

# Performance of the Experimental Seasonal Forecasts of Monsoon-2015

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**Associate Mission Director  
Monsoon Mission**



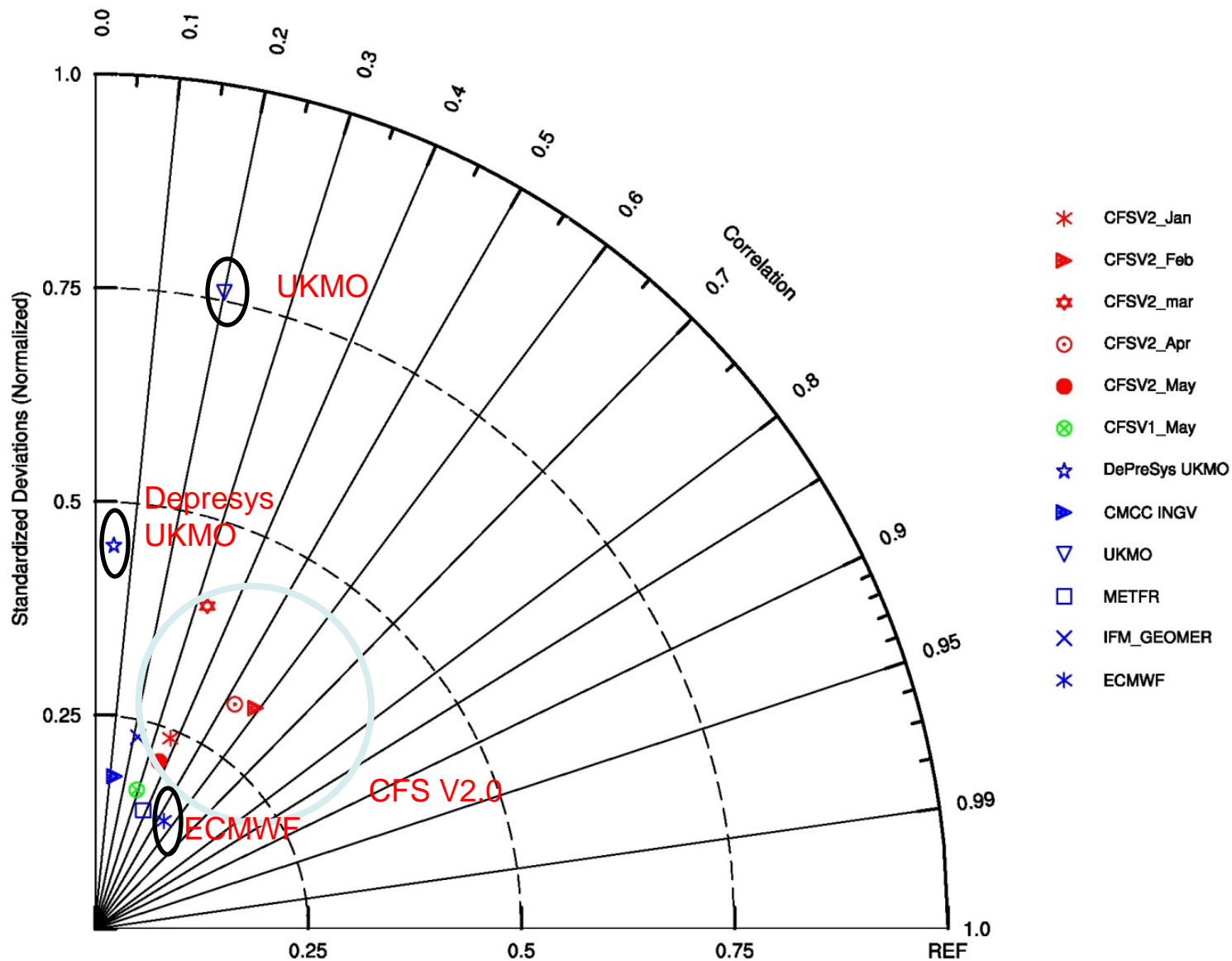
**Indian Institute of Tropical Meteorology, Pune  
Earth System Science Organization**

**Contributors: Maheshwar Pradhan, Ankur SriVastava, Anil Pandey,  
Gibies George, Ashish Dhakate, Kiran Solunki, Rajib Chattopadhyay,  
Mahapatra etc. and IMD colleagues of LRF division**

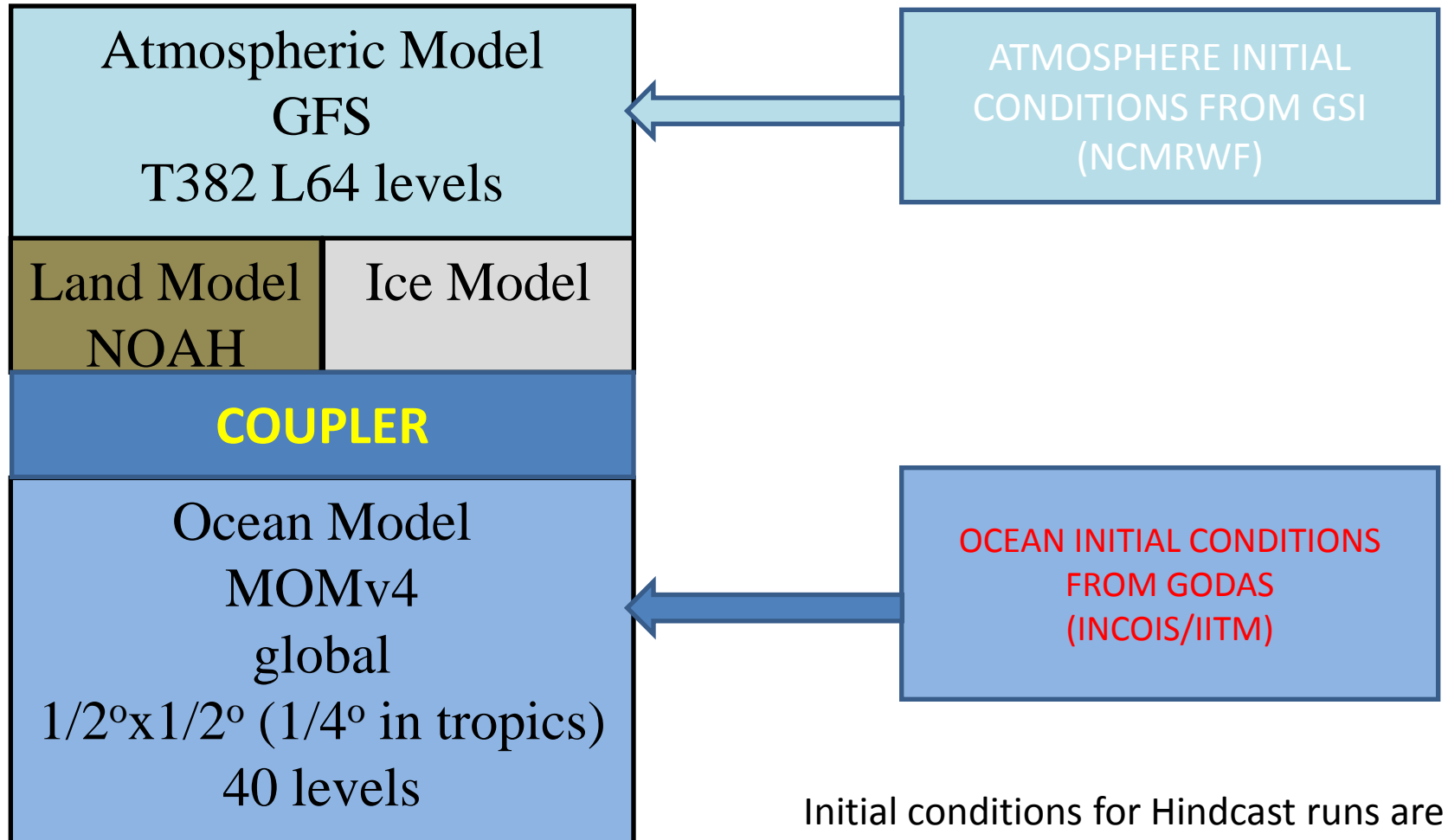
# Outline

- **Model used for Experimental Forecast and its skill**
- **Performance of the model**
- **Why the model forecasts are reliable this year?**

# Rainfall Prediction skill over Land points



# IITM CFS Model: Seasonal Prediction



**(Original model is adopted from NCEP)**

# Model Initial Conditions

## Hindcast runs

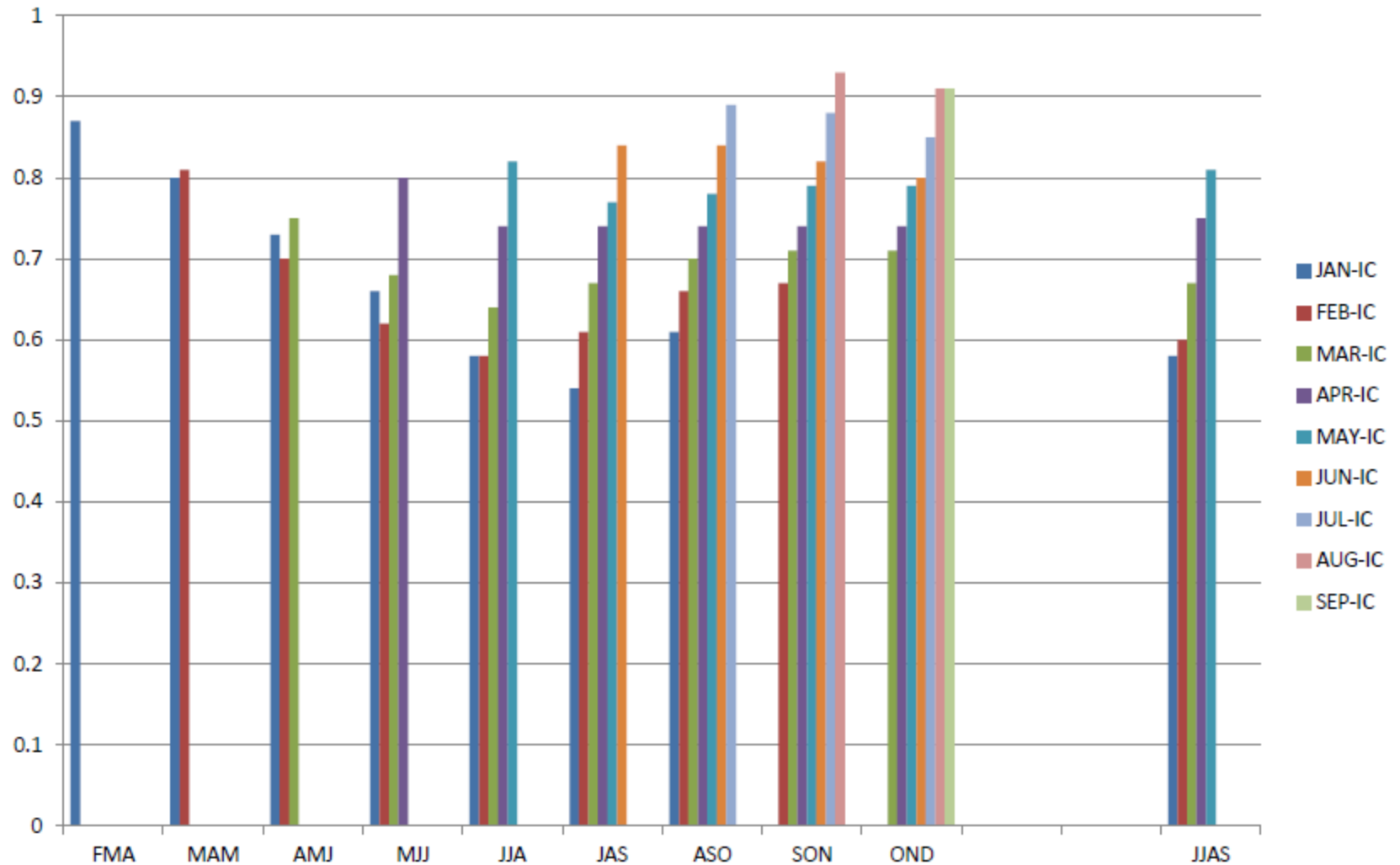
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JAN	06,11,16,21,26	00 & 12 UTC	10
FEB	5,10,15,20,25	00 & 12 UTC	10
MAR	2,7,12,17,22,27	00 UTC	06
APR	01,06,11,16,21,26	00 & 12 UTC	12
MAY	01,06,11,16,21,26 , 31	00 & 12 UTC	14
JUNE	05,10,15,20,25,30	00 & 12 UTC	12
JULY	05,10,15,20,25,30	00 & 12 UTC	12
AUG	04,09,14,19,24,29	00 & 12 UTC	12
SEP	05,10,15,20,25,30	00 & 12 UTC	12
OCT	05,10,15,20,25,30	00 & 12 UTC	12
NOV	05,10,15,20,25,30	00 & 12 UTC	12
DEC	05,10,15,20,25,30	00 & 12 UTC	12

