NMME ISI Prediction Experiment

Ben Kirtman and the NMME Team

University of Miami - RSMAS

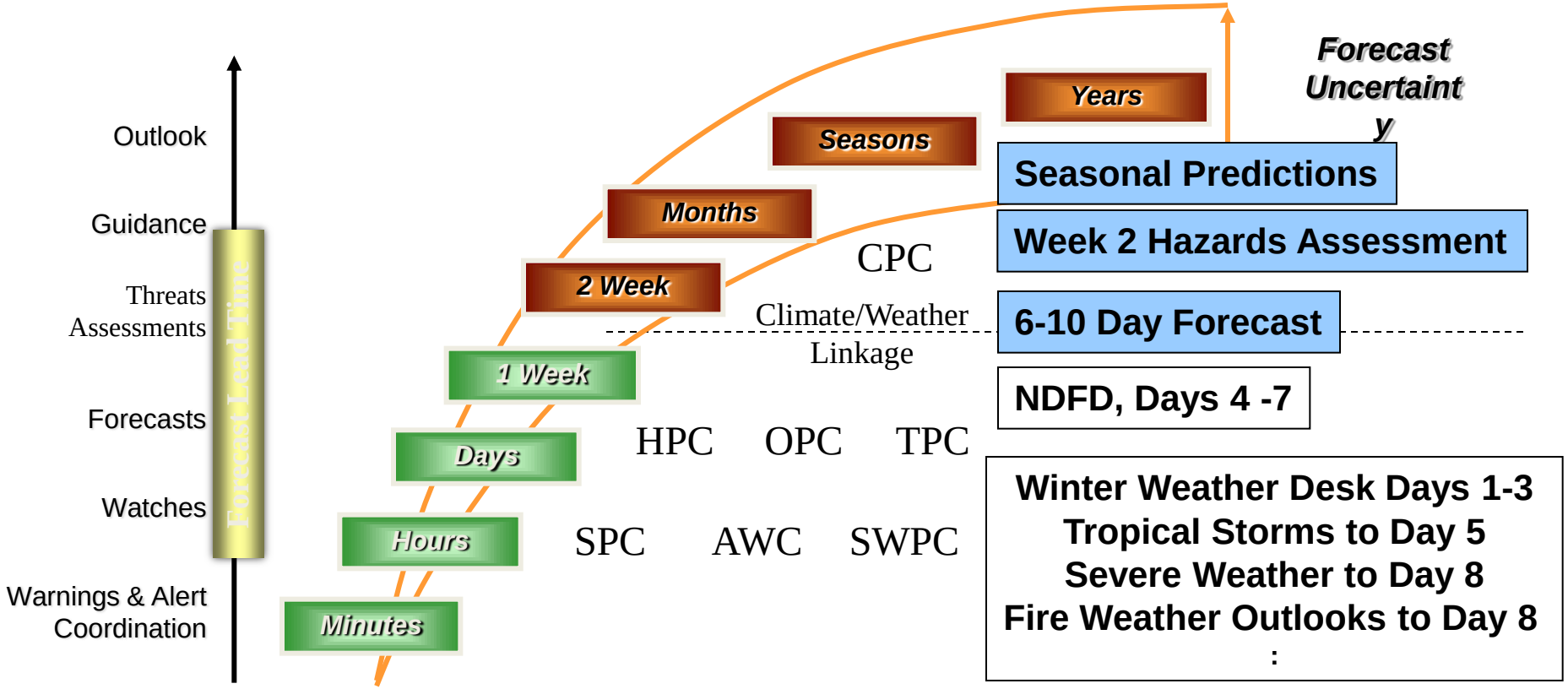
UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

CCS | CENTER FOR COMPUTATIONAL SCIENCE
UNIVERSITY OF MIAMI

NMME

- **Description of NMME System**
  - **Overall Skill Assessment**
    - **Deterministic and Probabilistic Metrics**
    - **Comparisons with CFSv2**
- **Diversity of ENSO in NMME**
  - **“Agnostic” view**
  - **Event Based: SST, Precipitation**
    - **Pattern Correlation**
    - **Lead Time**

How NMME fits in the NOAA Seamless Suite of Forecast Products



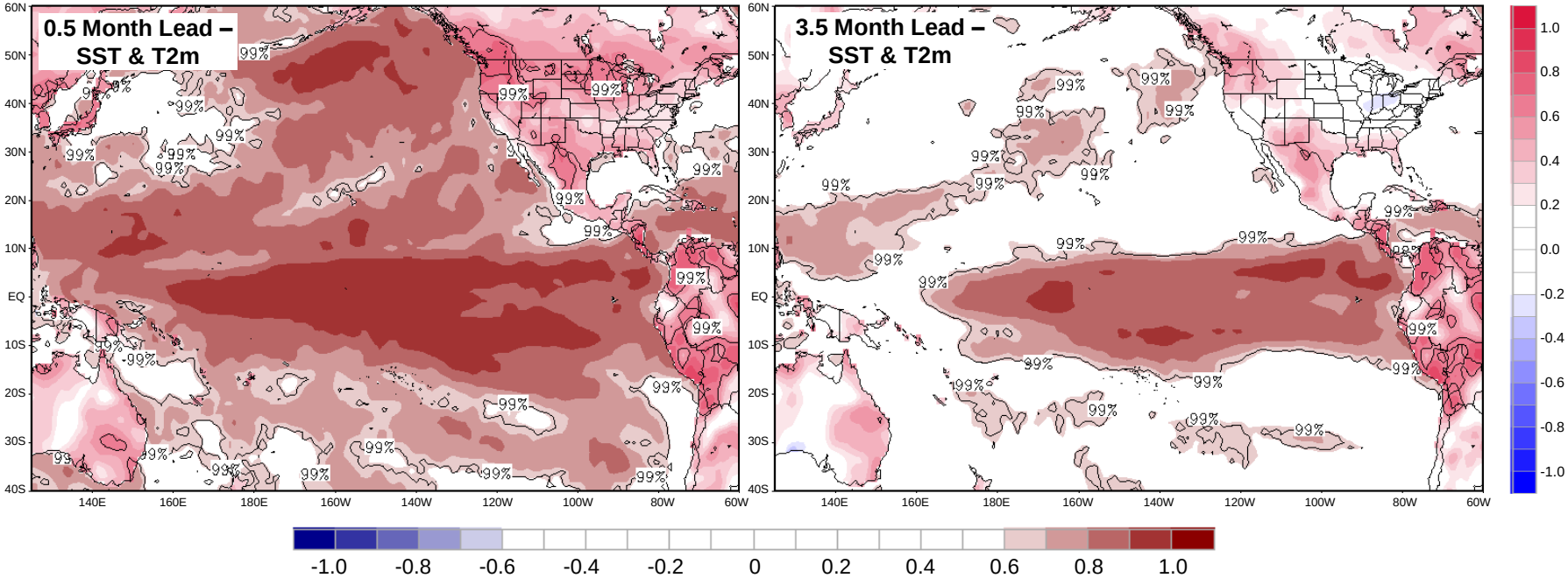
To develop week2 to seasonal-interannual forecasts, CPC uses

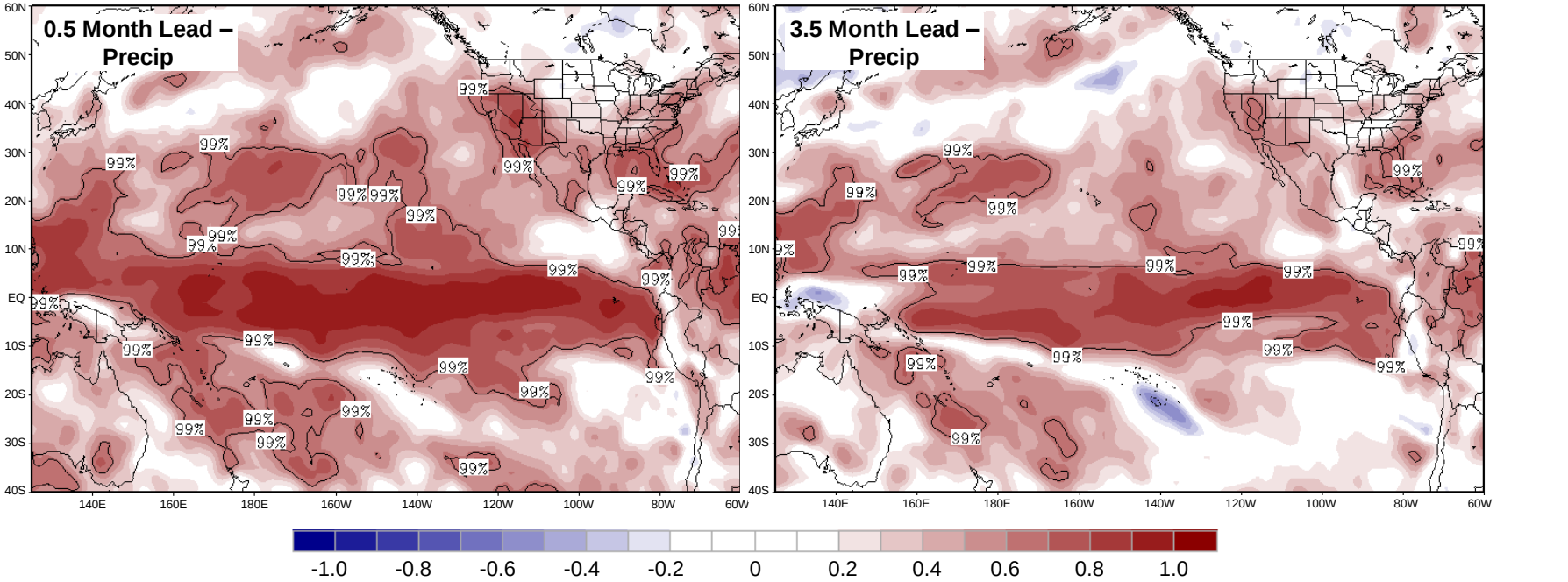
- Statistical forecast tools
- NCEP Climate Forecast System (CFSv2)
- National Multi-model ensemble (NMME) (currently experimental)

Model	Hindcast Period	Ensemble Size	Lead Times	Arrangement of Ensemble Members	Contact and reference
CFSv1	1981-2009	15	0.5-8.5 Months	1st 0Z +/-2 days, 21st0Z +/-2d, 11th 0Z+/- 2d	Saha (Saha et al. 2006)
CFSv2	1982-2010	24(28)	0.5-9.5 Months	4 members (0,6,12,18Z) every 5th day	Saha (Saha et al. 2010)
GFDL-CM2.2	1982-2010	10	0.5-11.5 Months	All 1st of the month 0Z	Rosati (Zhang et al. 2007)
IRI-ECHAM4-f[1]	1982-2010	12	0.5-7.5 Months	All 1st of the month 0Z	DeWitt (DeWitt 2005)
IRI-ECHAM4-a[2]	1982-2010	12	0.5-7.5 Months	All 1st of the Month 0Z	DeWitt (Dewitt 2005)
CCSM3.0	1982-2010	6	0.5-11.5 Months	All 1st of the Month 0Z	Kirtman (Kirtman and Min 2009)
GEOS5	1981-2010	11[2]	0.5-9.5 Months	1 Member every 5th day	Schubert (Vernieres et al. 2011)
CMC1-CanCM3	1981-2010	10	0.5-11.5	All 1st of the month 0Z	Merryfield Merryfield et al. (2013)
CMC2-CanCM4	1981-2010	10	0.5-11.5	ALL 1st of the month 0Z	Merryfield Merryfield et al. (2013)

