Diversity of ENSO in the NMME Experiment

Ben Kirtman and the NMME Team

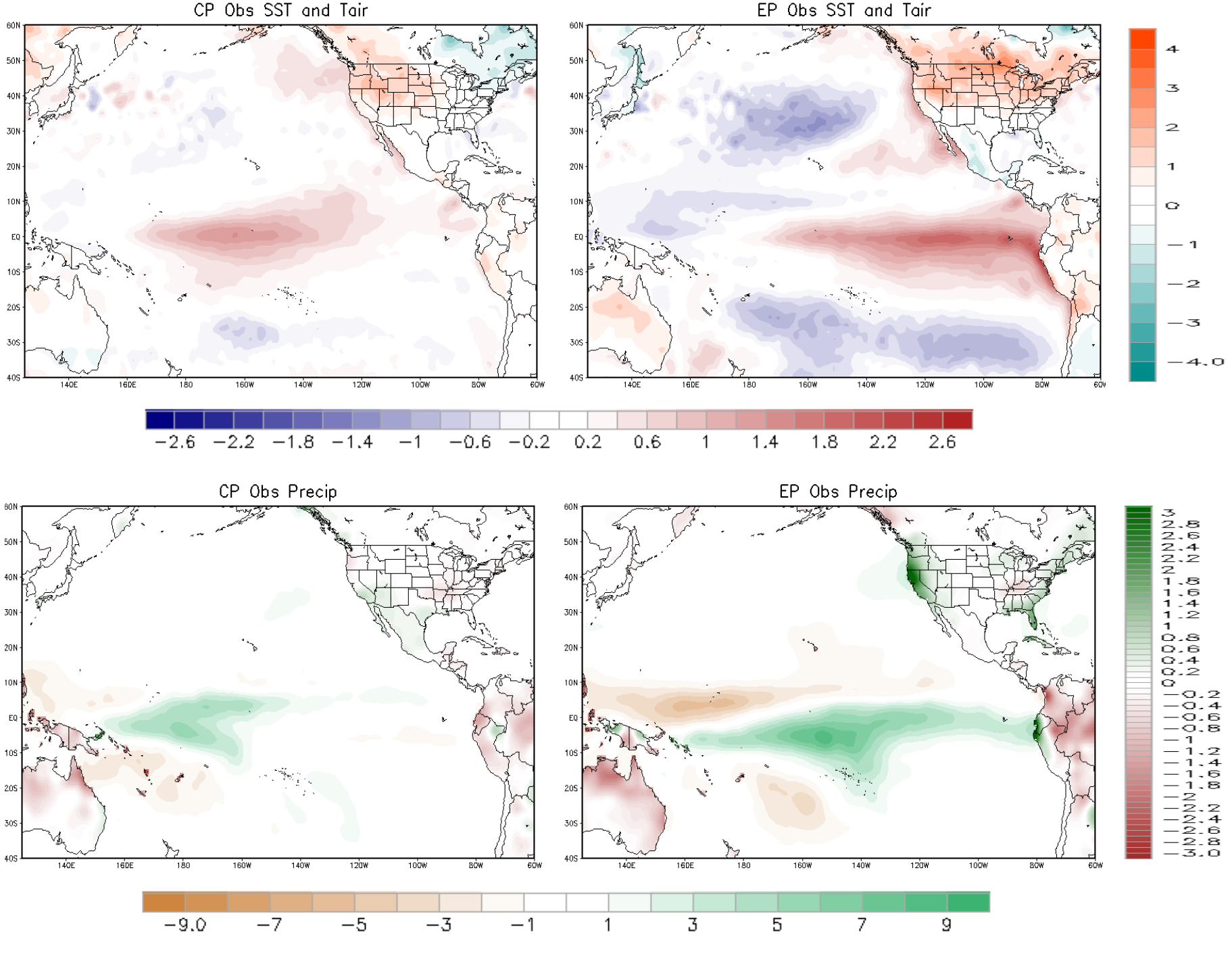
University of Miami - RSMAS

UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

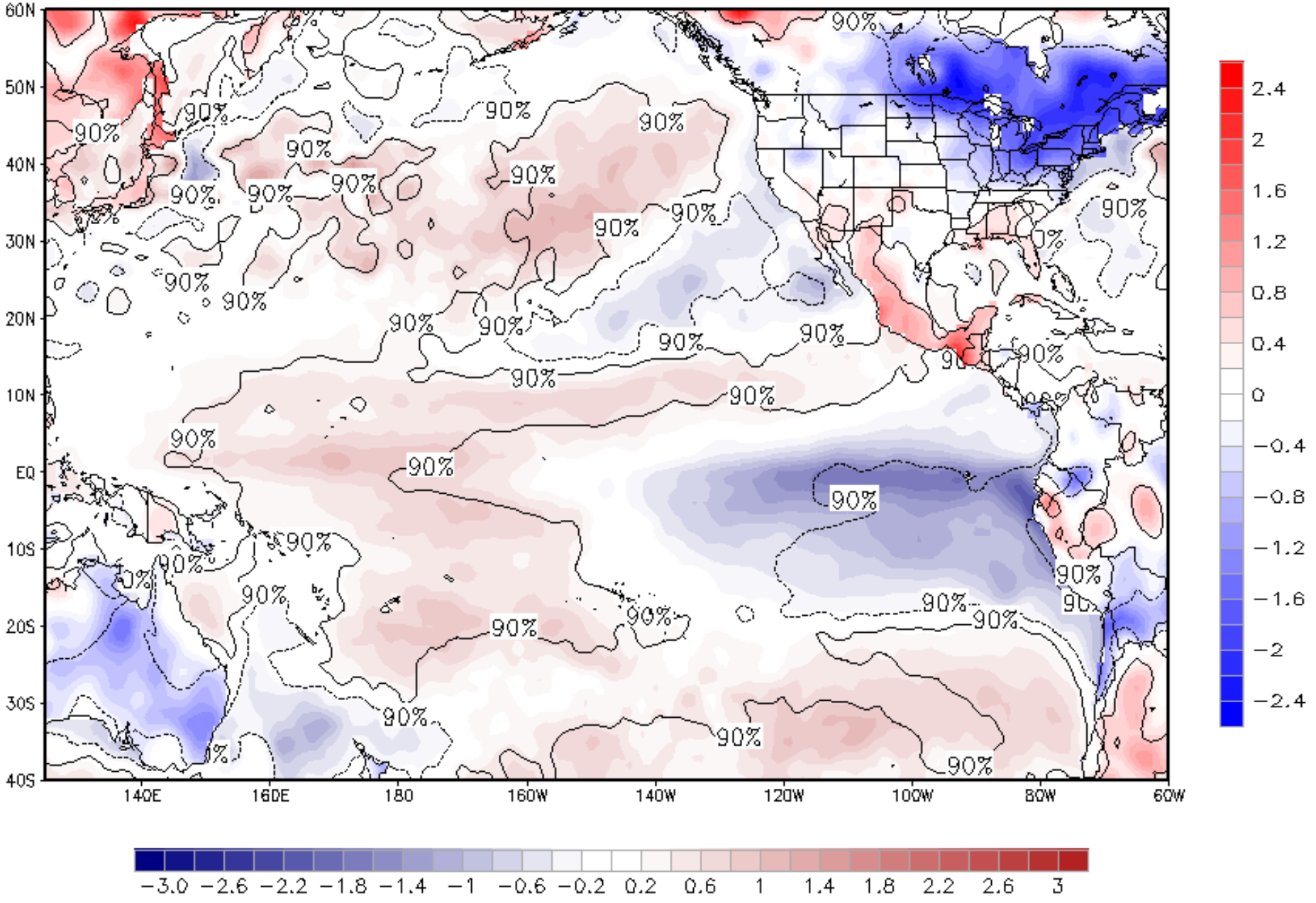
CCS | CENTER FOR COMPUTATIONAL SCIENCE
UNIVERSITY OF MIAMI

Diversity of ENSO

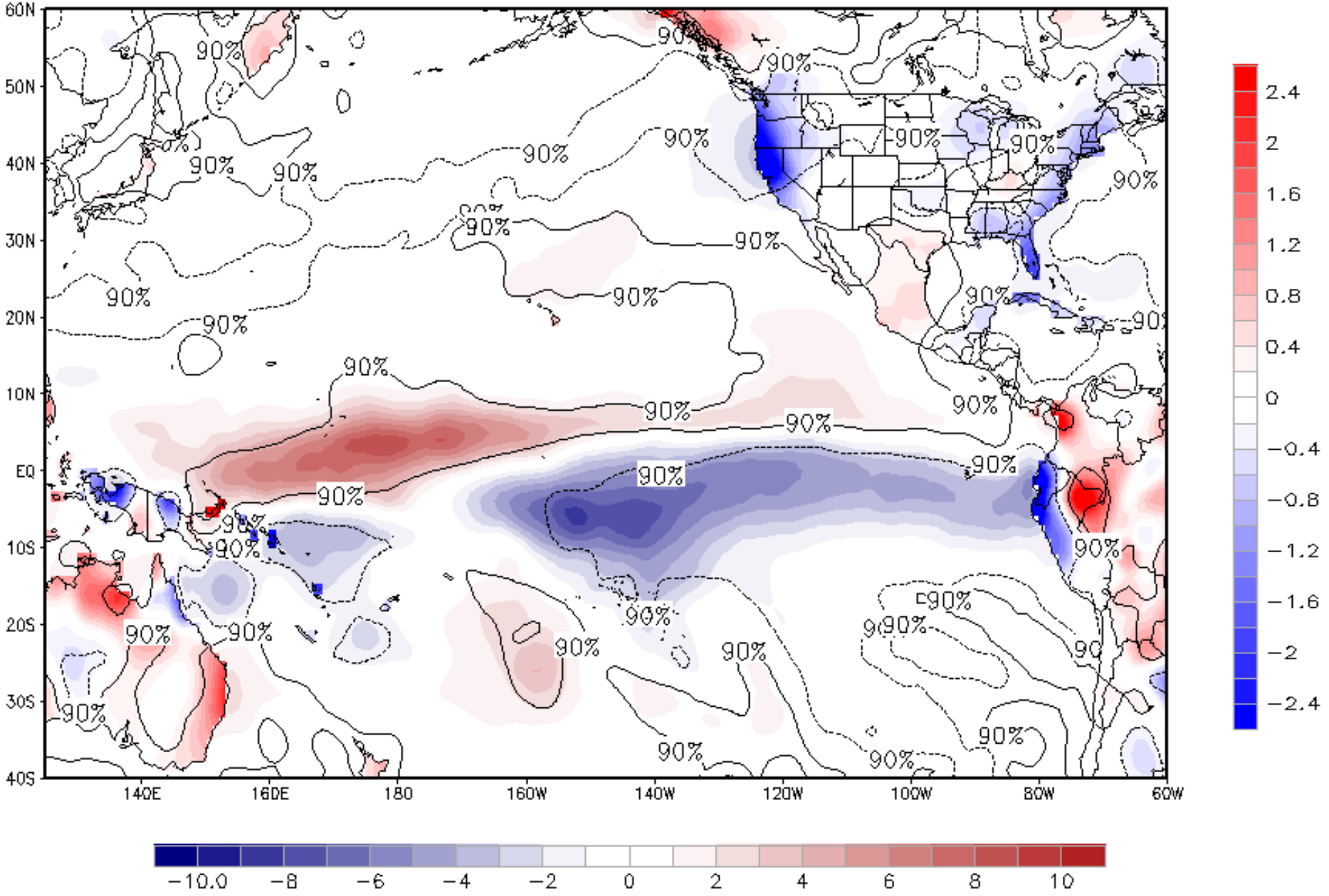
- **Diversity of ENSO (CP vs. EP) in NMME**
  - **Tropical Pacific Sector and North America**
    - **Event Based – JFM 1995 vs. 1998**
      - **Some Composites**
    - **SST, T2m and Precipitation**
    - **Short Lead (SL) – 0.5 Months**
    - **Long Lead (LL) – 3.5 Months**
- **CP vs. EP ENSO Debate (Agnostic View)**
  - **Continuum vs Discrete Events**
  - **Different Teleconnections**
    - **Pattern Correlation**