# Model Initial Conditions (Forecast Runs)

MONTH	IC Days	UTC	ENSEMBLES
JAN	06,08,11,13,16,18,21,23,26,28	00,06,12,18	40
FEB	05,08,10,12,15,18,20,23,25,28	00,06,12,18	40
MAR	02,07,12,17,20,22,25,27,28,30	00,06,12,18	40
APR	01,03,06,09,11,16,19,23,26,30	00,06,12,18	40
MAY	01,02,04,06,09,11,13,16,19,21,23,26,28	00,06,12,18	52
JUNE	01,03,05,10,13,15,18,20,23,25,27,28,29, 30	00,06,12,18	52
JULY	01,03,05,08,10,13,15,18,20,23,25,27,28	00,06,12,18	52
AUG	02,04,07,09,12,14,17,19,22,24,26,27,29	00,06,12,18	52
SEP	01,03,05,08,10,13,15,18,20,23,25,27,28	00,06,12,18	52
OCT	02,04,07,09,12,14,17,19,22,24,26,27,29	00,06,12,18	52
NOV	01,03,05,08,10,13,15,18,20,23,25,27,28	00,06,12,18	52

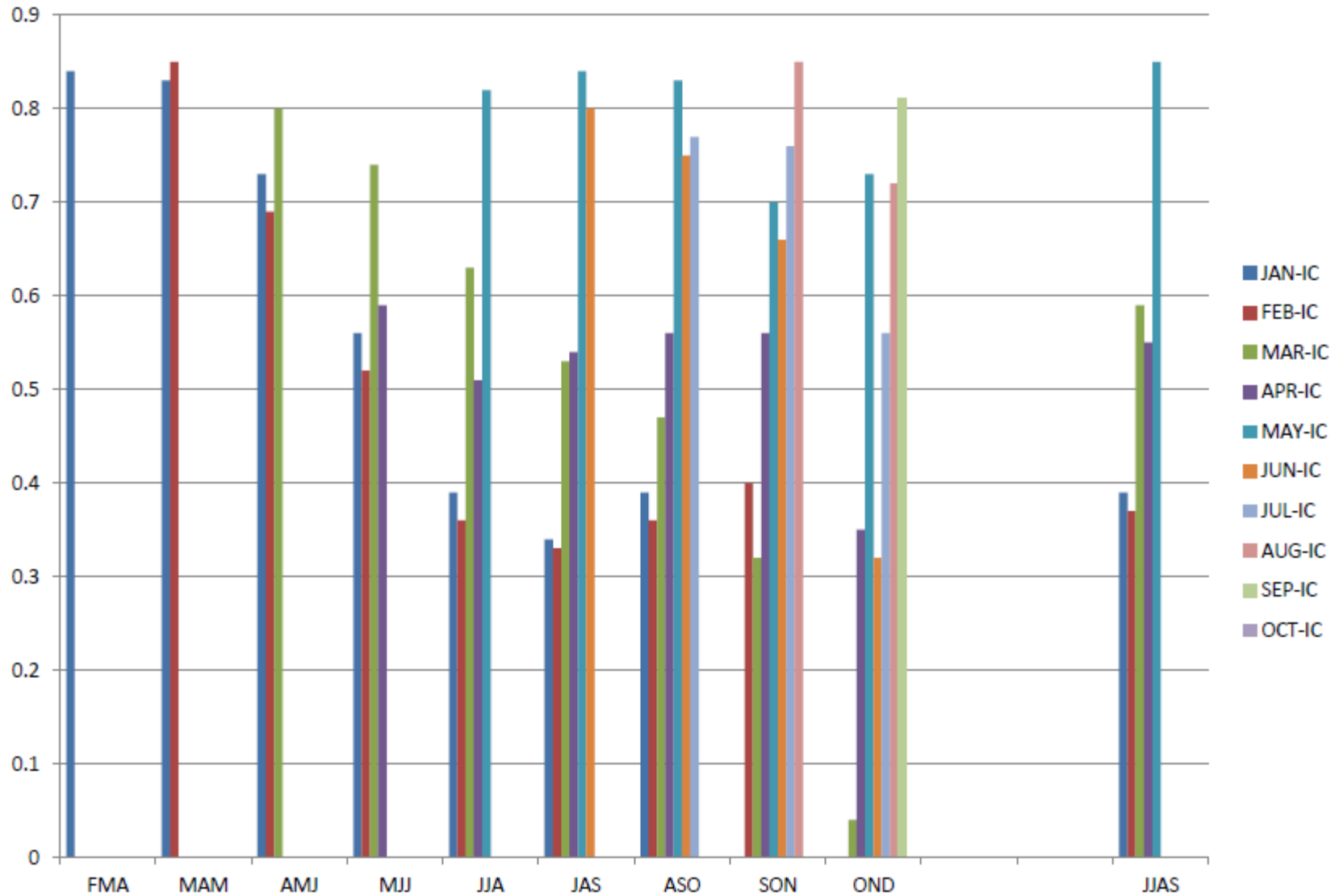
# CFSv2 Prediction Skill

Anomaly Correlation Coefficient (ACC): NINO 3.4



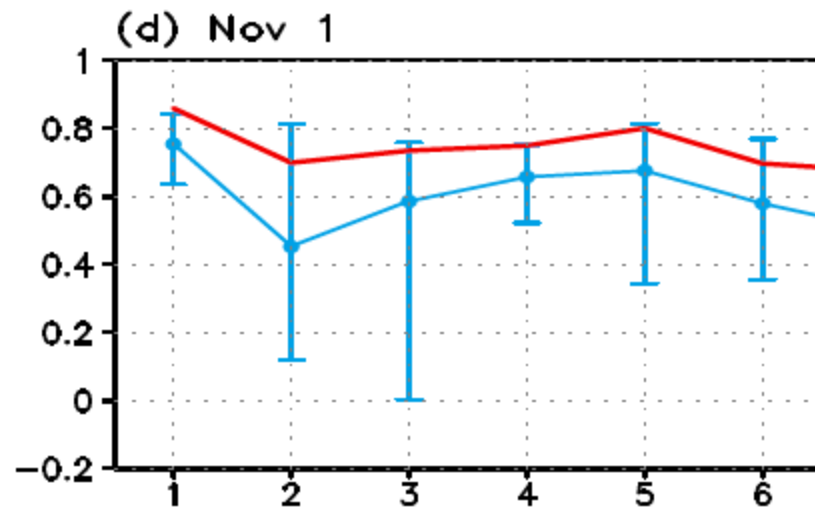
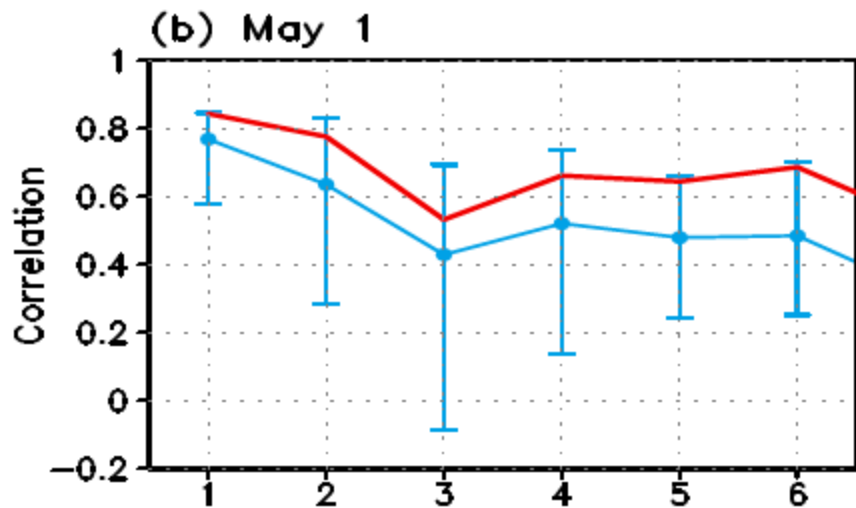
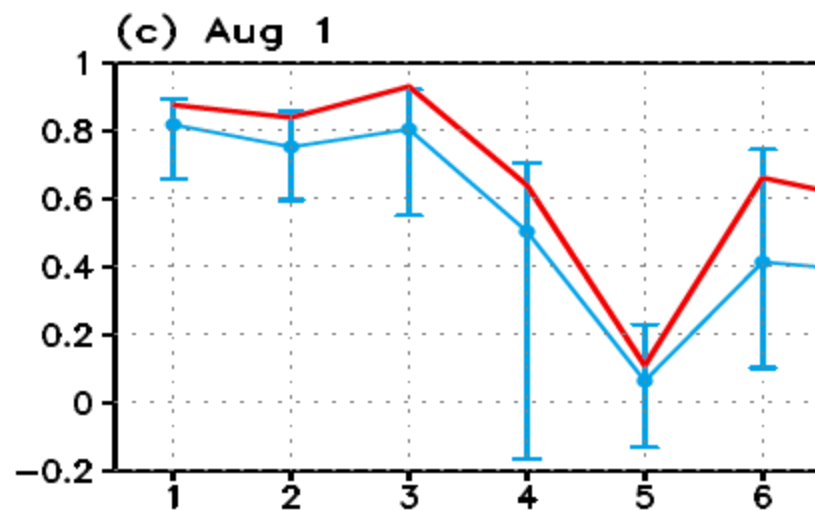
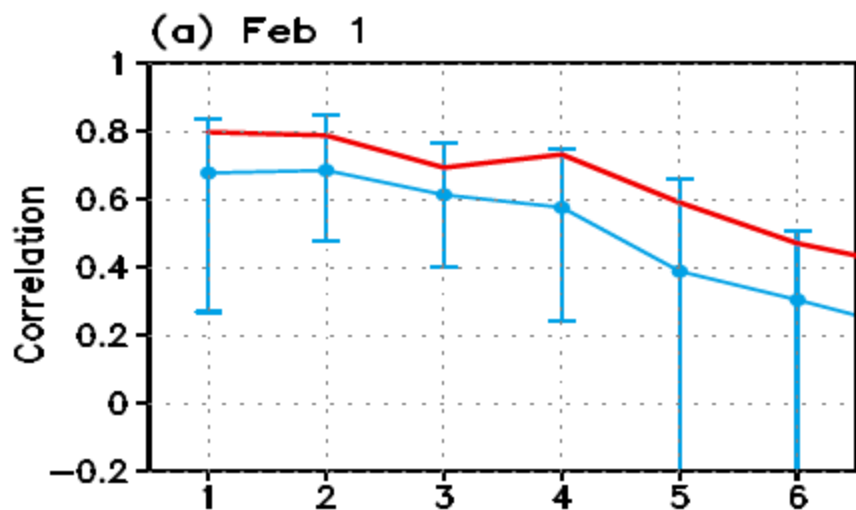
# CFSv2 Prediction Skill