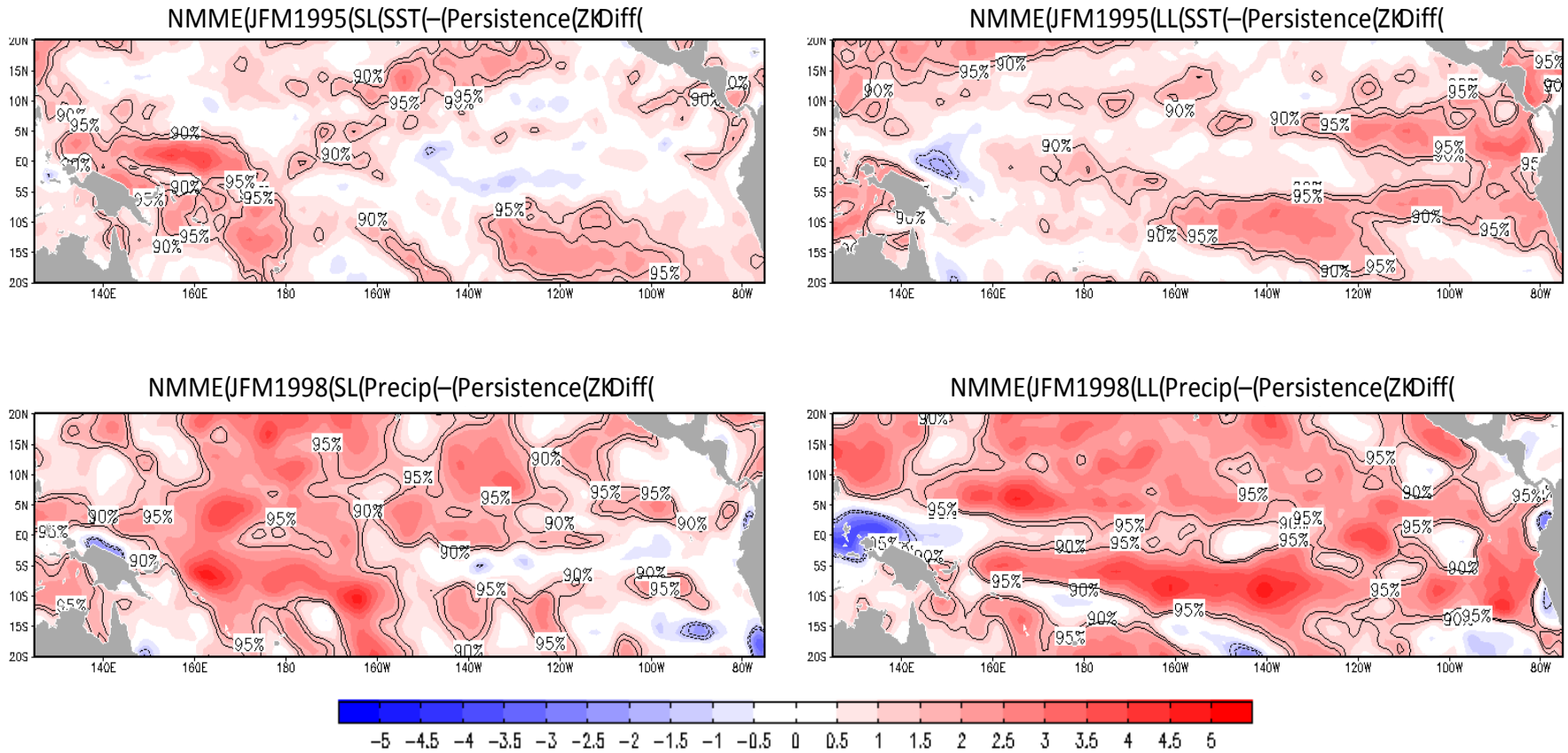
Kirtman et al. (2013, BAMS Submitted)

JFM Verification Time

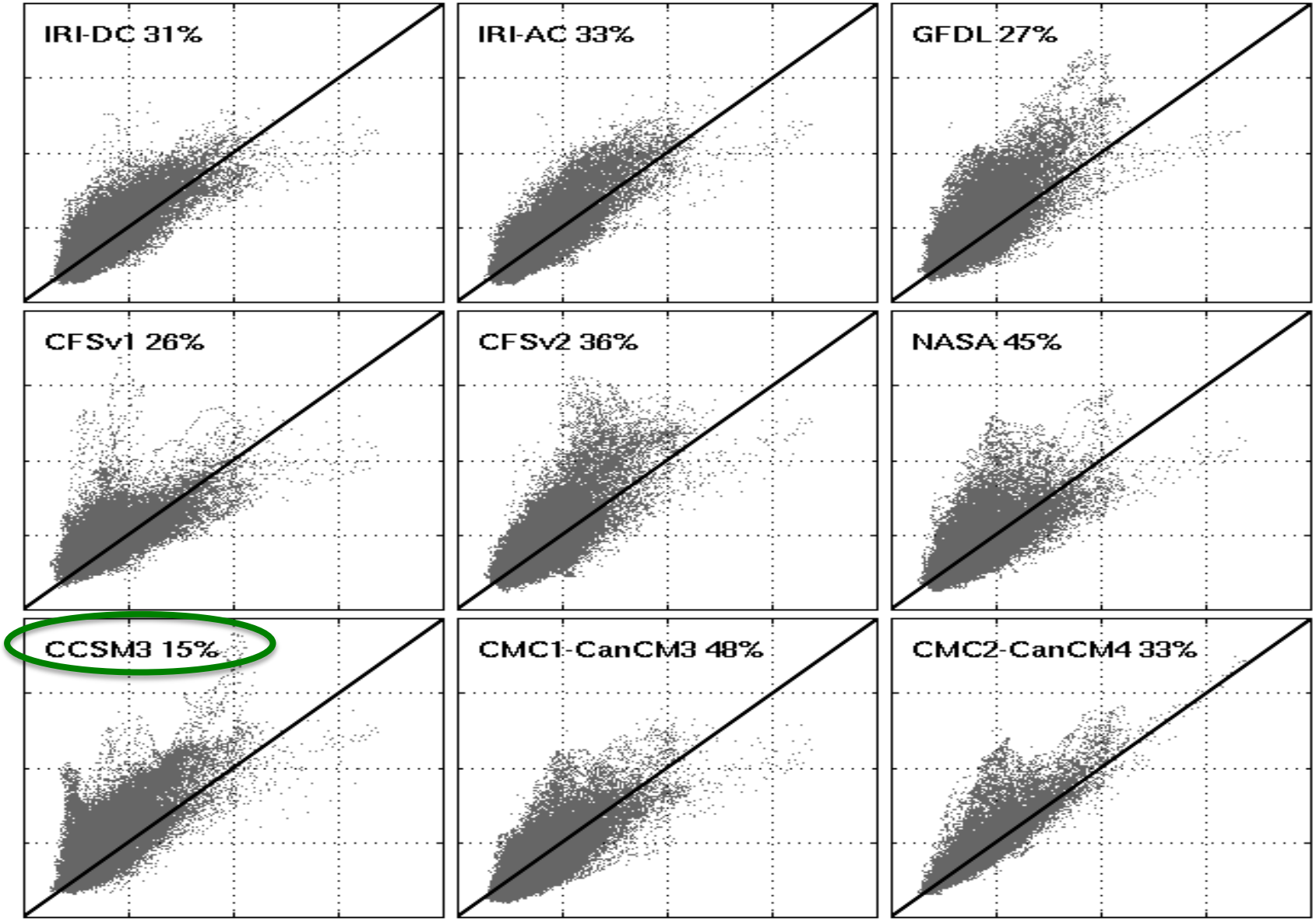




Does NMME "Beat" Persistence?



