Predictability of Indian Ocean variability and its Impacts over ISMR in the ECMWF System 4 Model

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OUT LINE

- ❖ Model and Data Sets Used

- ❖ Prediction of Precipitation over South Asian Monsoon and Indian Ocean SST From ECMWF System 4 Model.

- ❖ Inter-annual Variability of South Asian Monsoon from the Model.

- ❖ Prediction of SST Variability in the Indian Ocean and its Impact on Indian Summer Monsoon.

- ❖ Predictability Limit over the Domain of study from the Model Initialized in the Month of February and May.

Model and Data Description:

ECMWF System 4 Coupled model

Atmospheric model – Integrated Forecast System (IFS) cy 36r4 (T255); 91 levels

Ocean Model – Nucleus European Modeling for Ocean (NEMO) v 3.0; ~1 Degree, 42 levels

Coupler – OASIS

Coupling Frequency – 3 hrs

Atmospheric perturbation based on Singular Vector

Ensembles Members: 15

Time Domain: 1981 to 2012

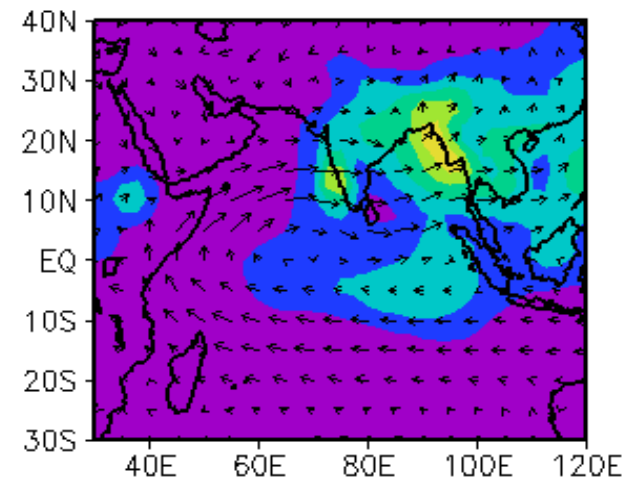Forecast up to 6 month based on Feb. and May initial condition
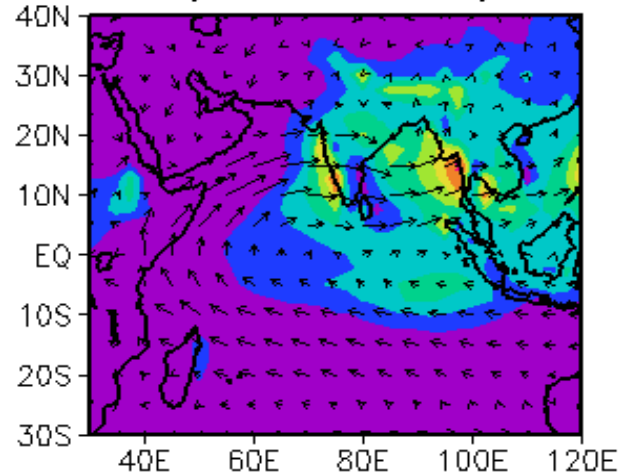
Verification Data

GPCP for Precipitation
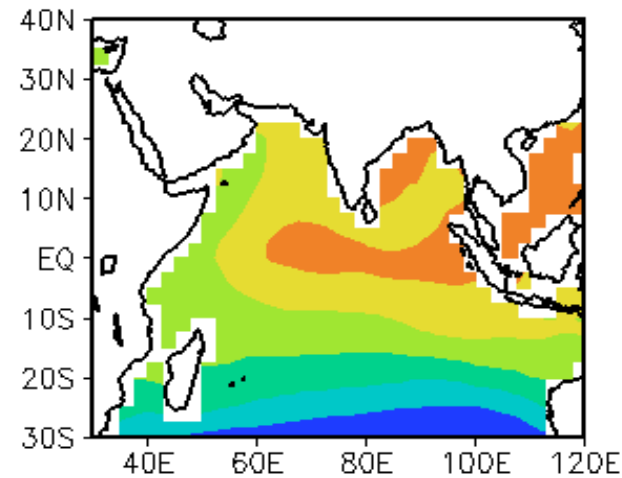
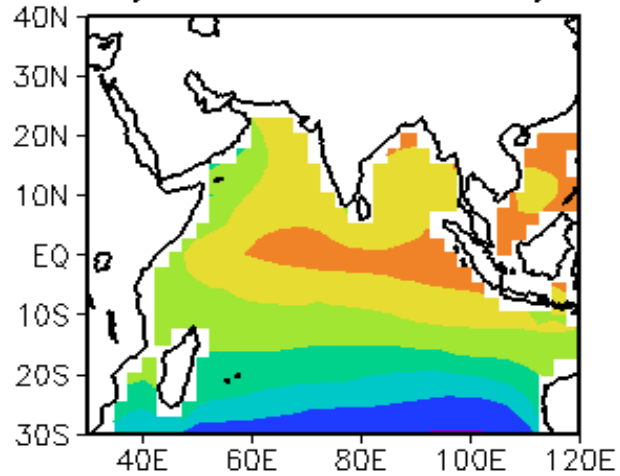HadSST for SST

Climatology of Rainfall AND 850 hPa winds
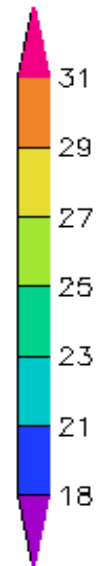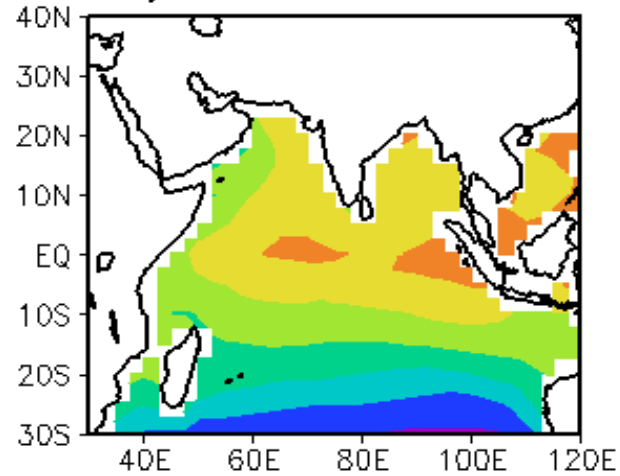
Climatology of SST

clim HadSST JJA 81-12
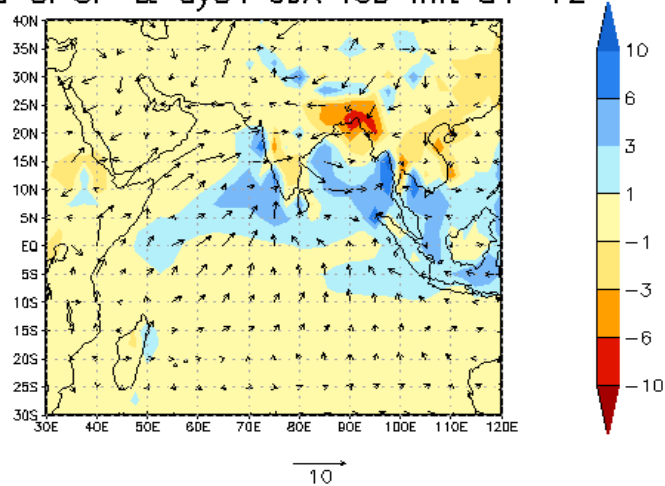
clim sys4 JJA SST may init
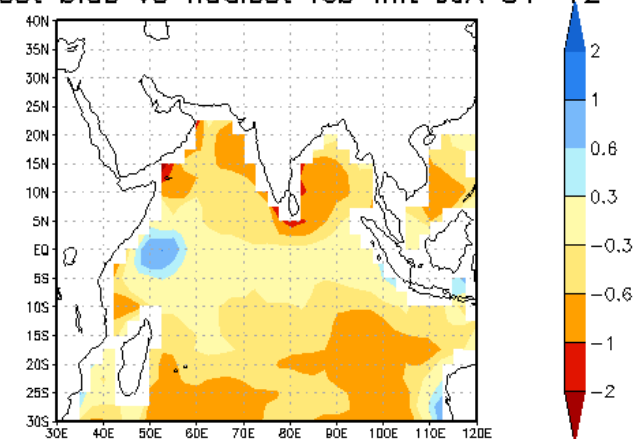
clim sys4 JJA SST feb init