CP Obs SST and Tair
EP Obs SST and Tair
4
3
2
1
0
−1
−2
−3
−4.0
−2.6 −2.2 −1.8 −1.4 −1 −0.6 −0.2 0.2 0.6 1 1.4 1.8 2.2 2.6
CP Obs Precip
EP Obs Precip
−9.0 −7 −5 −3 −1 1 3 5 7 9

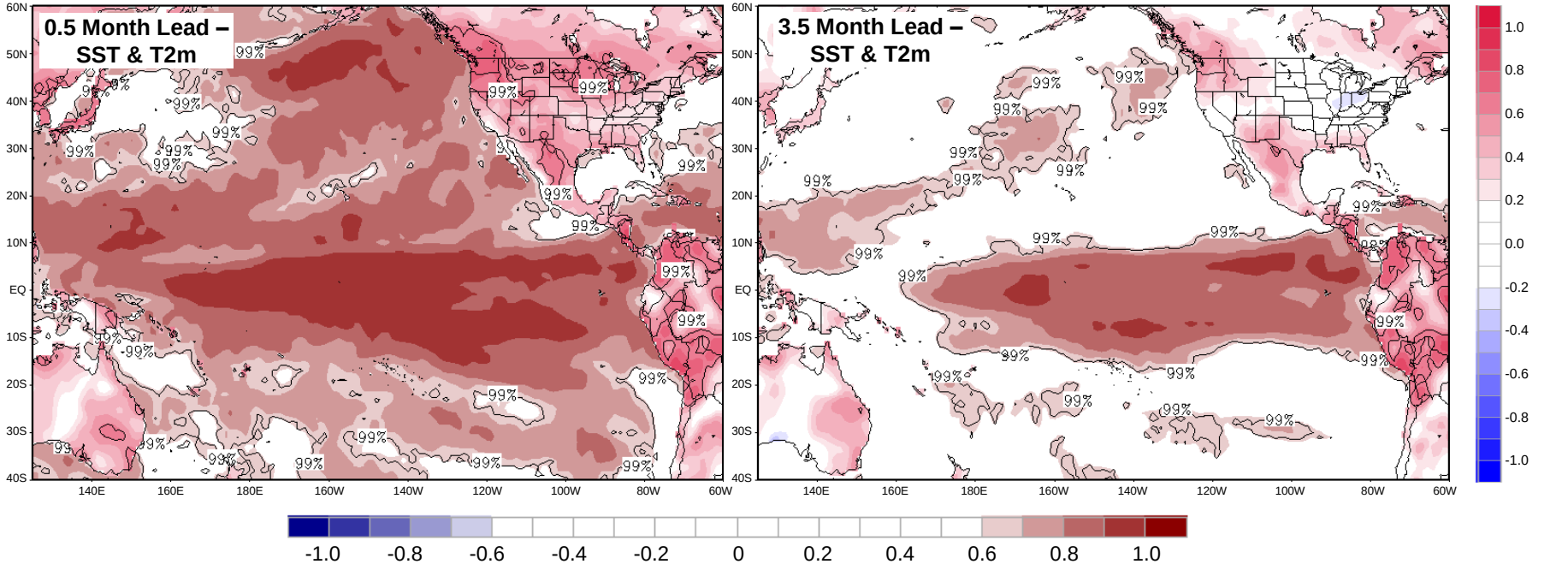
Observational Estimate SST, T2m CP-EP

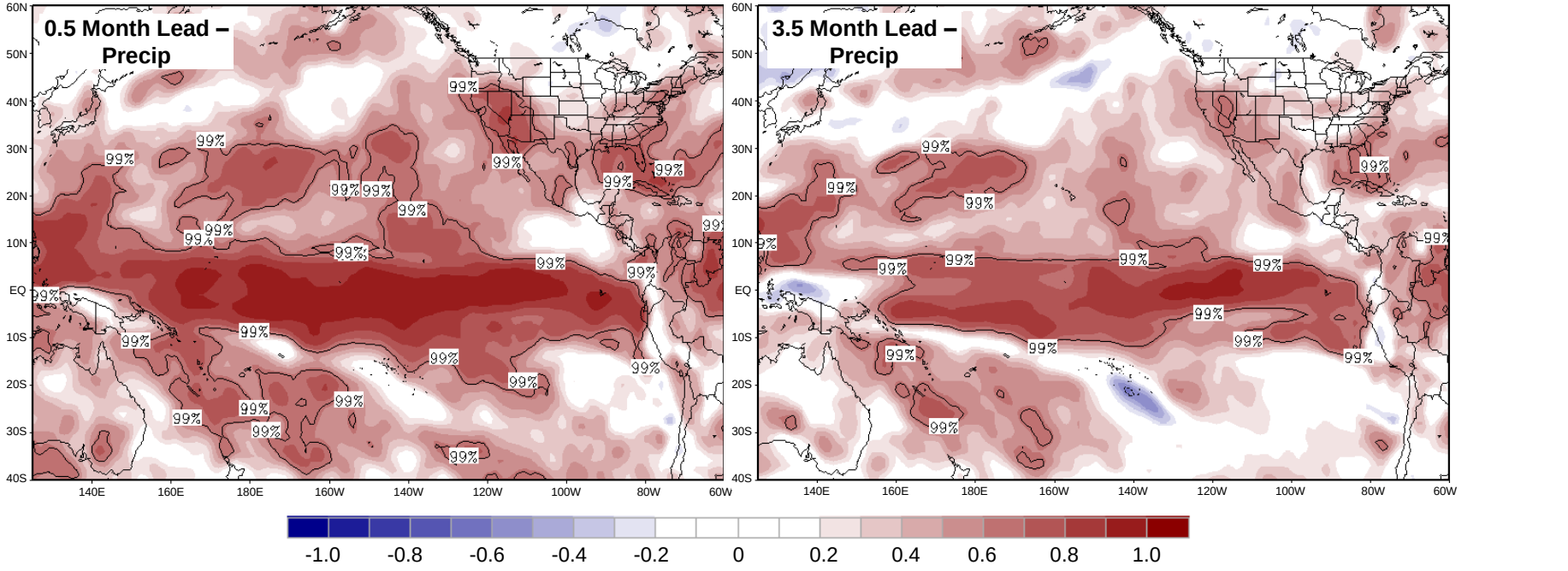


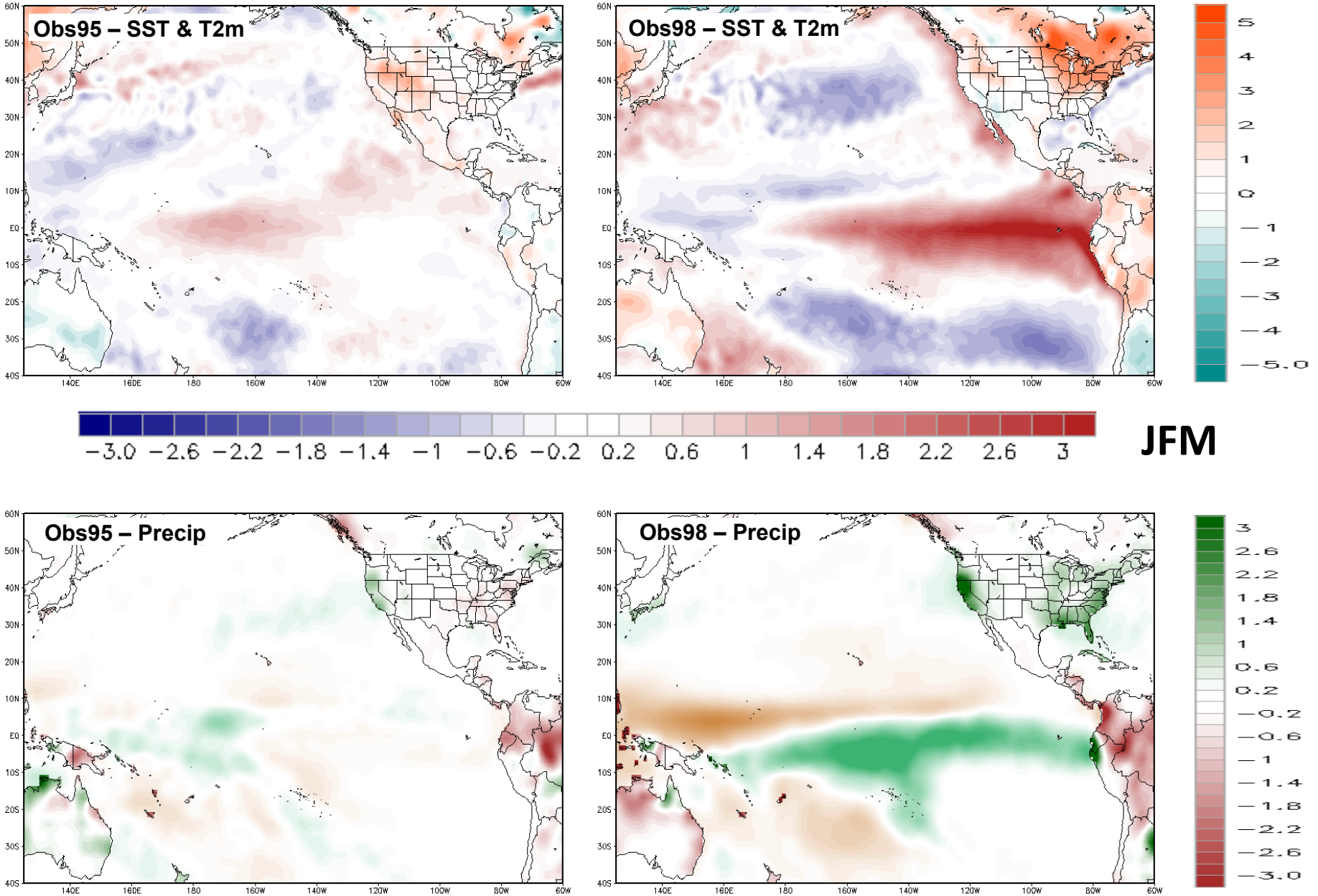
Observational Estimate Precip CP-EP