T2m RMSE: 20N-20S



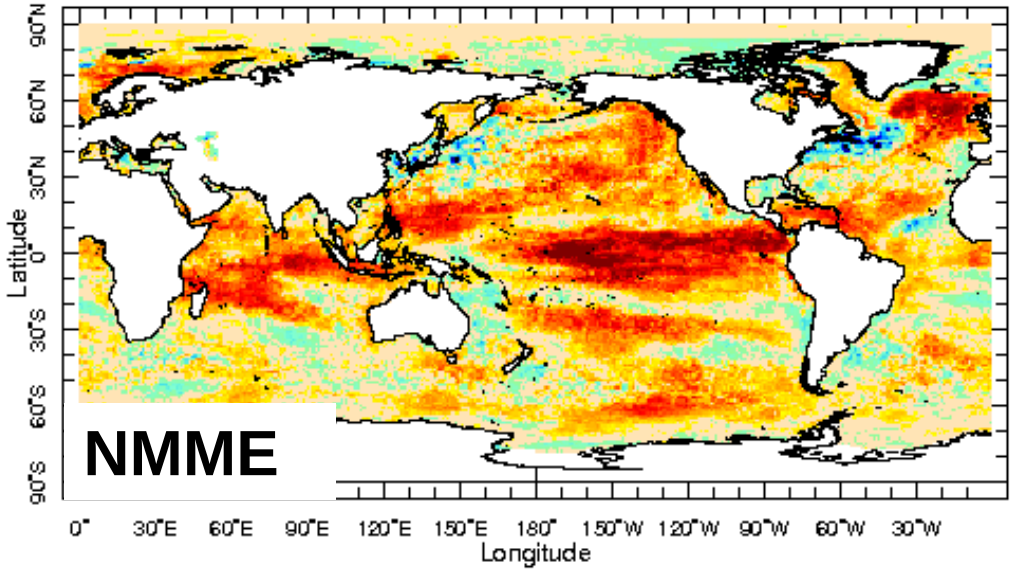
Single Model

NMME

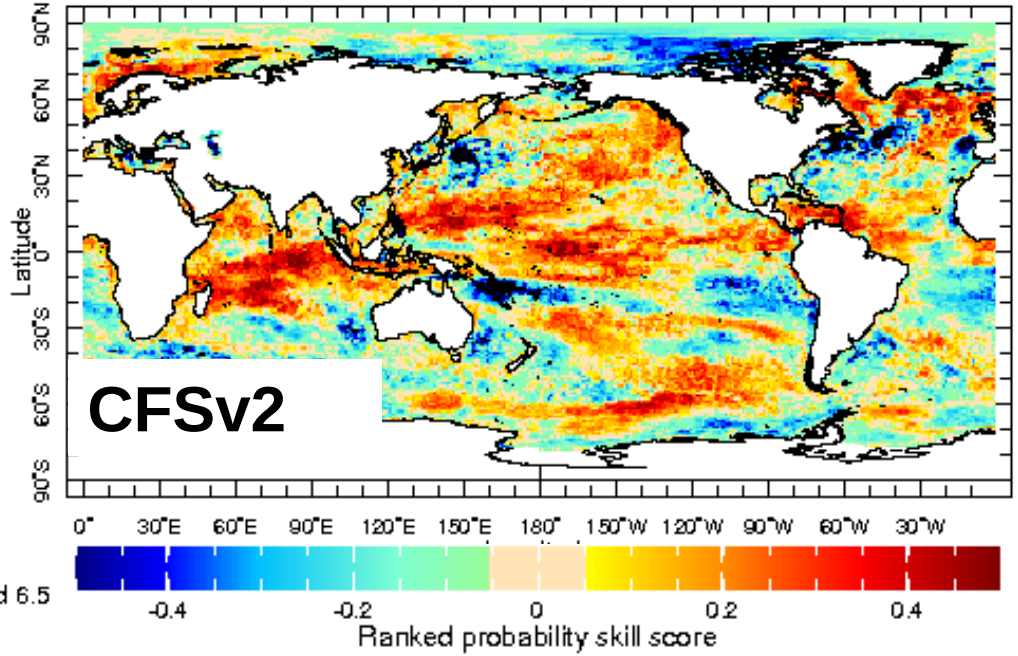
September Starts 0.5-5.5 Lead Times

Comparison of CFSv2 skill vs NMME

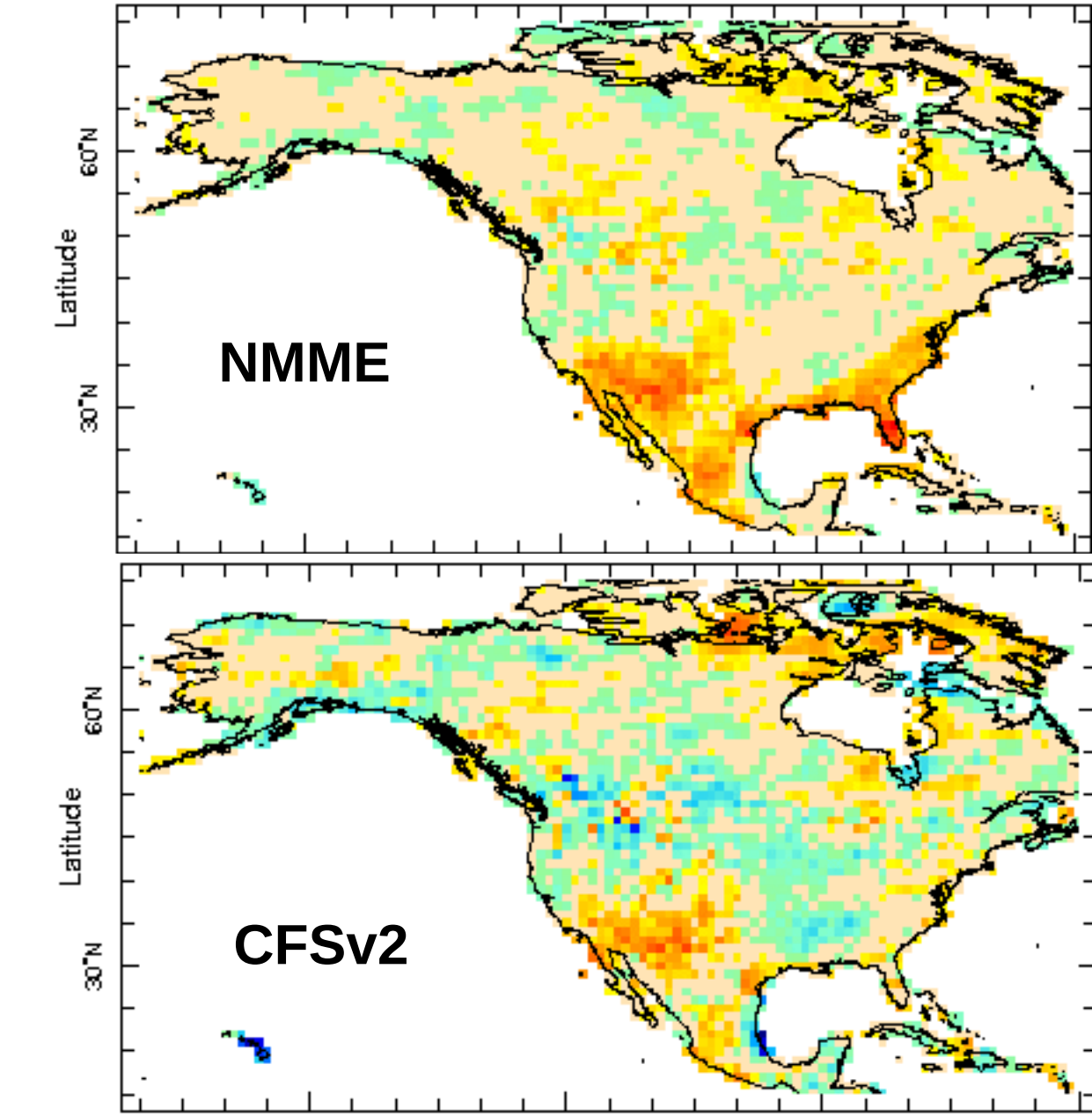
July 1 start
DJF SST forecast
Ranked Probability Skill Score



lead 6.5 months S2 Jul

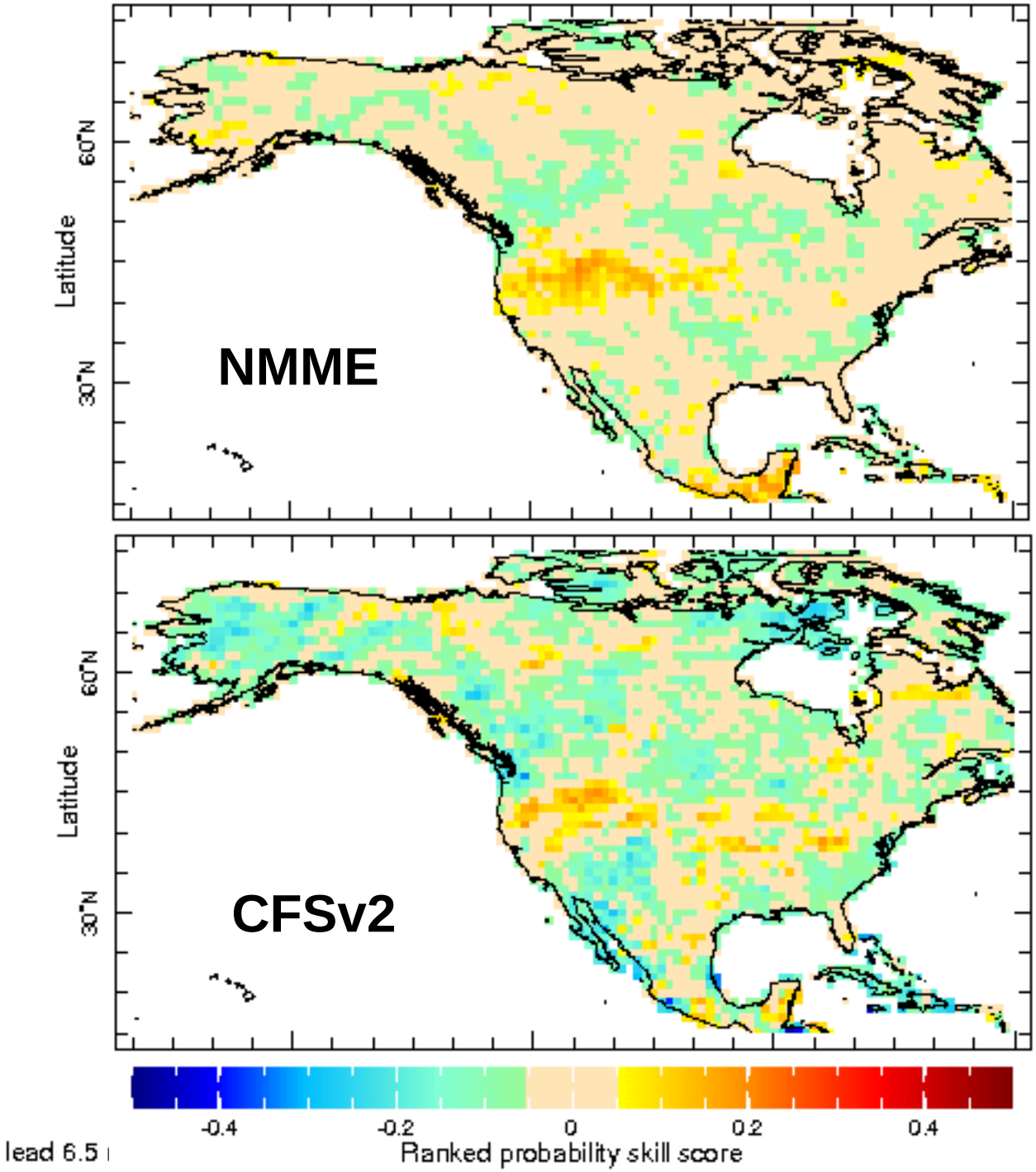


July 1 start DJF prec forecast RPSS

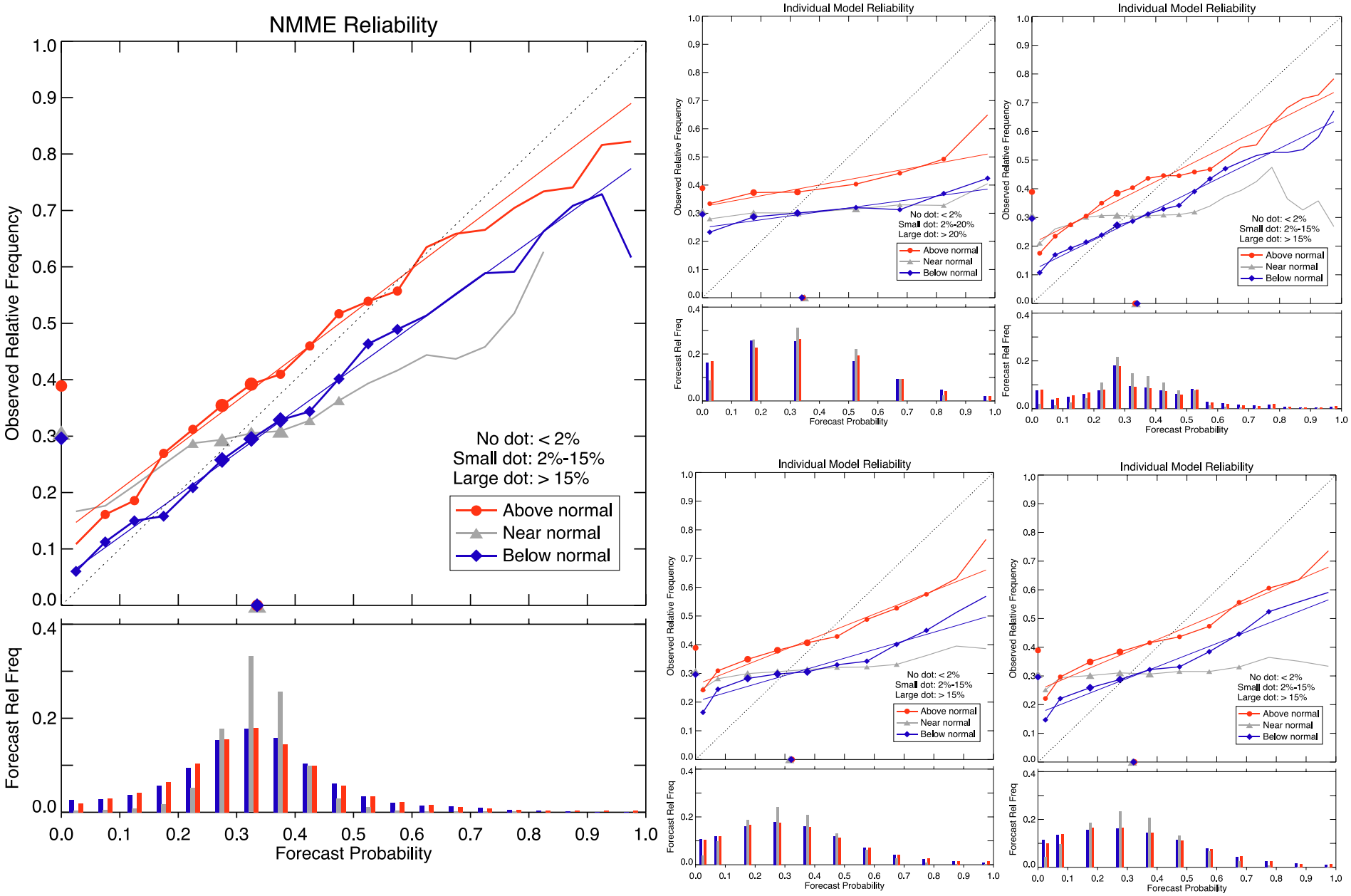


lead 6.5

Jan 1 start
JJA prec
forecast
RPSS



lead 6.5



T2m October Starts JFM Verification

home tippett NMME

home tippett NMME.

