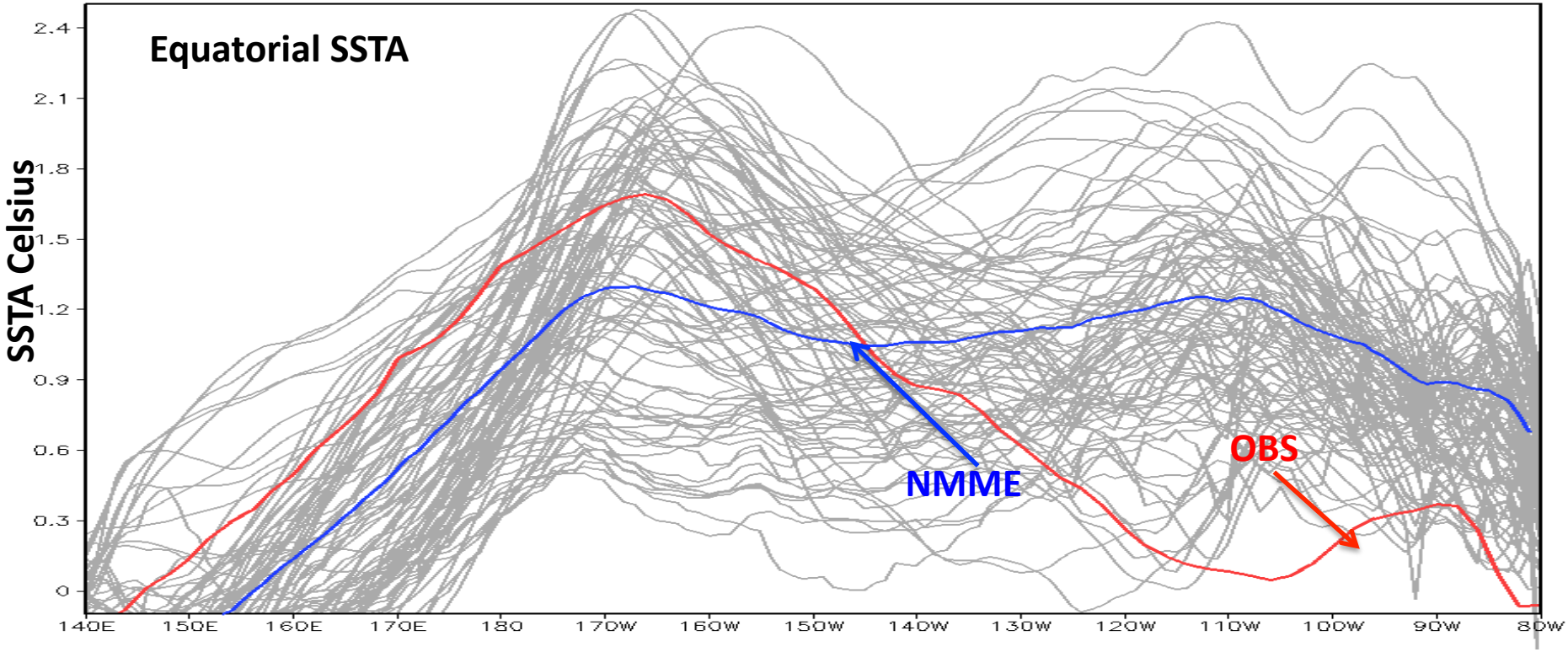
UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

CENTER FOR COMPUTATIONAL SCIENCE
UNIVERSITY OF MIAMI

Diversity of ENSO in the North American Multi-Model Ensemble (NMME)

0.5T JFM1995

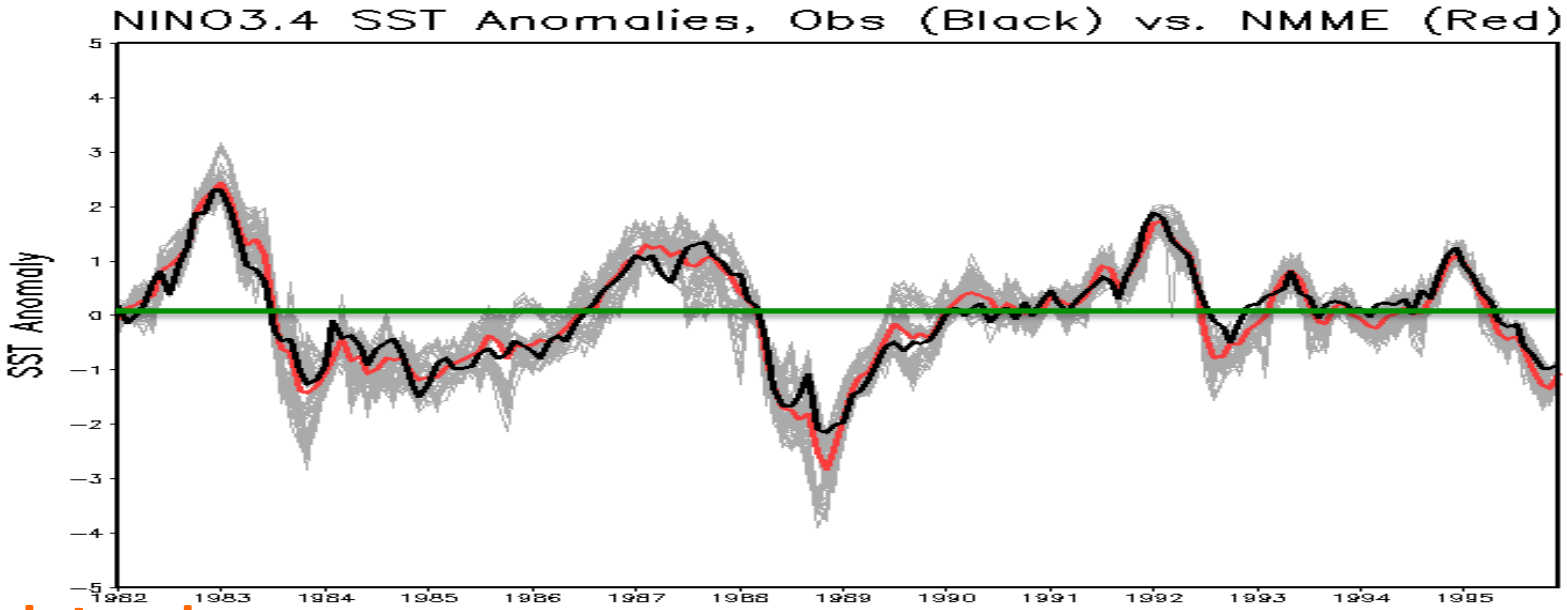


Outline: NMME Captures Diversity of ENSO?

