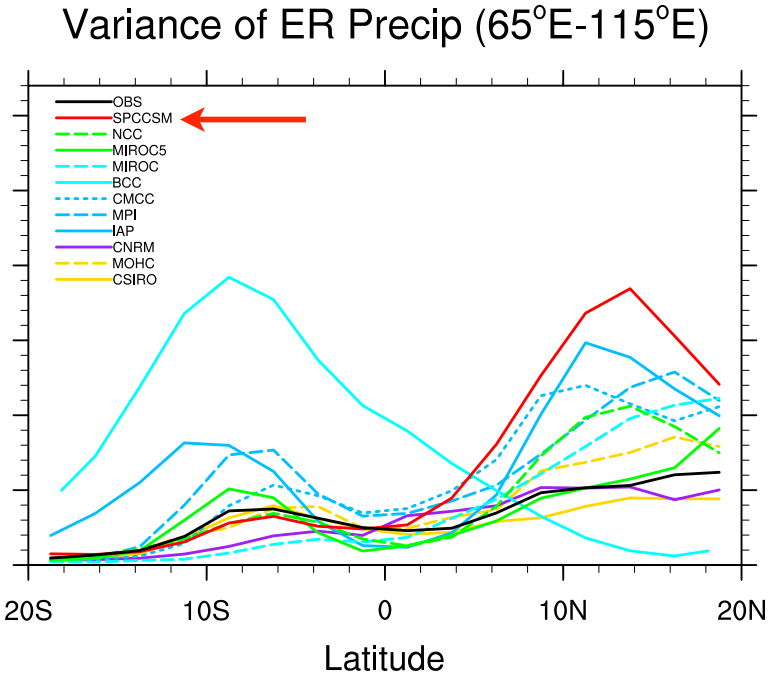
ER waves are closely related to northward propagation

JJA ER wave variance vs latitude

cape



other



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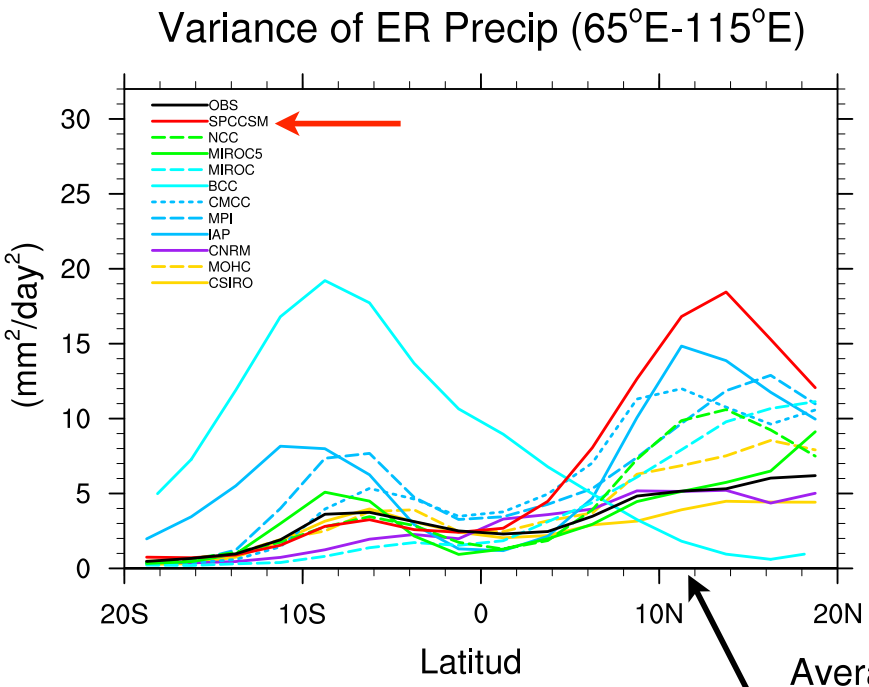
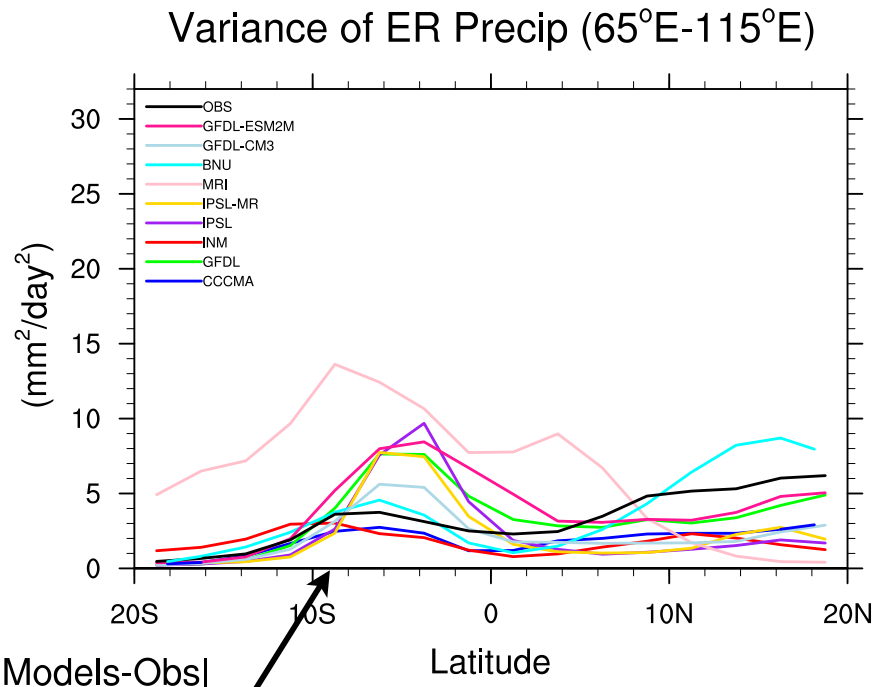
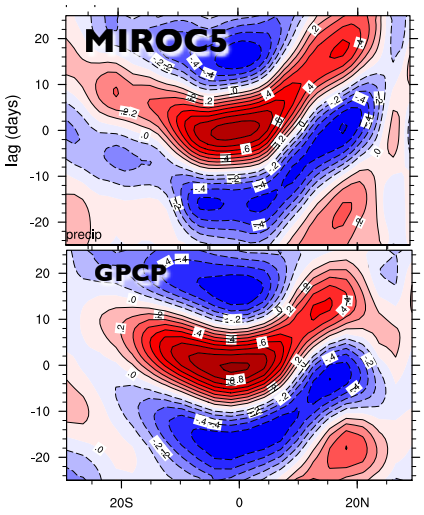
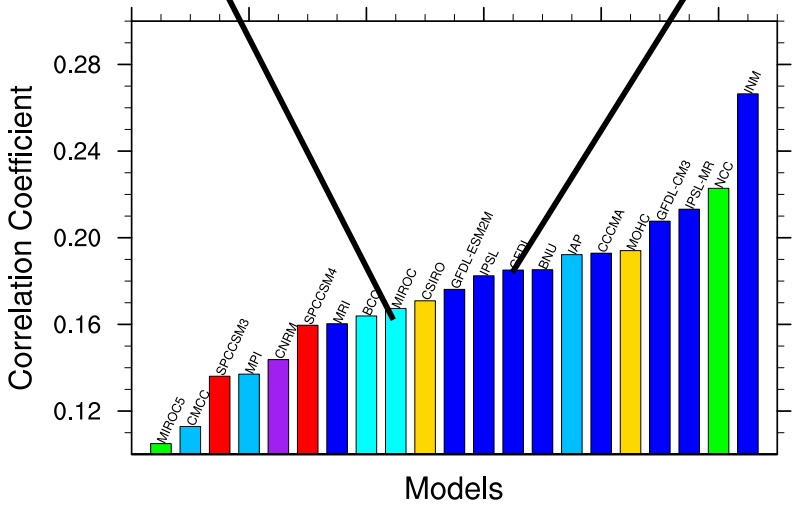
other