## Anomaly Correlation Coefficient (ACC) : IOD East Box



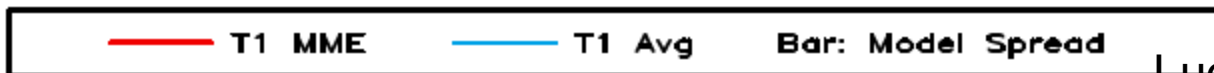


# IODE (EIO, 10°S-0°, 90°E-110°E) SSTA (14 coupled models, 1981-2001)



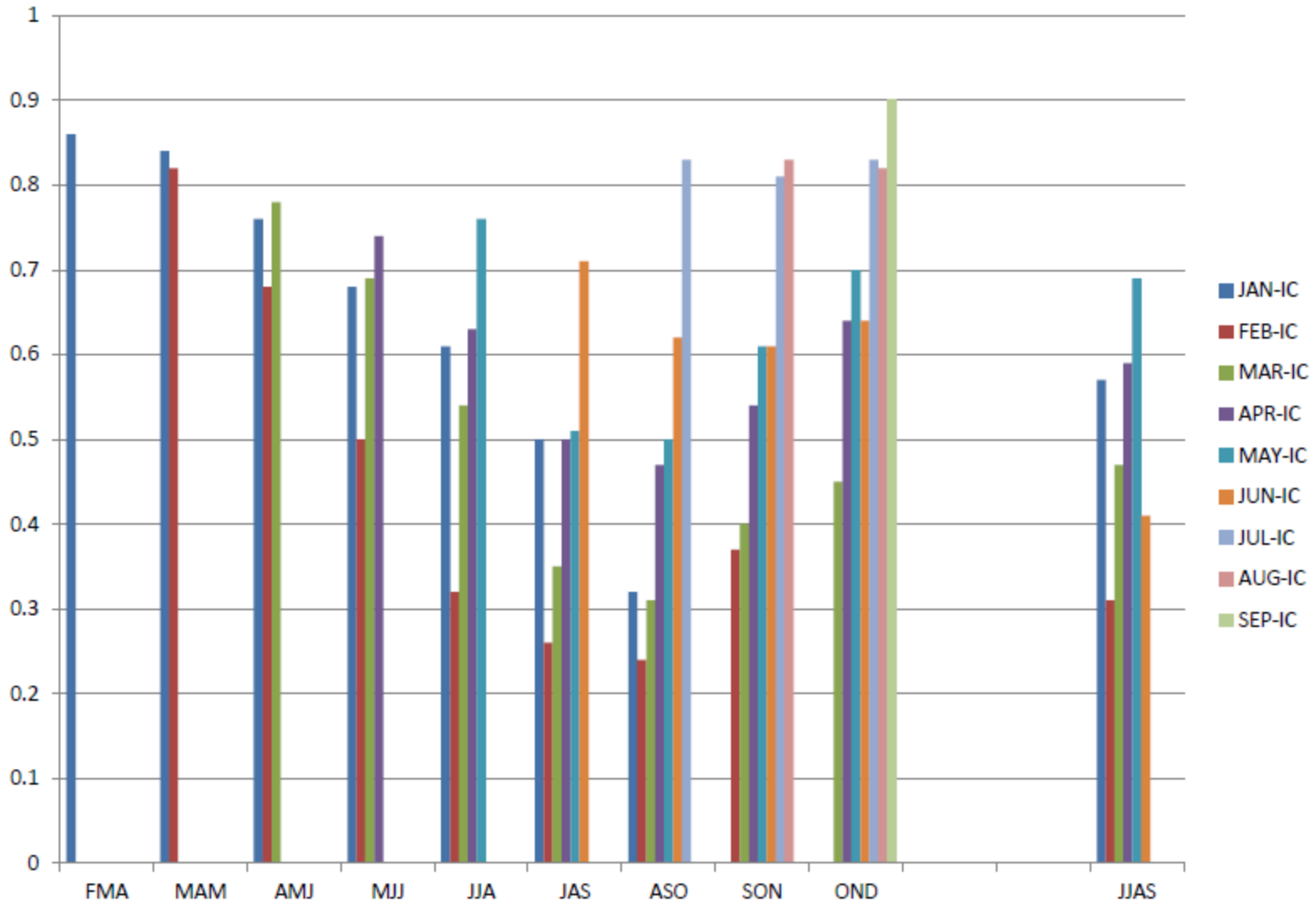
Forecast Lead Month

Forecast Lead Month



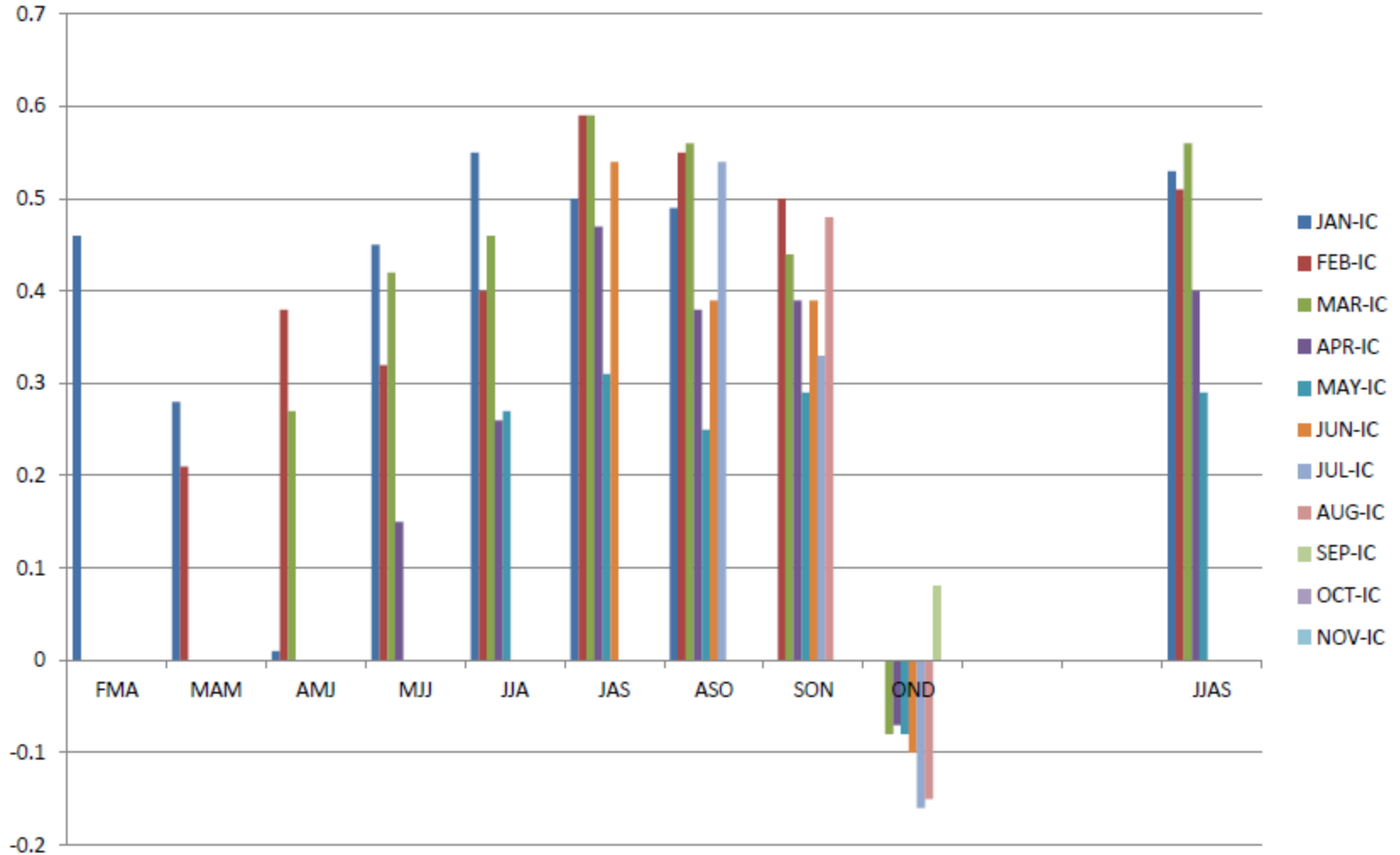
# CFSv2 Prediction Skill

## Anomaly Correlation Coefficient (ACC): IOD West Box

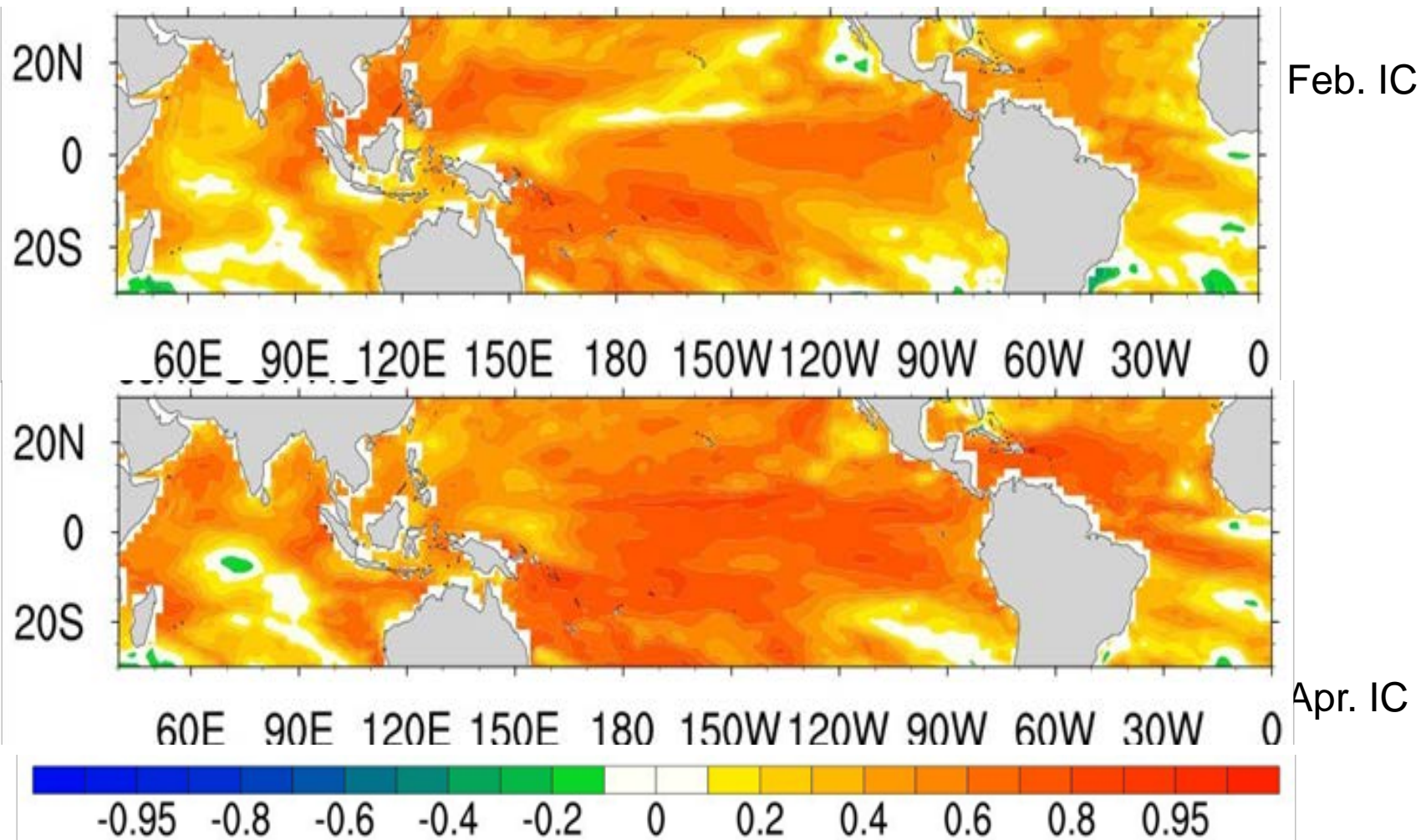


# CFSv2 Prediction Skill

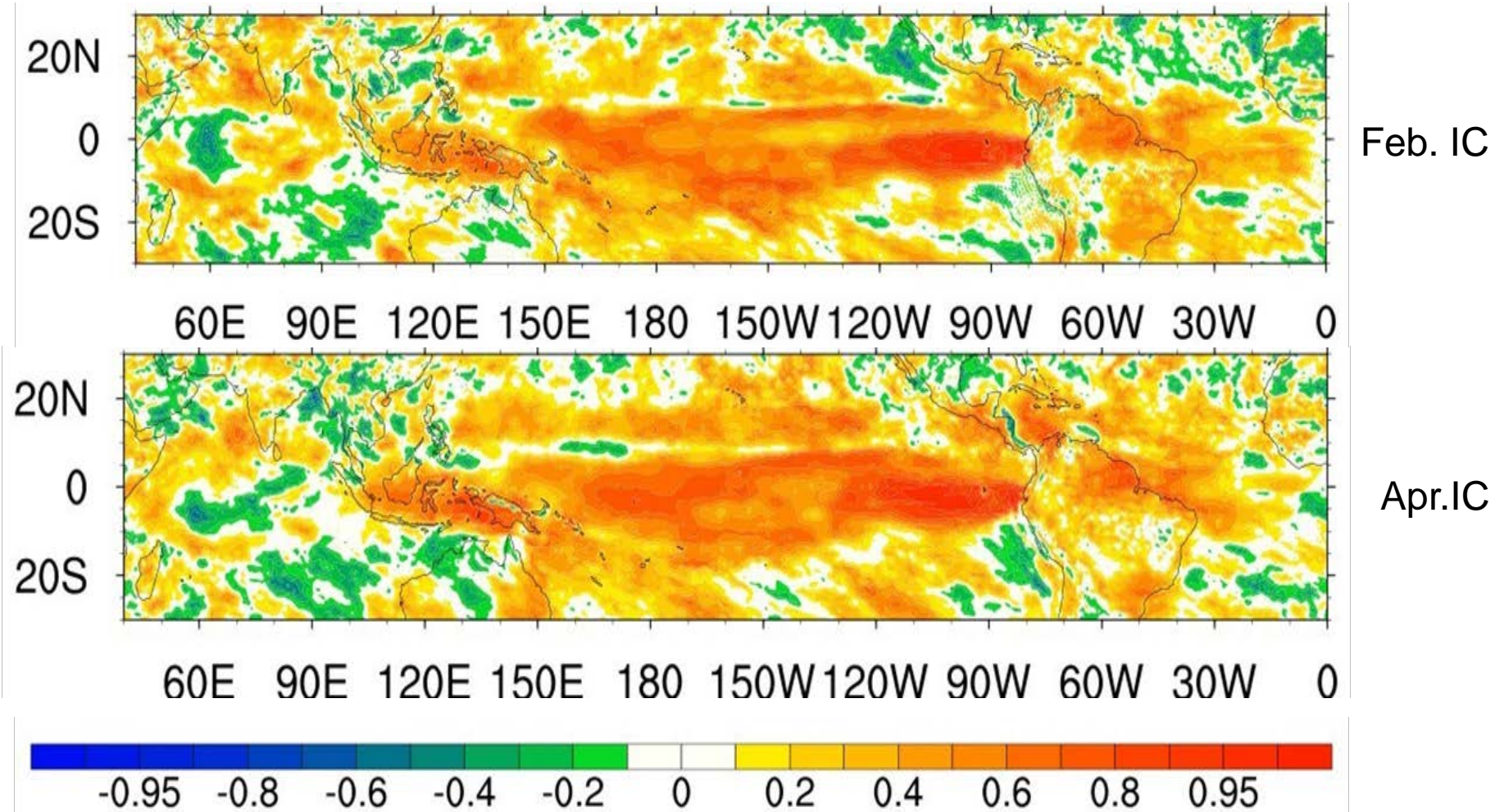
Anomaly Correlation Coefficient (ACC): All India Land Rainfall



## *Anomaly Correlation Between Observed and Predicted (SST: 1982-2008)*



# Anomaly Correlation Between Observed and Predicted (Rain: 1982-2008)



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Research Article

# Indian Summer Monsoon Rainfall Simulation and Prediction Skill in the CFSv2 Coupled Model: Impact of Atmospheric Horizontal Resolution<sup>†</sup>

D.A. Ramu, C.T. Sabeerali, Rajib Chattopadhyay, D. Nagarjuna Rao, Gibies George, A.R. Dhakate, K. Salunke, A. Srivastava, Suryachandra A Rao [✉](#)

Accepted manuscript online: 19 February 2016 [Full publication history](#)

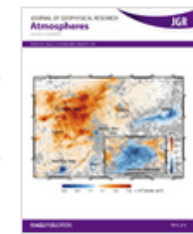
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Accepted Articles



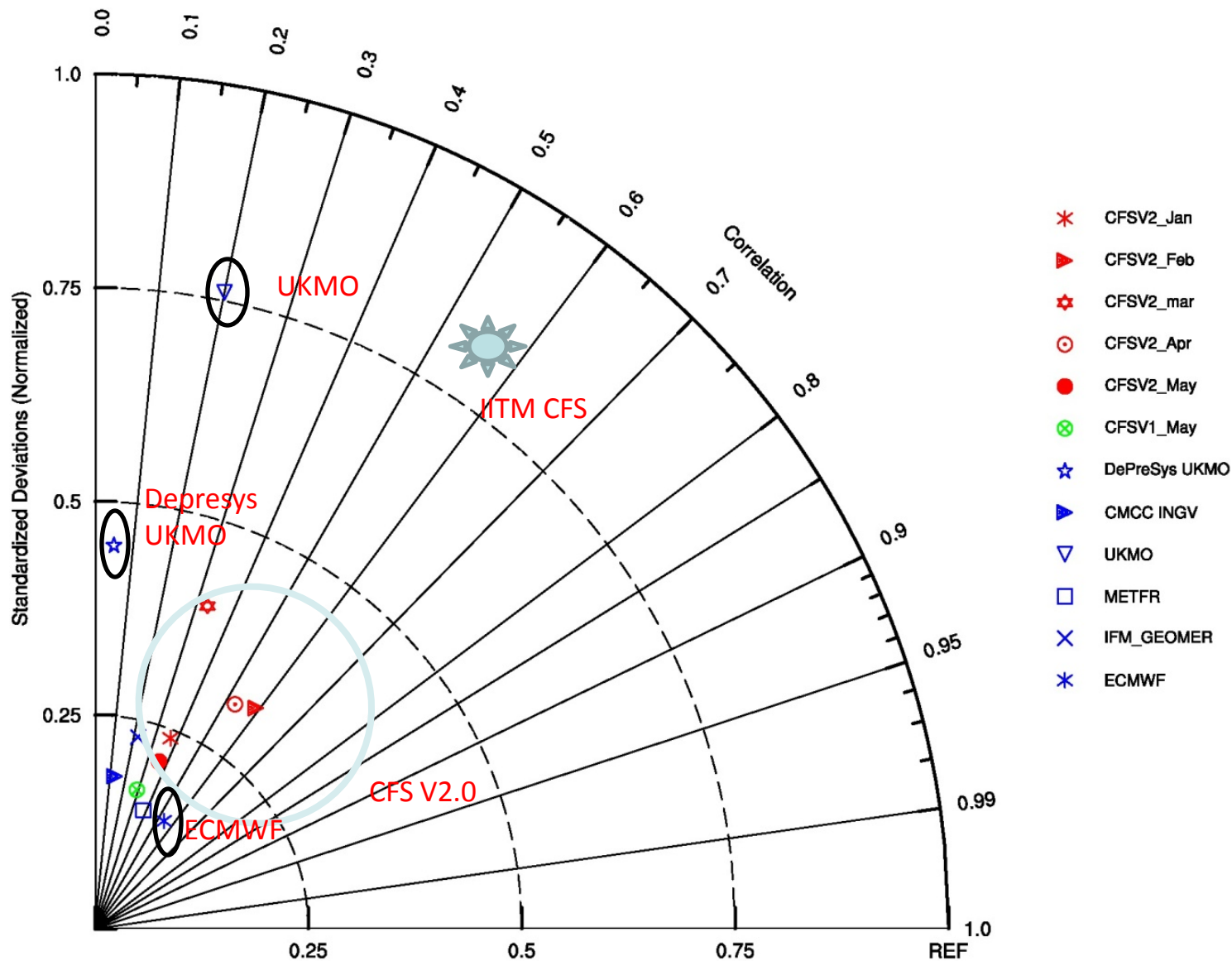