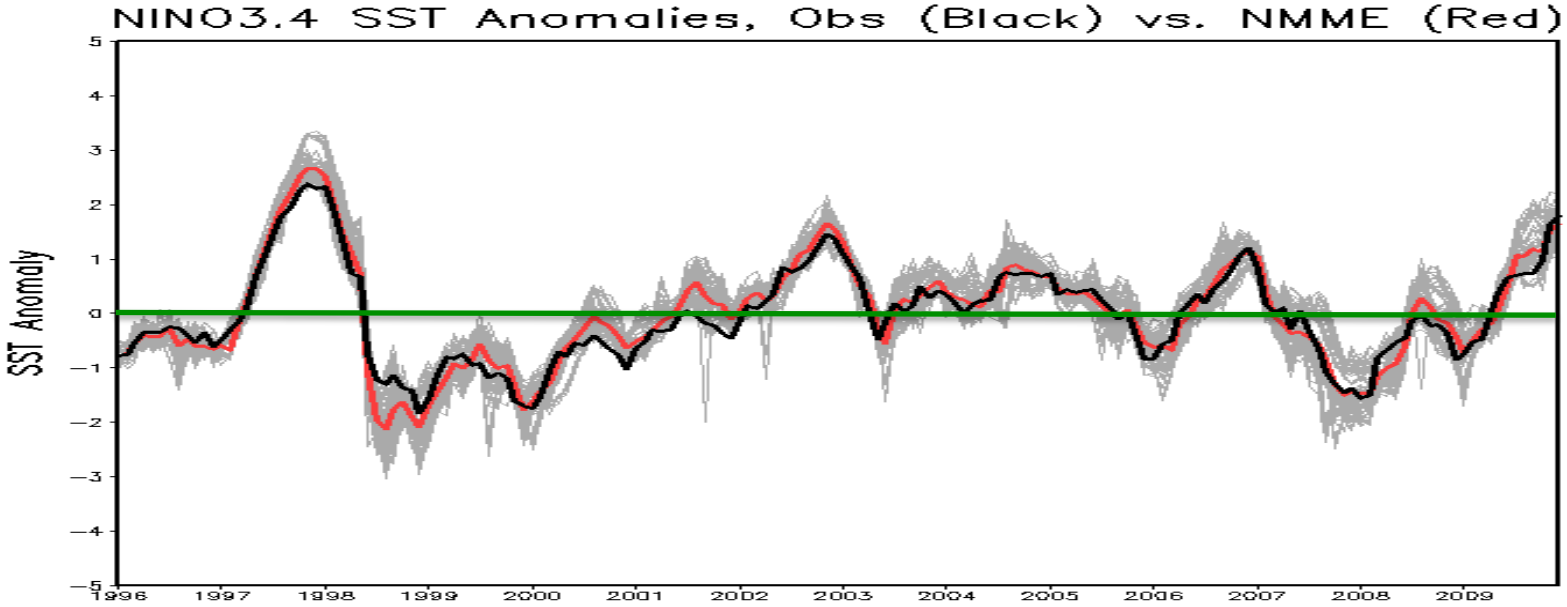
- Very Brief Description of NMME System
- Diversity of ENSO in NMME
  - "Agnostic" view
  - Event Based: SST, Precipitation
    - Pattern Correlation
    - Lead Time
- North American Rainfall
  - 2006-07 SE US Drought

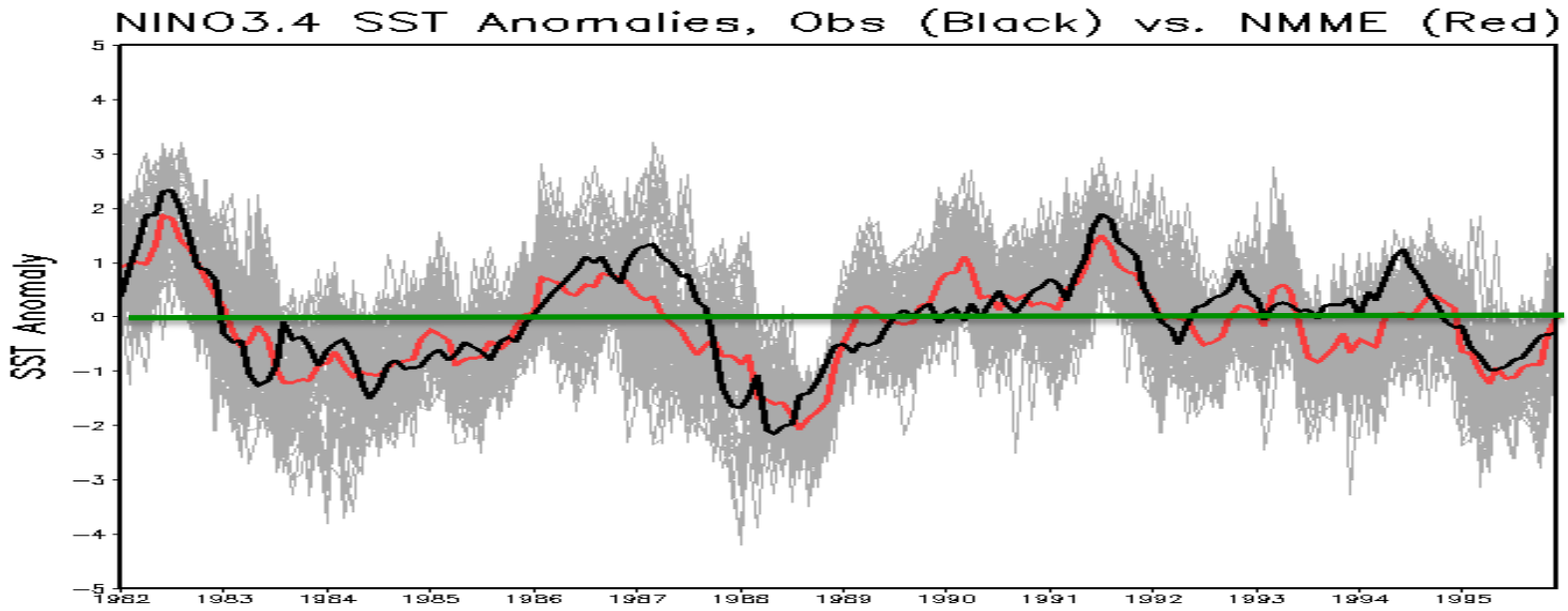
Model	Hindcast Period	Ensemble Size	Lead Times	Arrangement of Ensemble Members	Contact and reference
CFSv1	1981-2009	15	0.5-8.5 Months	1st 0Z +/-2 days, 21st0Z +/-2d, 11th 0Z+/- 2d	Saha (Saha et al. 2006)
CFSv2	1982-2010	24(28)	0.5-9.5 Months	4 members (0,6,12,18Z) every 5th day	Saha (Saha et al. 2010)
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)

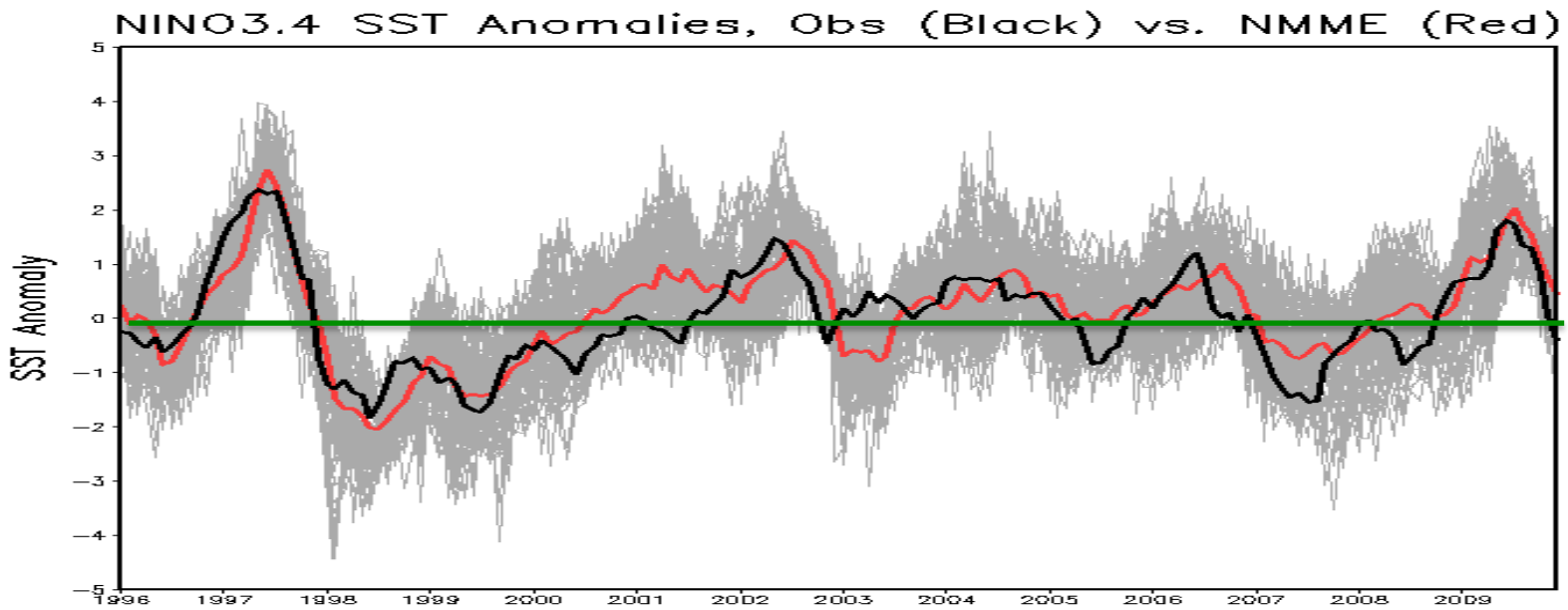

NINO3.4 SST Anomalies, Obs (Black) vs. NMME (Red)
SST Anomaly
5
4
3
2
1
0
−1
−2
−3
−4
−5
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995