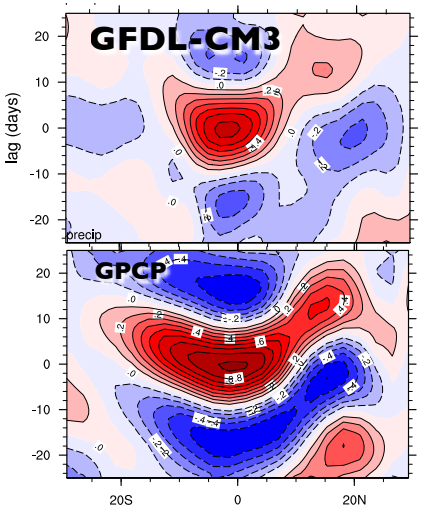
cape


Variance of ER Precip (65°E-115°E)
(mm²/day²)
Latitud
OBS
SPCCSM
NCC
MIROC5
MIROC
BCC
CMCC
MPI
IAP
CNRM
MOHC
CSIRO

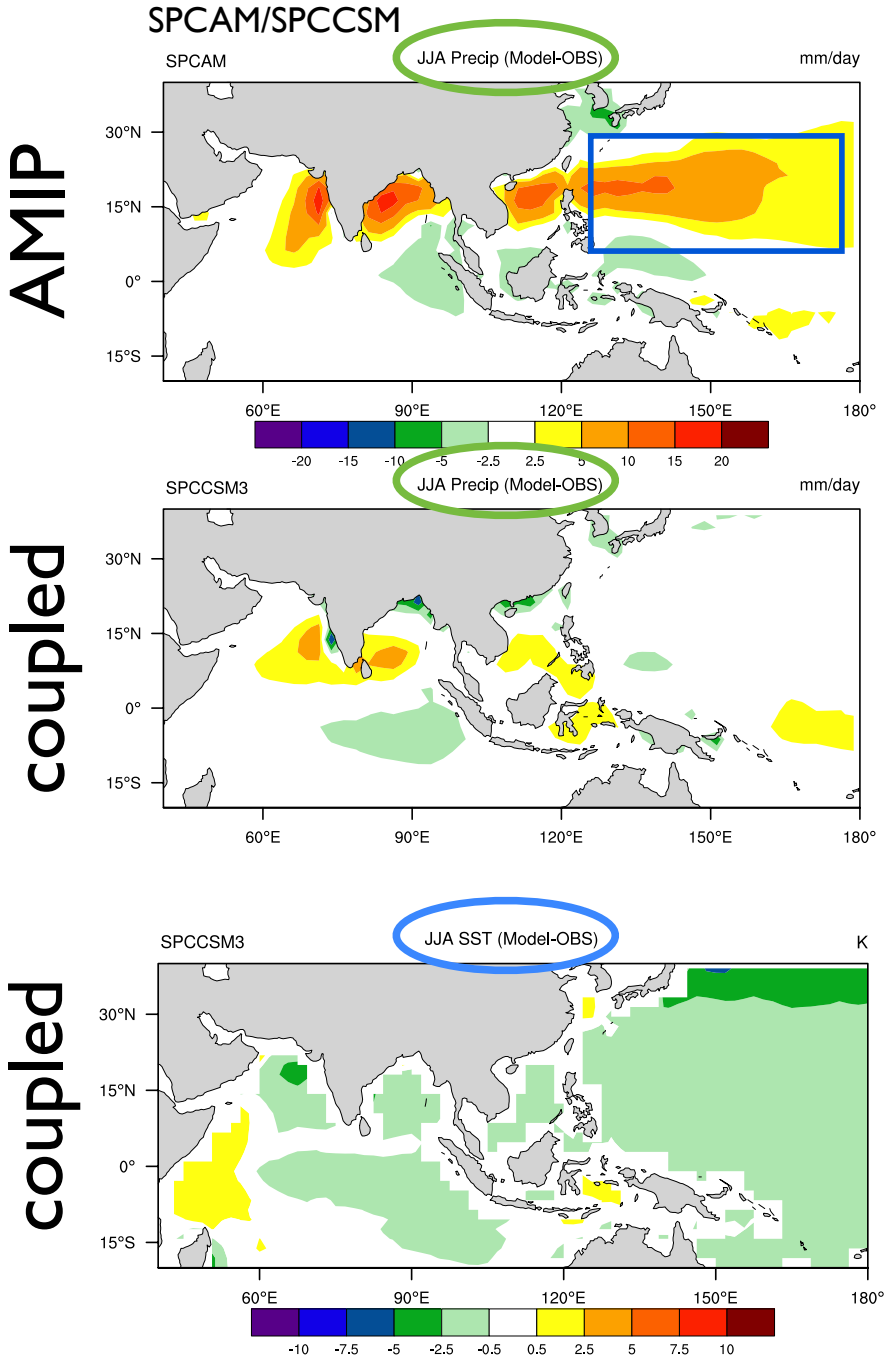

Variance of ER Precip (65°E-115°E)
(mm²/day²)
Latitude
OBS
GFDL-ESM2M
GFDL-CM3
BNU
MRI
IPSL-MR
IPSL
INM
GFDL
CCCMA