Documents

outline an outline showing all sub-datasets and variables contained in this dataset

Datasets and variables

land mask	home tippett NMME Lmask[X Y]
nino34	home tippett NMME nino34[**AC Normal Above Dominant Mean rpss Below**]
ocean mask	home tippett NMME Omask[X Y]
prec	home tippett NMME prec[**AC Normal Above Dominant Mean RPSS rpss Below rain**]
sst	home tippett NMME sst[**AC Normal Above Dominant Mean RPSS rpss Below**]
tref	home tippett NMME tref[**AC Normal Above Dominant Mean rpss RPSS Below**]

Independent Variables (Grids)

lead	grid: /L (months) ordered (1.5 months) to (10.5 months) by 1.0 N= 10 pts :grid
start	grid: /S (months since 1960-01-01) ordered (0000 1 Jan 1982) to (0000 1 Dec 2010) by 1.0 N= 348 pts :grid
Longitude	grid: /X (degree_east) periodic (0.0) to (1W) by 1.0 N= 360 pts :grid
Latitude	grid: /Y (degree_north) ordered (90S) to (90N) by 1.0 N= 181 pts :grid

Welcome to the National Multi-Model Ensemble home!

Data and Current Forecasts

- 3-month mean spatial anomalies
- 1-month mean spatial anomalies
- Niño3.4 Plumes
- International MME
- Experimental: Probability forecasts

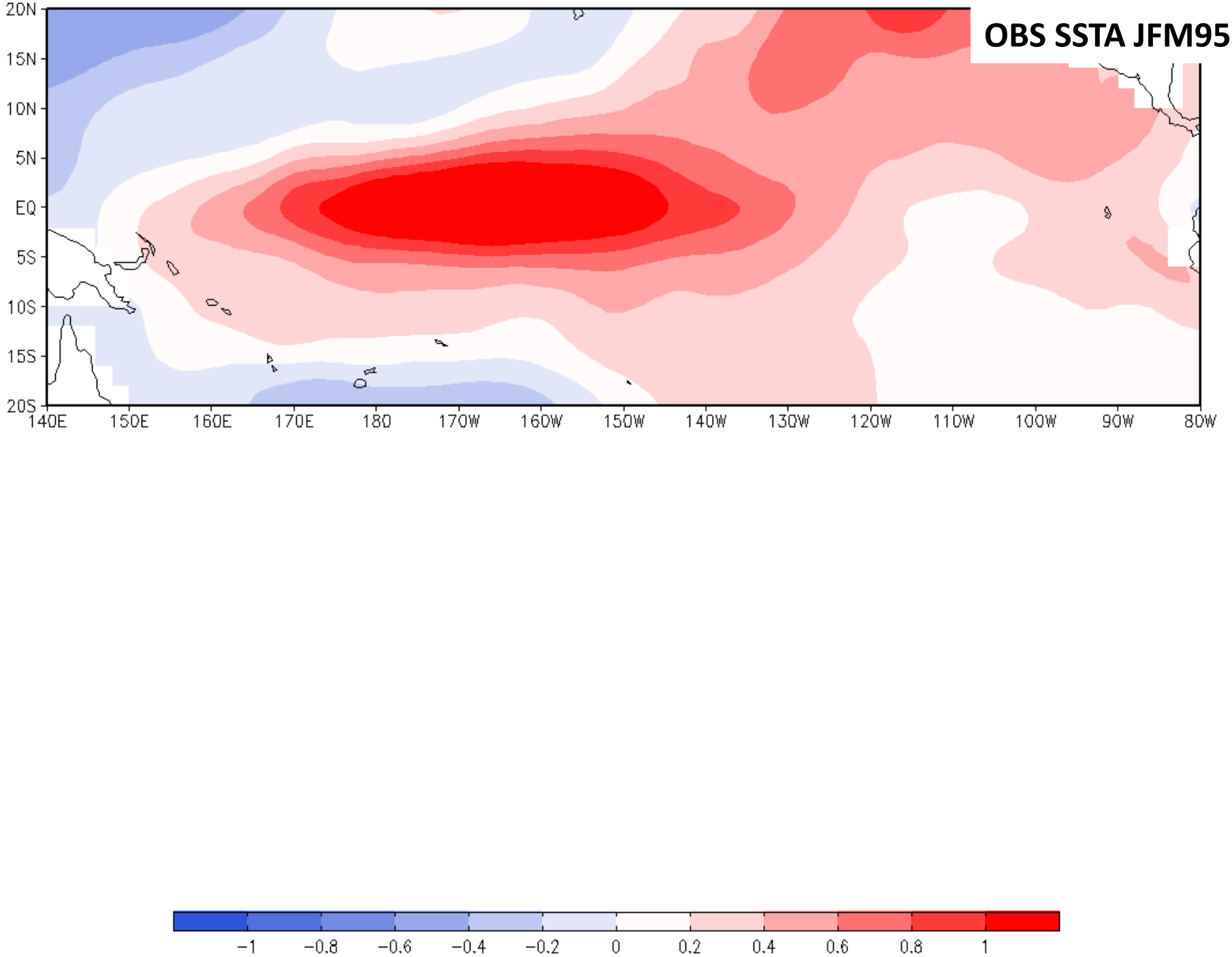
NMME Realtime Forecasts **Archive**
NMME Phase-I Hindcast Data

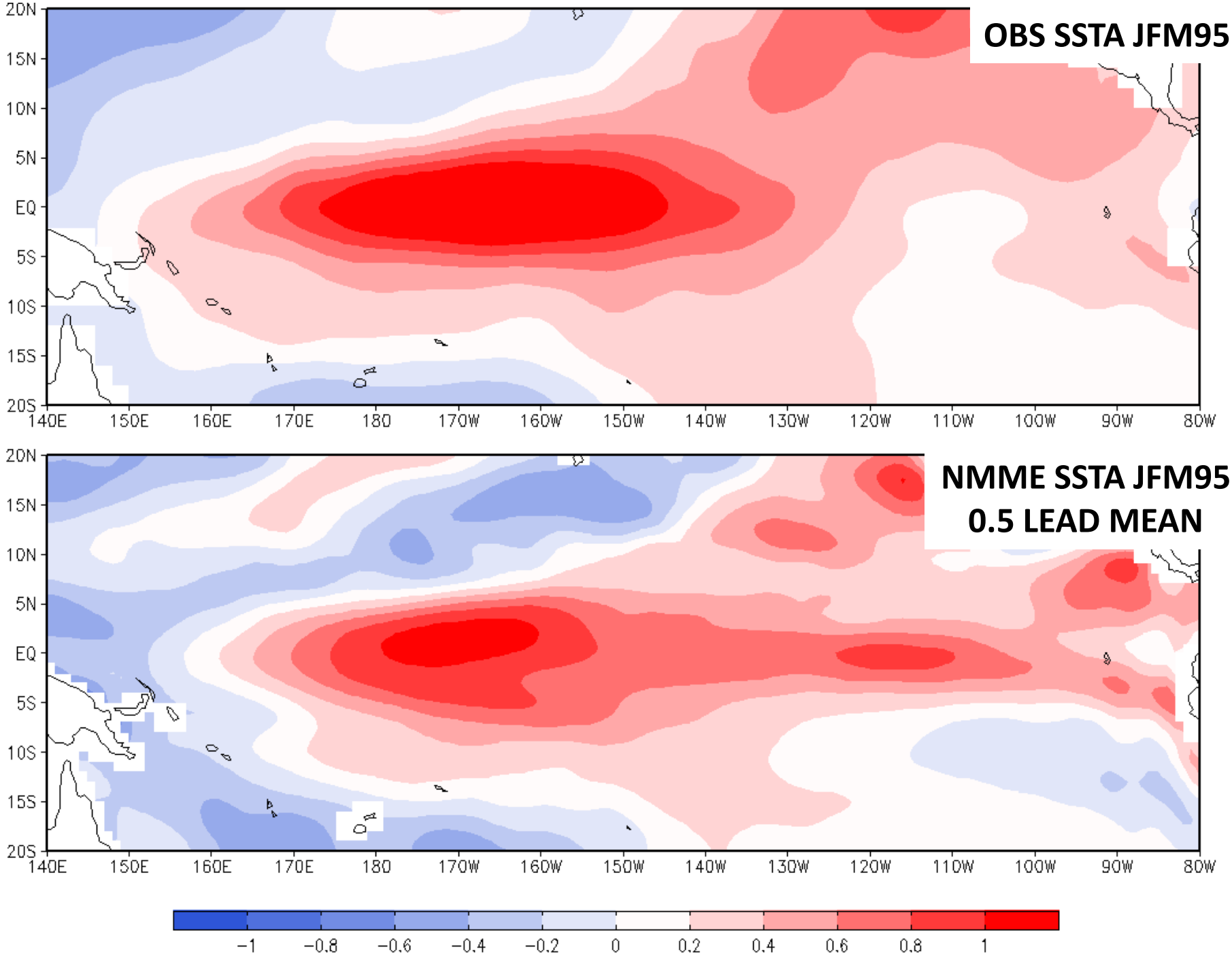
About the NMME

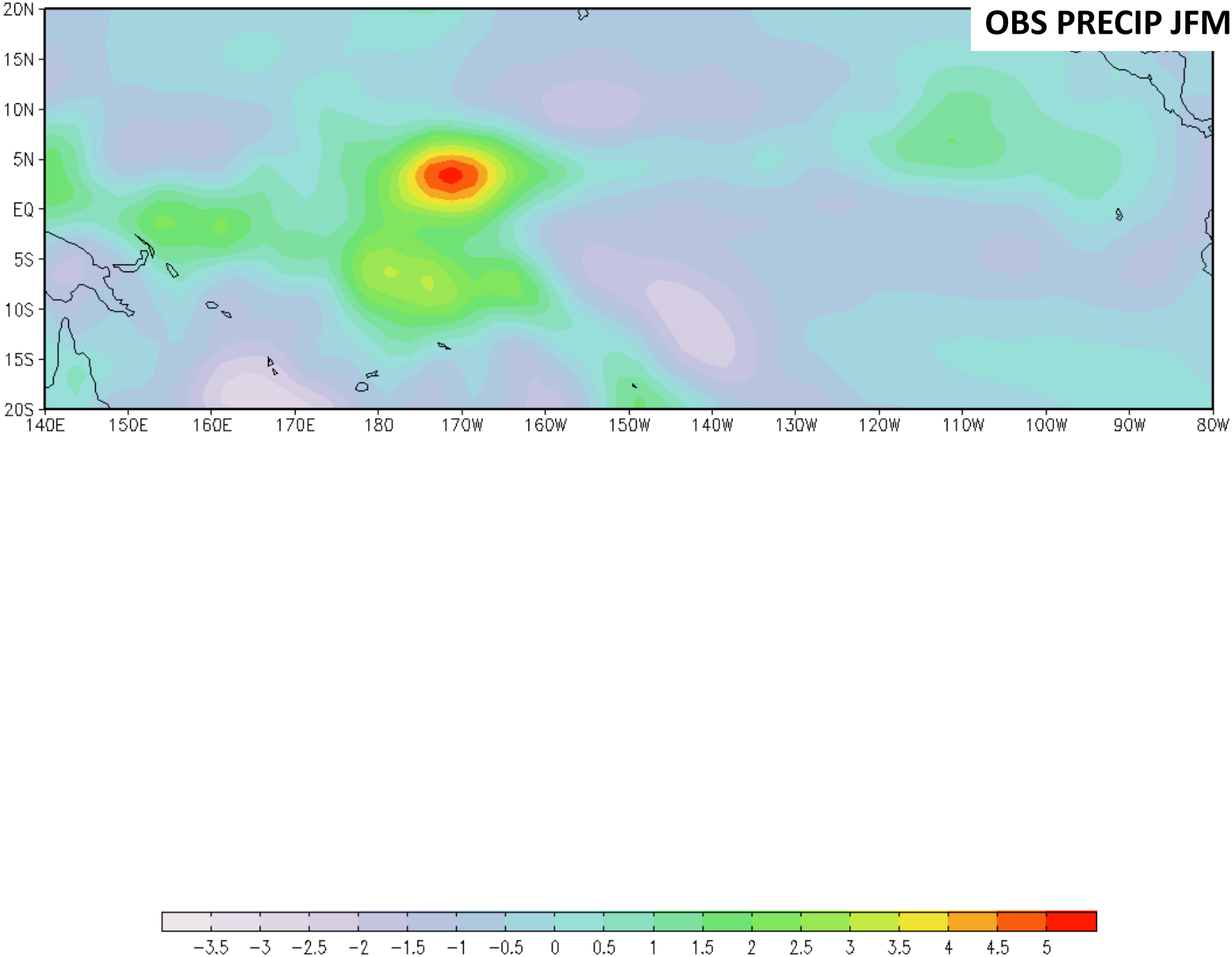
- Description of the NMME
- Phase-I Forecast Models
- CTB Activities & Documents
- **Join the NMME mailing list**