1-month Lead

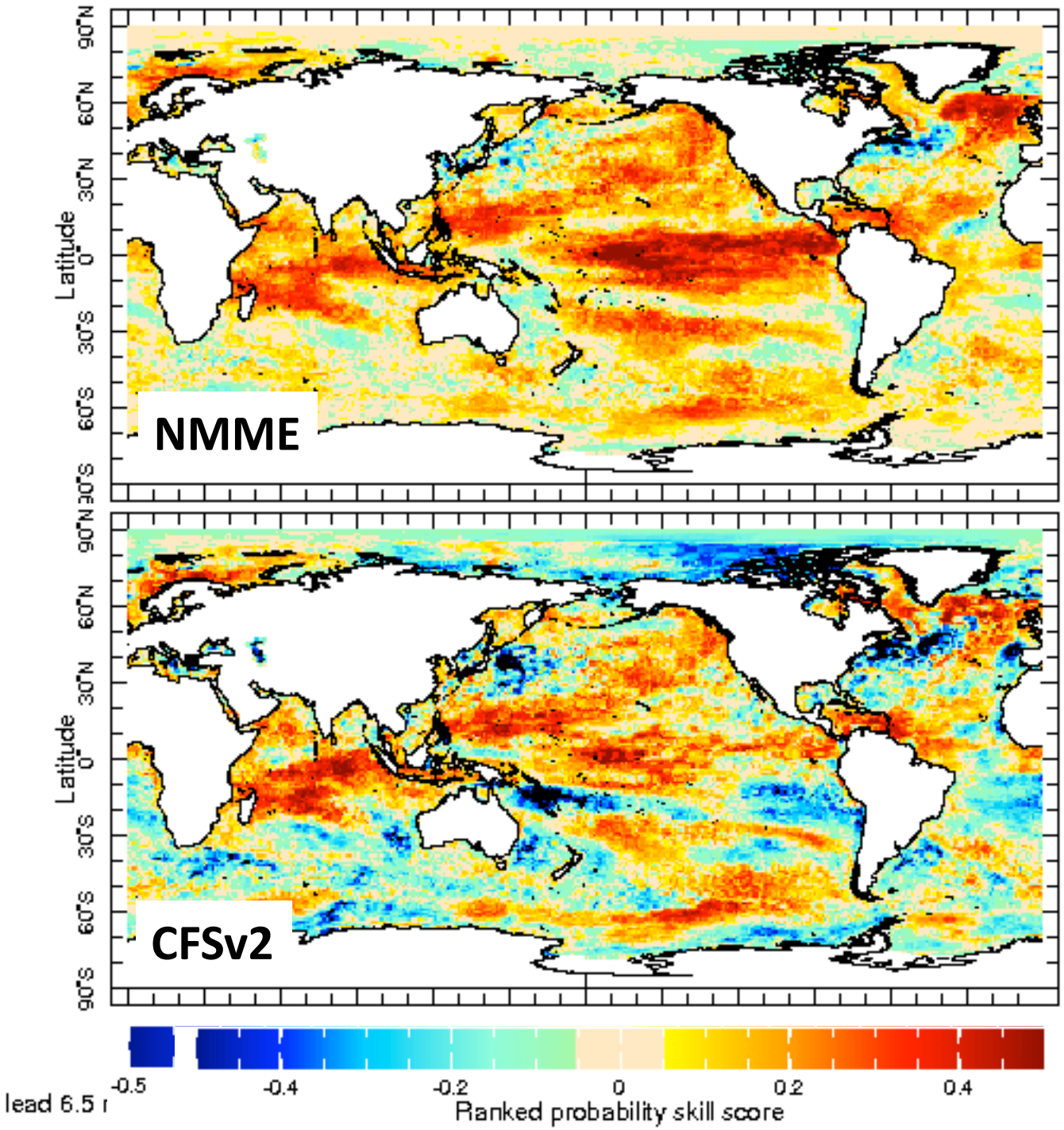

NINO3.4 SST Anomalies, Obs (Black) vs. NMME (Red)
SST Anomaly
5
4
3
2
1
0
−1
−2
−3
−4
−5
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009


NINO3.4 SST Anomalies, Obs (Black) vs. NMME (Red)
SST Anomaly
5
4
3
2
1
0
−1
−2
−3
−4
−5
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995