MIROC5
GPCP
lag (days)
precip

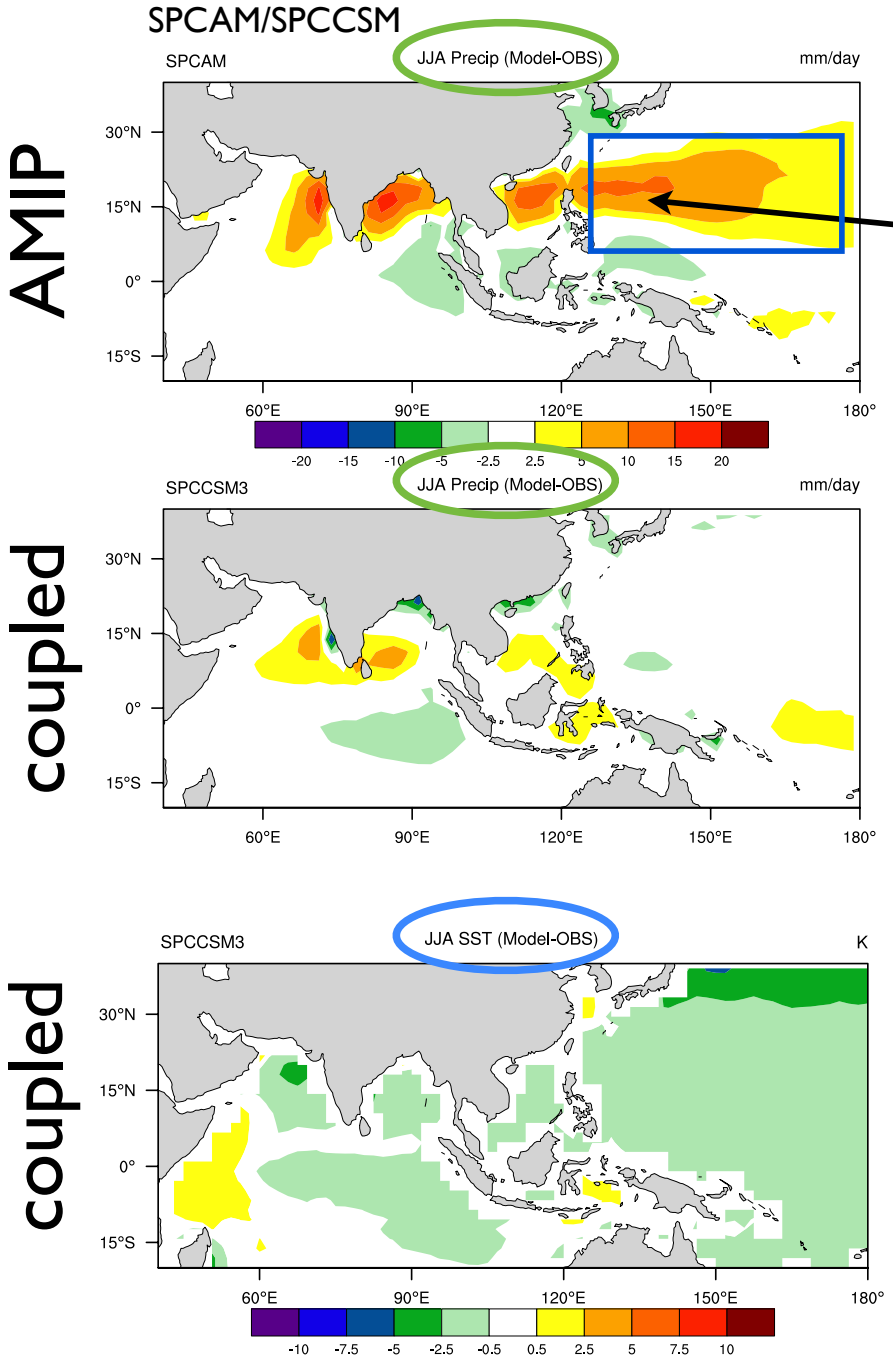

Averaged |Models-Obs|
Correlation Coefficient
Models
MIROC5
CMCC
SPCCSM3
MPI
CNRM
SPCCSM4
MRI
BCC
MIROC
CSIRO
GFDL-ESM2M
IPSL
GFDL
BNU
IAP
CCCMA