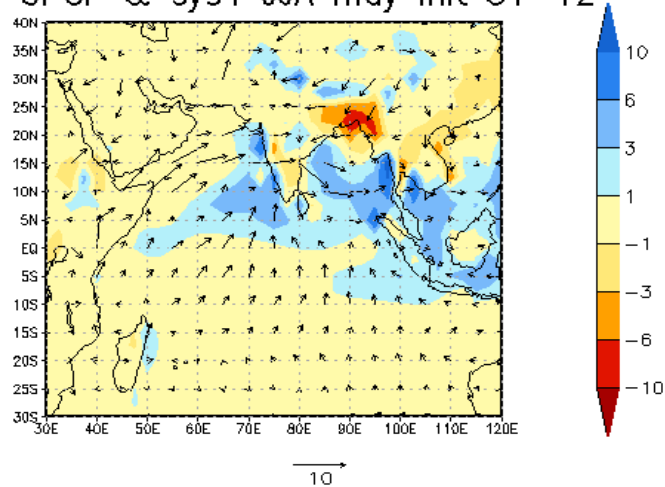# Bias: Model vs Observation

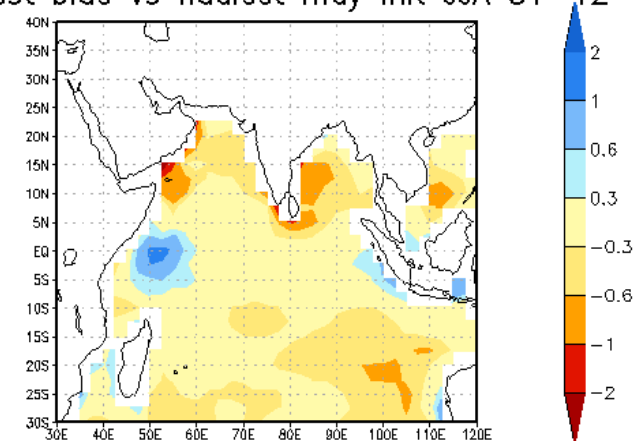

Bias GPCP & sys4 JJA feb init 81-12

sys4 sst bias vs hadisst feb init JJA 81-12
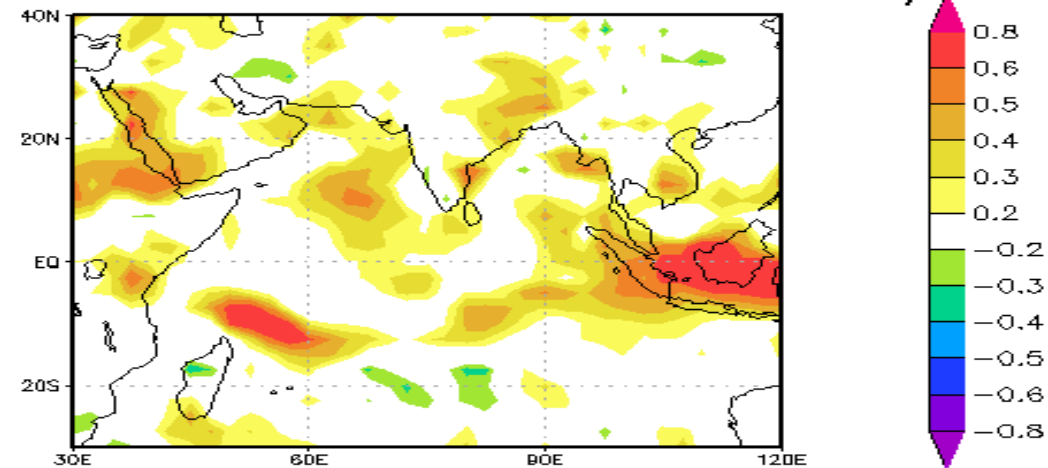

Bias GPCP & sys4 JJA may init 81-12

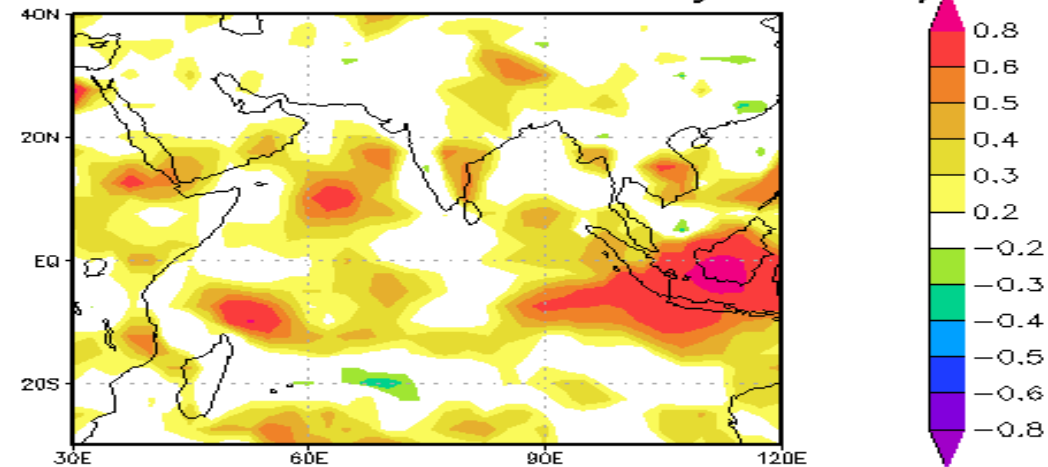sys4 sst bias vs hadisst may init JJA 81-12
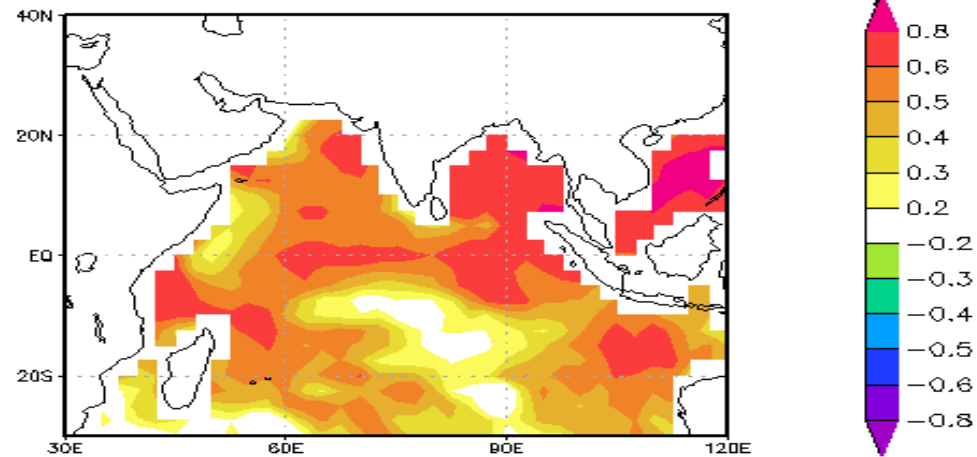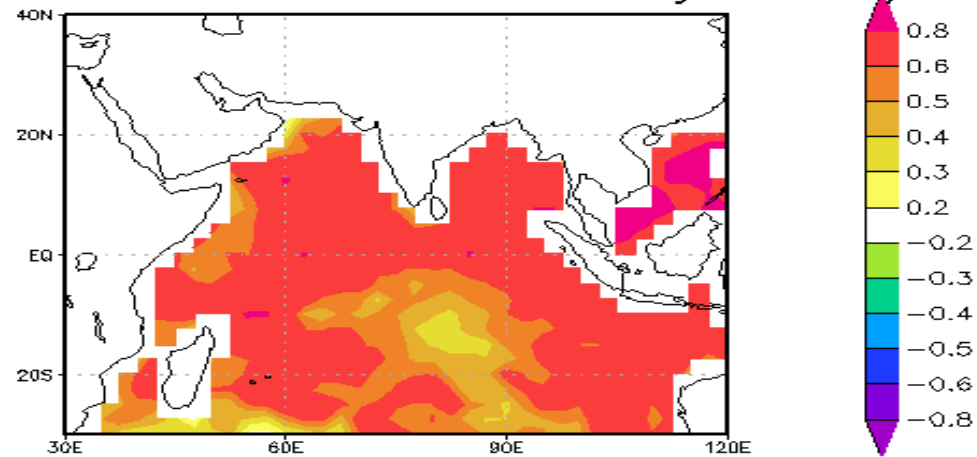
Rainfall Correlation: Model vs Observation