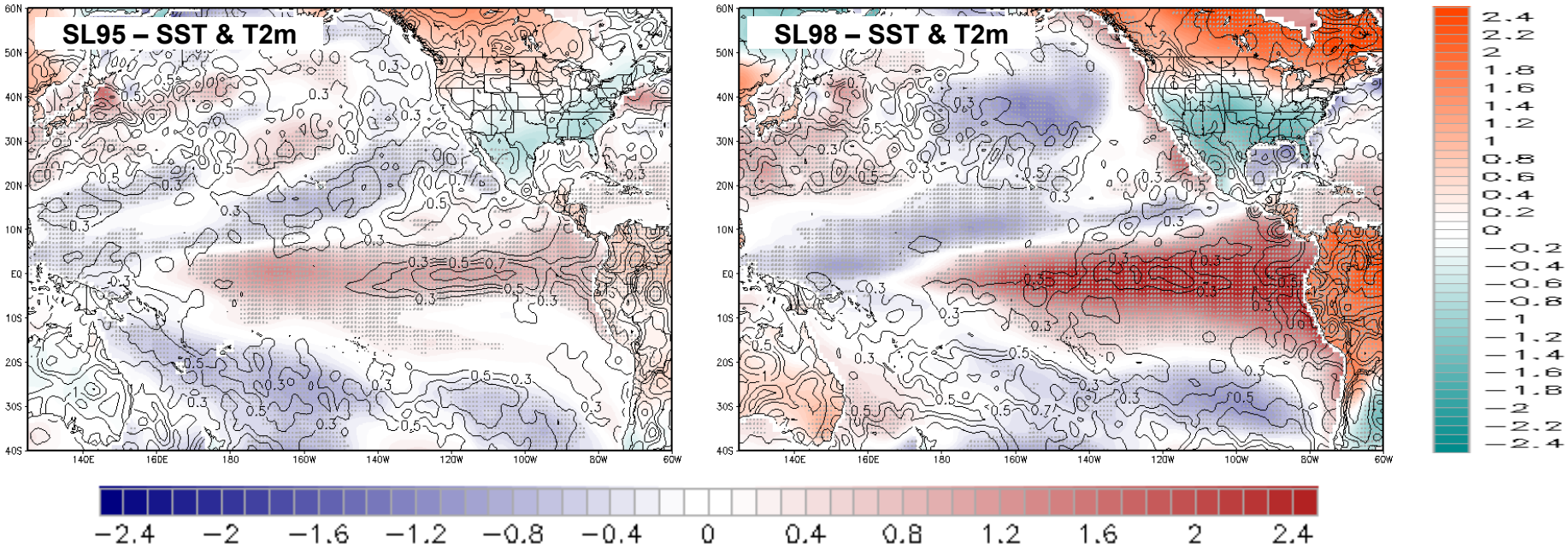


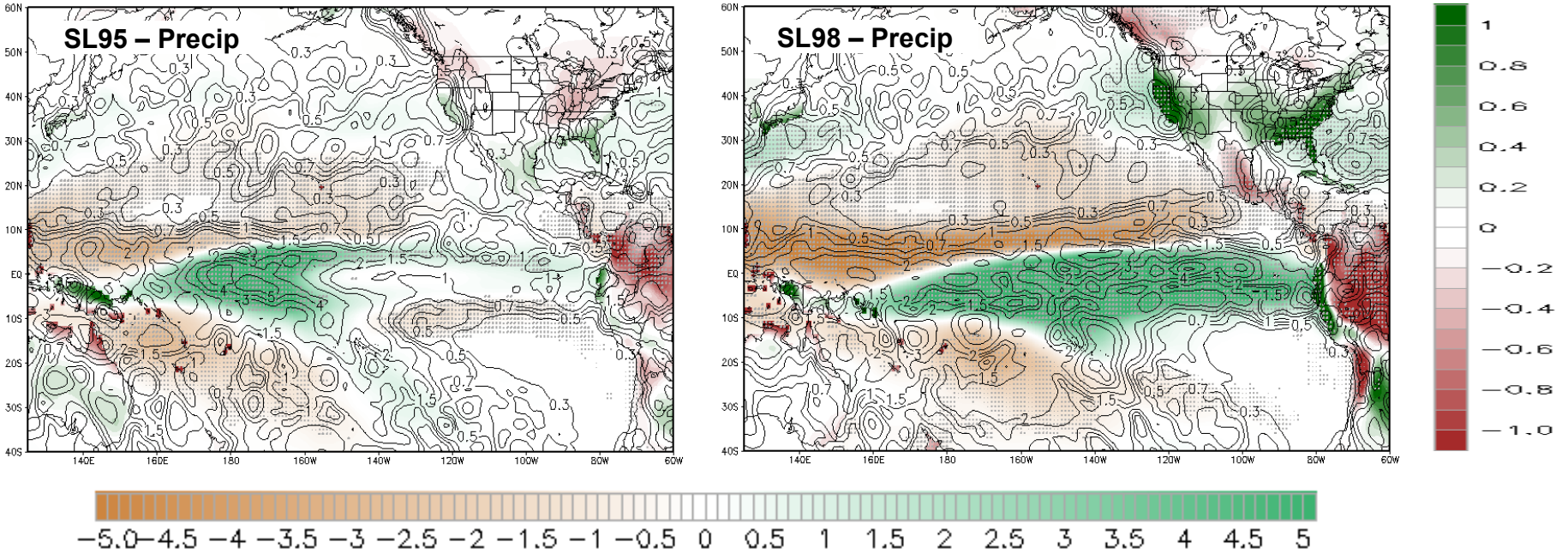
JFM Verification Time

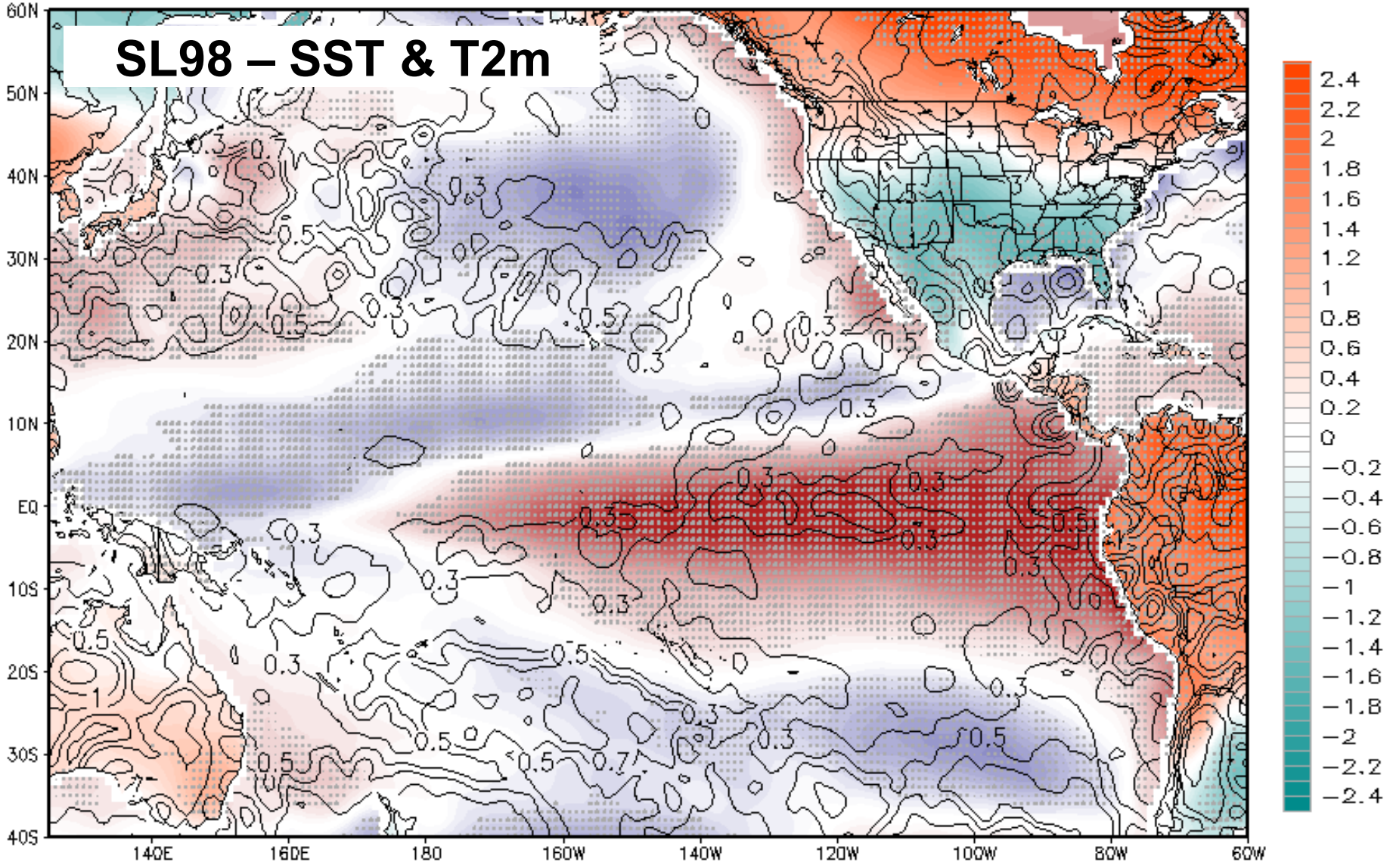


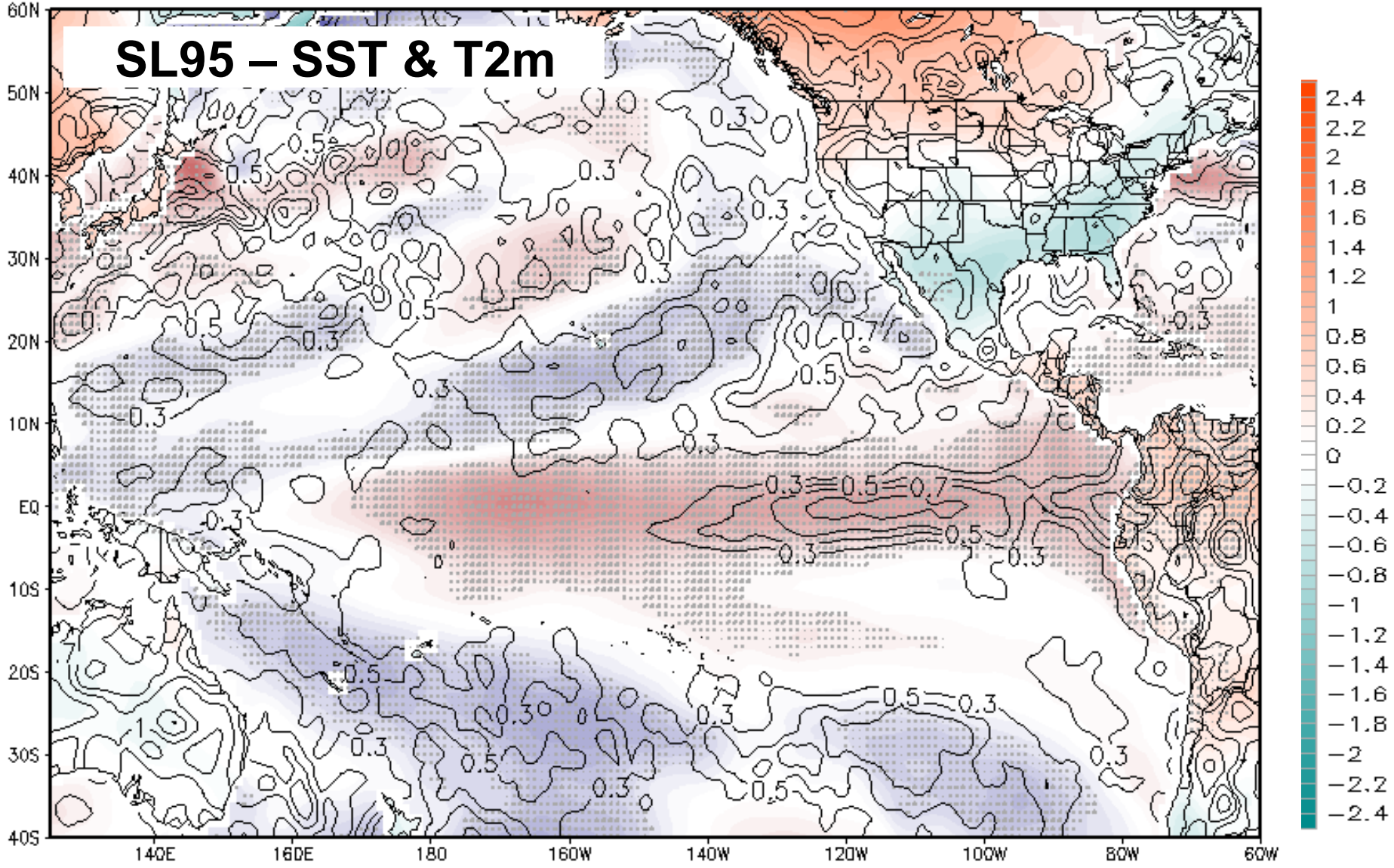


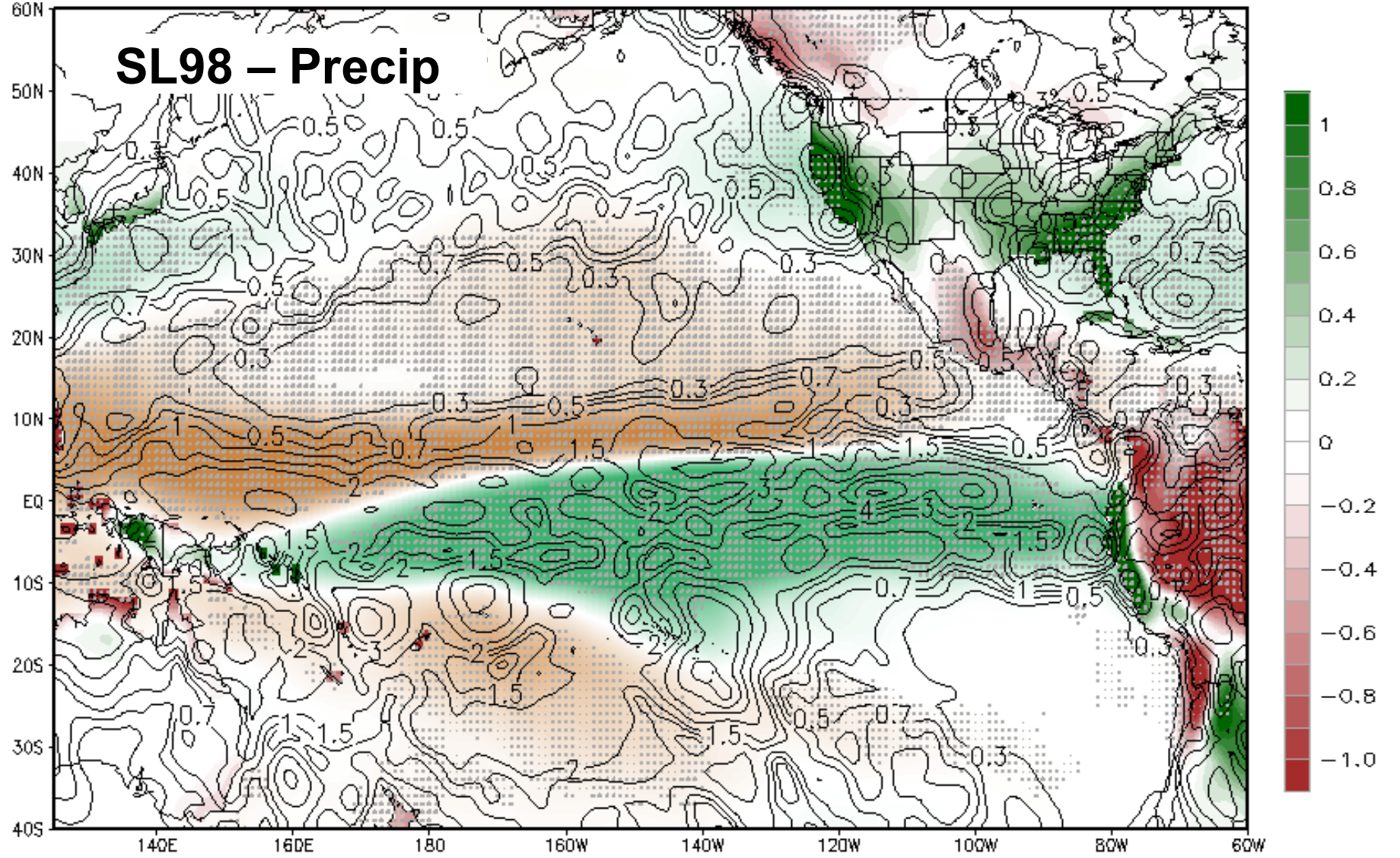

Obs95 – SST & T2m
Obs98 – SST & T2m
5
4
3
2
1
0
−1
−2
−3
−4
−5.0
−3.0 −2.6 −2.2 −1.8 −1.4 −1 −0.6 −0.2 0.2 0.6 1 1.4 1.8 2.2 2.6 3
JFM