MOHC
GFDL-CM3
IPSL-MR
NCC
INM


GFDL-CM3
GPCP
lag (days)
precip

further musings on the great red spot...

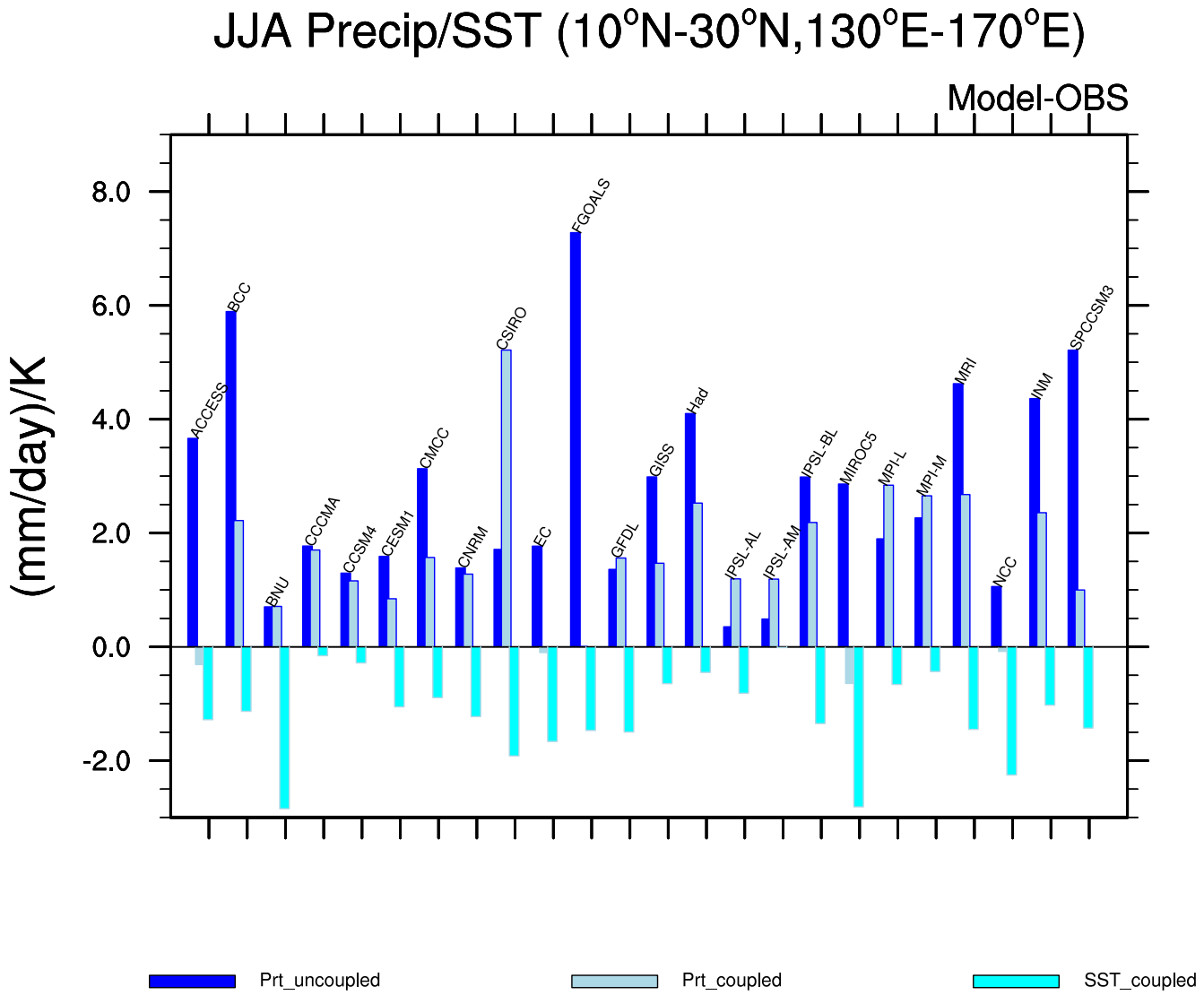


Does the GRS go away because cloud and rain cool the ocean surface?