SST Correlation: Model vs Observation
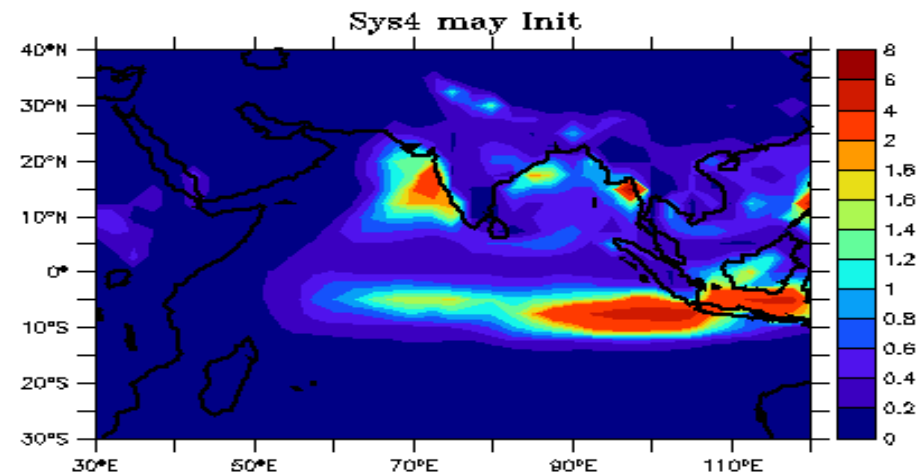

ECMWF SYS4–HadISST JJA feb init 81/12
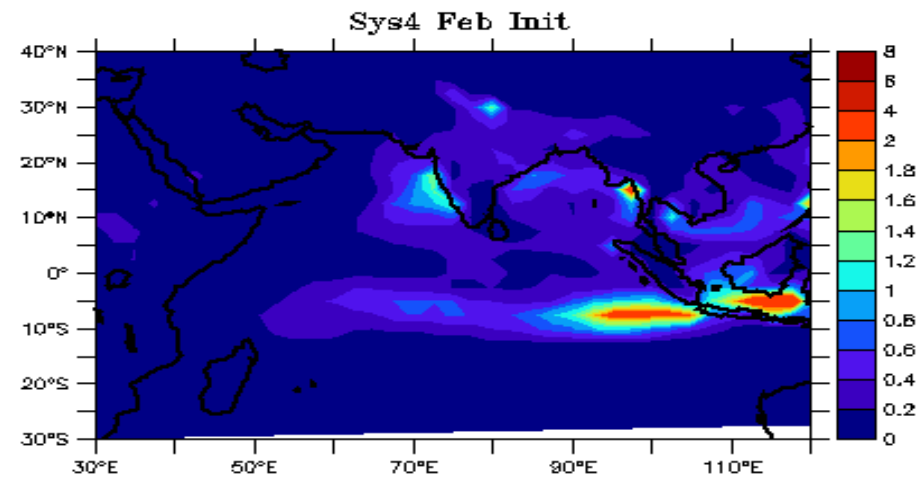
ECMWF SYS4–HadISST JJA may init 81/12