Obs95 – Precip
Obs98 – Precip
3
2.6
2.2
1.8
1.4
1
0.6
0.2
−0.2
−0.6
−1
−1.4
−1.8
−2.2
−2.6
−3.0
−10.0 −9 −8 −7 −6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6 7 8 9 10

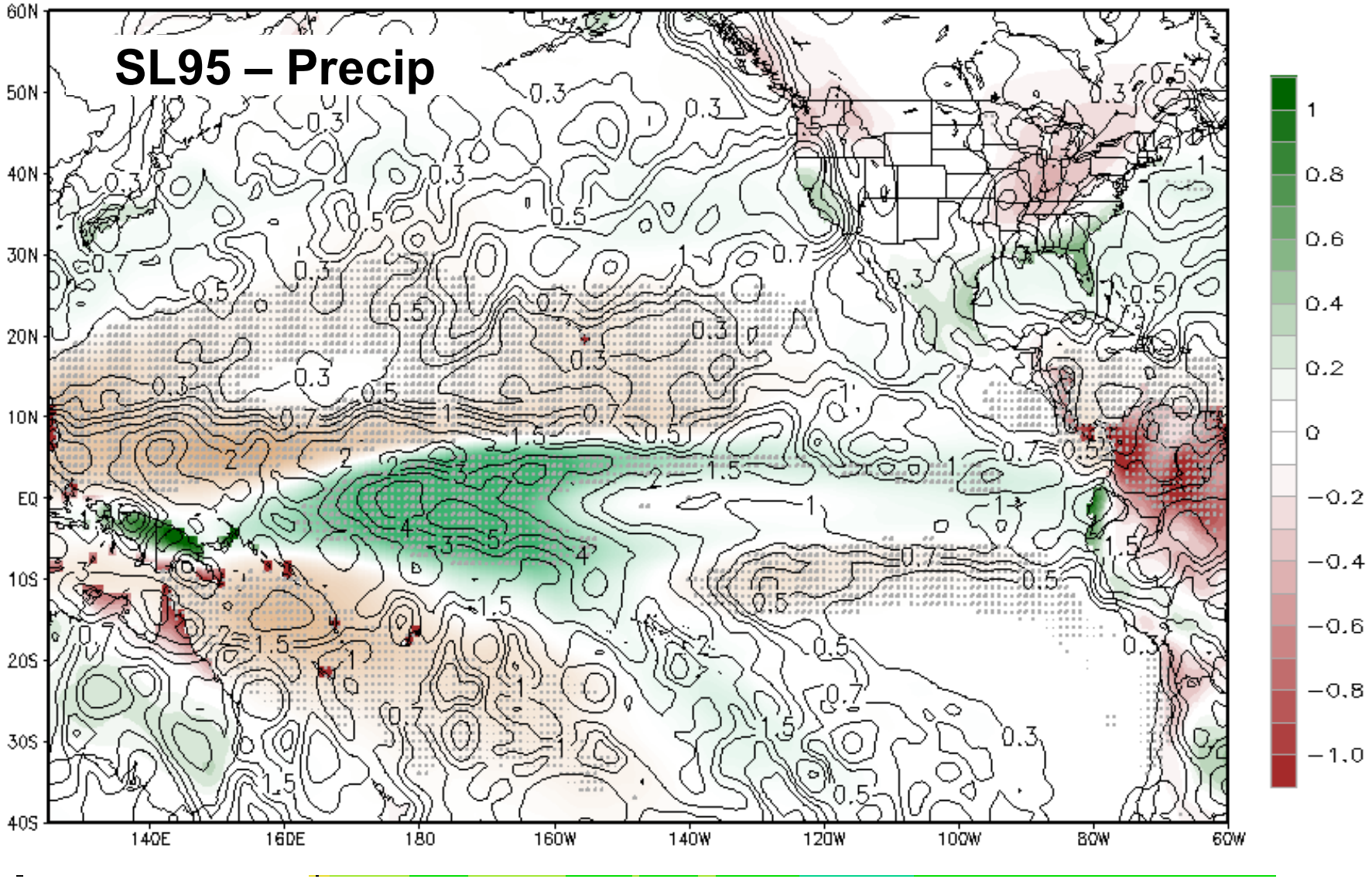

SL95 – SST & T2m
SL98 – SST & T2m
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
−1.8
−2
−2.2
−2.4
−2.4 −2 −1.6 −1.2 −0.8 −0.4 0 0.4 0.8 1.2 1.6 2 2.4