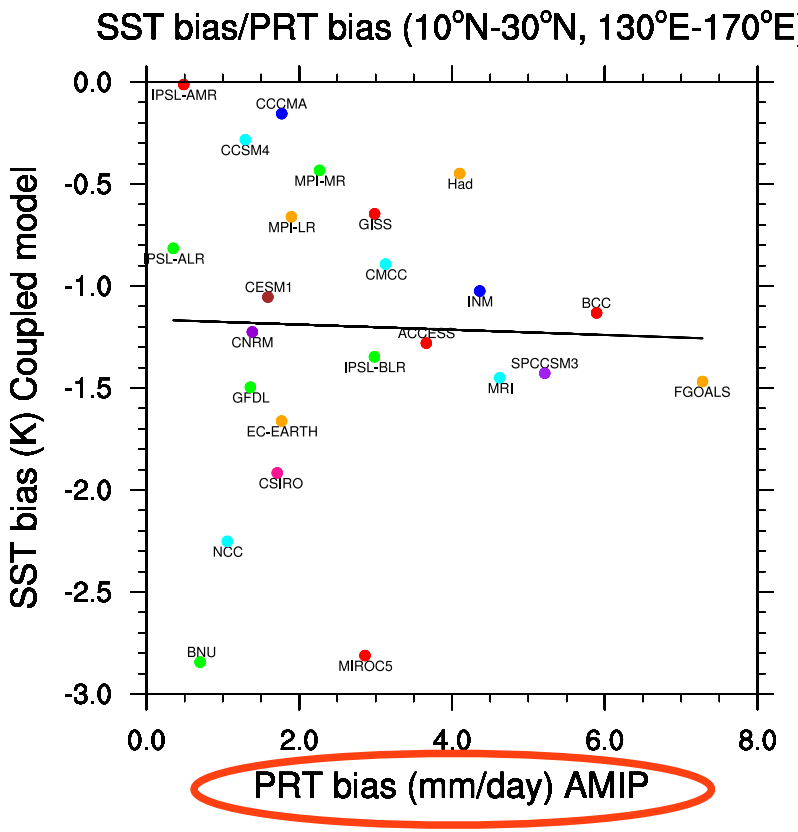


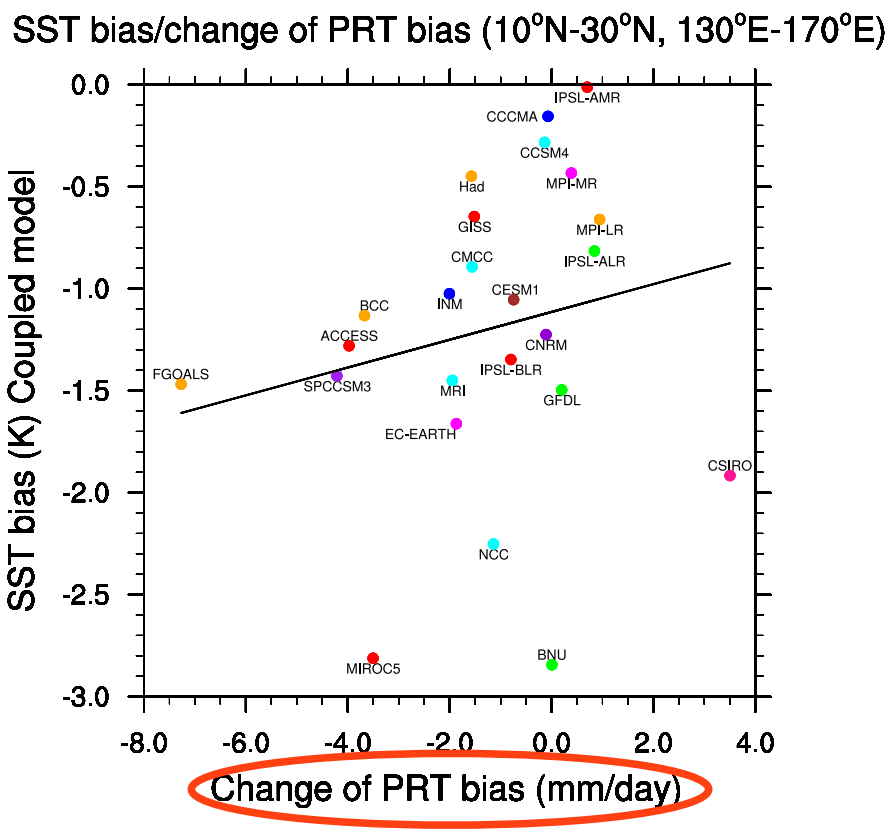
Does the GRS go away because cloud and rain cool the ocean surface?