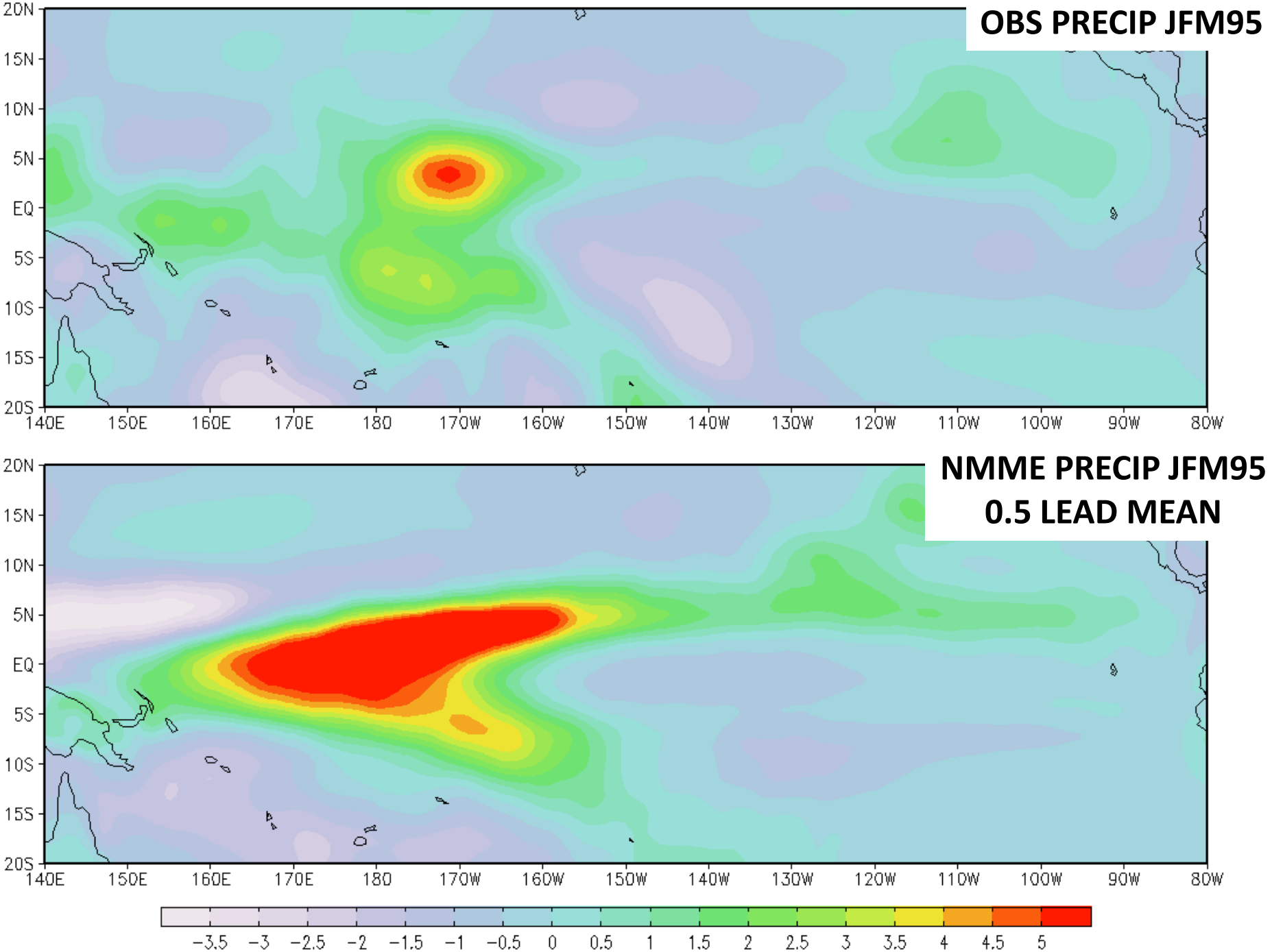
NMME

- **Description of NMME System**
  - **Overall Skill Assessment**
    - **Deterministic and Probabilistic Metrics**
    - **Comparisons with CFSv2**
- **Diversity of ENSO in NMME**
  - **“Agnostic” view**
  - **Event Based: SST, Precipitation**
    - **Pattern Correlation**
    - **Lead Time**

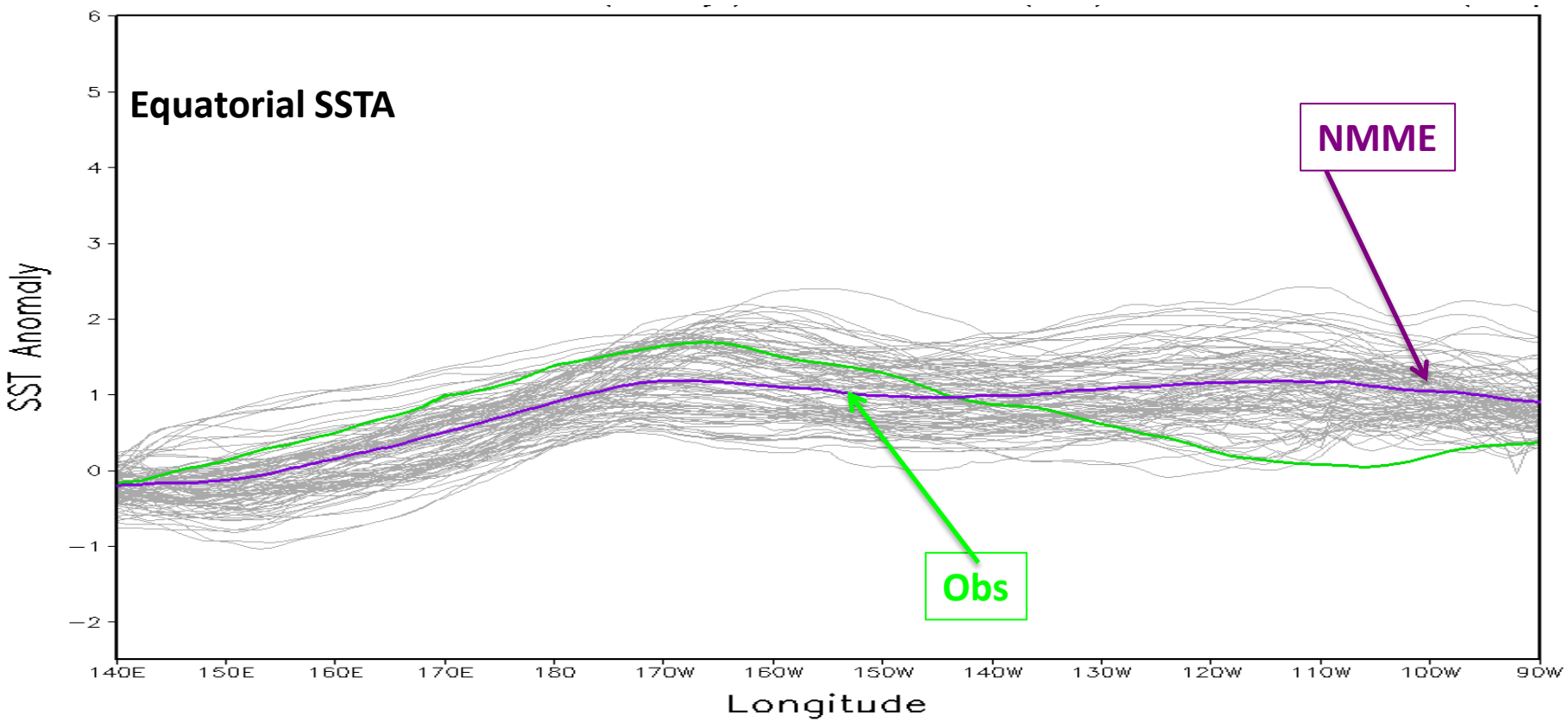

OBS SSTA JFM95
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

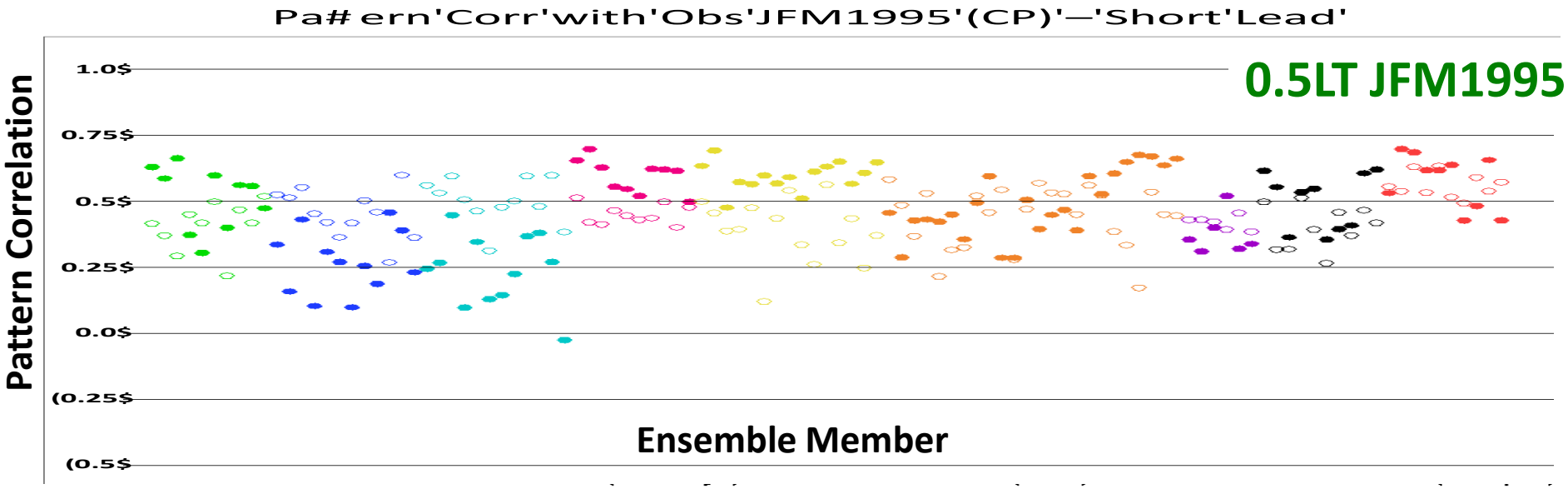

OBS SSTA JFM95
NMME SSTA JFM95
0.5 LEAD MEAN
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