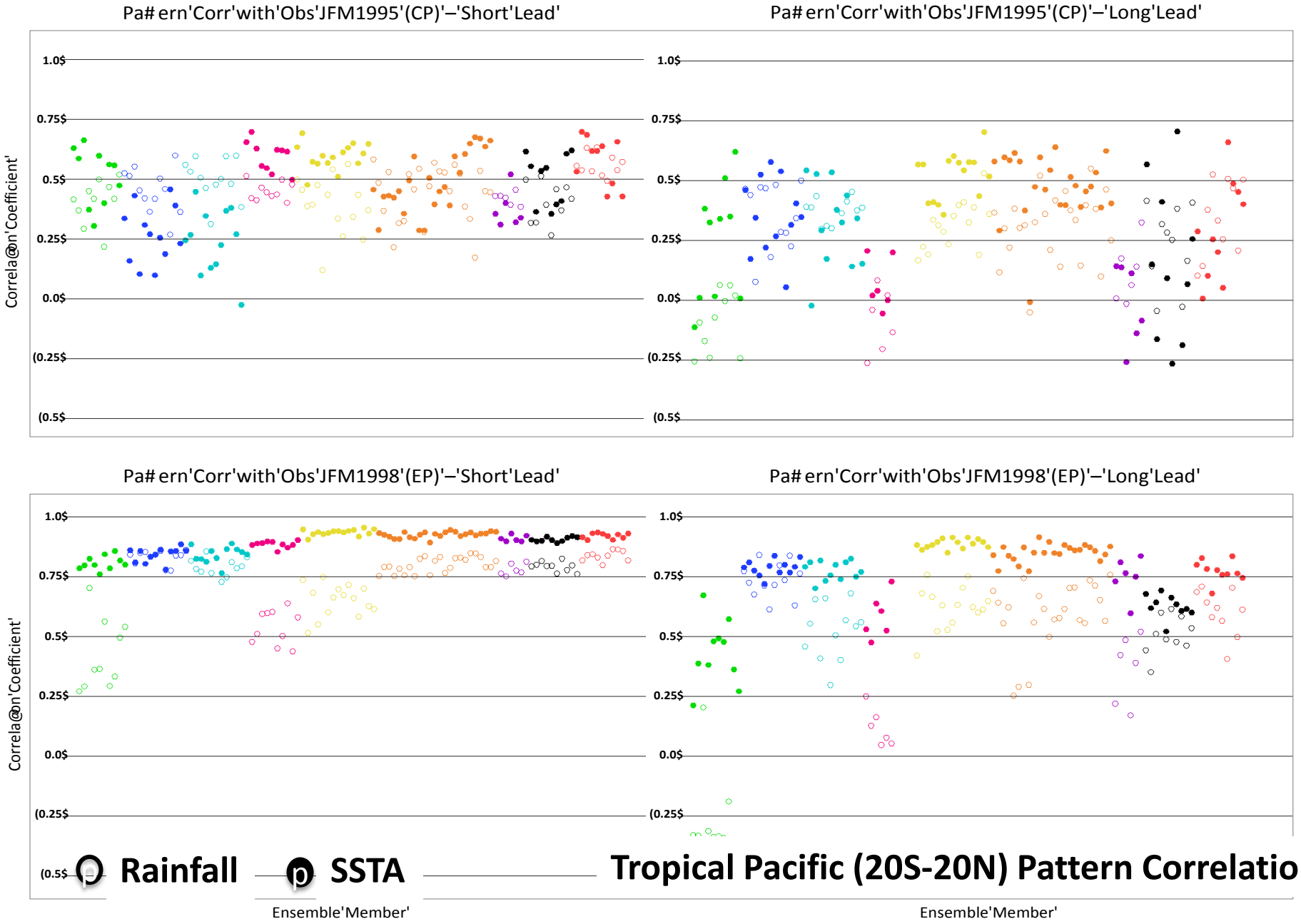

SL95 – Precip
SL98 – Precip
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1.0
−5.0 −4.5 −4 −3.5 −3 −2.5 −2 −1.5 −1 −0.5 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5

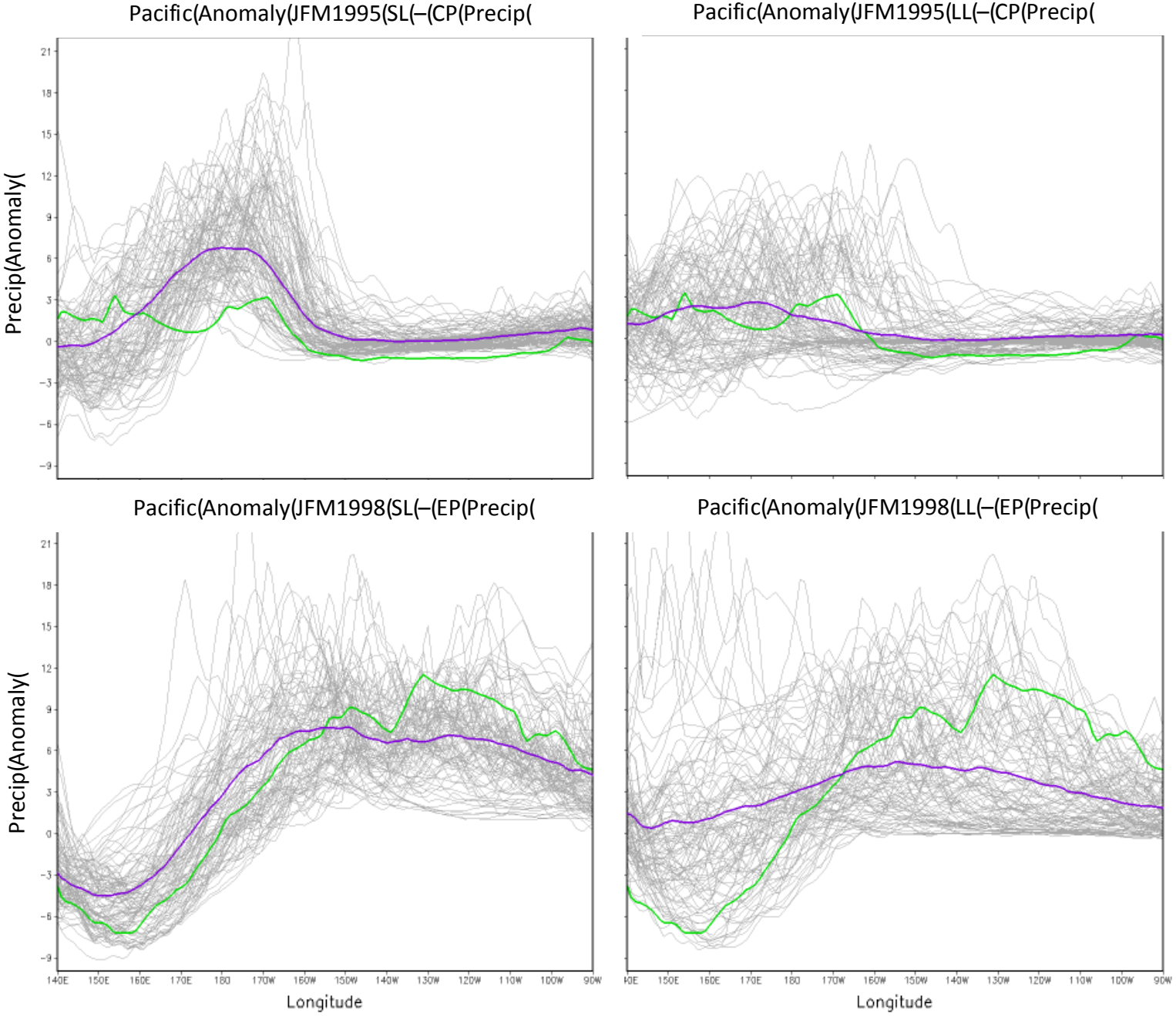

SL98 – SST & T2m
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
−1.8
−2
−2.2
−2.4

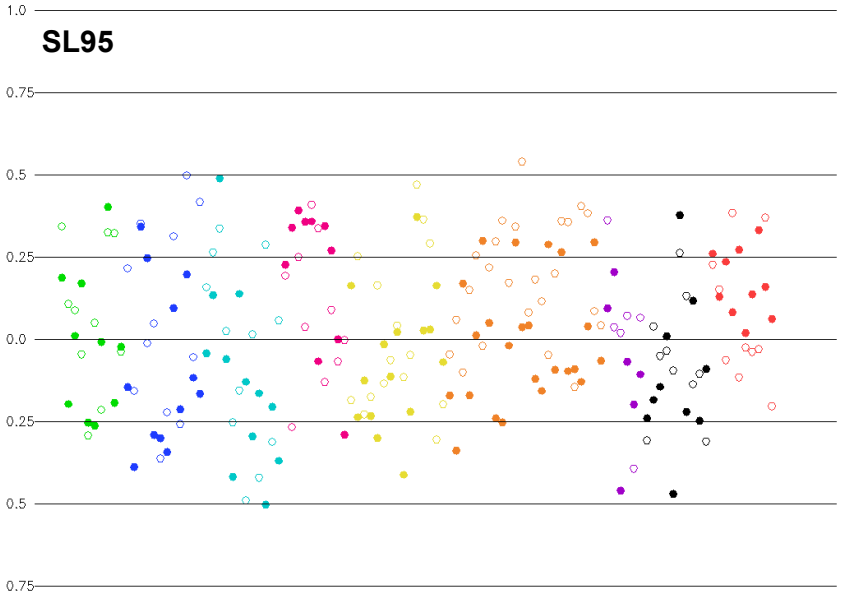

SL95 – SST & T2m
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
−1.8
−2
−2.2
−2.4

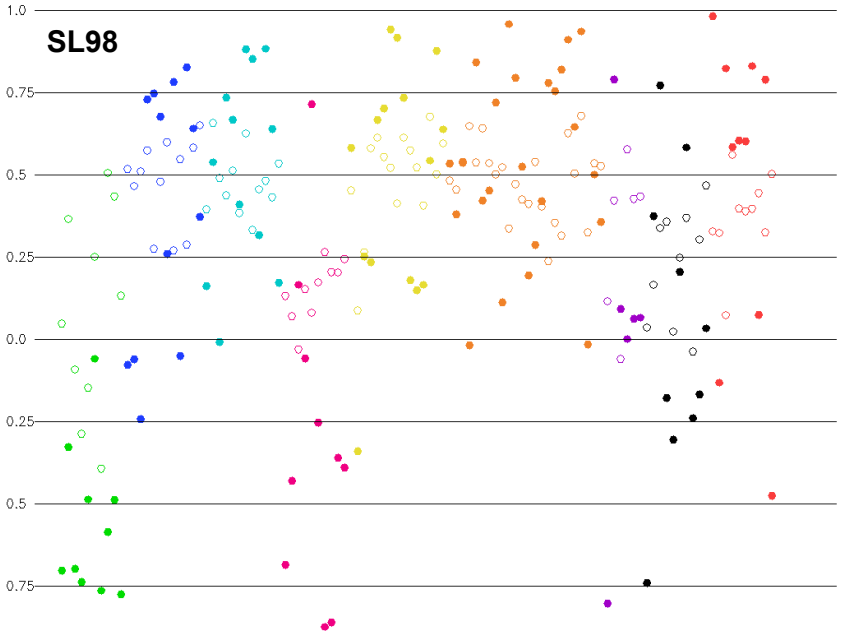

SL98 – Precip
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1.0


SL95 – Precip
60N
50N
40N
30N
20N
10N
EQ
10S
20S
30S
40S
140E
160E
180
160W
140W
120W
100W
80W
60W
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1.0


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$
Rainfall
SSTA
Tropical Pacific (20S-20N) Pattern Correlation
Ensemble'Member'