CMIP5 vs AMIP5 simulations



CMIP5 vs AMIP5





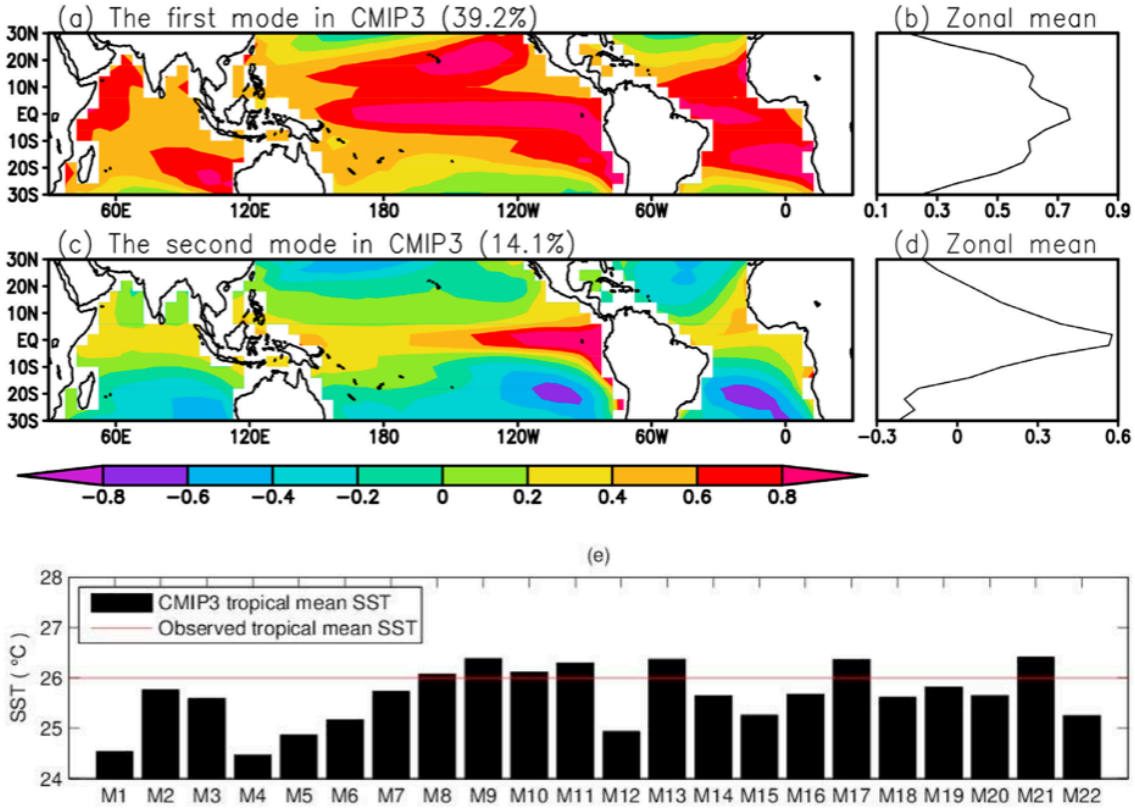
trends are small. spread is large.

SST decreases may have multiple causes.

what causes SST biases in coupled models?

cloudiness effect

ocean model effect



GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L22703, doi:10.1029/2012GL053777, 2012

Origins of tropical-wide SST biases in CMIP multi-model ensembles

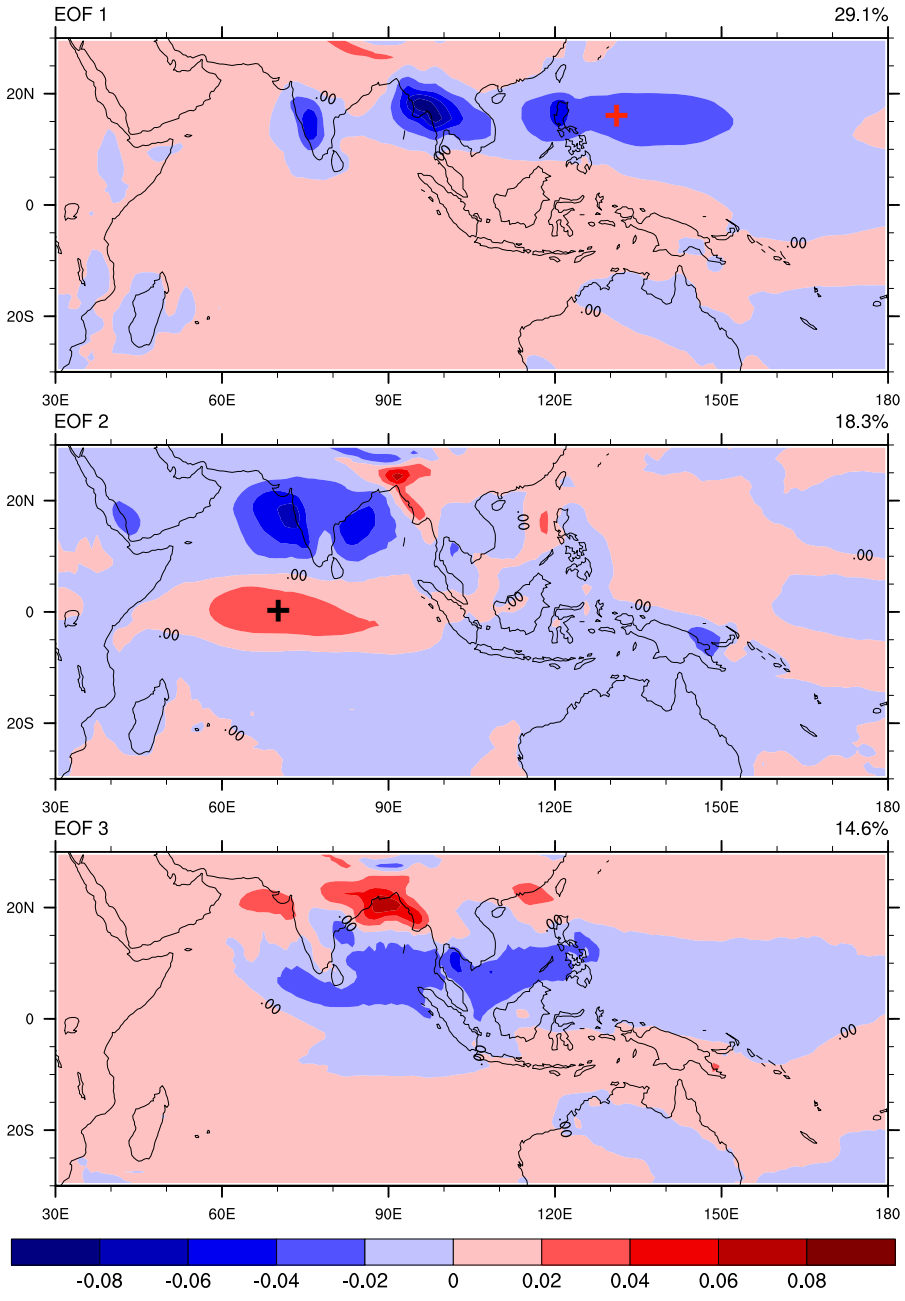
Gen Li[1,2,3] and Shang-Ping Xie[2,3,4]