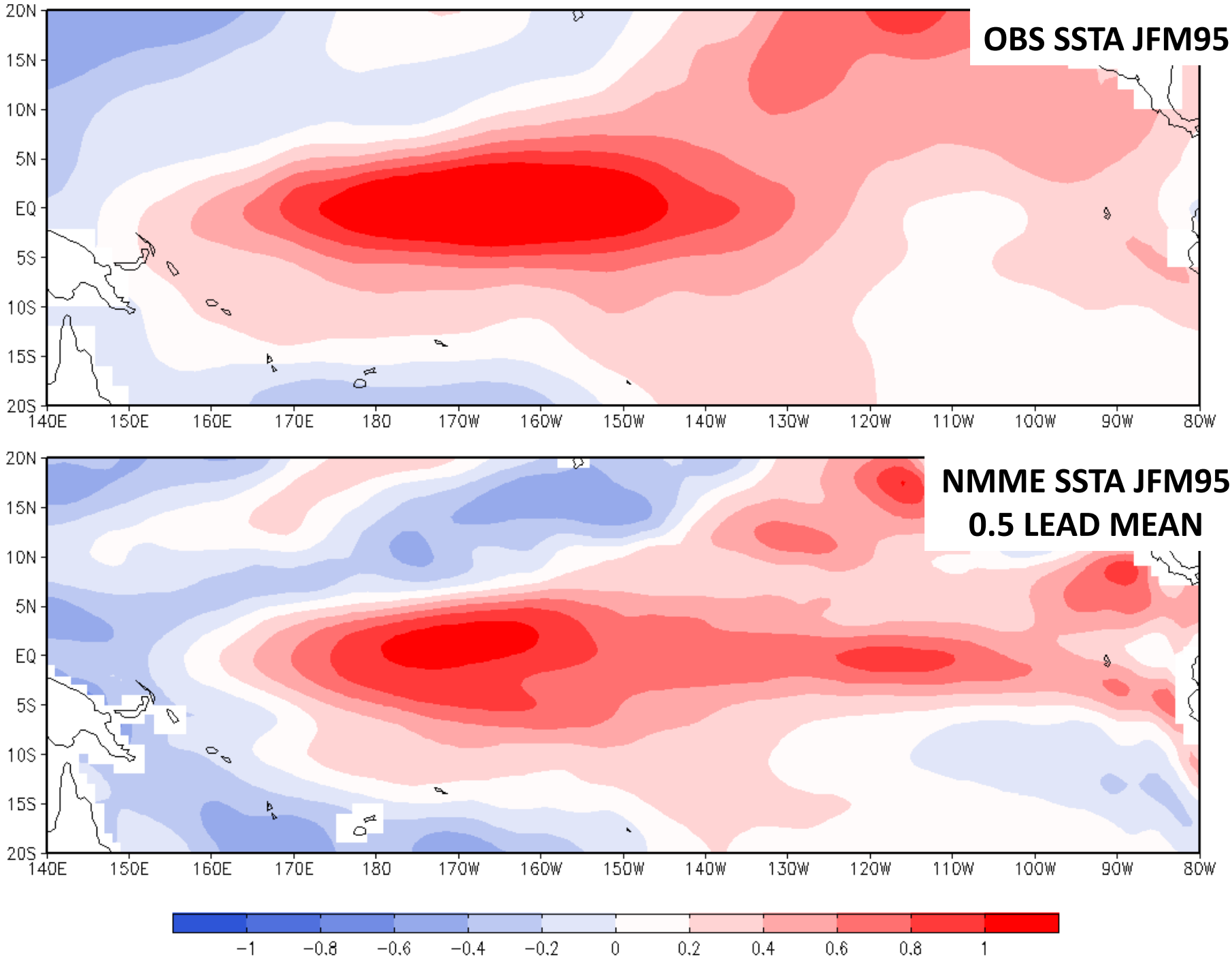
6-month Lead

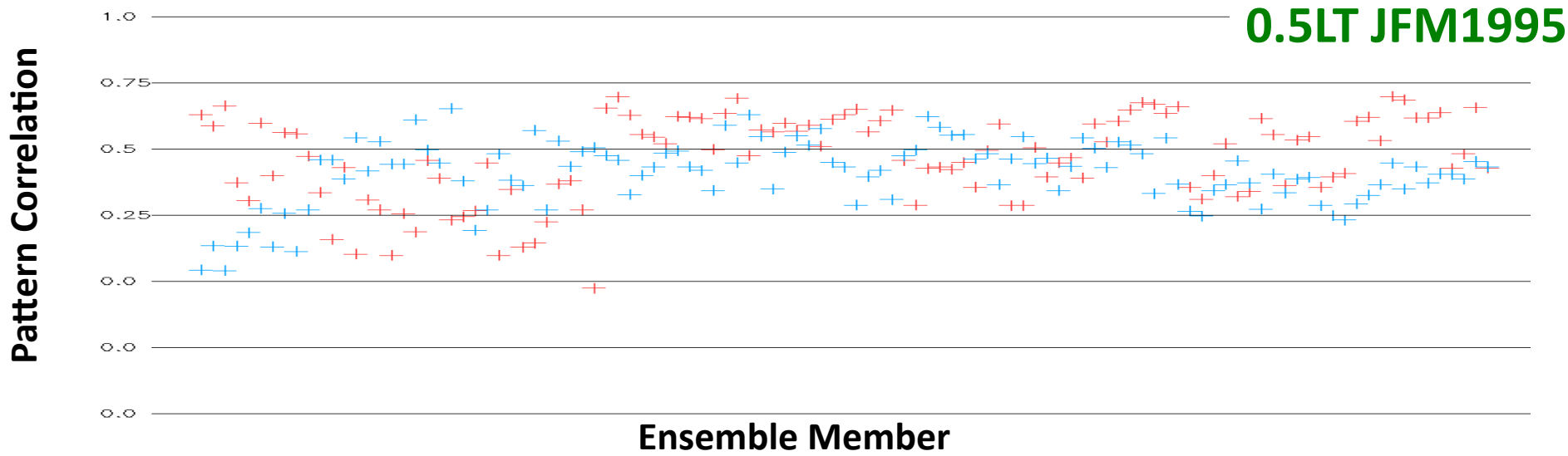

NINO3.4 SST Anomalies, Obs (Black) vs. NMME (Red)
SST Anomaly
5
4
3
2
1
0
−1
−2
−3
−4
−5
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009