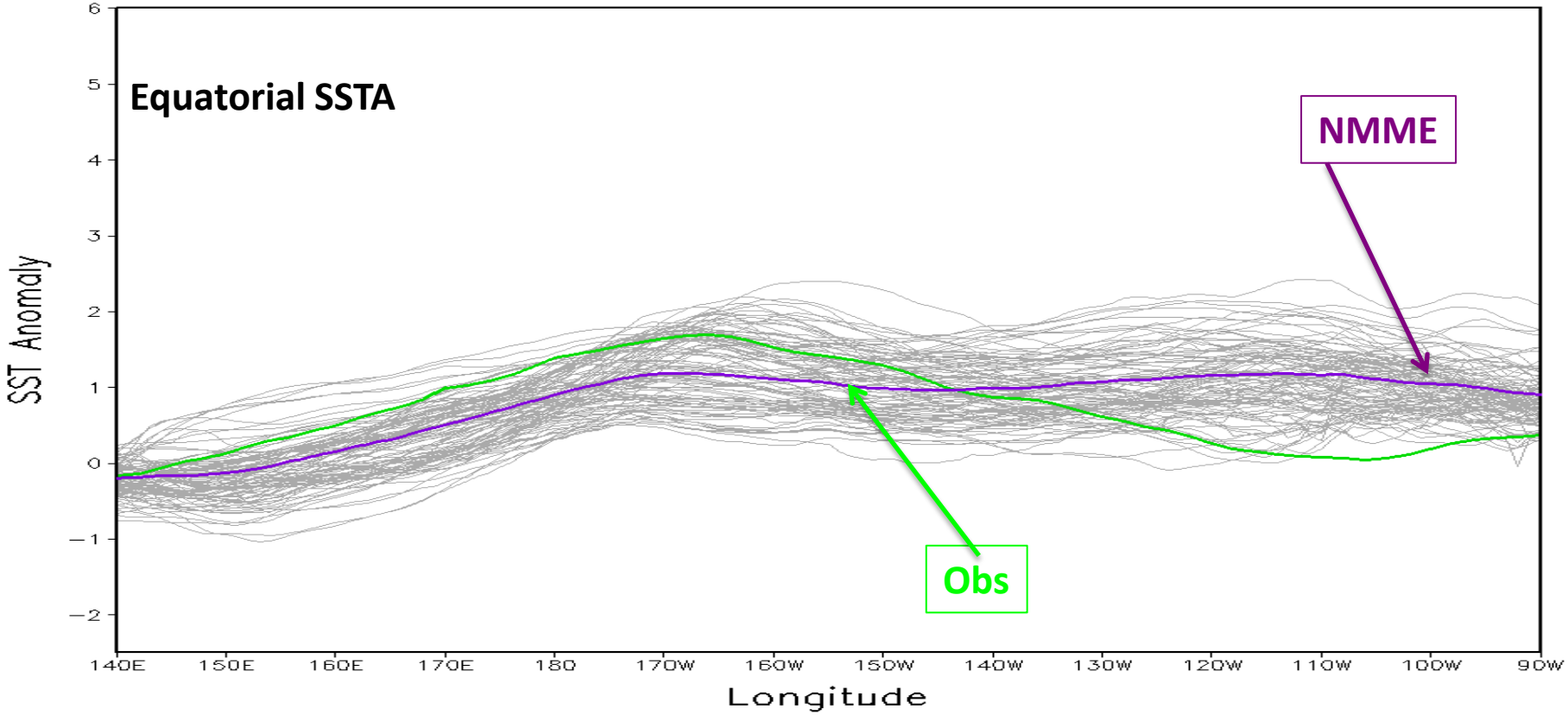

OBS PRECIP JFM95
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−3.5
−3
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

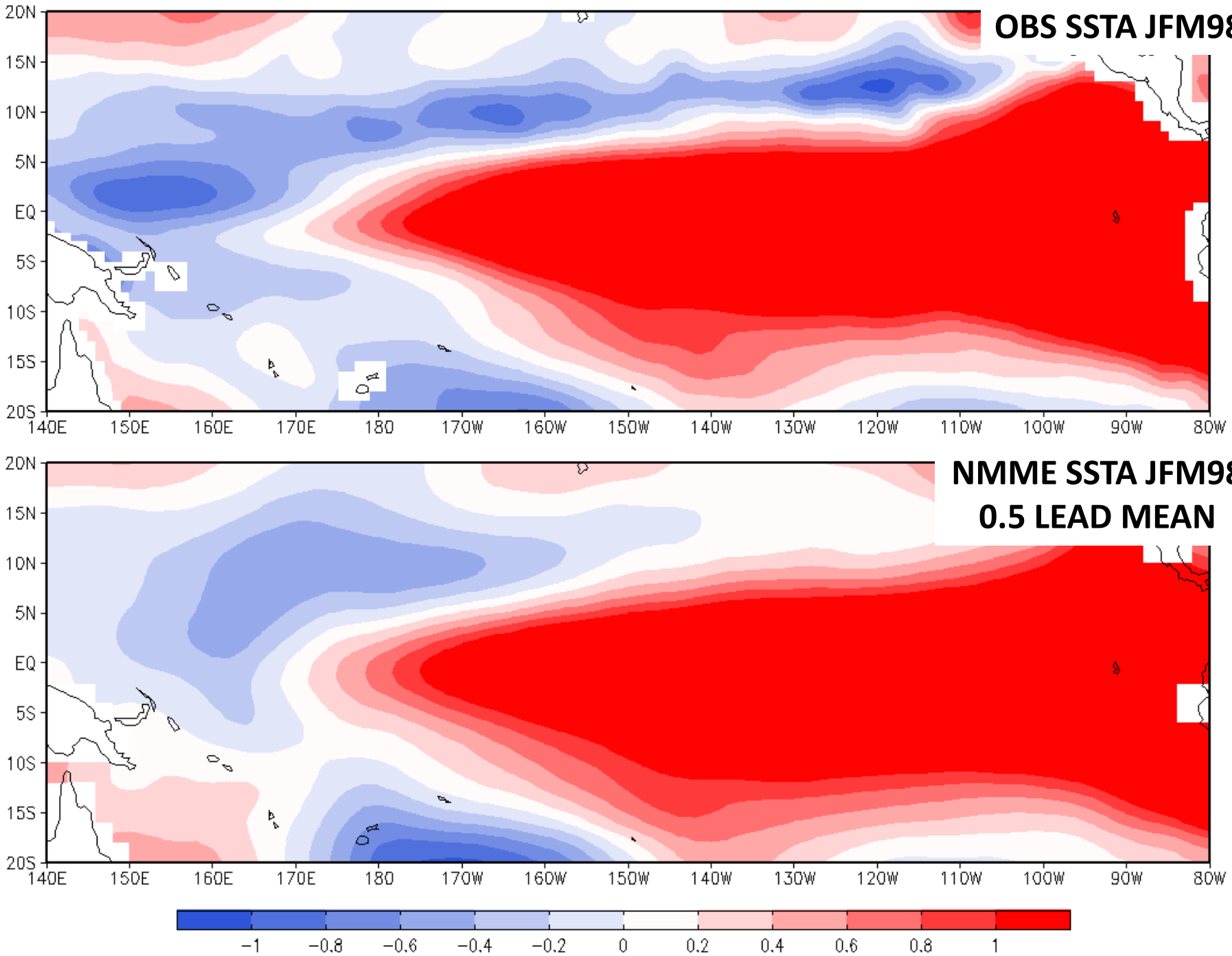

OBS PRECIP JFM95
NMME PRECIP JFM95
0.5 LEAD MEAN
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−3.5
−3
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

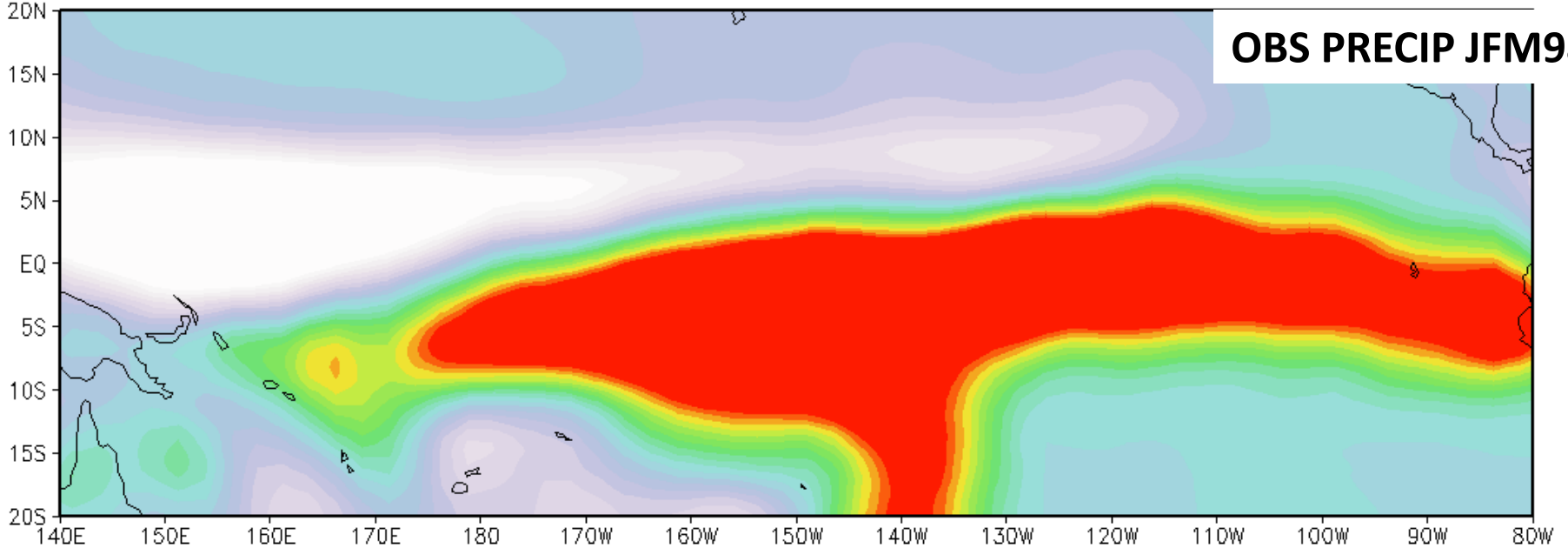
0.5LT JFM1995

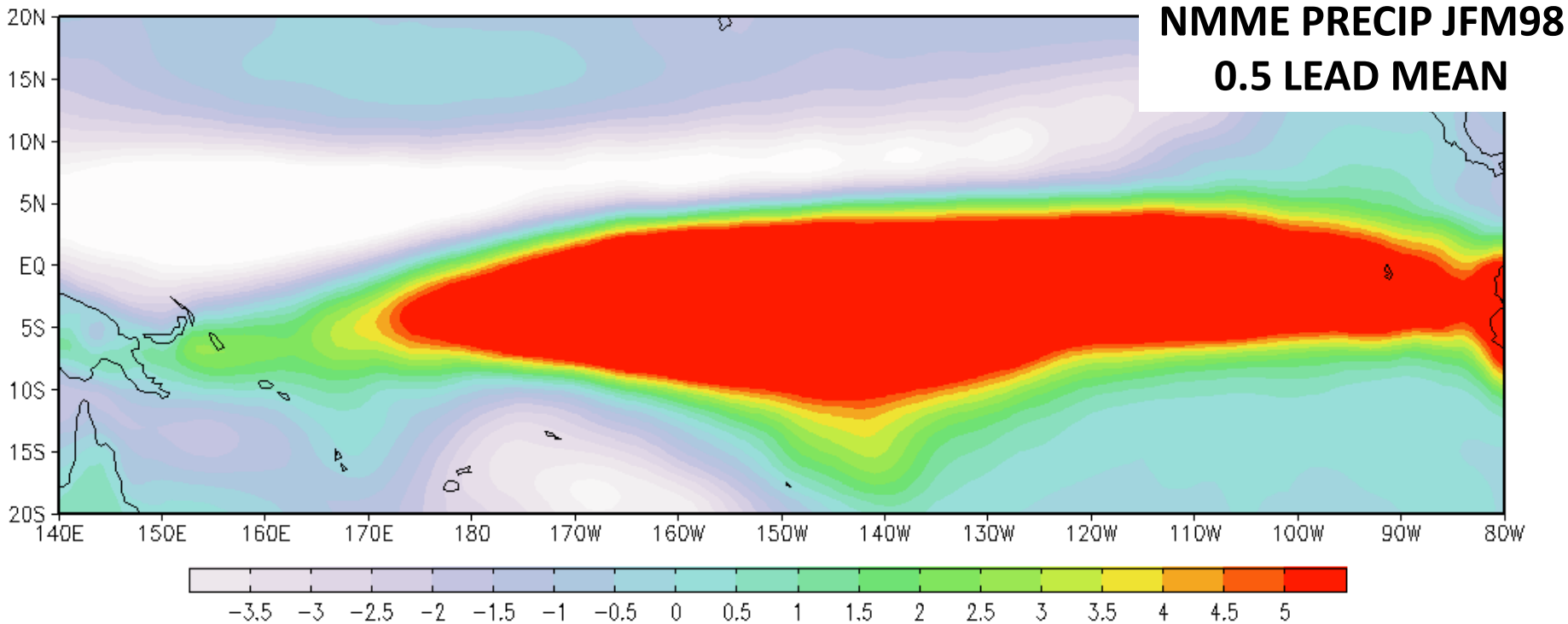



Pa# ern'Corr'with'Obs'JFM1995'(CP)'—'Short'Lead'
0.5LT JFM1995
Pattern Correlation
1.0$
0.75$
0.5$
0.25$
0.0$
(0.25$
(0.5$
Ensemble Member