Inter-annual JJA rainfall (mm/day) variability
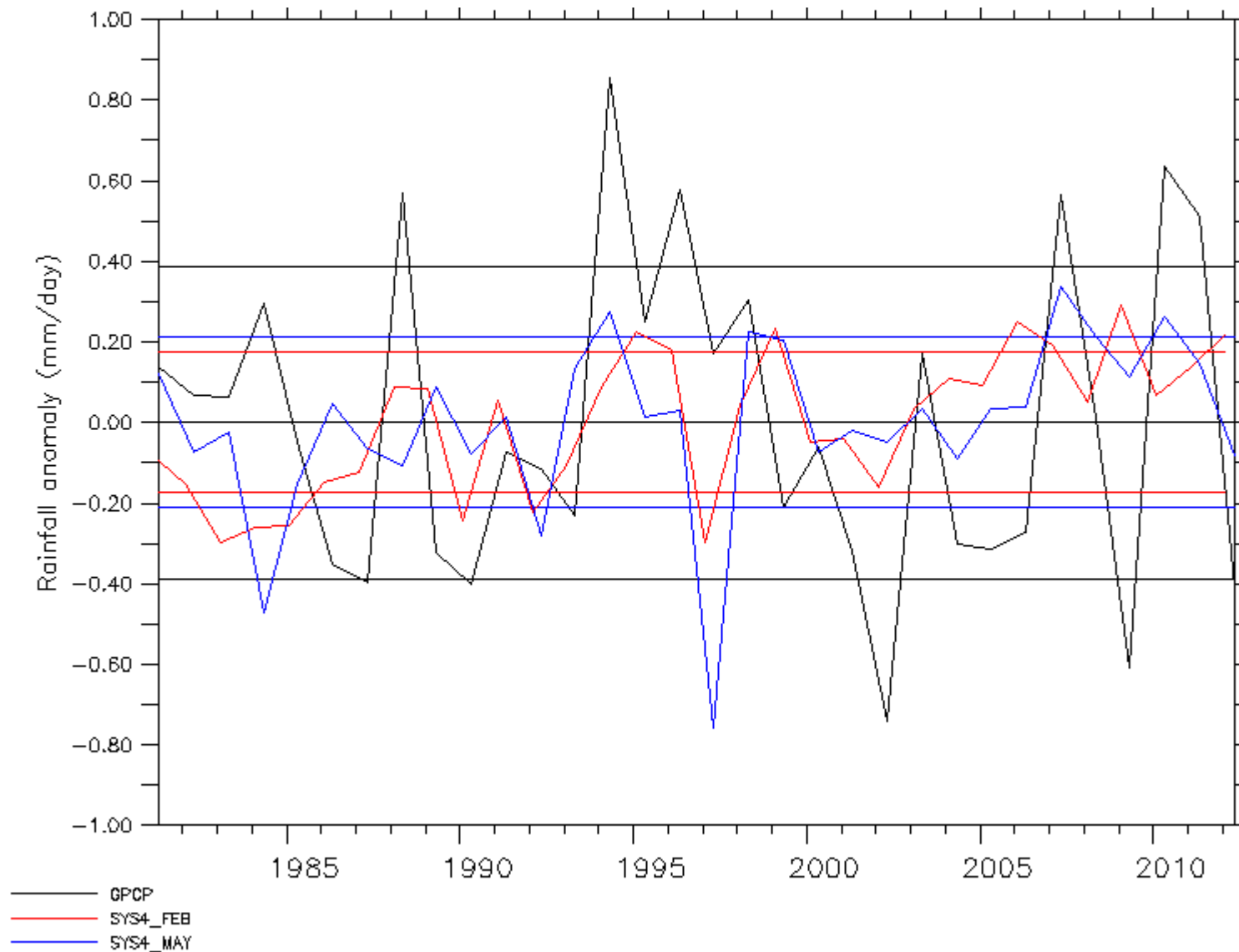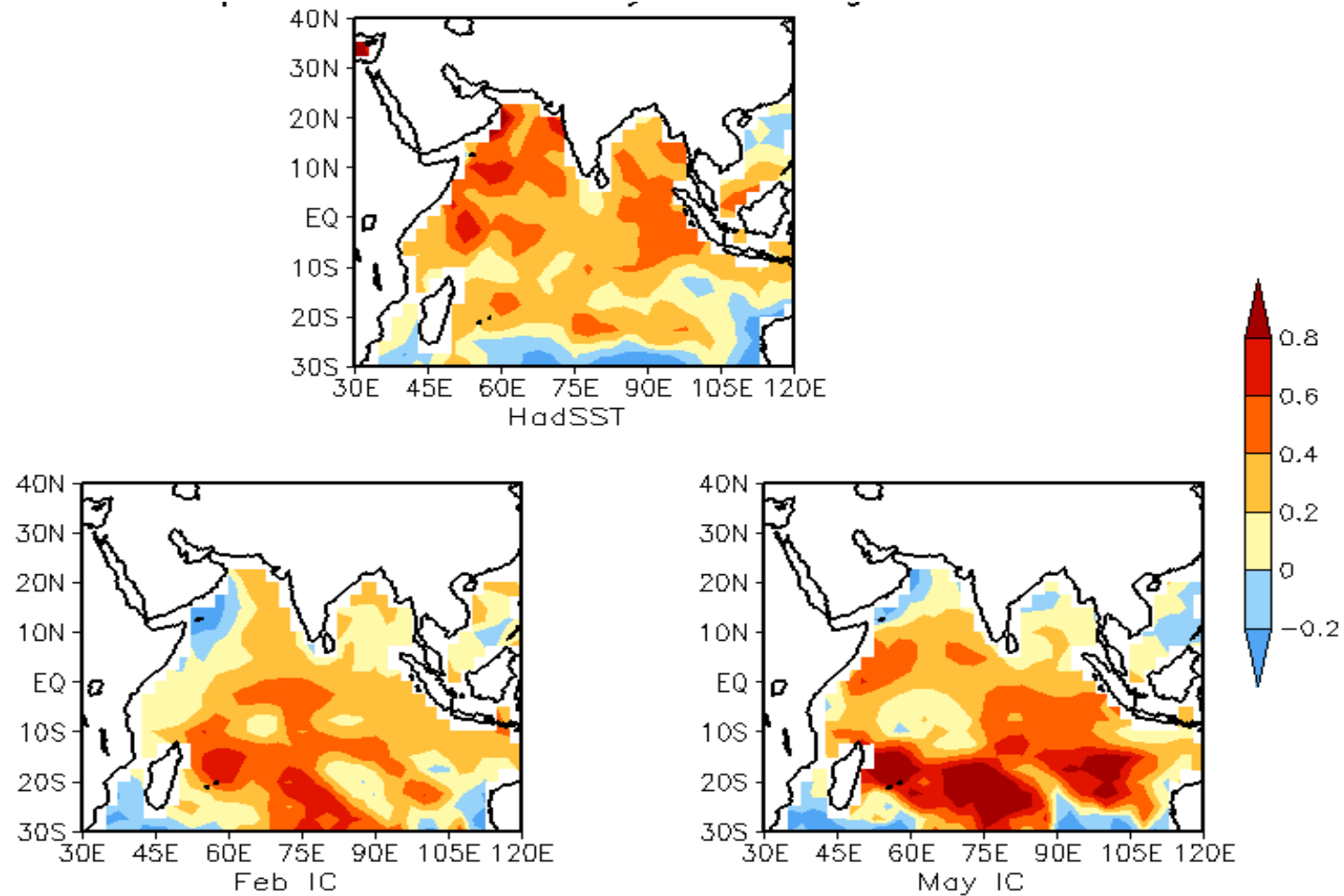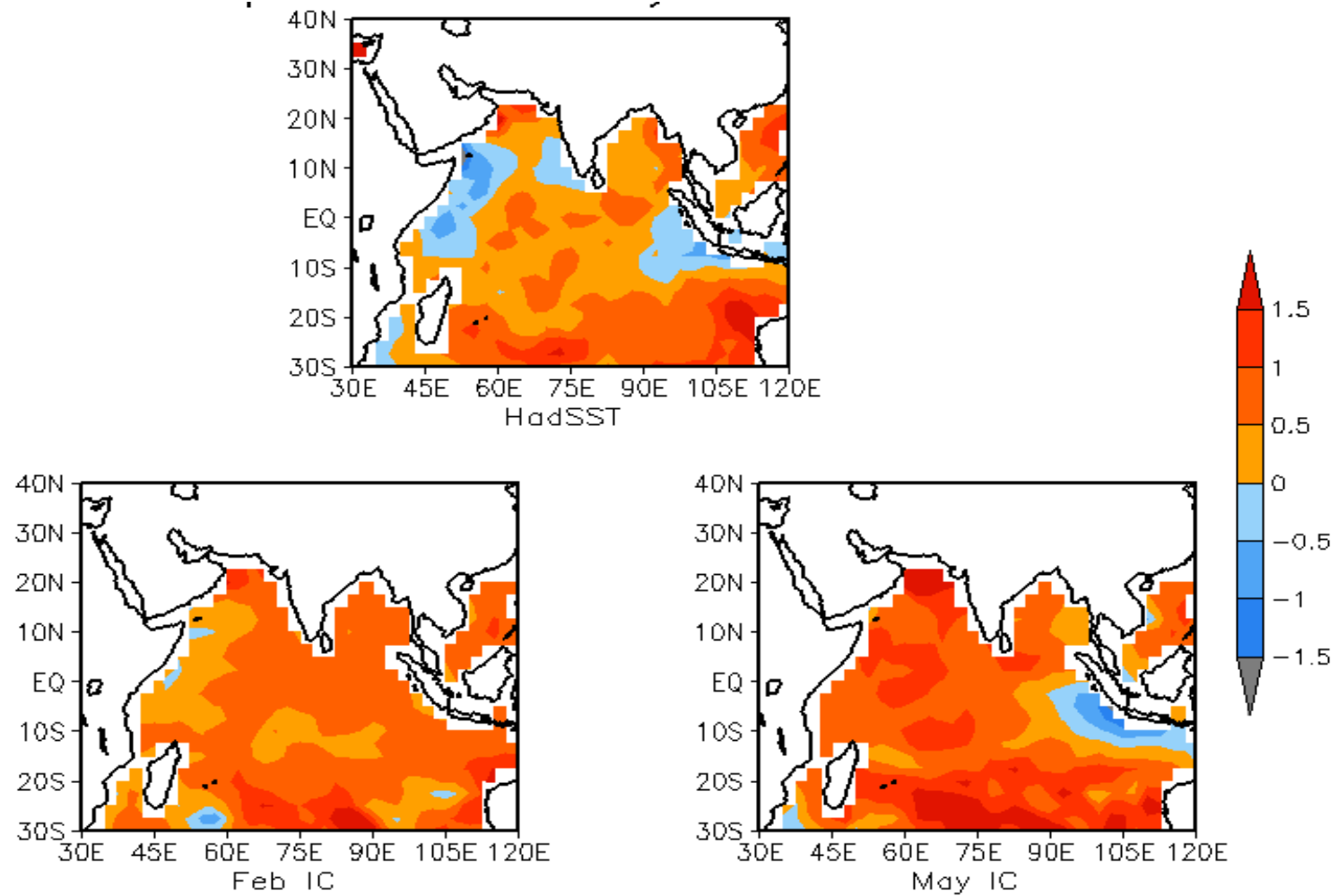
Rainfall Anomaly over Indian region (ISMR)
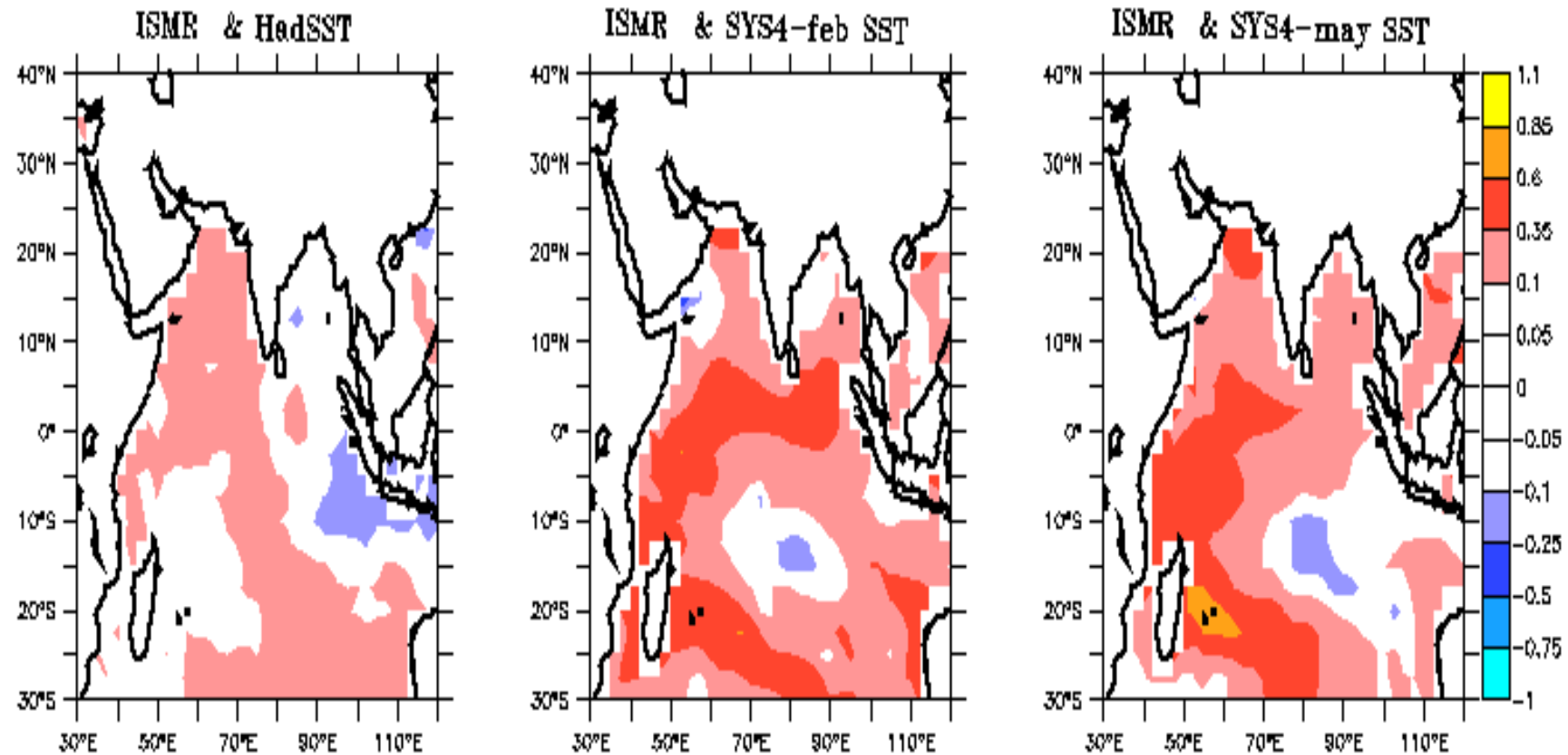66^0–100^0E   7–38^0N