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(Unit : degree Kelvin)	Observations (degree Kelvin)	T126 (degree Kelvin)	T382 (degree Kelvin)
<b>(a) Upper Tropospheric Temperature</b>			
North Box (5N-35N,40E-100E)	251.4	250.2	251.7
South Box (15S-5N, 40E-100E)	249.1	248.6	250.2
TT Gradient (NB-SB)	2.3	1.6	1.5
<b><i>(b) Seasonal Mean and Standard Deviation of rainfall over Indian landmass and Nino 3.4 index</i></b>			
	Observations	T126	T382
AISMR JJAS Mean Rainfall (mm/day)	7.5	4.6	5.3
AISMR JJAS Standard Deviation (mm)	0.6	0.4	0.5
Nino 3.4 Standard deviation	0.7	0.6	0.7

<b>Teleconnections</b>	Observations	T126	T382
AISMR vs NINO3.4 (1981-2008)	-0.46	-0.74	-0.78
CIR vs EIOD (1981-2008)	-0.38	+0.47	+0.33
d) After excluding 7 years of common failure			
	Observations	T126	T382
AISMR vs NINO3.4 (21 years)	-0.61	-0.72	-0.83
CIR vs EIOD (21 years)	-0.43	+0.59	+0.26
e) Accumulated Rainfall and standard deviation(STD: in parenthesis) in mm			
	Observation(IMD)	T126	T382
Accumulated AISMR and STD (mm)	918.3(77.4)	566.1(50.7)	643.6(67.0)
Accumulated AIR and STD in June (mm)	187.8(25.4)	129.3(14.6)	118.3(17.9)
Accumulated AIR and STD in July (mm)	296.1(41.2)	160.9(22.5)	187.8(24.4)
Accumulated AIR and STD in AUG (mm)	260.2(27.9)	158.0(16.9)	193.1(25.0)
Accumulated AIR and STD in SEP (mm)	177.1(34.2)	118.9(16.9)	146.2(19.8)