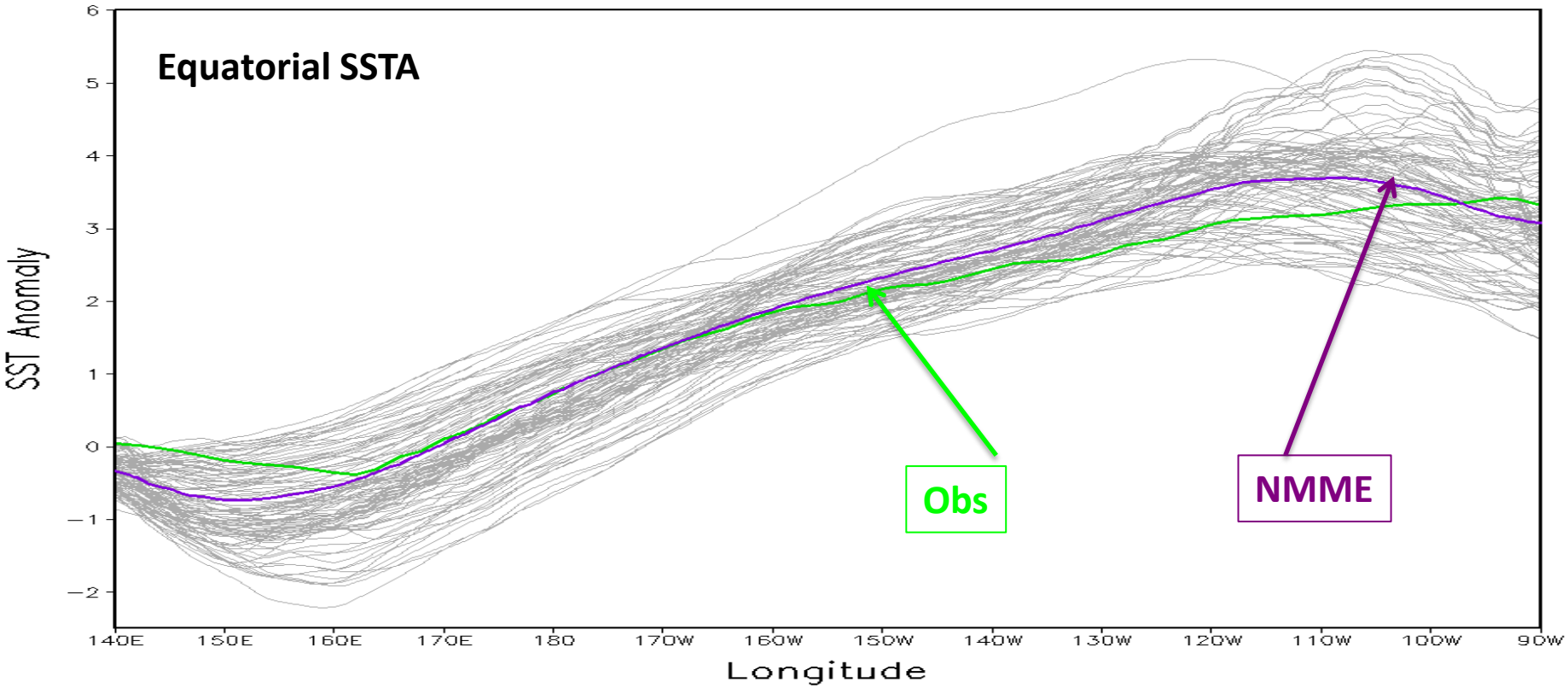

Equatorial SSTA
NMME
Obs
SST Anomaly
6
5
4
3
2
1
0
−1
−2
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
Longitude

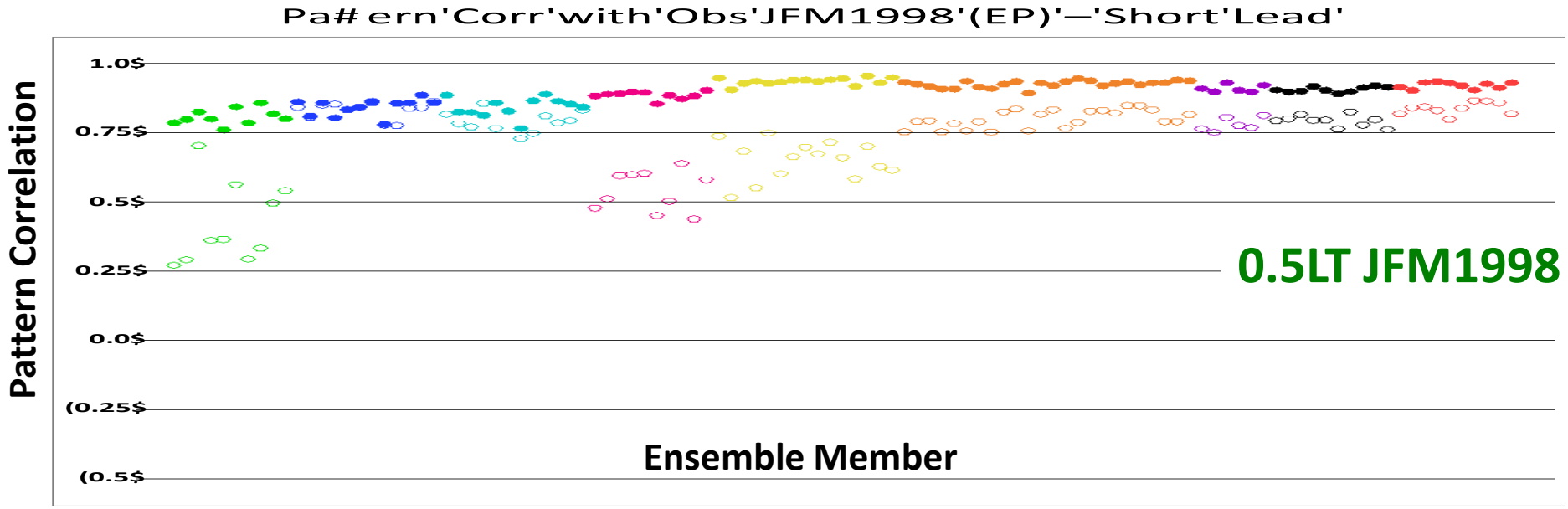

OBS SSTA JFM98
NMME SSTA JFM98
0.5 LEAD MEAN
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