Composite SST Anomaly of Drought Year

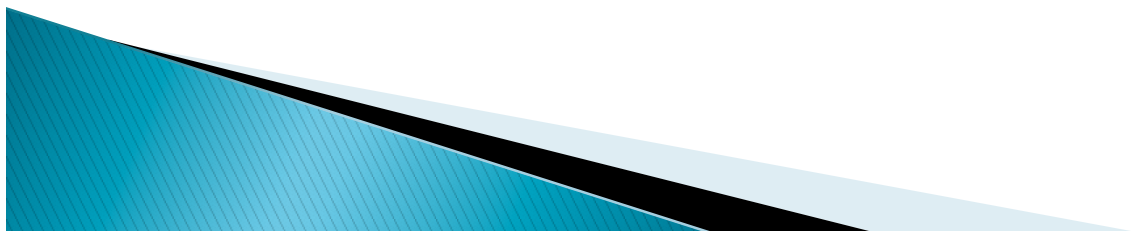# Composite SST Anomaly of Flood Year
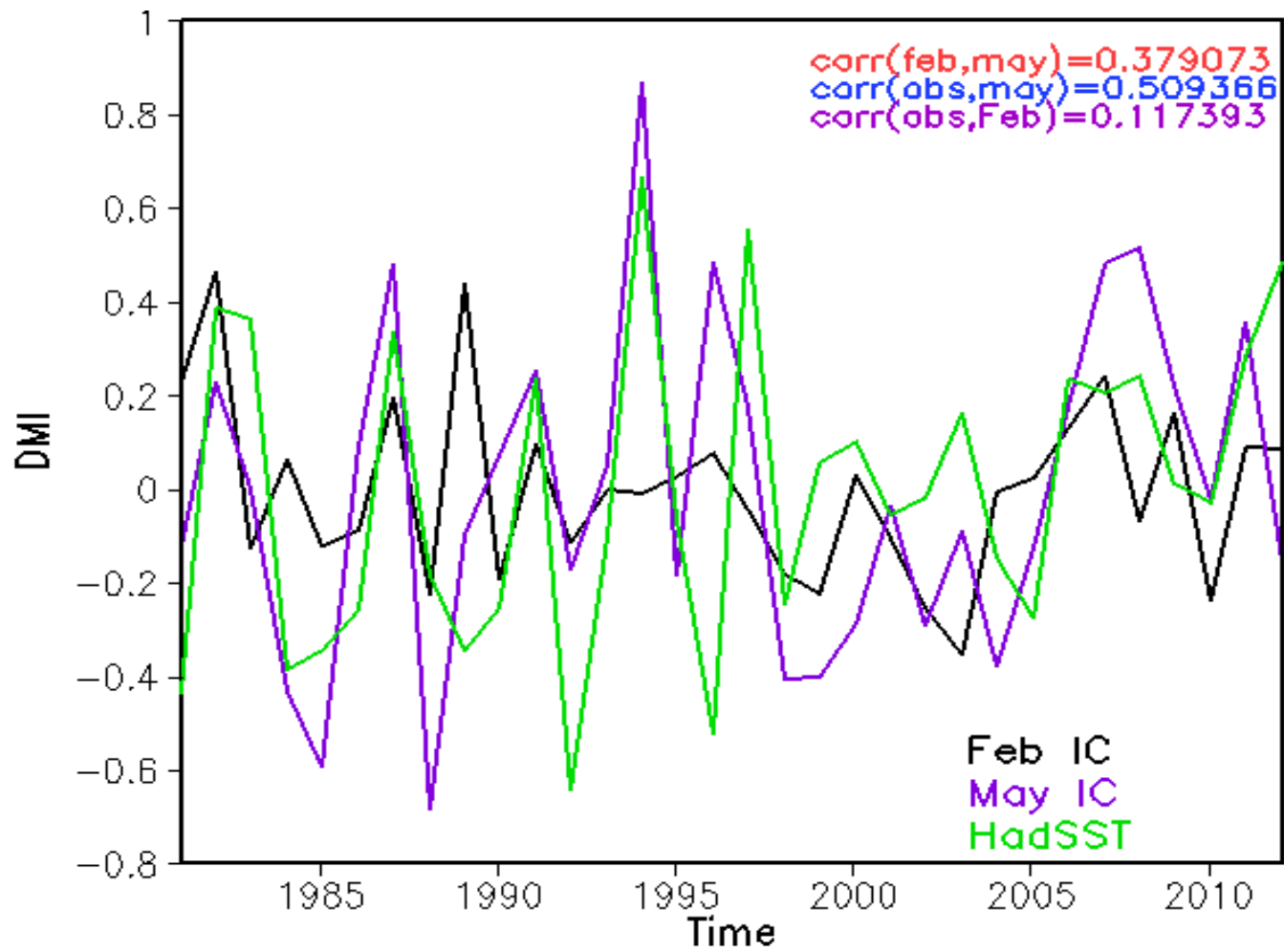
Correlation between ISMR with SST

Dipole model Index (DMI)

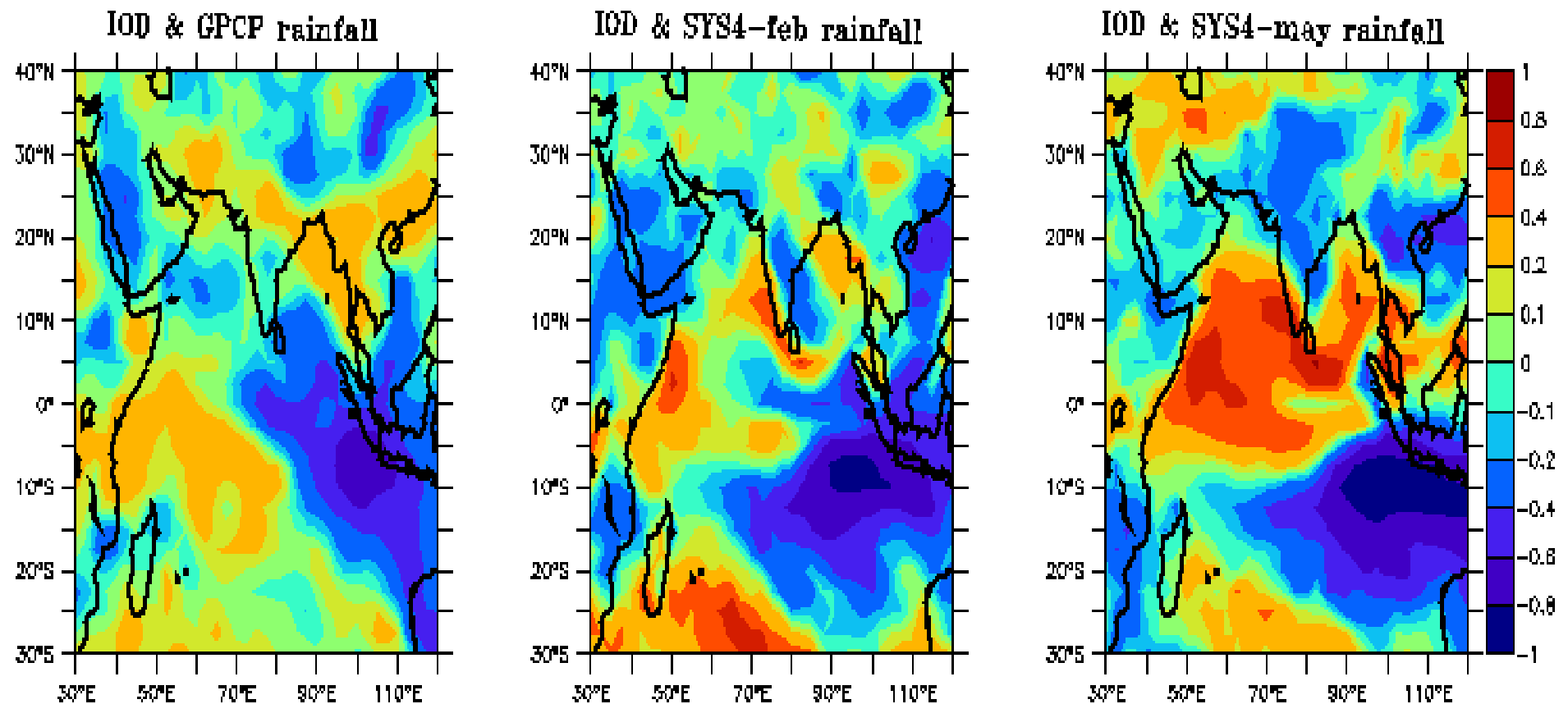The Dipole Mode Index (DMI) is a measure of the anomalous zonal SST gradient across the equatorial Indian Ocean.