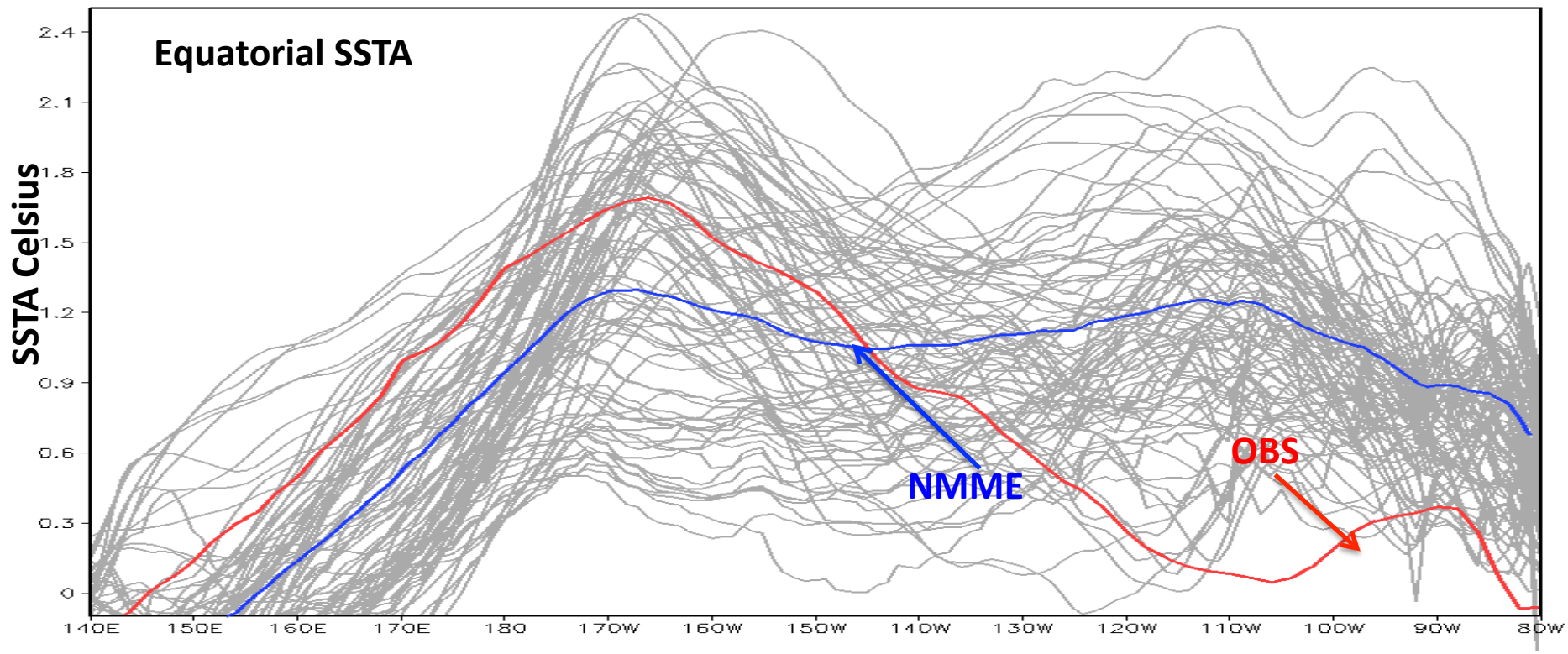
July 1 start DJF SST forecast RPSS

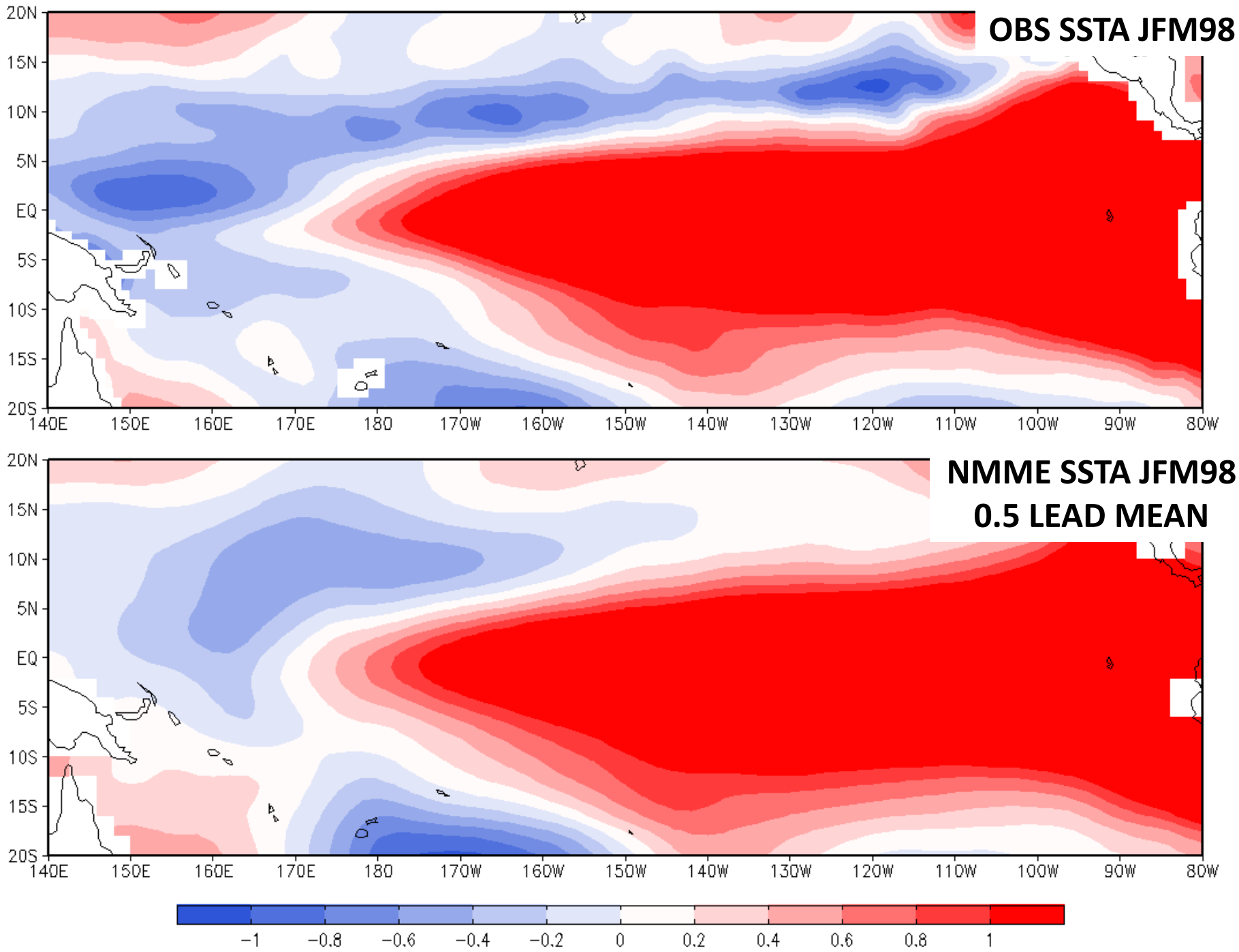


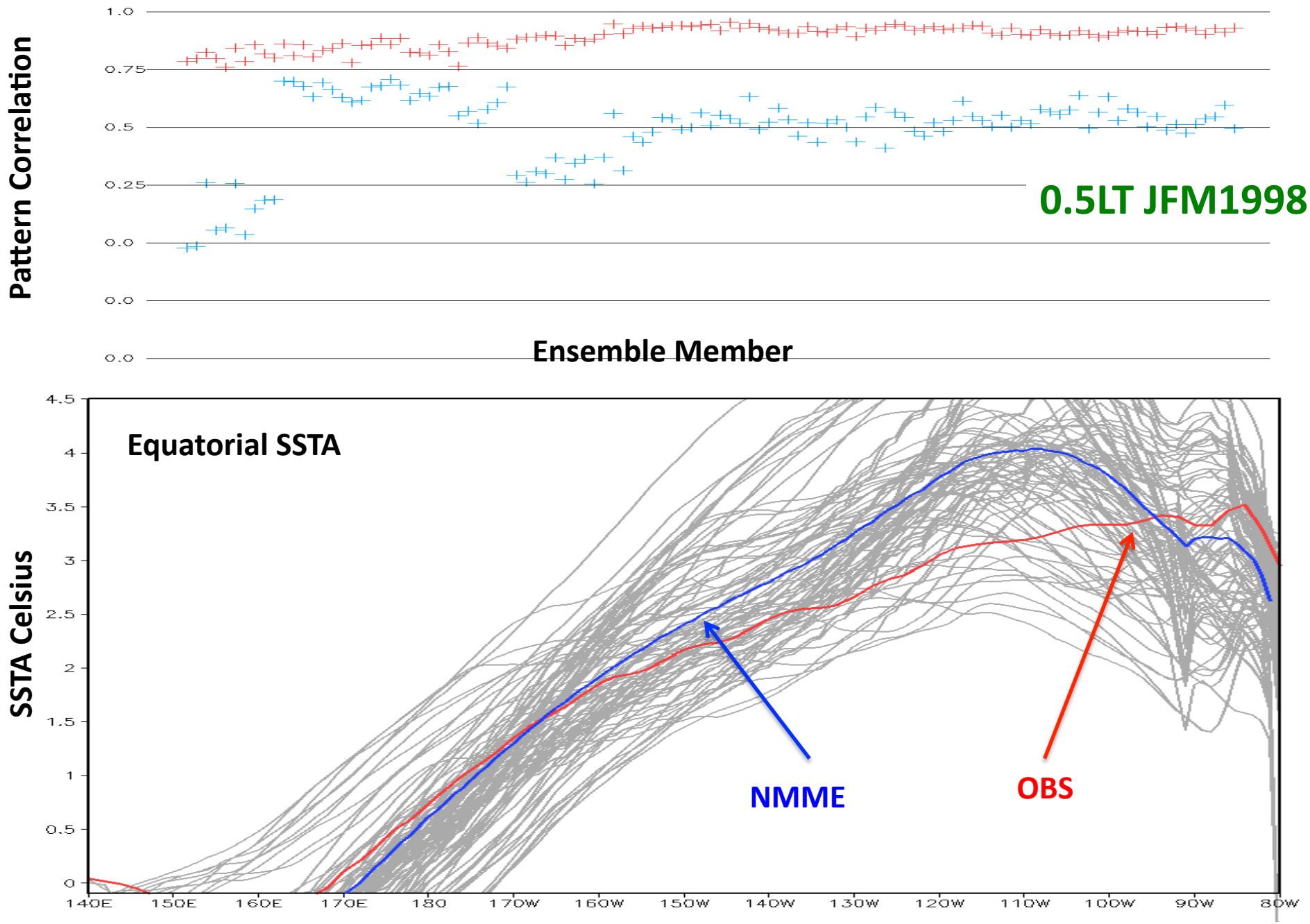
lead 6.5 r

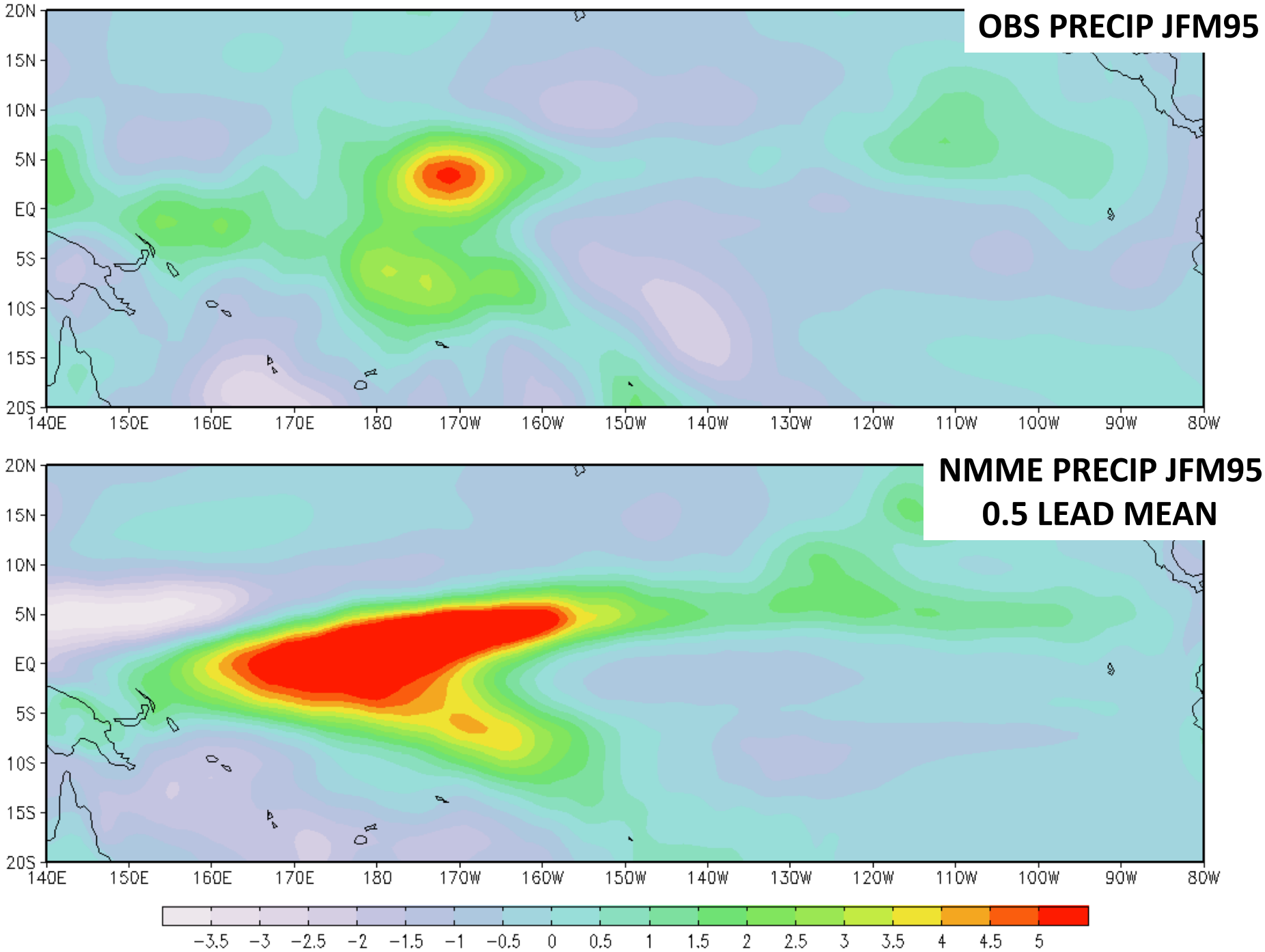

OBS SSTA JFM95
NMME SSTA JFM95
0.5 LEAD MEAN
20N
15N
10N
5N
EQ
5S
10S
15S
20S
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1

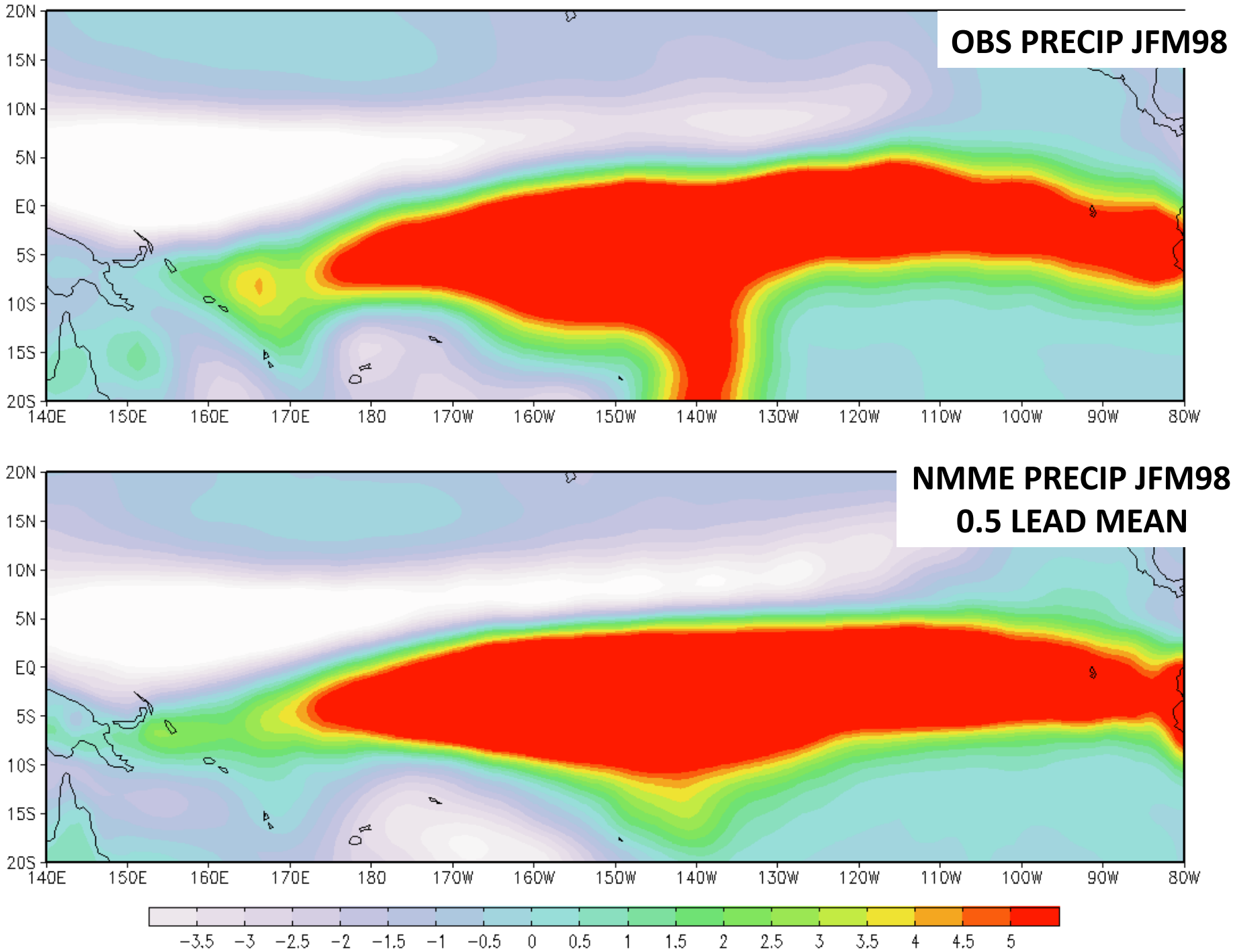

0.5LT JFM1995
Pattern Correlation
1.0
0.75
0.5
0.25
0.0
0.0
0.0
Ensemble Member


Equatorial SSTA
SSTA Celsius
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
NMME
OBS
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W


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


Pattern Correlation
1.0
0.75
0.5
0.25
0.0
0.0
0.0
0.5LT JFM1998
Ensemble Member
SSTA Celsius
Equatorial SSTA
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
80W
NMME
OBS