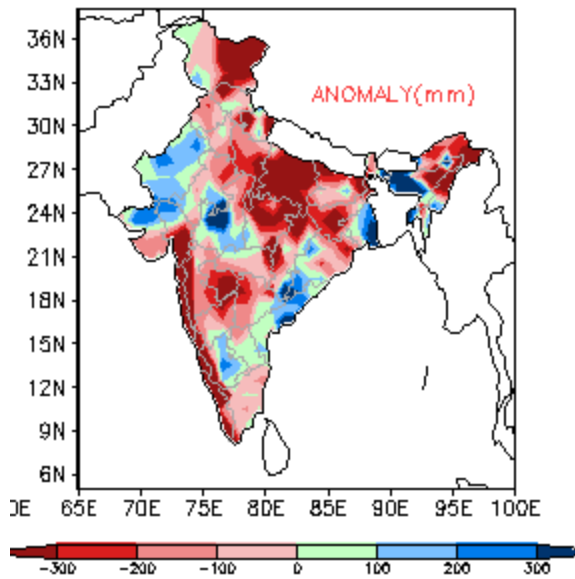


# Rainfall Prediction skill over Land points

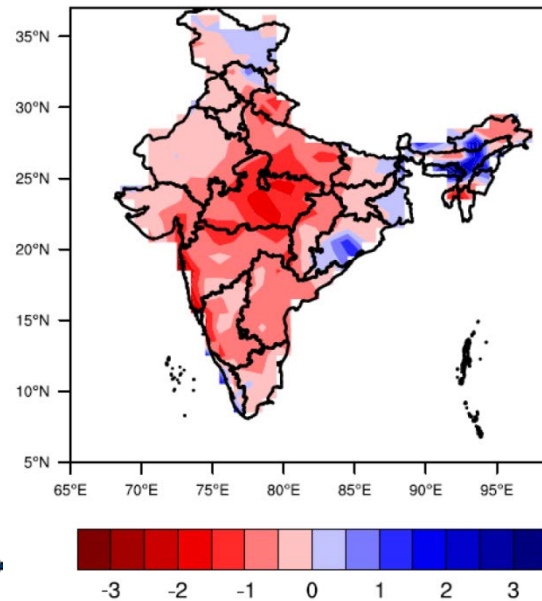


# Forecast Verification

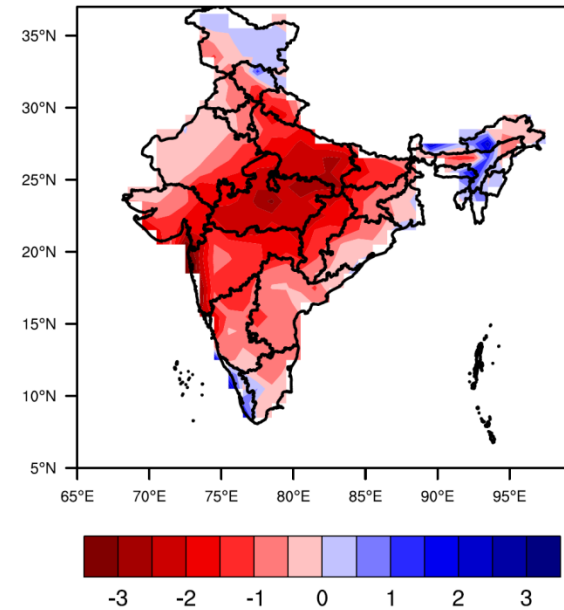
Observed, 84%



Feb. IC, 91%



Apr. IC, 84%



# Probability Forecast : All India Land Rainfall

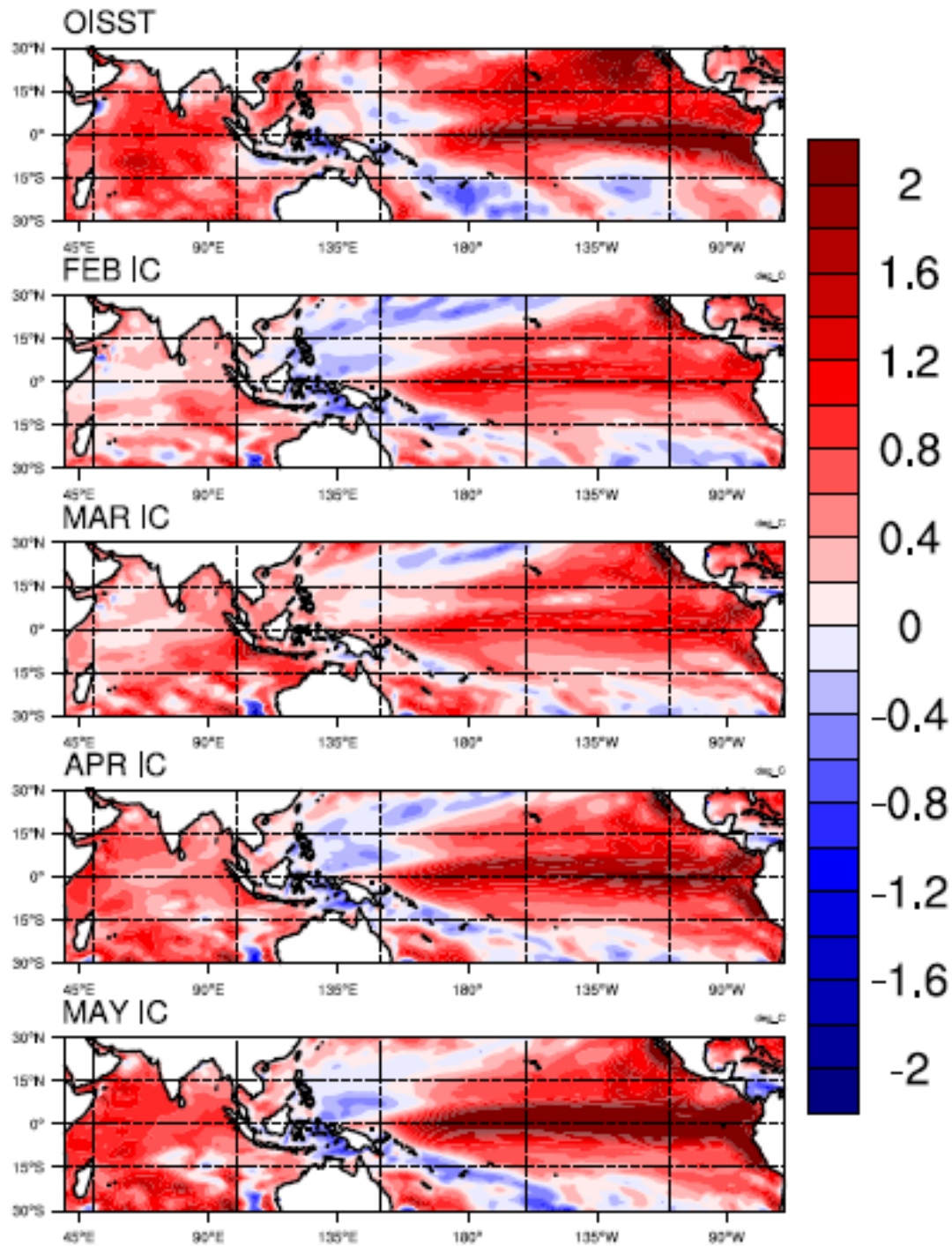
JAN IC	JJA	JAS	JJAS
>15	42	48	44
5:15	32	22	28
-5:5	18	10	18
-5:-15	8	15	8
<-15		20	2

FEB IC	JJA	JAS	JJAS
>15	5		
5:15	25	5	15
-5:5	25	15	35
-5:-15	30	35	25
<-15	15	45	25

APR IC	JJA	JAS	JJAS
>15			
5:15	2	2	2
-5:5	23	14	14
-5:-15	36	41	45
<-15	39	43	39

The bins are percentage departures of forecasted precipitation from hindcast climatology

# Forecast Verification



JJAS 2015

# Probability Forecast : Nino3.4

## JAN IC

	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO
>2.5							2
1.5:2.5					2	10	17
0.5:1.5	40	26	29	36	33	33	40
-0.5:0.5	60	74	71	62	62	52	36
-0.5:-1.5				2	2	5	5
-1.5:-2.5							
<-2.5							

## FEB IC

	MAM	AMJ	MJJ	JJA	JAS	ASO	SON
>2.5						5	10
1.5:2.5				10	15	50	50
0.5:1.5	90	75	80	75	80	40	35
-0.5:0.5	10	25	20	15	5	5	5
-0.5:-1.5							
-1.5:-2.5							
<-2.5							

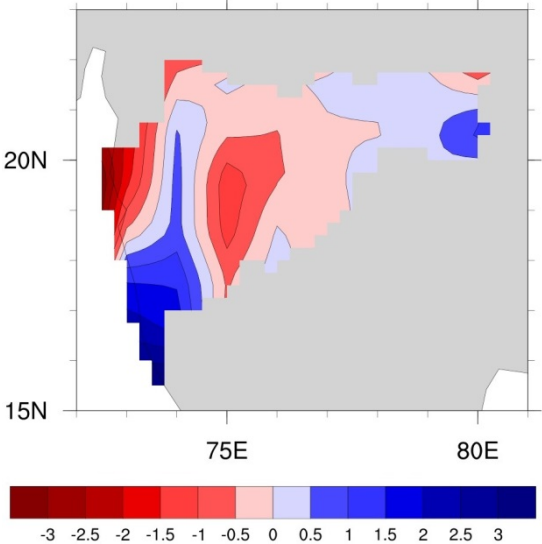
## APR IC

	MJJ	JJA	JAS	ASO	SON	OND
>2.5				11	43	61
1.5:2.5	7	54	73	80	55	39
0.5:1.5	93	46	27	9	2	
-0.5:0.5						
-0.5:-1.5						
-1.5:-2.5						
<-2.5						

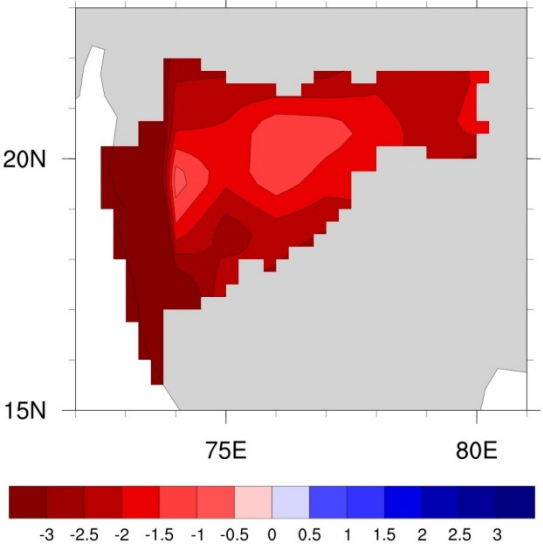
The bins are SST anomalies in °C

# Forecasted Rainfall Anomalies over Maharashtra

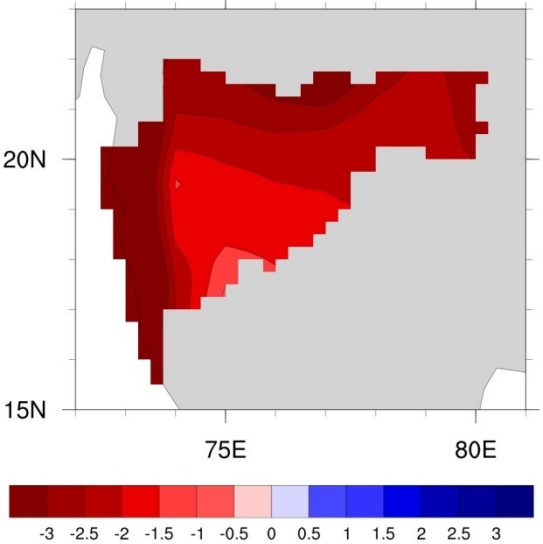
July Precipitation Rate Anomaly



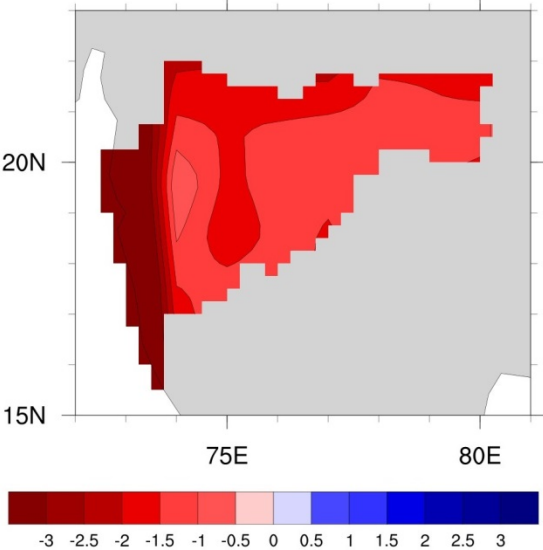
Aug Precipitation Rate Anomaly



Sep Precipitation Rate Anomaly



JAS Precipitation Rate Anomaly



***Why Other Leading Centers  
Could Not Capture this signal  
at long leads in spite of  
Strong El Nino was  
predicted?***