Received 3 September 2012; revised 20 October 2012; accepted 23 October 2012; published 29 November 2012.

what causes GRS biases in AMIP models?

use the same approach as Li and Xie

Precipi bias: JJA: AMIP models



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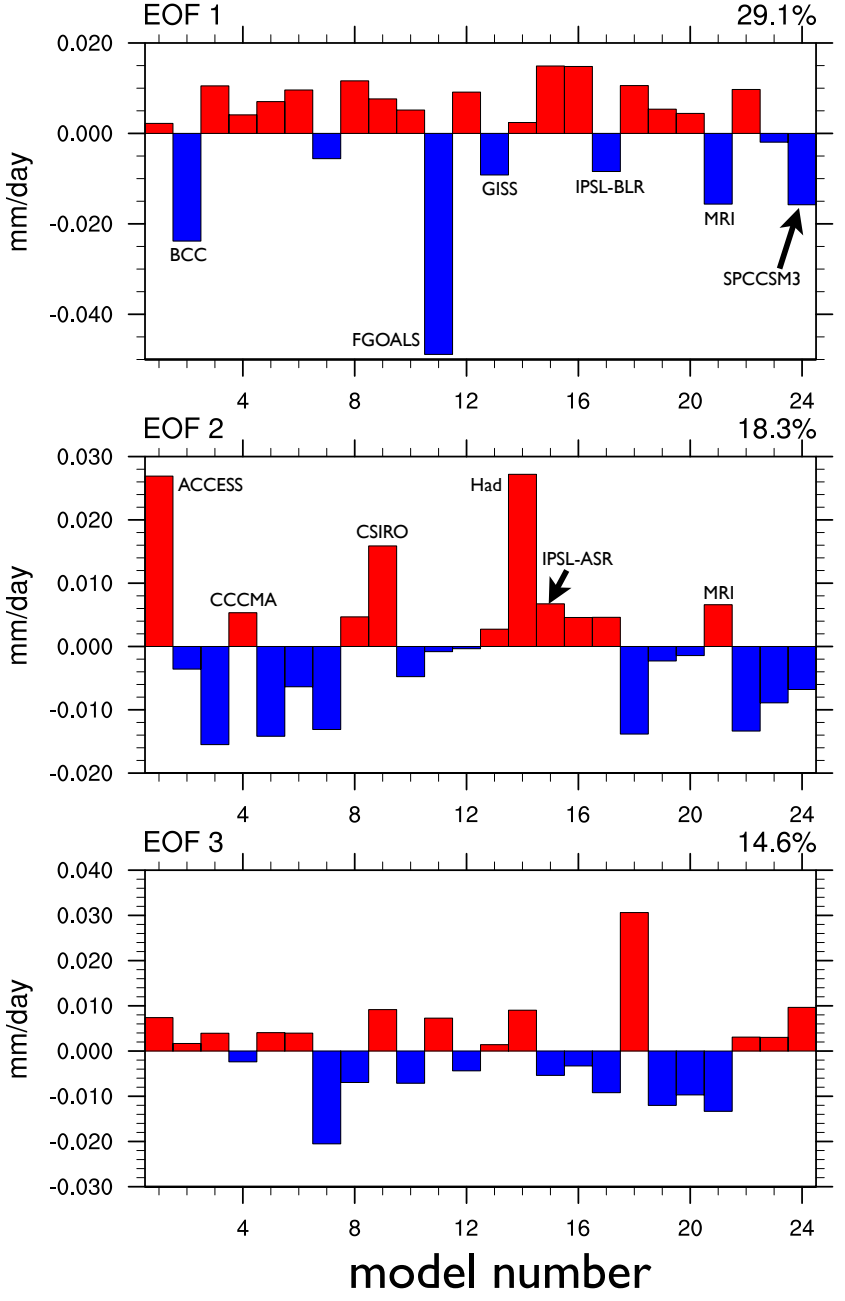