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


OBS PRECIP JFM98
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

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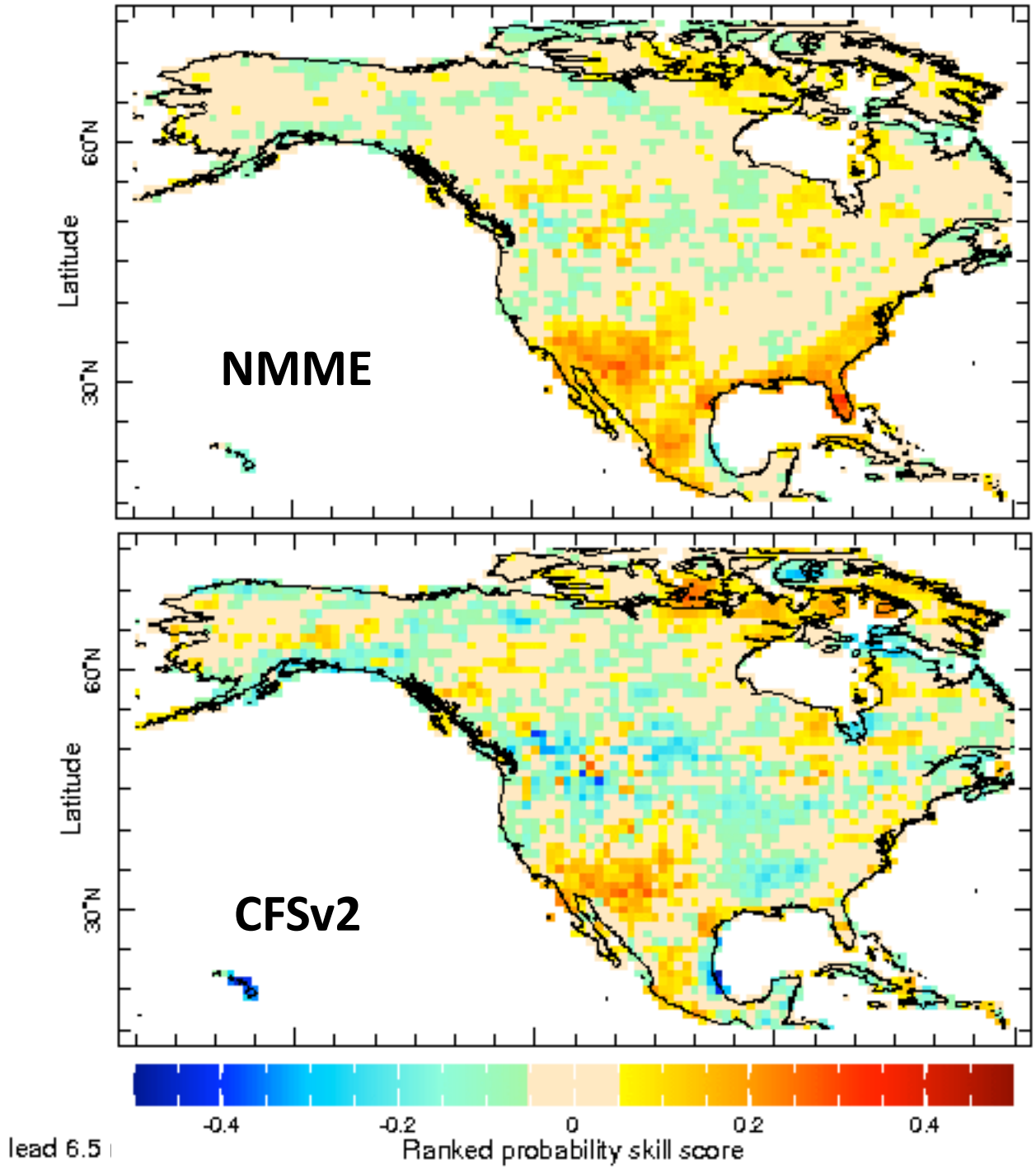
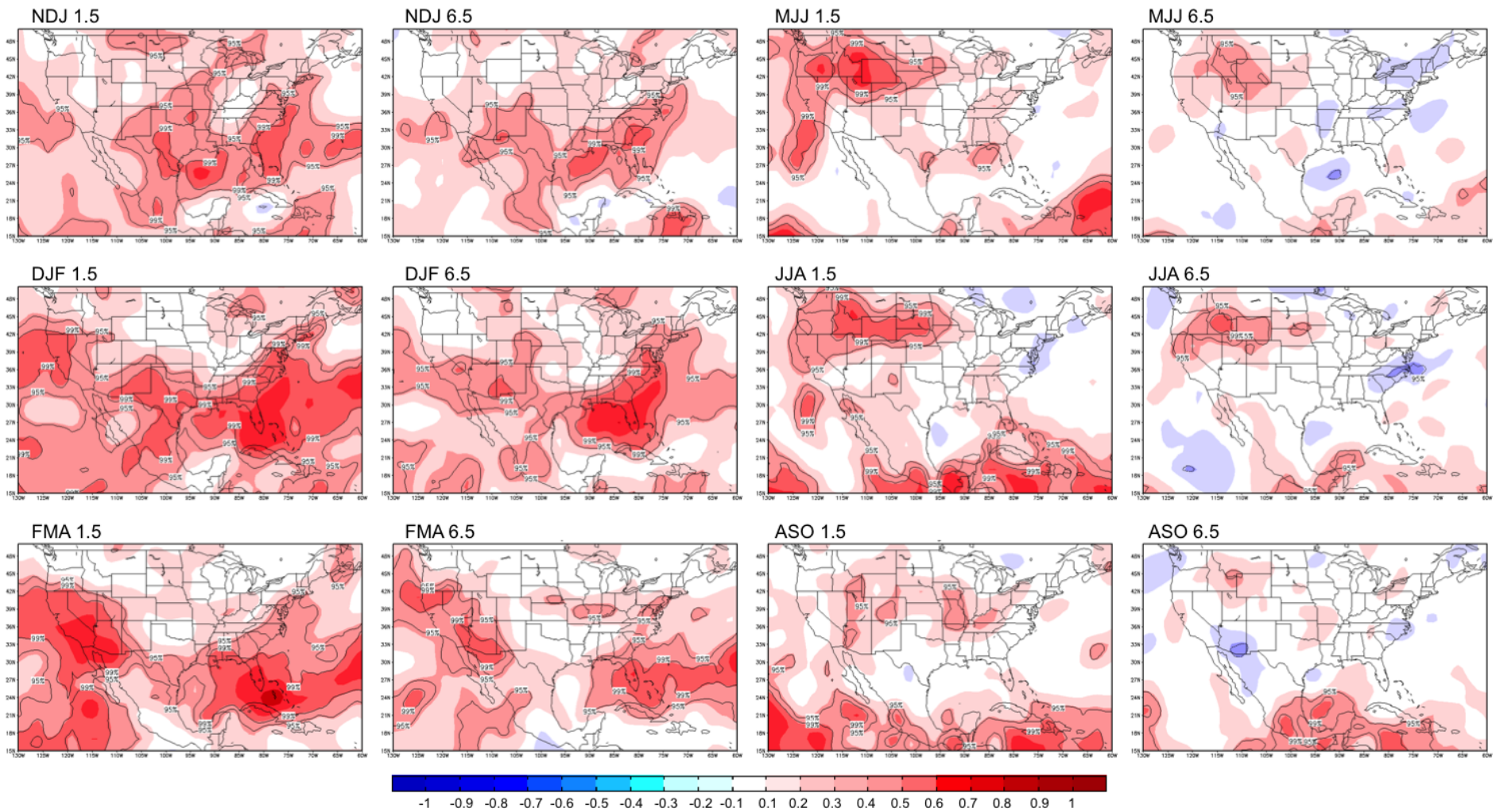
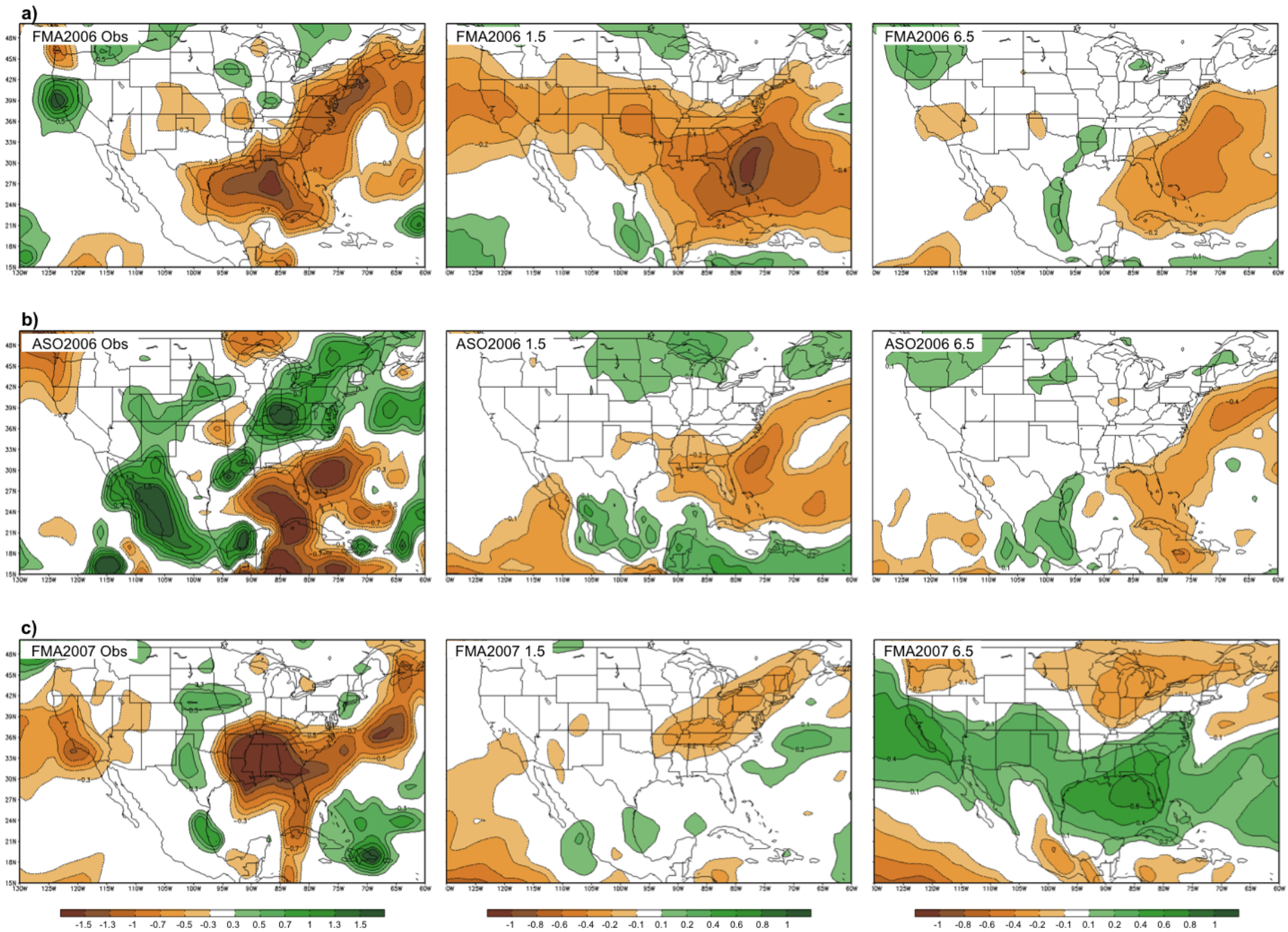
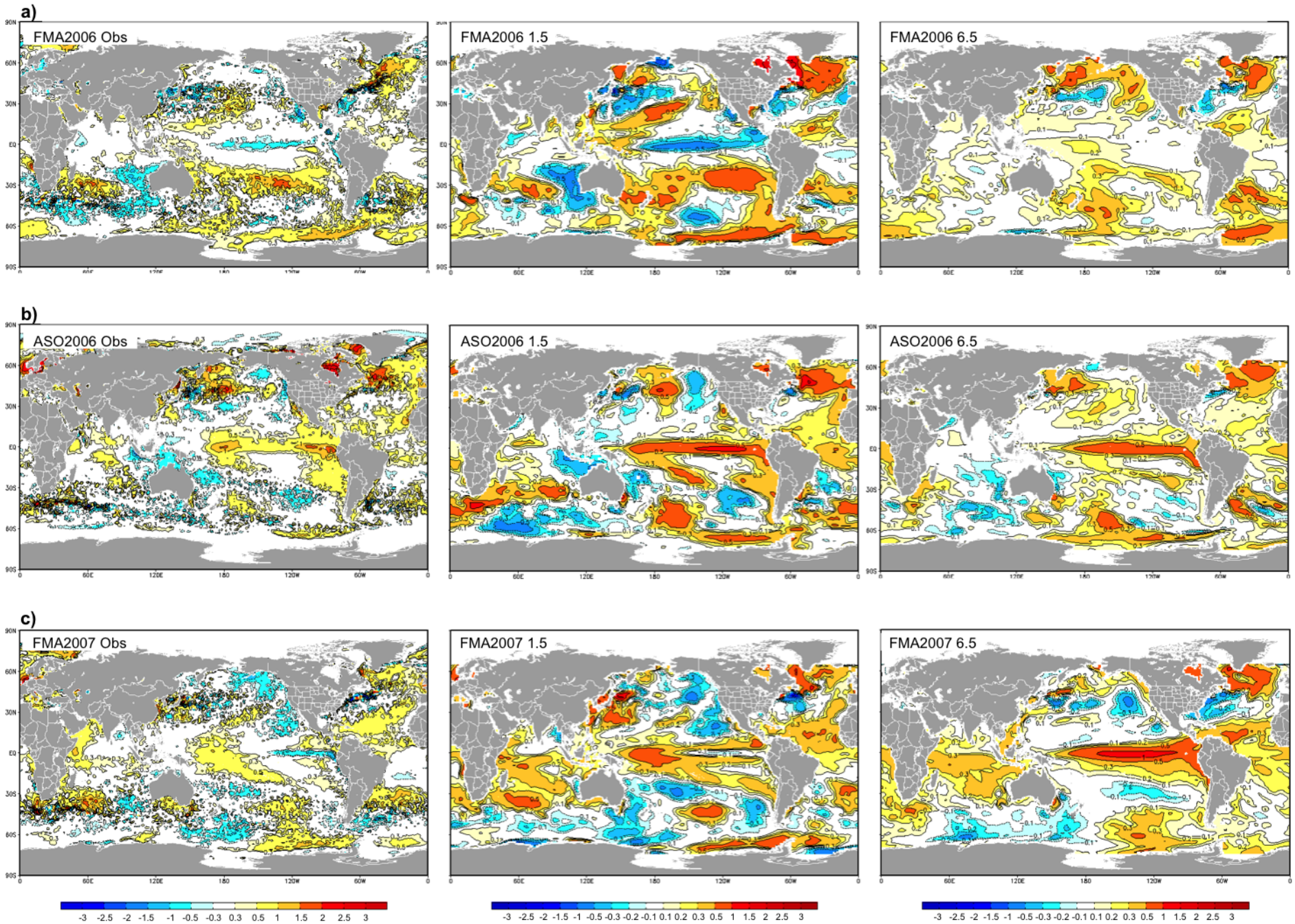