# ECMWF Seasonal Forecast

## Mean precipitation anomaly

Forecast start reference is 01/02/15

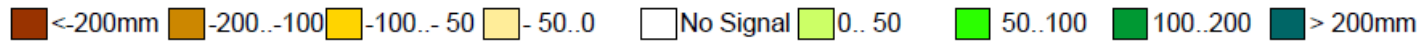
Ensemble size = 51, climate size = 450

System 4

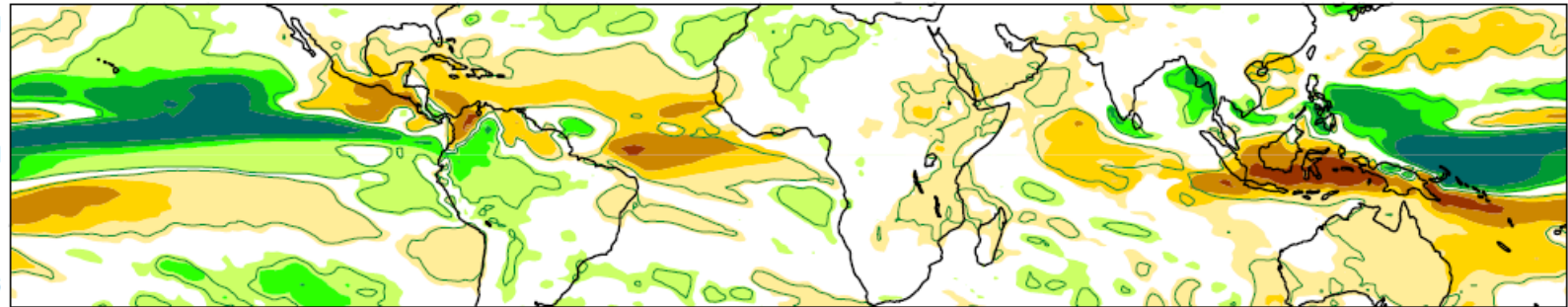
JJA 2015

Shaded areas significant at 10% level

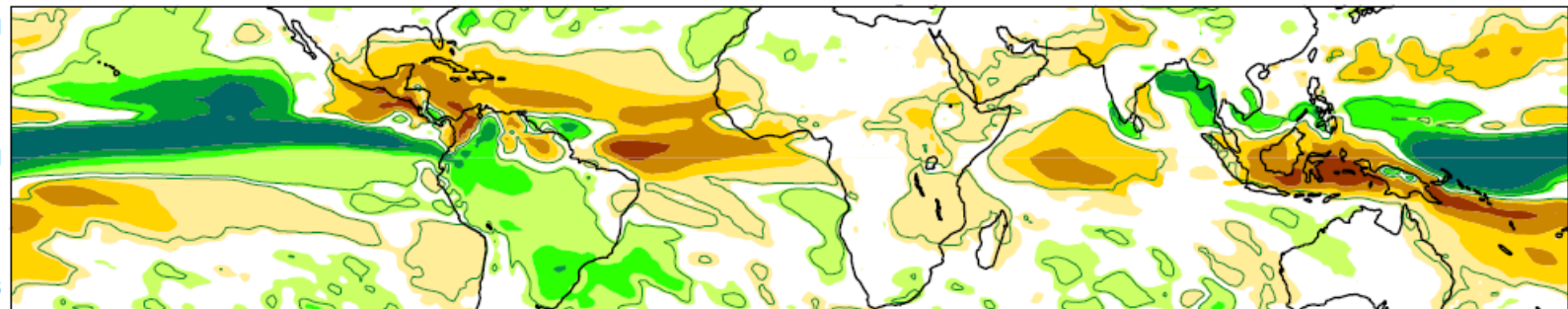
Solid contour at 1% level



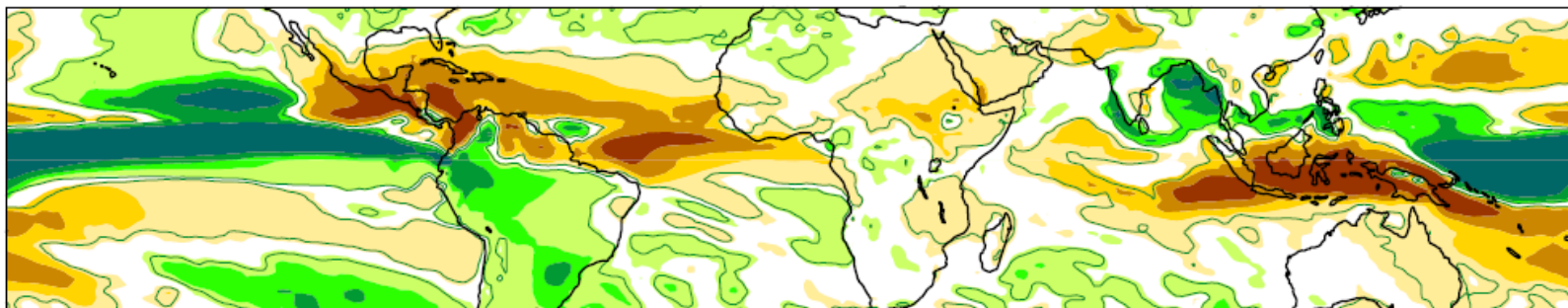
150°W 120°W 90°W 60°W 30°W 0°E 30°E 60°E 90°E 120°E 150°E



Feb. JJA



Apr. JJA



May JJA



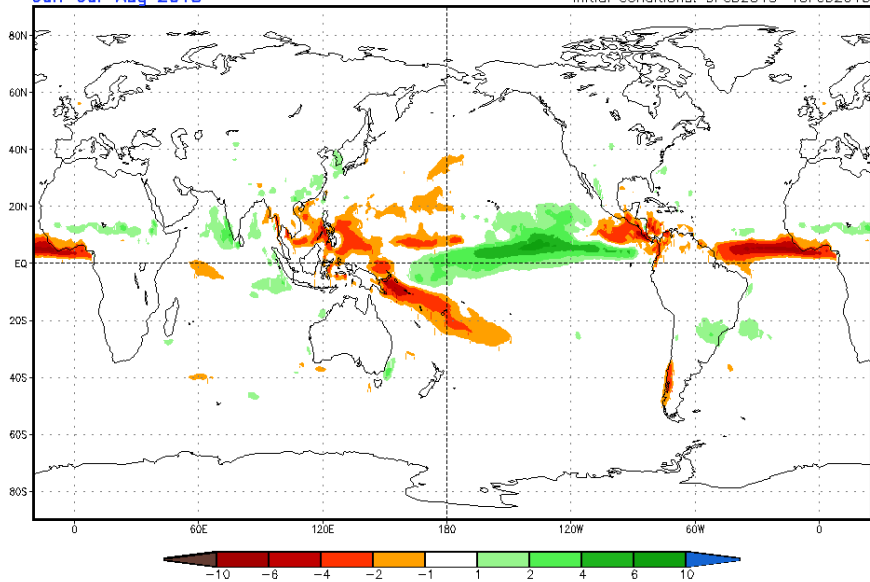


CFSv2 seasonal Prec anomalies (mm/day)

NWS/NCEP/CPC

Jun-Jul-Aug 2015

Initial conditions: 9Feb2015-18Feb2015

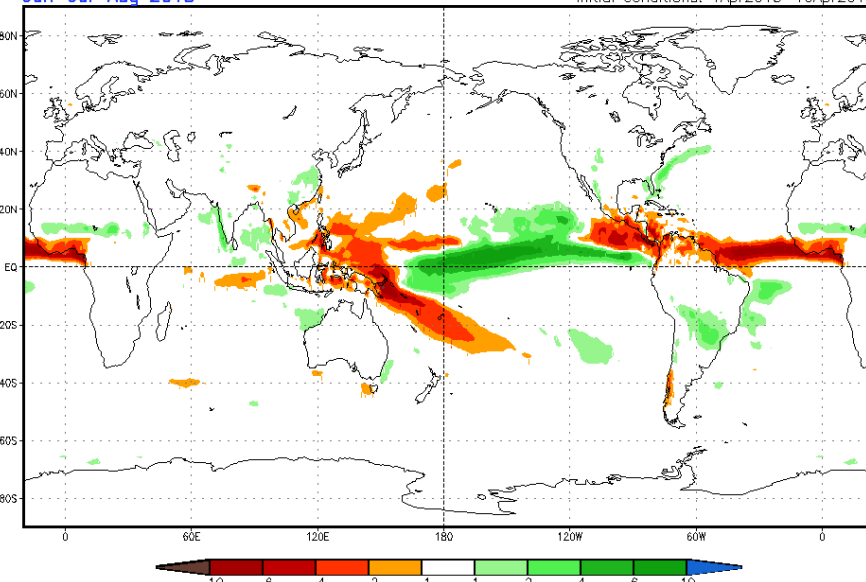


CFSv2 seasonal Prec anomalies (mm/day)

NWS/NCEP/CPC

Jun-Jul-Aug 2015

Initial conditions: 1Apr2015-10Apr2015



# NCEP Forecasts

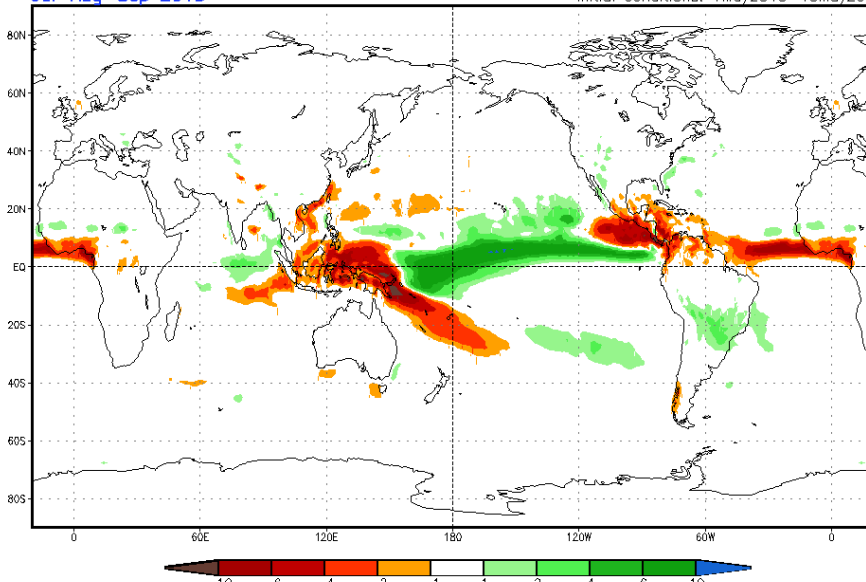


CFSv2 seasonal Prec anomalies (mm/day)