It is defined as the difference between SST anomaly in a western (60E–80E,10S–10N) and an eastern (90E–110E,10S–0S) *(Saji et. al., 1999)*.
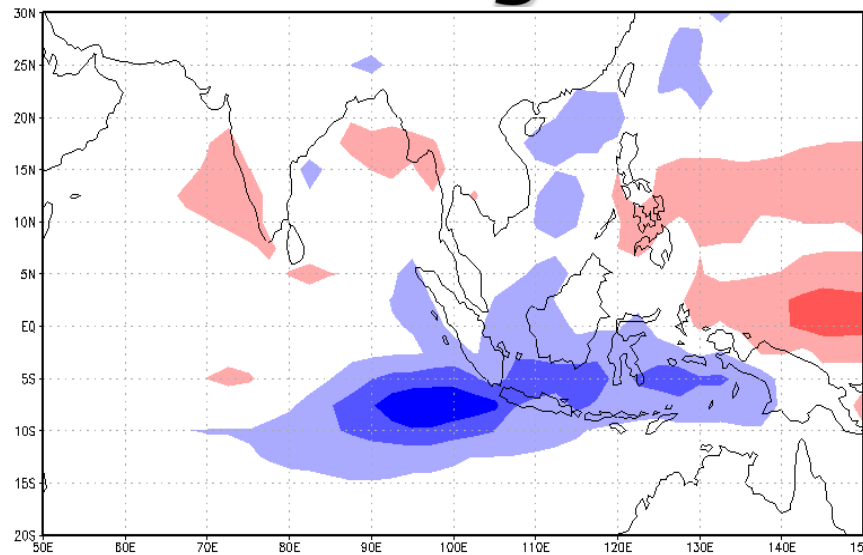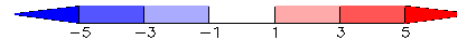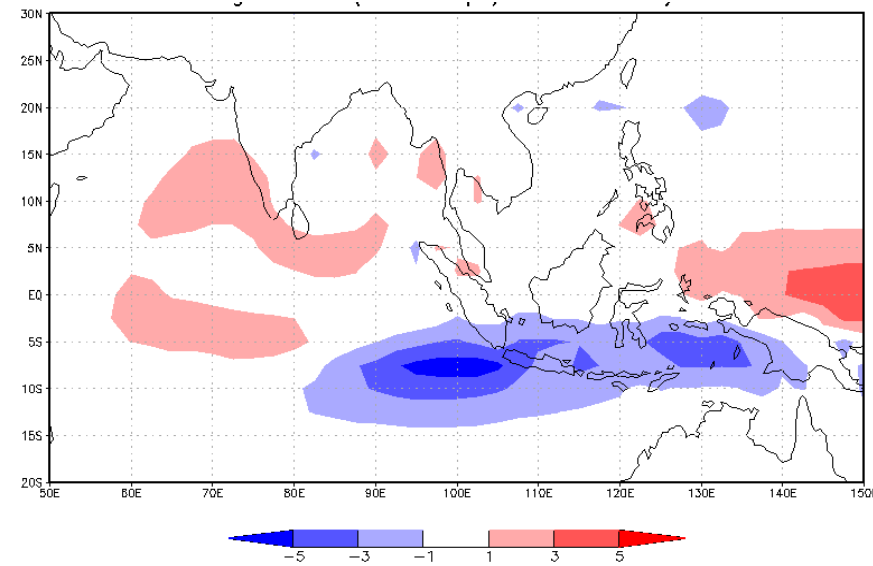
DMI

Correlation of DMI and JJA rainfall anomaly

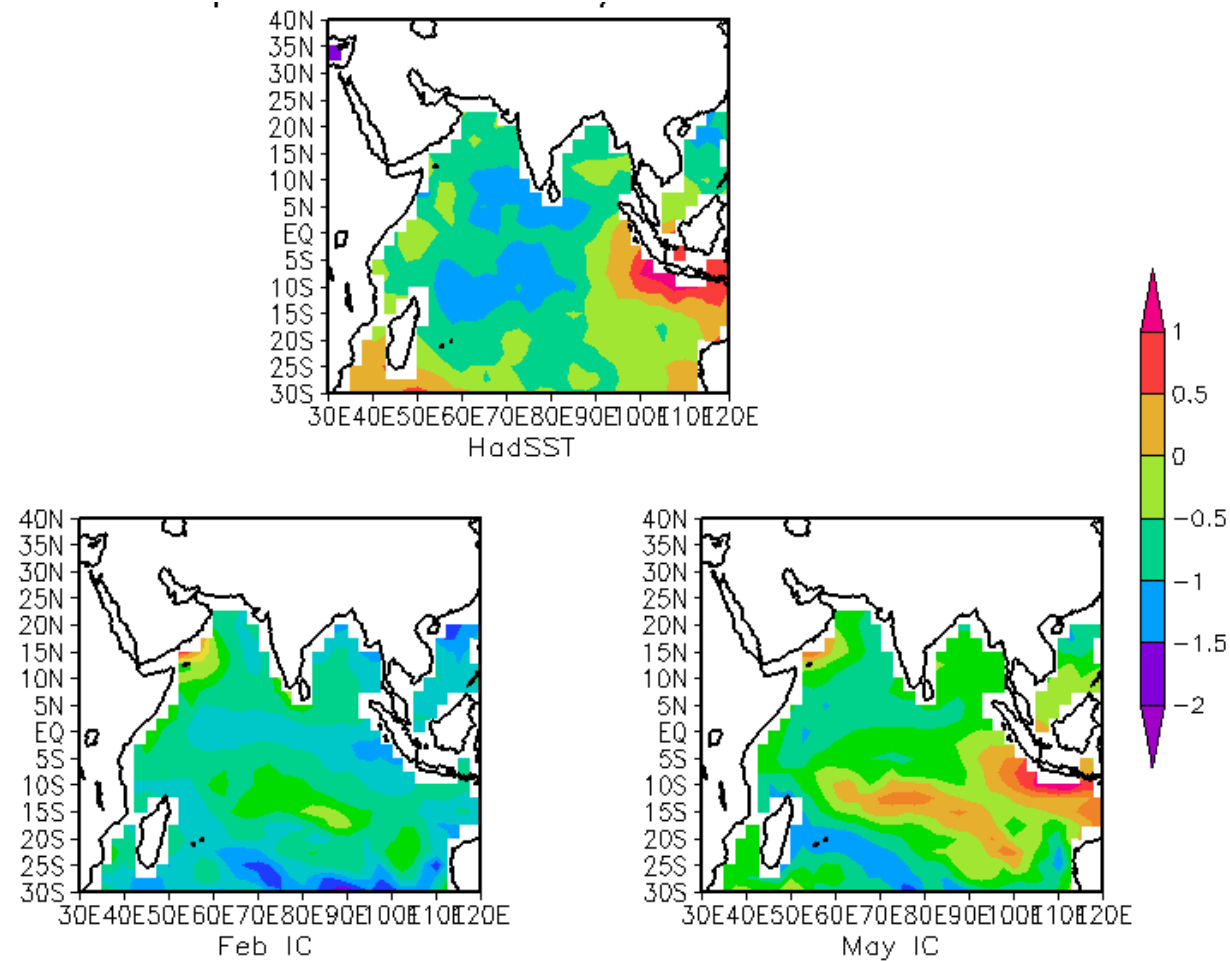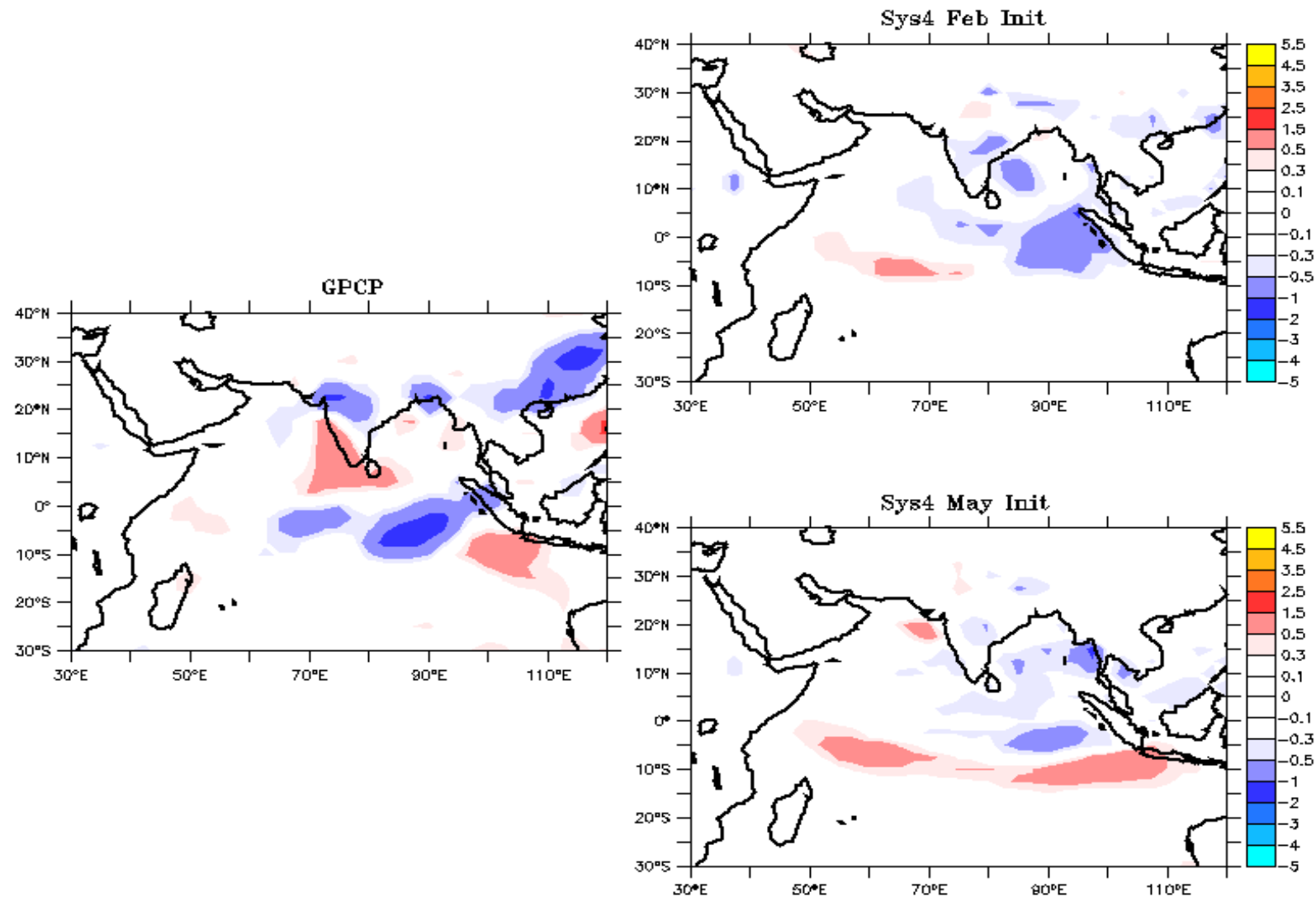# Coef. Regression Rainfall vs IOD