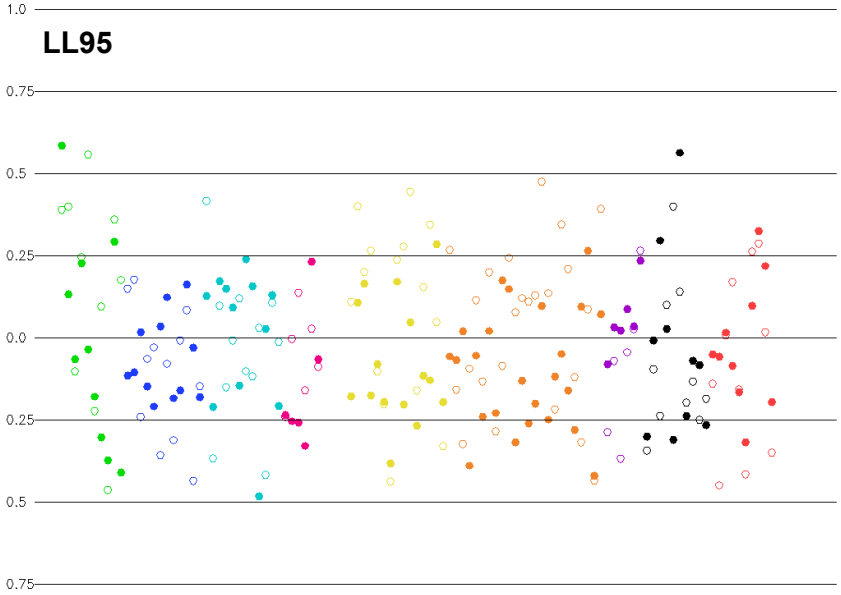

Pacific(Anomaly(JFM1995(SL(–(CP(Precip(
Pacific(Anomaly(JFM1995(LL(–(CP(Precip(
Pacific(Anomaly(JFM1998(SL(–(EP(Precip(
Pacific(Anomaly(JFM1998(LL(–(EP(Precip(
Precip(Anomaly(
Precip(Anomaly(
21
18
15
12
9
6
3
0
−3
−6
−9
140E
150E
160E
170E
180
170W
160W
150W
140W
130W
120W
110W
100W
90W
Longitude
Longitude