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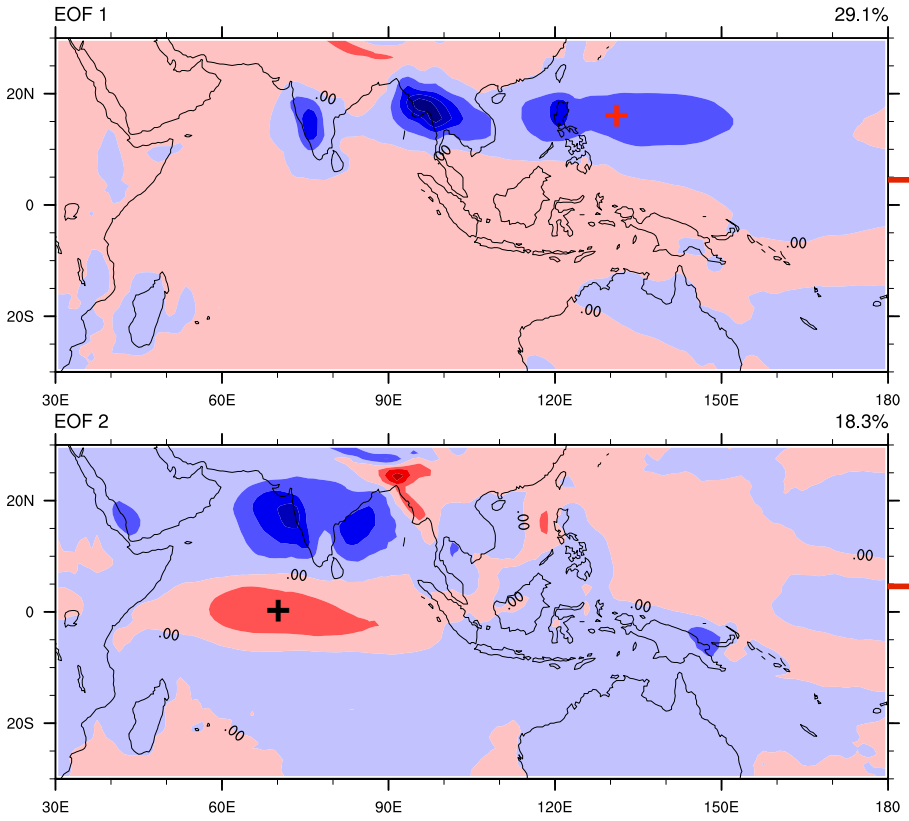
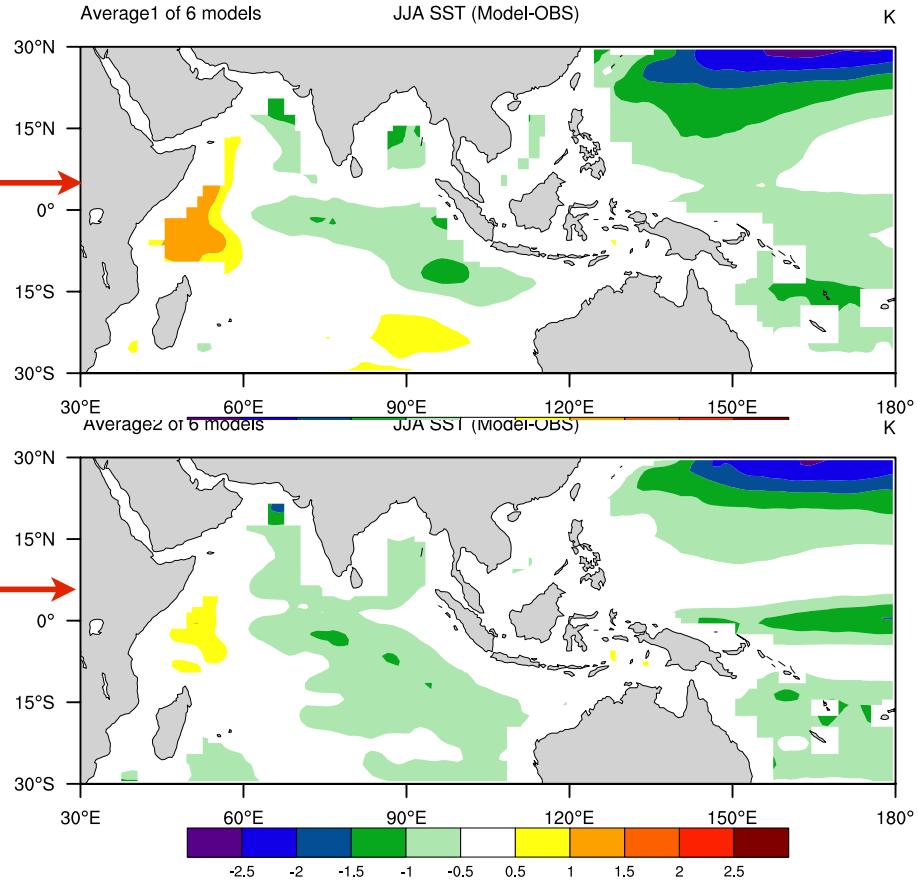
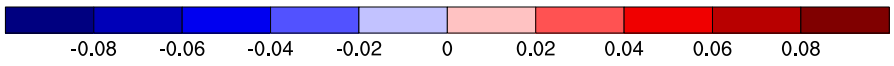


SST bias: JJA: CMIP models



ensuing coupled SST biases are not highly correlated with AMIP precipitation biases.