Feb IC

May IC

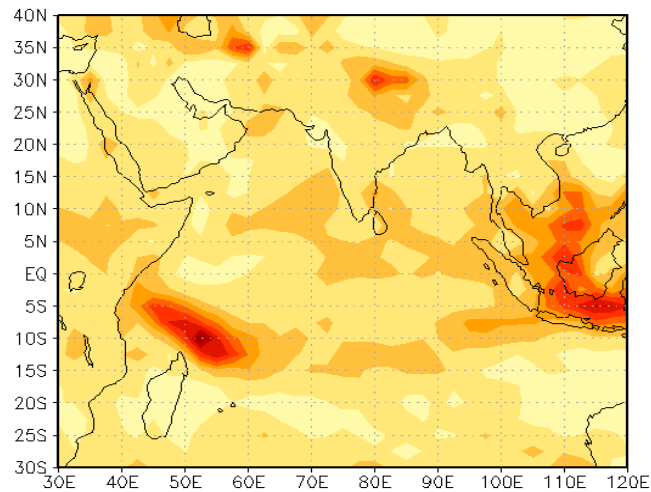# Composite of SST Anomaly (−ve IOD, No ENSO)
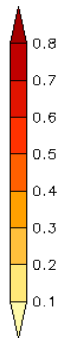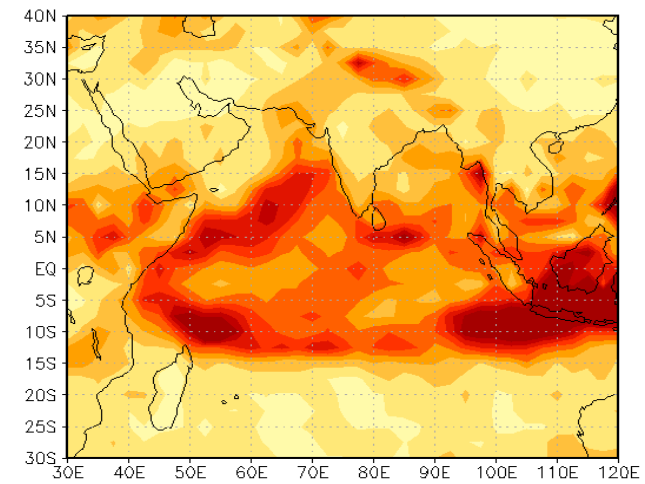
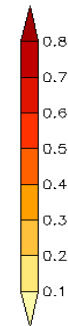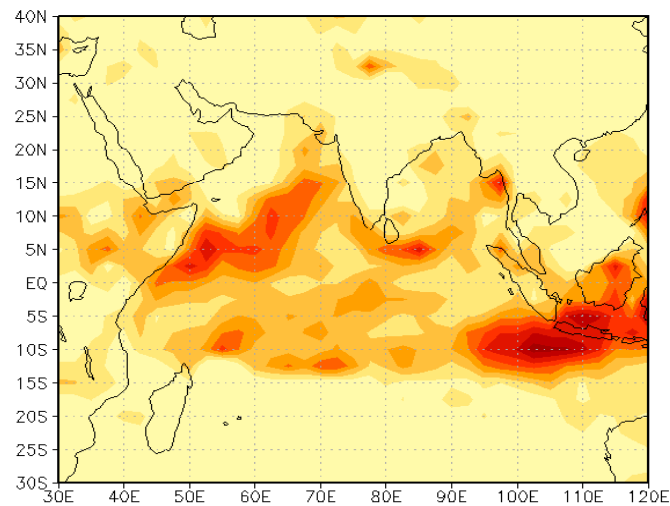# Composite of Rainfall Anomaly (−ve IOD, No ENSO)

Signal to Noise Ratio

Signal−to−Noise Ratio PRCP (SYS−4_FEB) JJA
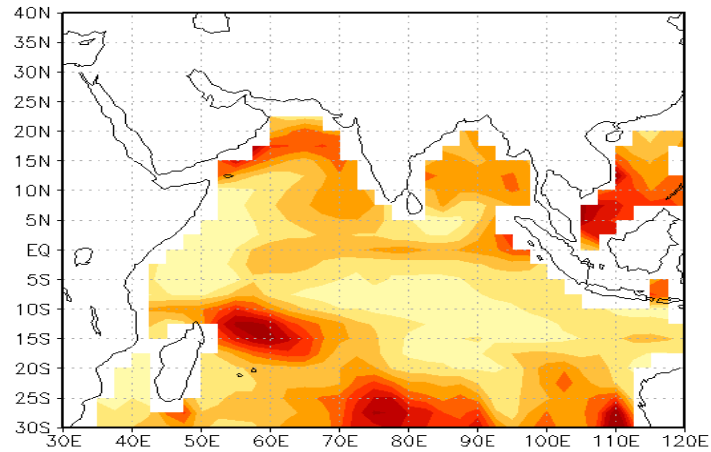
Signal−to−Noise Ratio PRCP (SYS−4_MAY) JJA

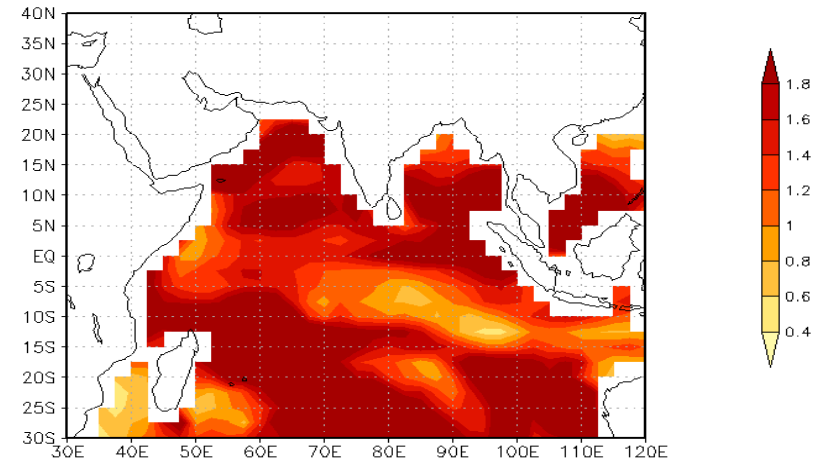Difference of Signal−to−Noise Ratio PRCP (SYS−4_MAY−FEB) JJA