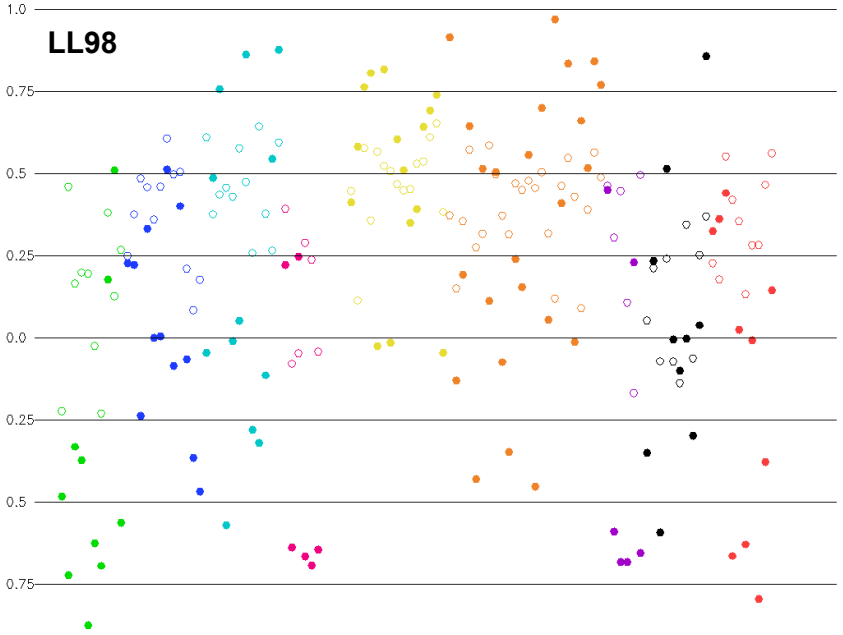




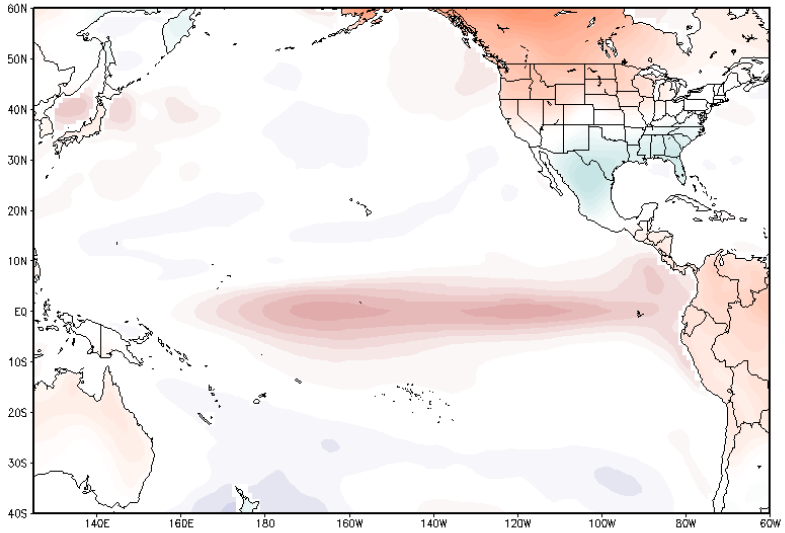
Rainfall T2m

North American Land Pattern Correlation

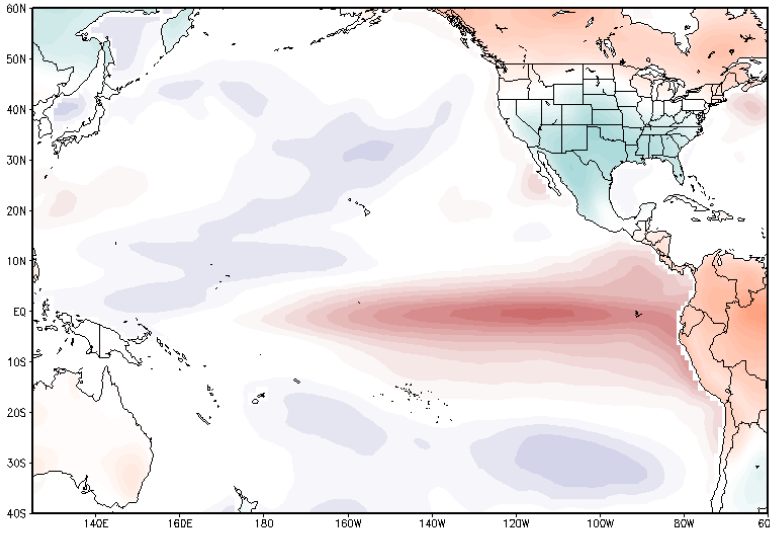


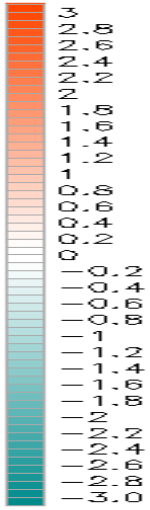


CP NMME SST and Tair SL

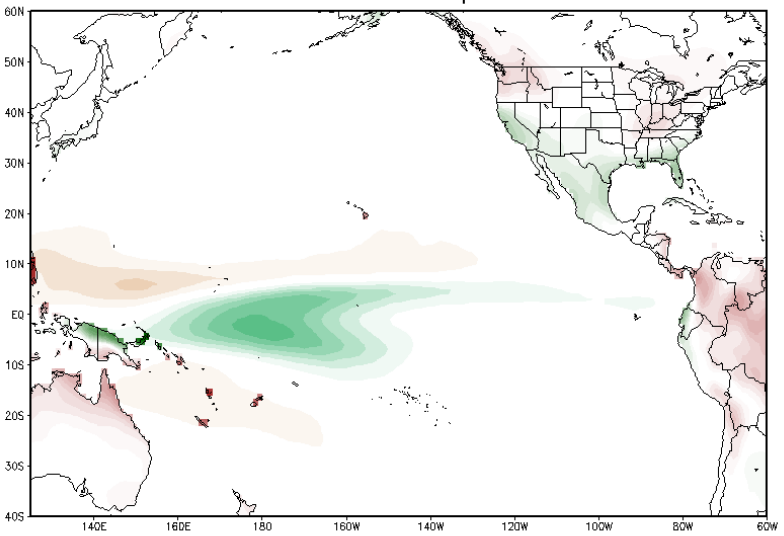


EP NMME SST and Tair SL

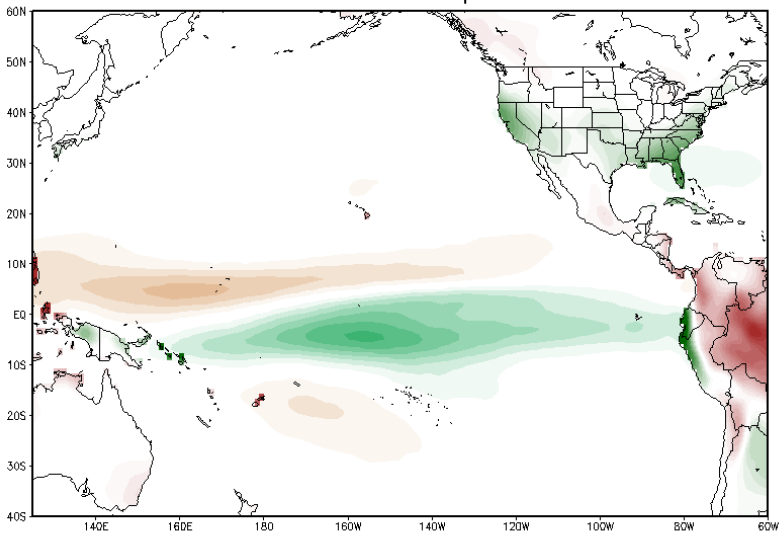


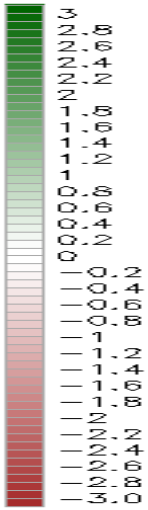


CP NMME Precip SL

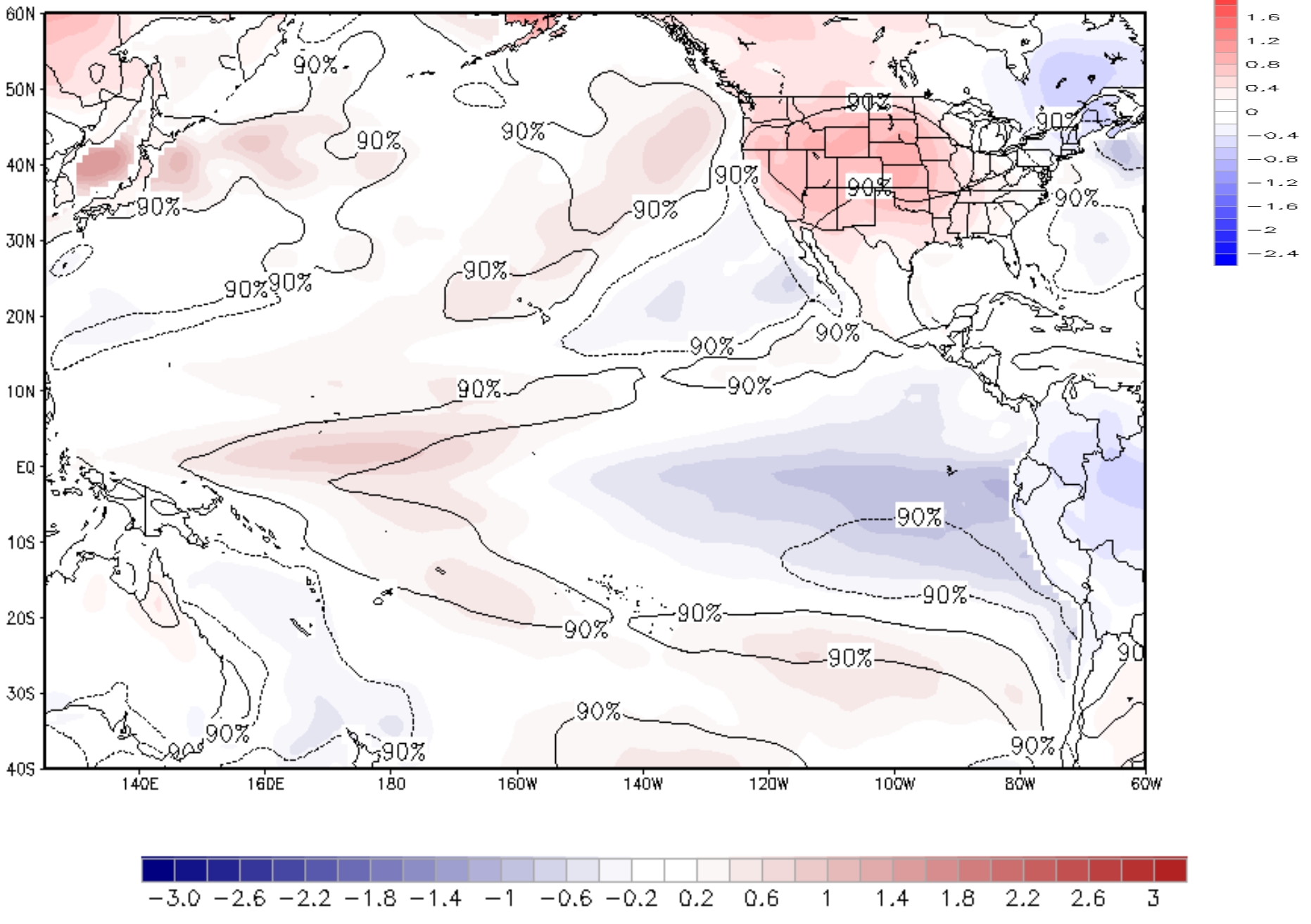


EP NMME Precip SL

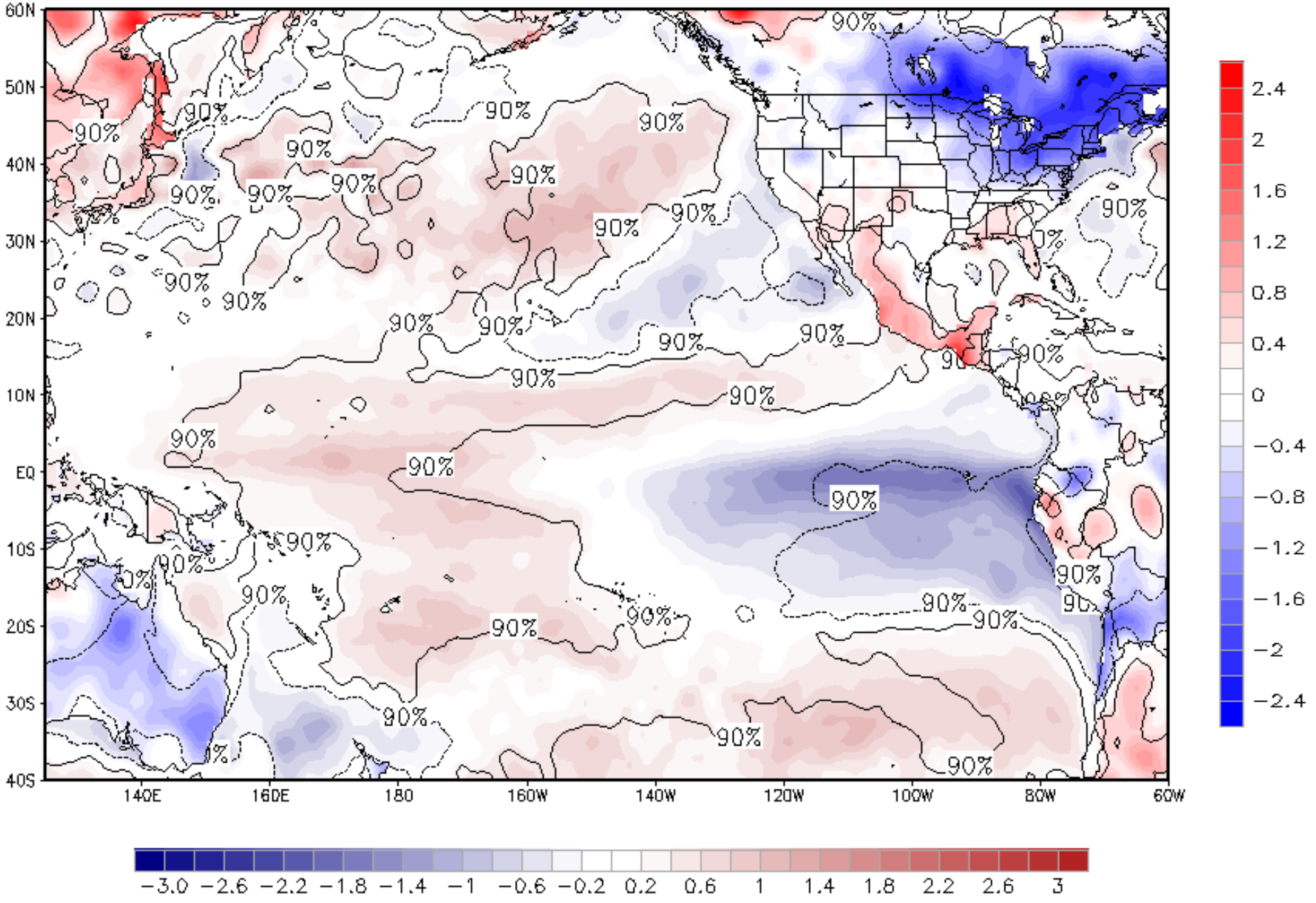




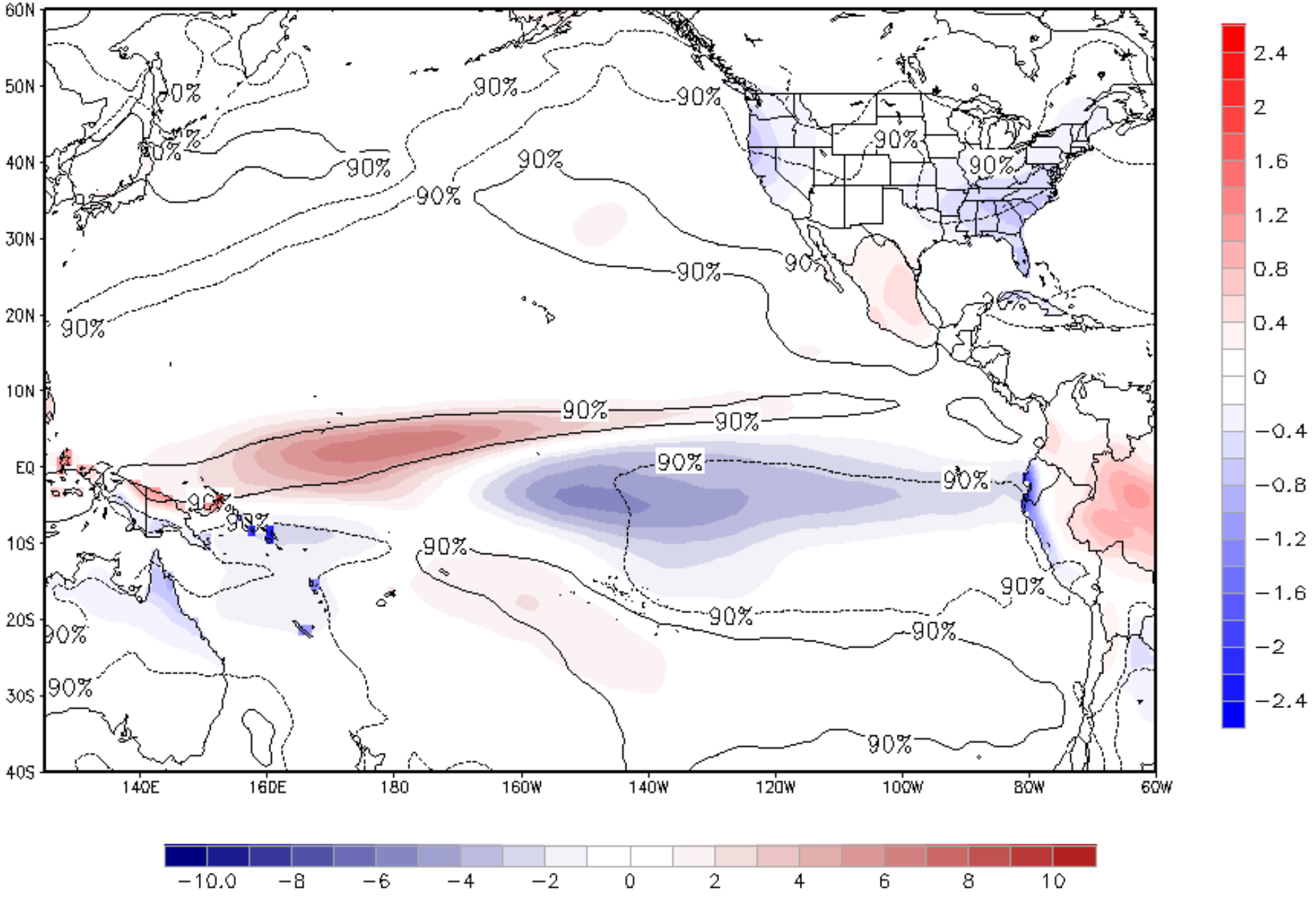
SL CP-EP NMME SST and T2m