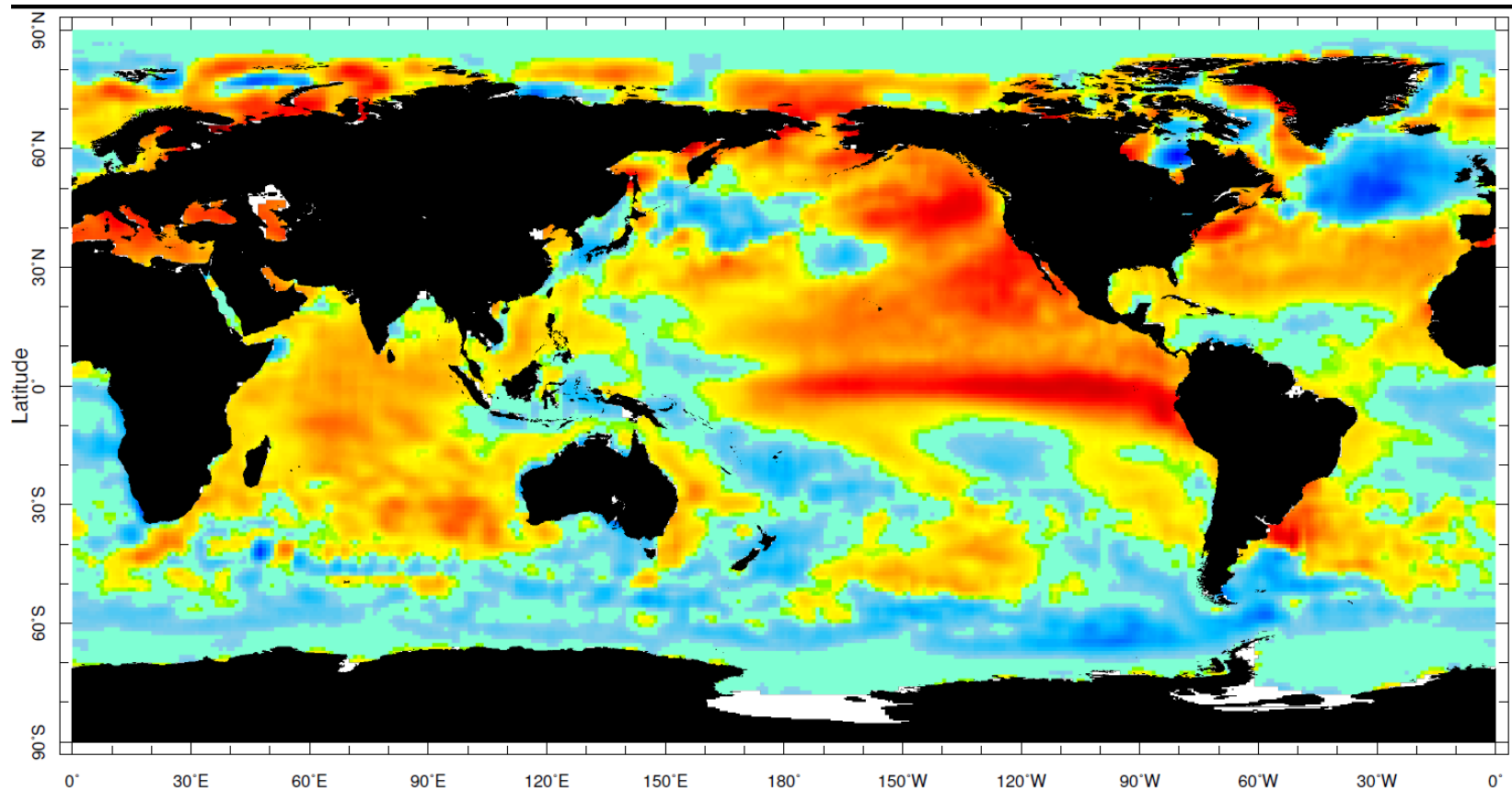
NWS/NCEP/CPC

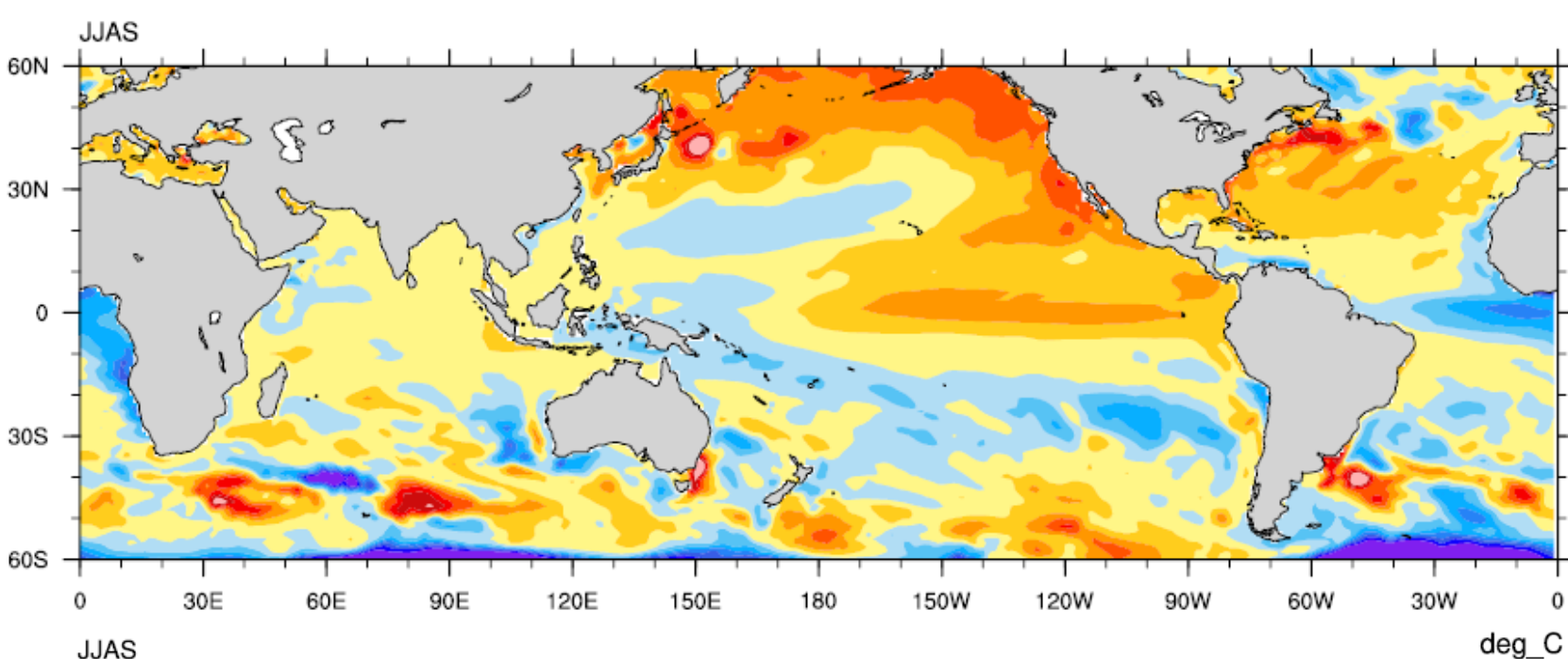
Jul-Aug-Sep 2015

Initial conditions: 1May2015-10May2015



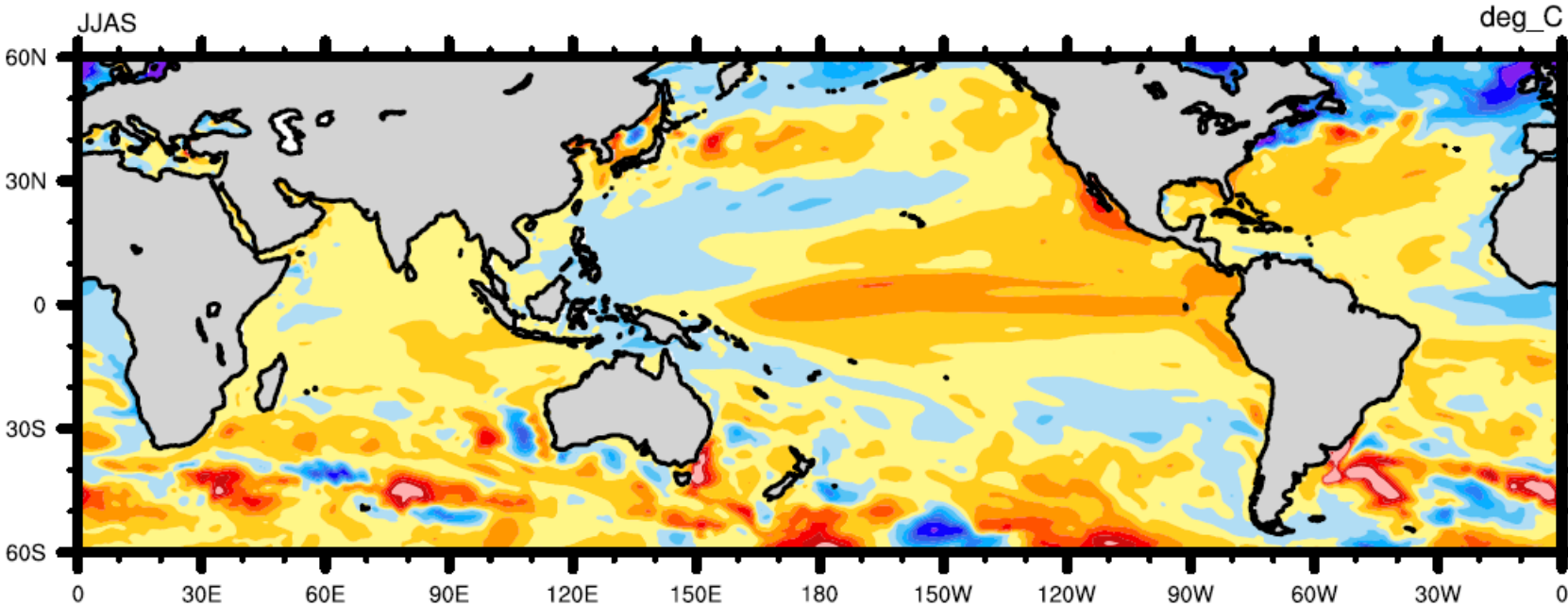
# *Observed SST Anomalies ERSST*



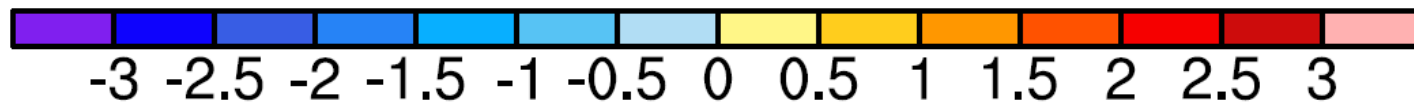


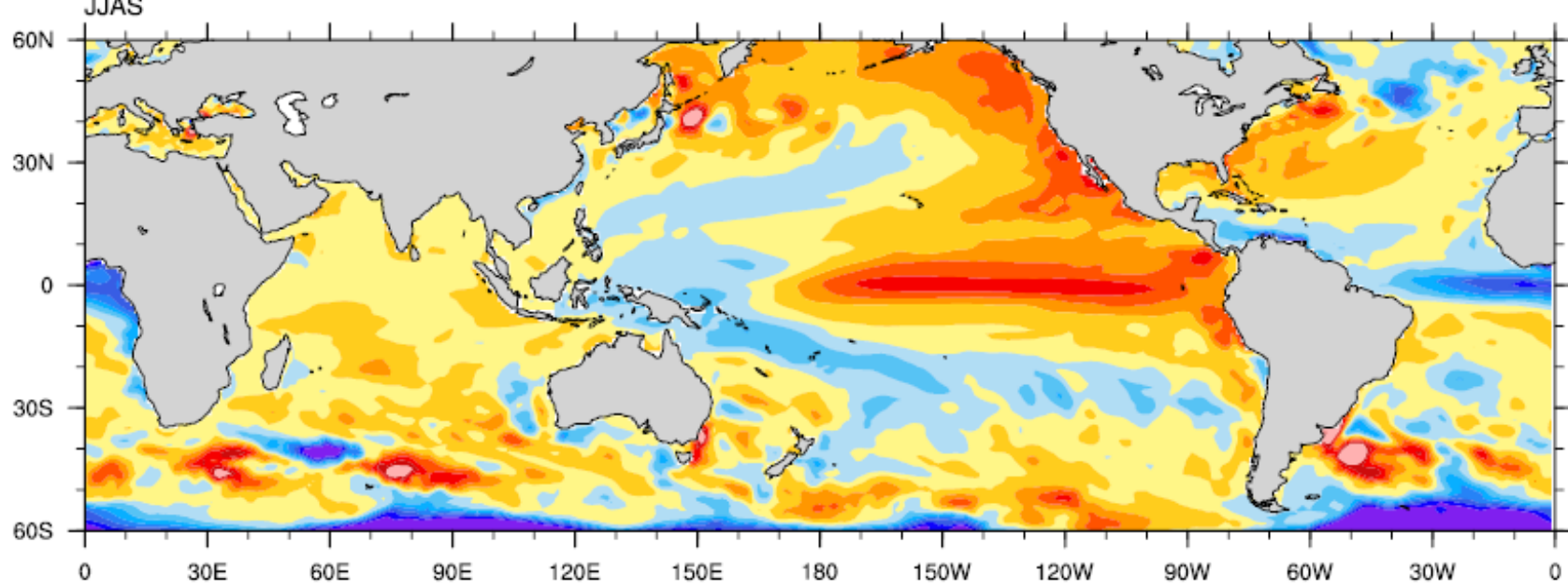
**NCEP-CFS-  
FEB-IC**

**SST  
ANOMALY**



**IITM-CFS-  
FEB-IC**

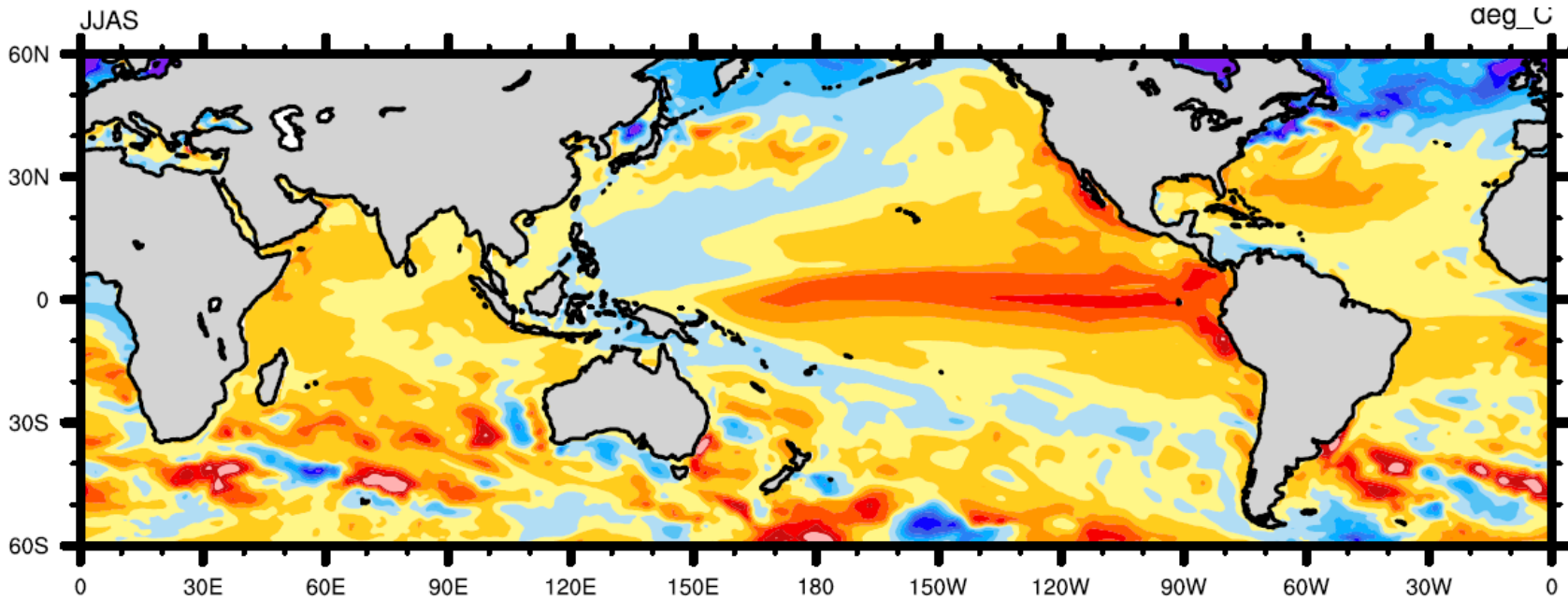




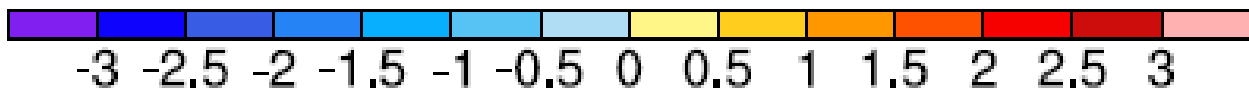