Signal to Noise ratio
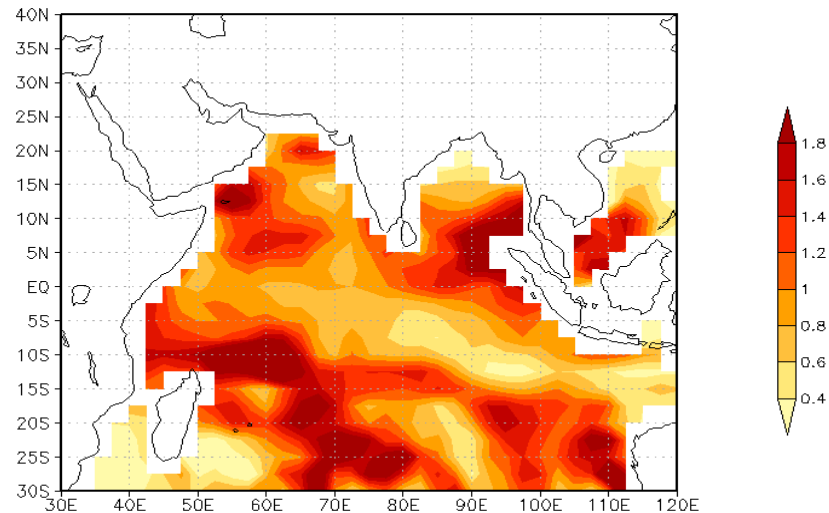

Signal−to−Noise Ratio SST (SYS−4_FEB) JJA
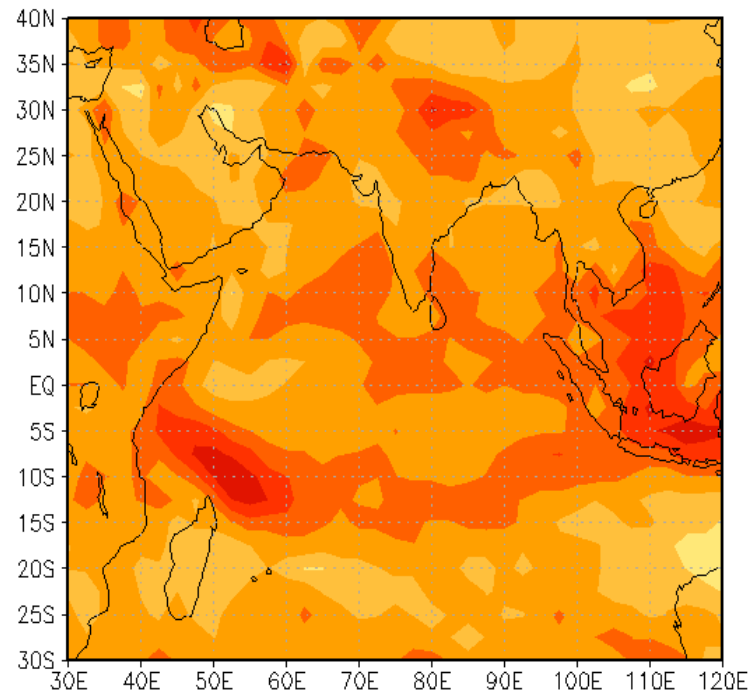
Signal−to−Noise Ratio SST (SYS−4_MAY) JJA

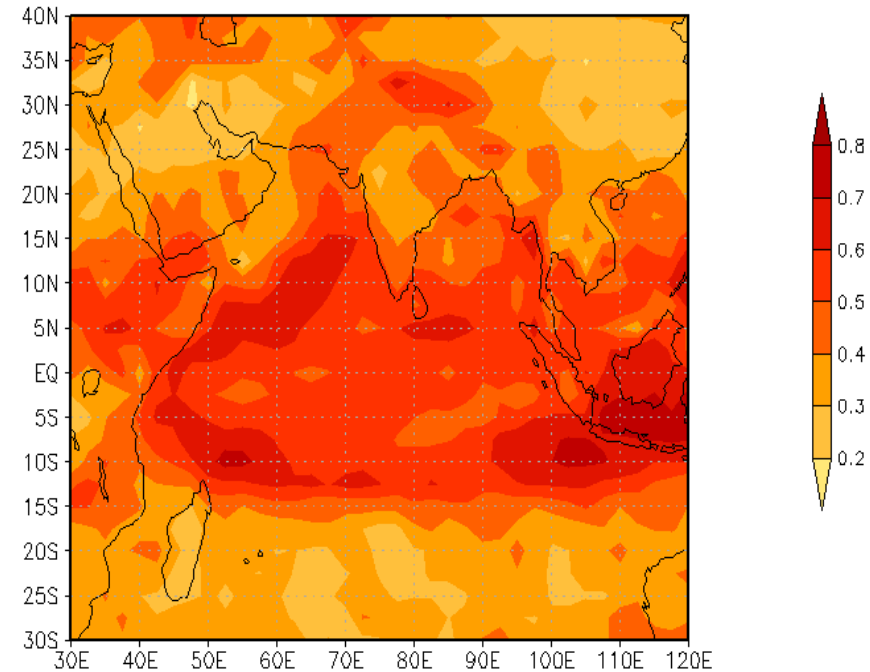Difference of Signal−to−Noise Ratio SST (SYS−4_MAY−FEB) JJA

Predictability Limit of the Model
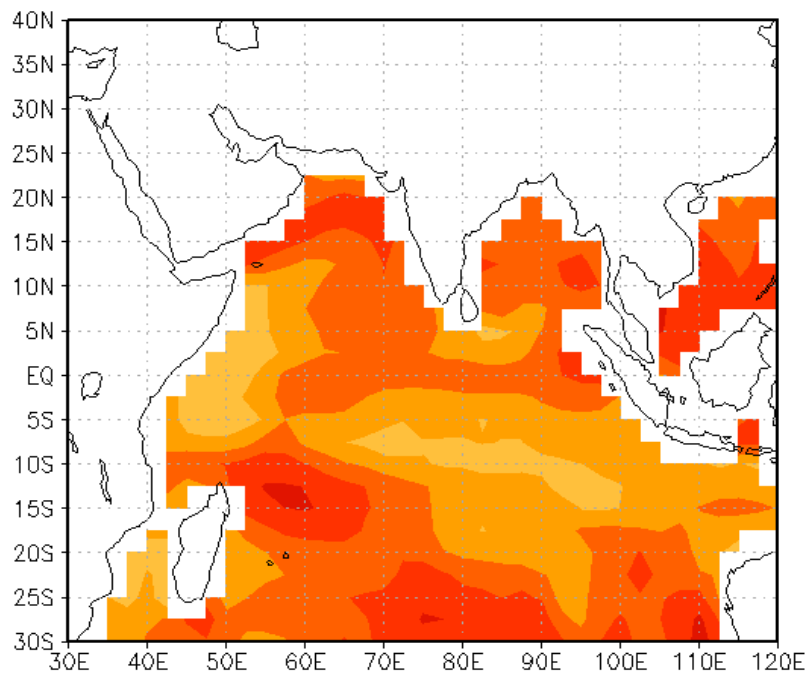
Limit of Predictibility PRCP (SYS-4_FEB) JJA

Limit of Predictability PRCP (SYS-4_MAY) JJA

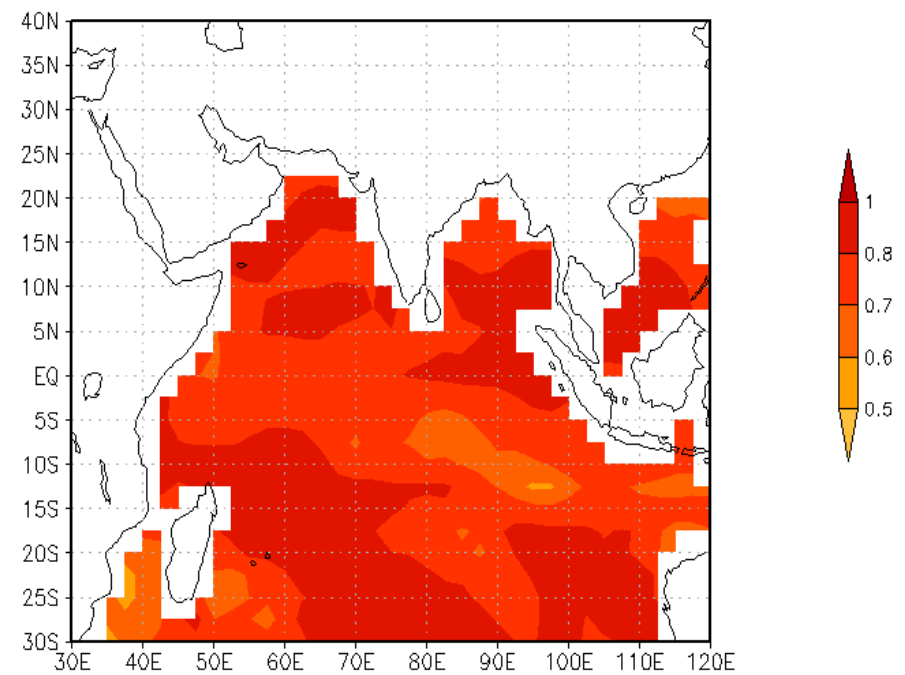# Predictability Limit of the Model

Limit of Preidictibilty SST (SYS-4_FEB) JJA

Limit of Predictability SST (SYS-4_MAY) JJA

Summary

- Model captures south Asian monsoon rainfall and Indian Ocean SST reasonably well from ECMWF system 4 model initialized in the month of February and May.

- The inter-annual variability of south Asian monsoon is low from the model as compared to observation.

- The signature of impact of Indian Ocean dipole on Indian summer monsoon is not seen in the model.

- Predictability limit is higher for the SST and precipitation over the domain of our study from May Initial condition as compared to February initial condition.