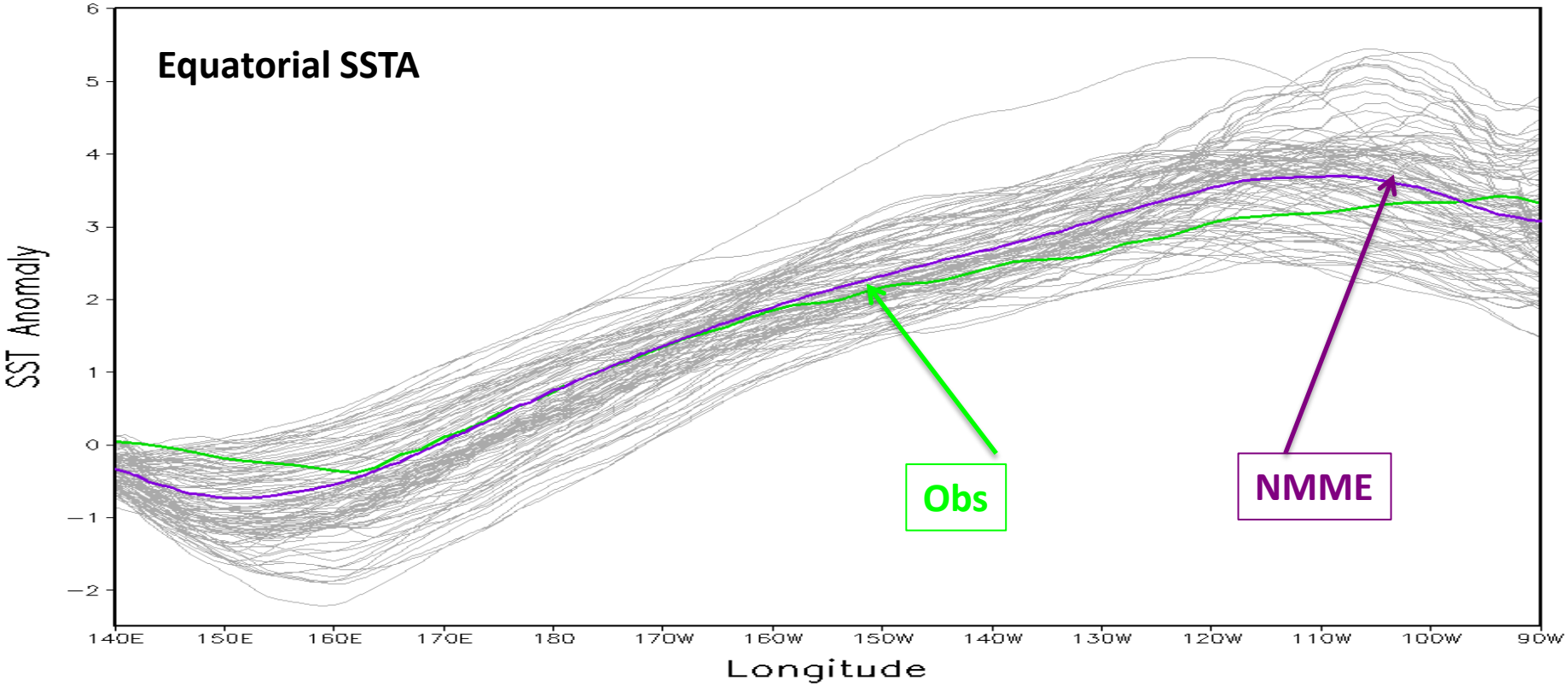

OBS PRECIP JFM98
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W

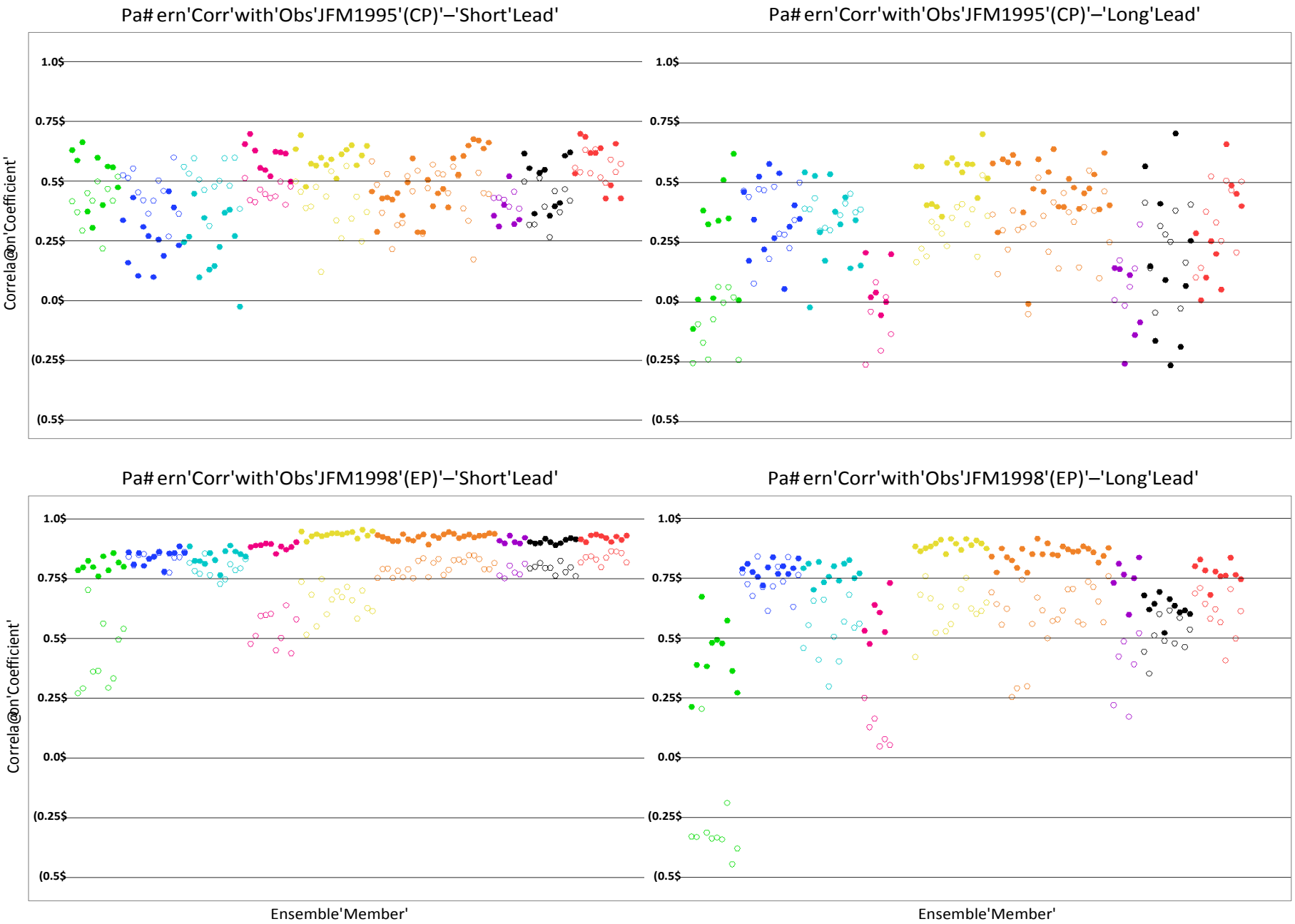

NMME PRECIP JFM98
0.5 LEAD MEAN
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−3.5
−3
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

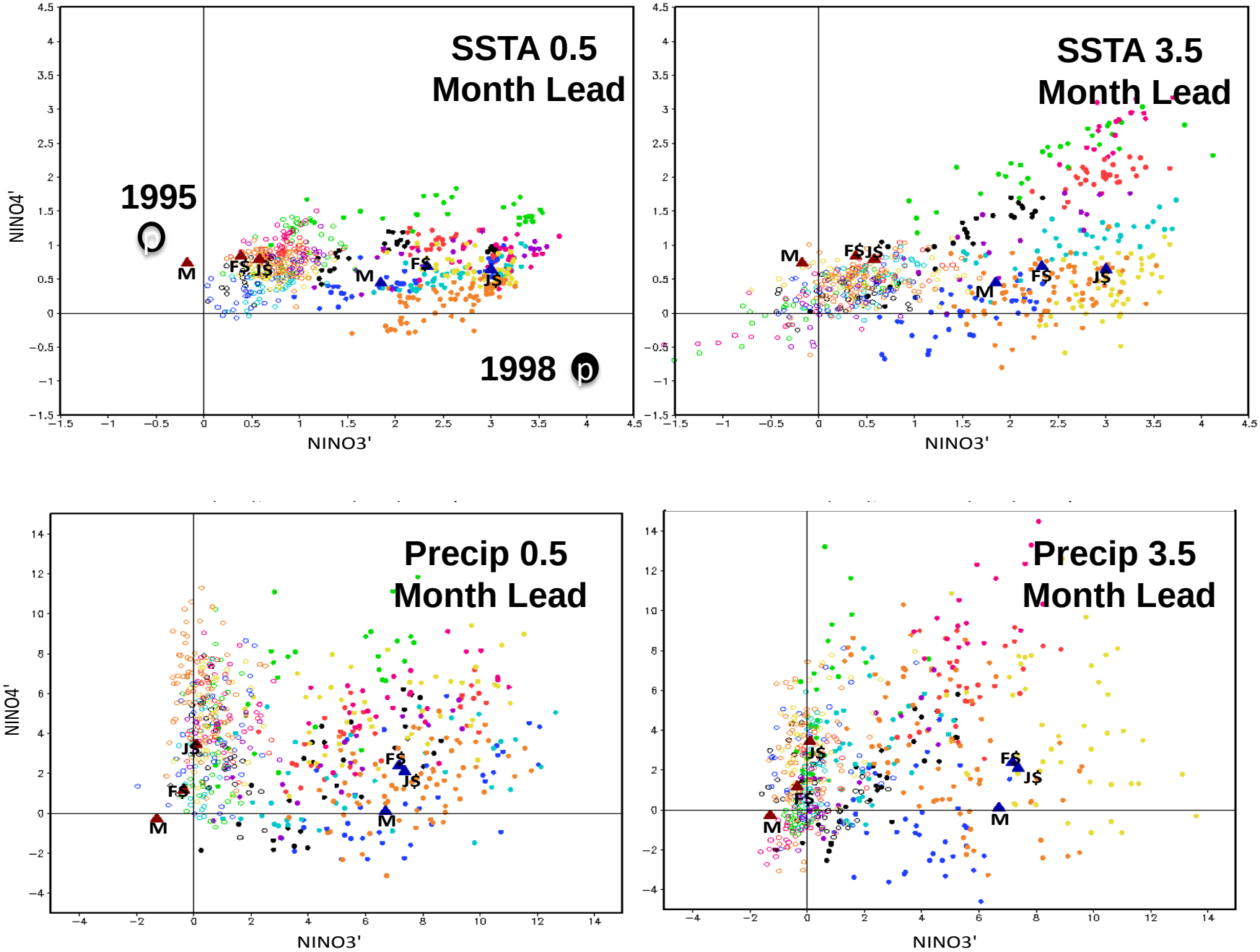
0.5LT JFM1998




Pa# ern'Corr'with'Obs'JFM1998'(EP)'—'Short'Lead'
Pattern Correlation
1.0$
0.75$
0.5$
0.25$
0.0$
(0.25$
(0.5$
0.5LT JFM1998
Ensemble Member

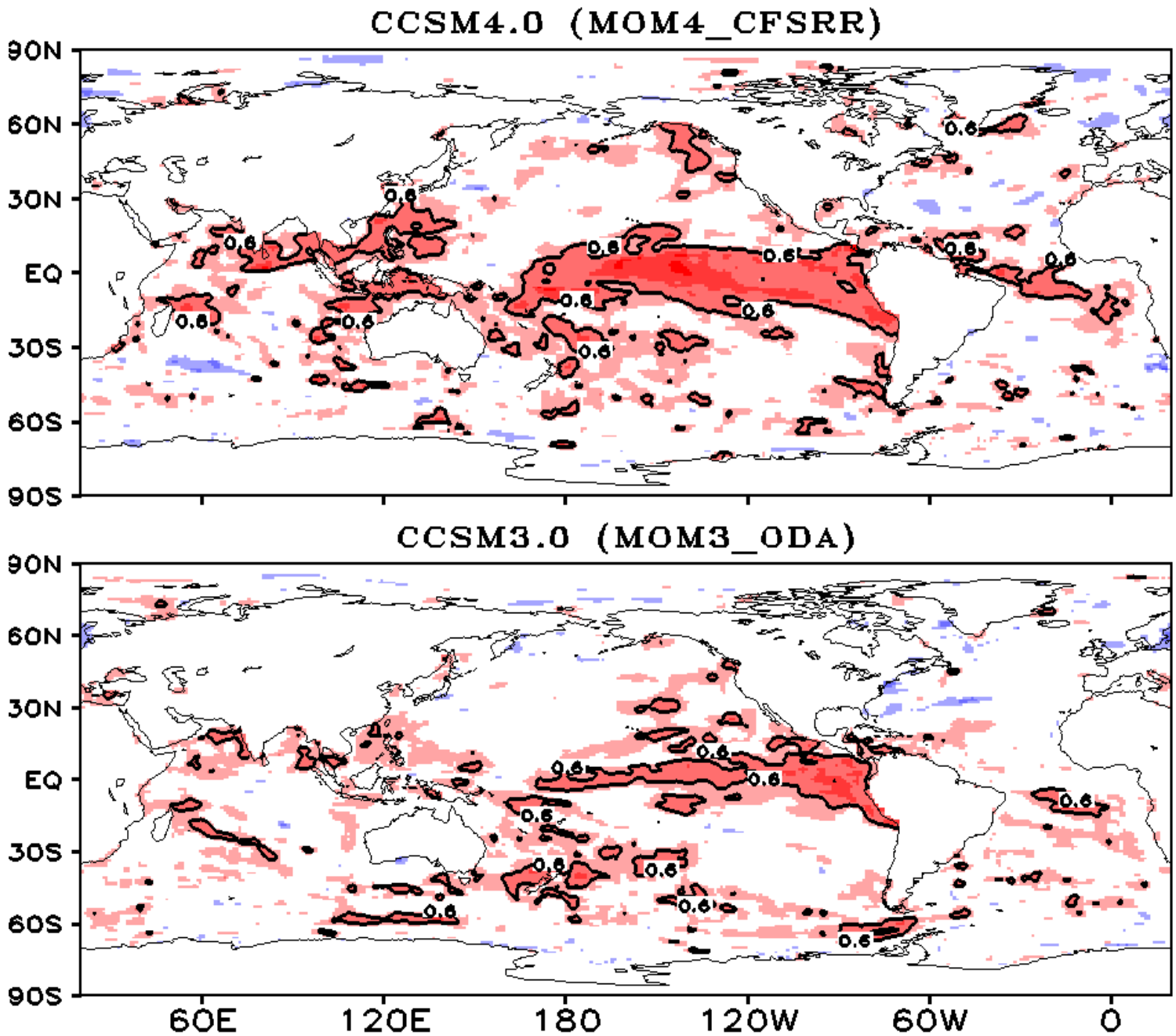

Equatorial SSTA
SST Anomaly
6
5
4
3
2
1
0
−1
−2
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
Longitude
Obs
NMME


Pa# ern'Corr'with'Obs'JFM1995'(CP)'–'Short'Lead'
Pa# ern'Corr'with'Obs'JFM1995'(CP)'–'Long'Lead'
Pa# ern'Corr'with'Obs'JFM1998'(EP)'–'Short'Lead'
Pa# ern'Corr'with'Obs'JFM1998'(EP)'–'Long'Lead'
Correla@on'Coefficient'
1.0$
0.75$
0.5$
0.25$
0.0$
(0.25$
(0.5$
Ensemble'Member'


SSTA 0.5
Month Lead
1995
1998
M
FS
JS
NINO4'
NINO3'
SSTA 3.5
Month Lead
Precip 0.5
Month Lead
Precip 3.5
Month Lead

NMME 2013-14 Plans

- Continue Real-Time SI Activity
  - NMME Session at CDPW
- Model Upgrades (e.g., CCSM4)
- Comprehensive Data Server
  - 3 hourly, 6 hourly, 24 hourly, Monthly Means
  - 189 2-d Fields
- Testing and Evaluating High Frequency Initialization Forecast Protocol
  - Not Real-time
  - Week 3-4 out to 12 Months
  - Burst vs. Every 6 hours
  - Forecast Availability Time-Line


CCSM4.0 (MOM4_CFSRR)
CCSM3.0 (MOM3_ODA)
90N
60N
30N
EQ
30S
60S
90S
60E
120E
180
120W
60W
0
0.6