lead 6.5


NDJ 1.5
NDJ 6.5
MJJ 1.5
MJJ 6.5
DJF 1.5
DJF 6.5
JJA 1.5
JJA 6.5
FMA 1.5
FMA 6.5
ASO 1.5
ASO 6.5
-1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1


a)
FMA2006 Obs
FMA2006 1.5
FMA2006 6.5
b)
ASO2006 Obs
ASO2006 1.5
ASO2006 6.5
c)
FMA2007 Obs
FMA2007 1.5
FMA2007 6.5
-1.5 -1.3 -1 -0.7 -0.5 -0.3 0.3 0.5 0.7 1 1.3 1.5
-1 -0.8 -0.6 -0.4 -0.2 -0.1 0.1 0.2 0.4 0.6 0.8 1
-1 -0.8 -0.6 -0.4 -0.2 -0.1 0.1 0.2 0.4 0.6 0.8 1


a)
FMA2006 Obs
FMA2006 1.5
FMA2006 6.5
b)
ASO2006 Obs
ASO2006 1.5
ASO2006 6.5
c)
FMA2007 Obs
FMA2007 1.5
FMA2007 6.5
-3 -2.5 -2 -1.5 -1 -0.5 -0.3 0.3 0.5 1 1.5 2 2.5 3
-3 -2.5 -2 -1.5 -1 -0.5 -0.3 -0.2 -0.1 0.1 0.2 0.3 0.5 1 1.5 2 2.5 3
-3 -2.5 -2 -1.5 -1 -0.5 -0.3 -0.2 -0.1 0.1 0.2 0.3 0.5 1 1.5 2 2.5 3