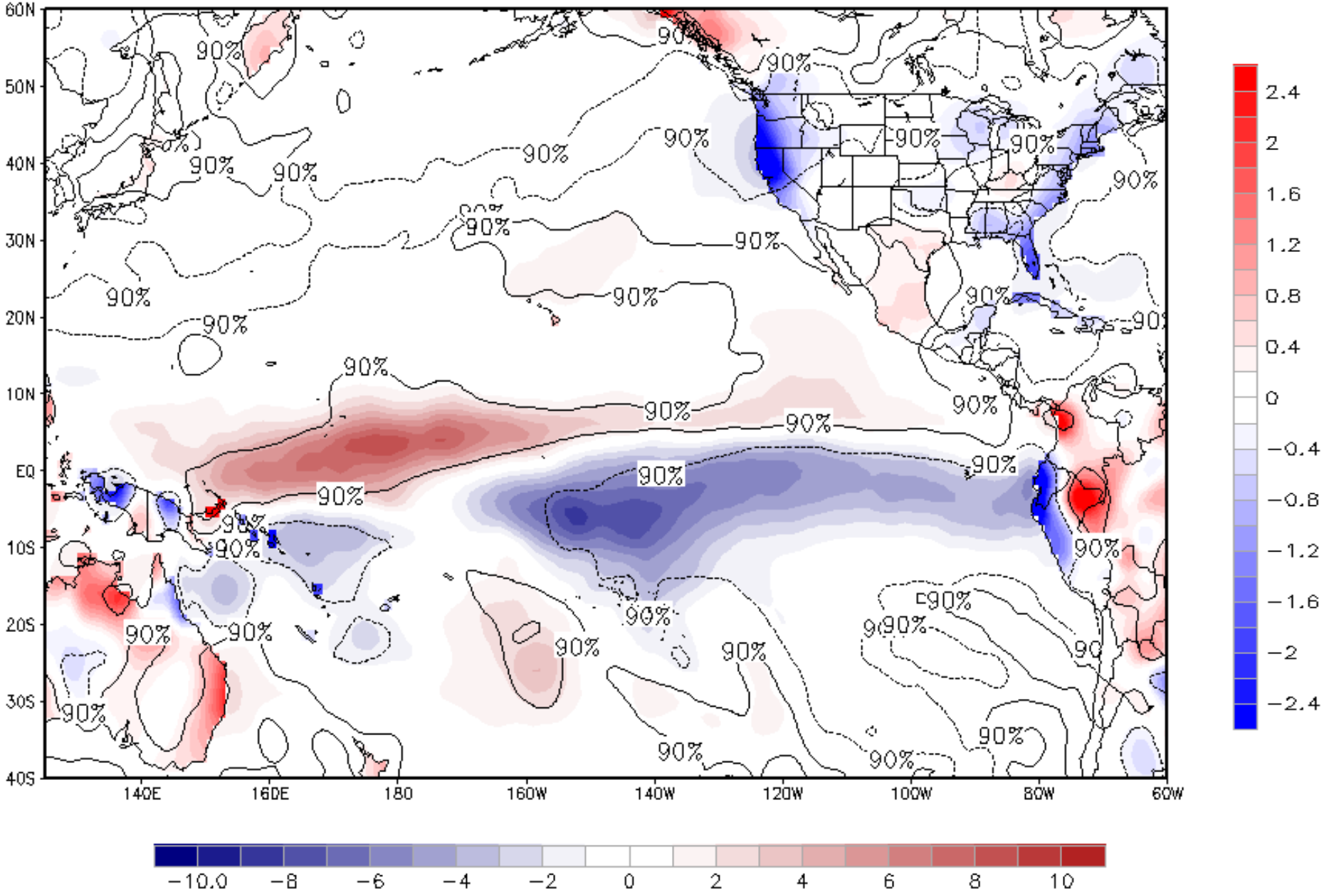
Observational Estimate SST, T2m CP-EP



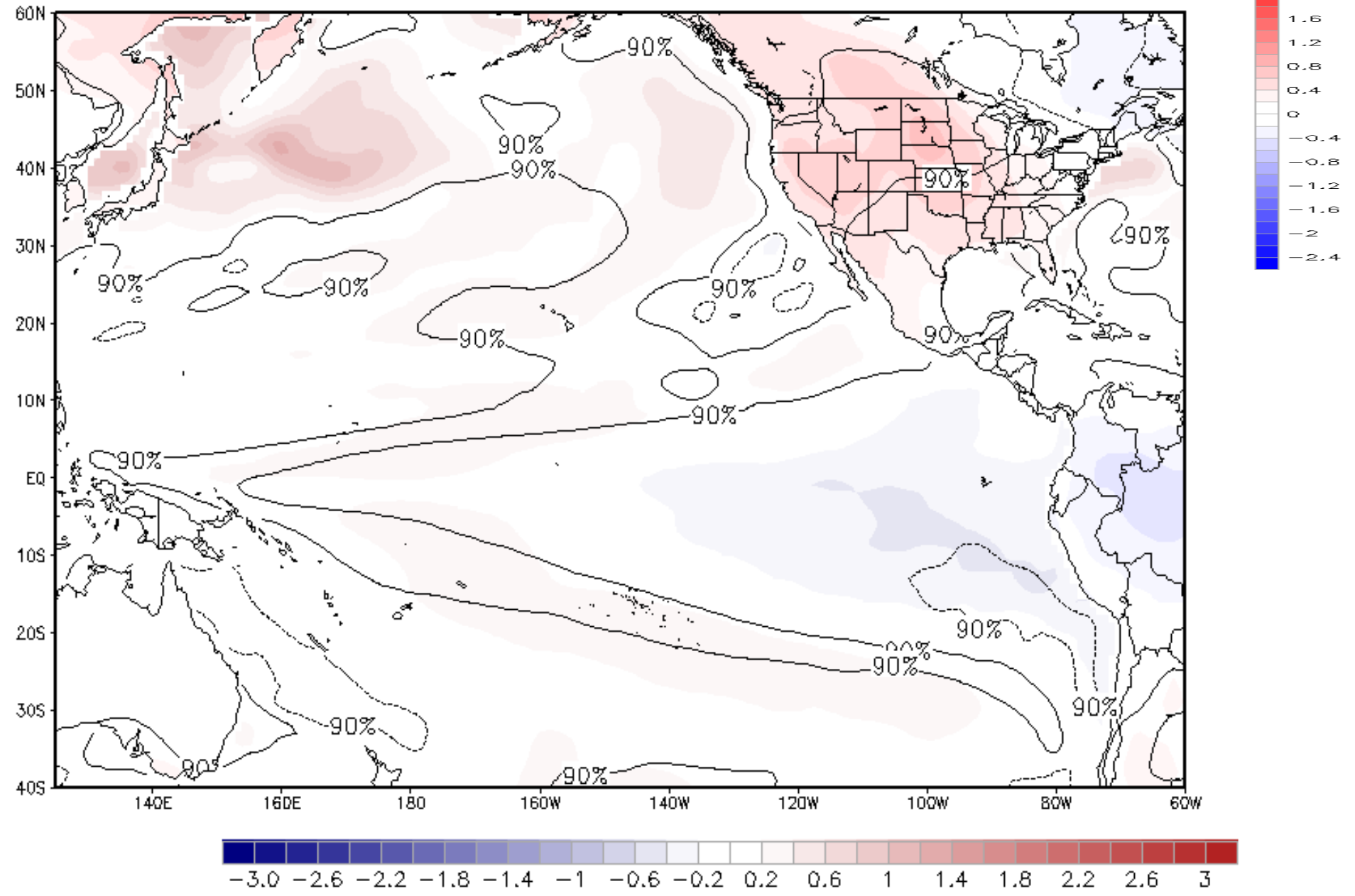
SL CP-EP NMME Precipitation



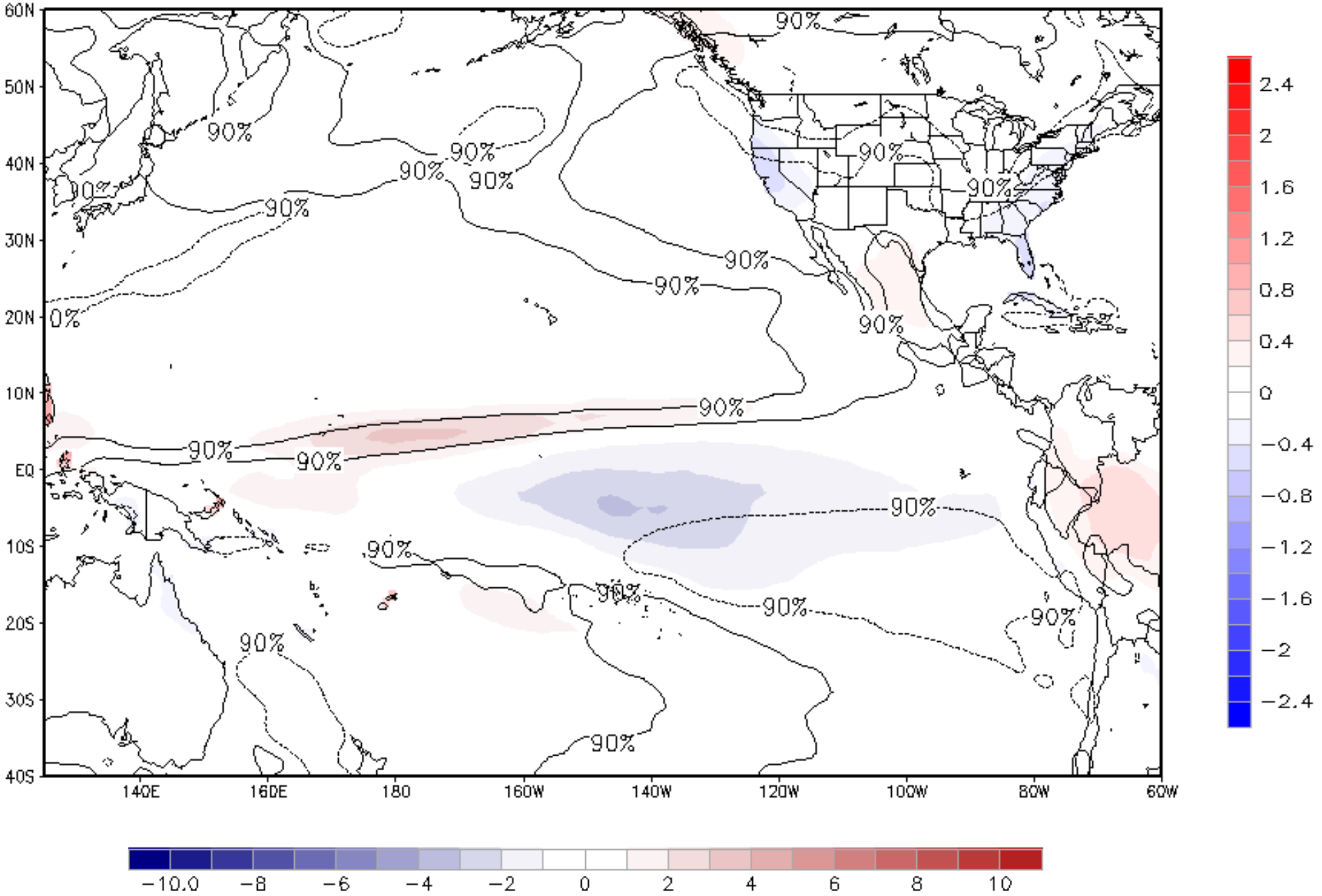
Observational Estimate Precip CP-EP



LL CP-EP NMME Precipition



LL CP-EP NMME Precipitation



Concluding Remarks

- **Tropical Pacific Sector**
  - **SST - EP Better Predicted; CP Warms to Rapidly**
  - **Precipitation Contrast “Captured”**
- **Teleconnections over North America**
  - **EP (Precip., T2m) Better Predicted**
  - **Contrast (CP-EP) Rainfall Difference “Captured”**
  - **CP-EP T2m Difference Not Captured**