NCEP-CFS-APR-IC

SST

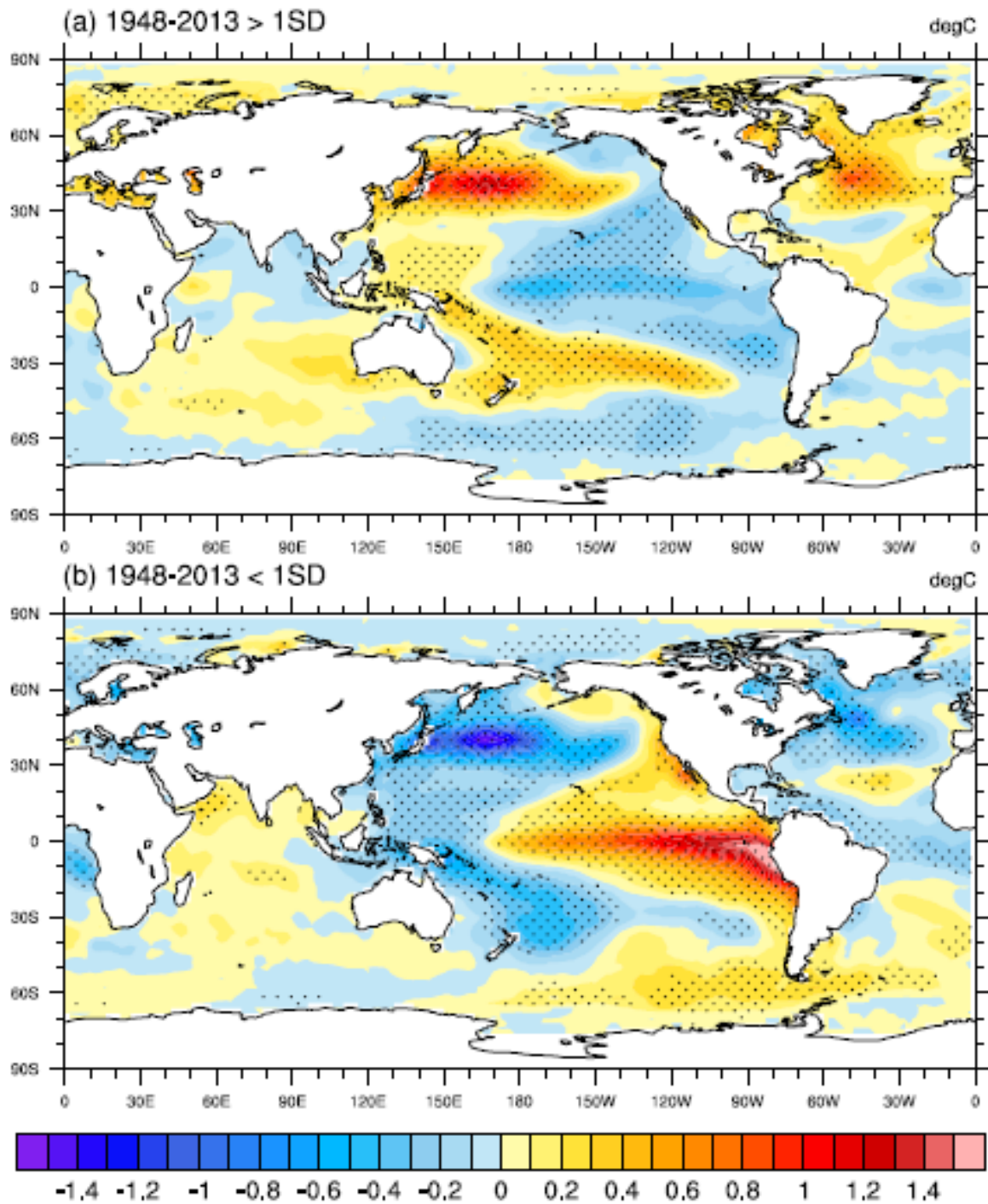
ANOMALY



IITM-CFS-APR-IC



# Extra Tropical Influence



# NE Monsoon Prediction Started in 2015

## Seasonal Mean Precipitation Anomaly

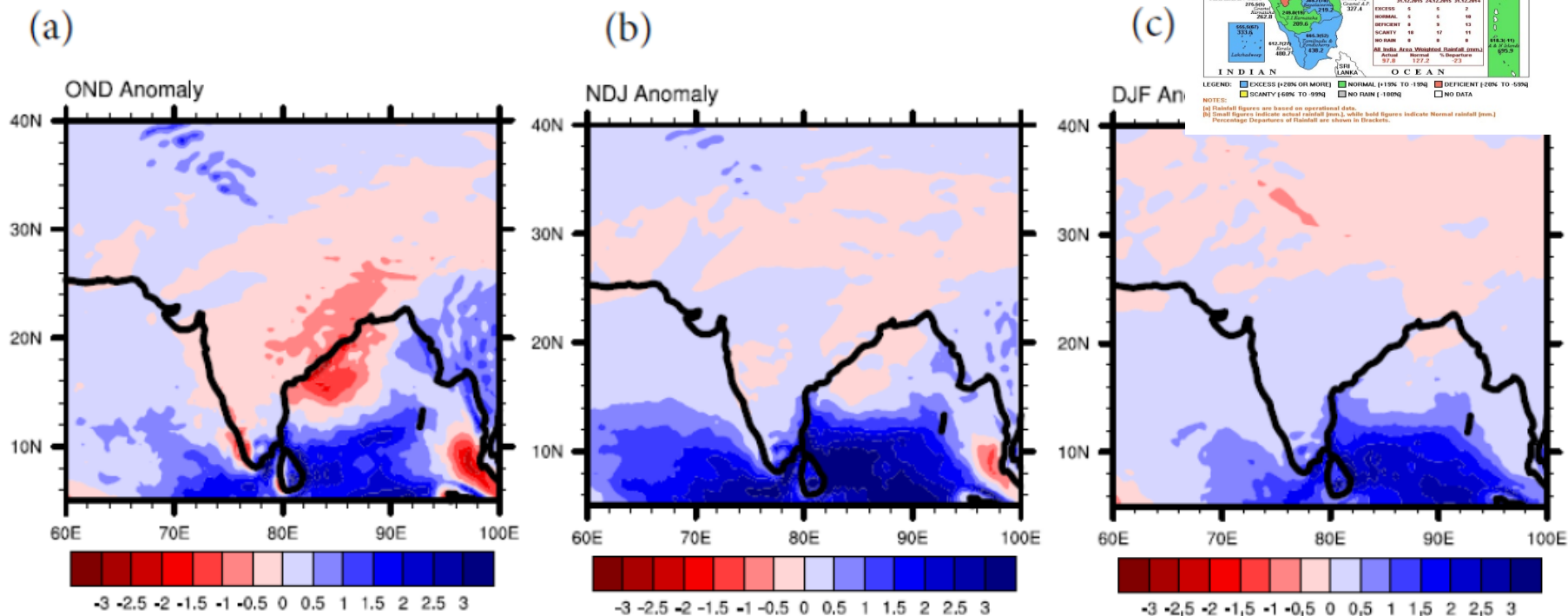


Figure : Forecasted precipitation rate anomalies over Indian region for (a) October through December (OND), (b) November through January (NDJ) and (c) December through February (DJF).

*Thank you . . . . .*