



Summer-Season Forecast Experiments with Upgrades in the Land Component of the NCEP Coupled Forecast System (CFS)

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EMC/NCEP/NWS

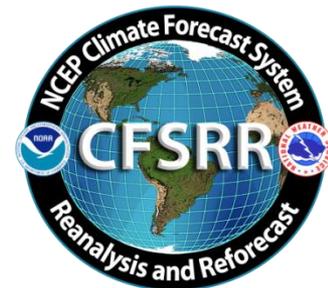
5830 University Research Court

College Park, MD 20740, USA

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College Park, Maryland



Objectives

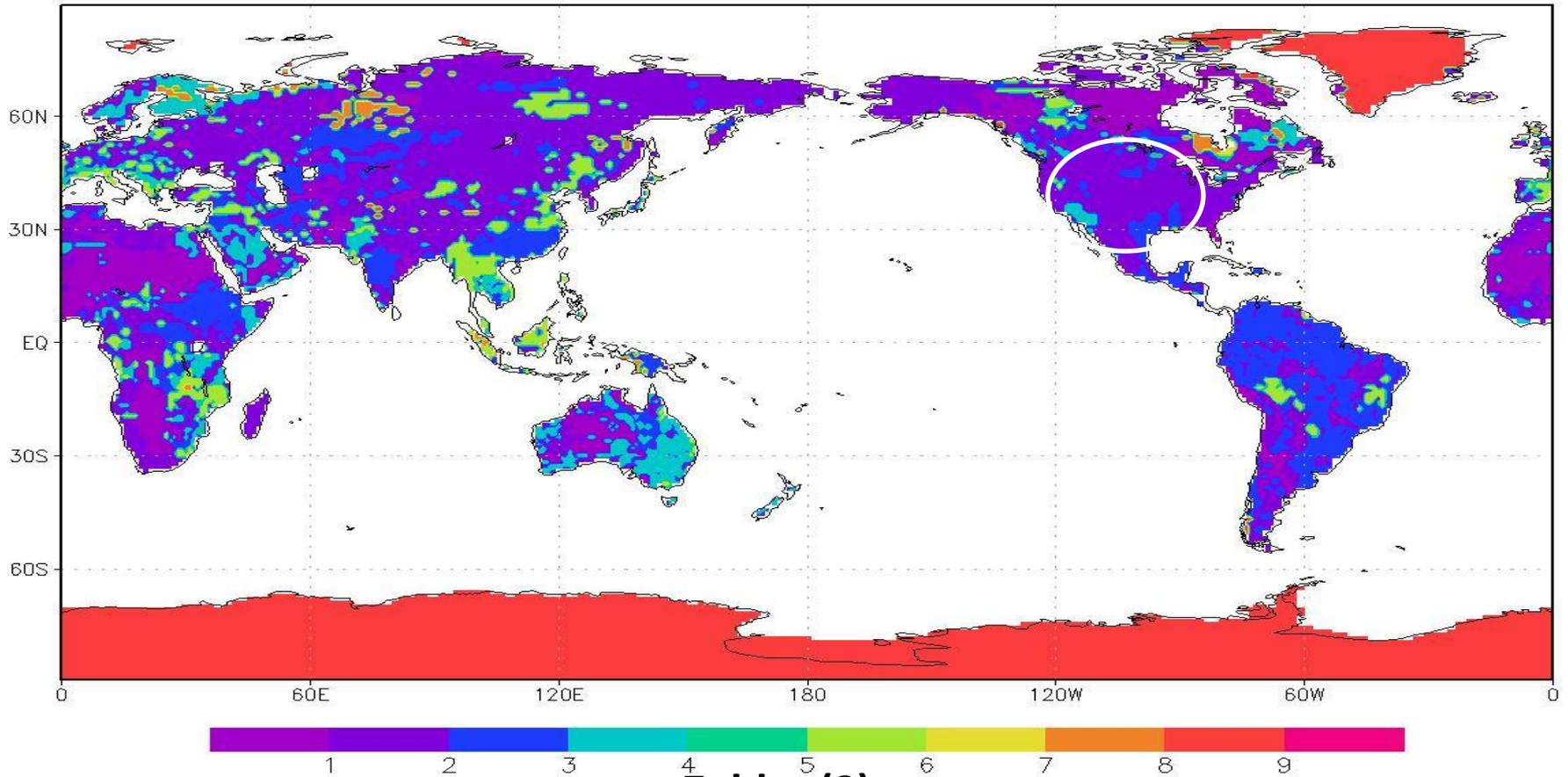
- Use the latest land model [Noah3.4.1](#) in the current operational GFS (replacing [Noah 2.7.1](#))
- Use more recent land use datasets in the experimental CFS ([Statsgo](#) and [Modis/IGBP](#))
- Compare the CFS experiments as one part of the efforts on porting Noah-Multiple Parameterization ([Noah-MP](#)) to the future CFS.

Noah 3.4.1 vs Noah 2.7.1

has improved treatments on

- Saturation slope
- Background albedo
- Emissivity
- Roughness length
- Snow albedo, and
- Potential evapotranspiration
- New fixed fields (soil and vegetation)

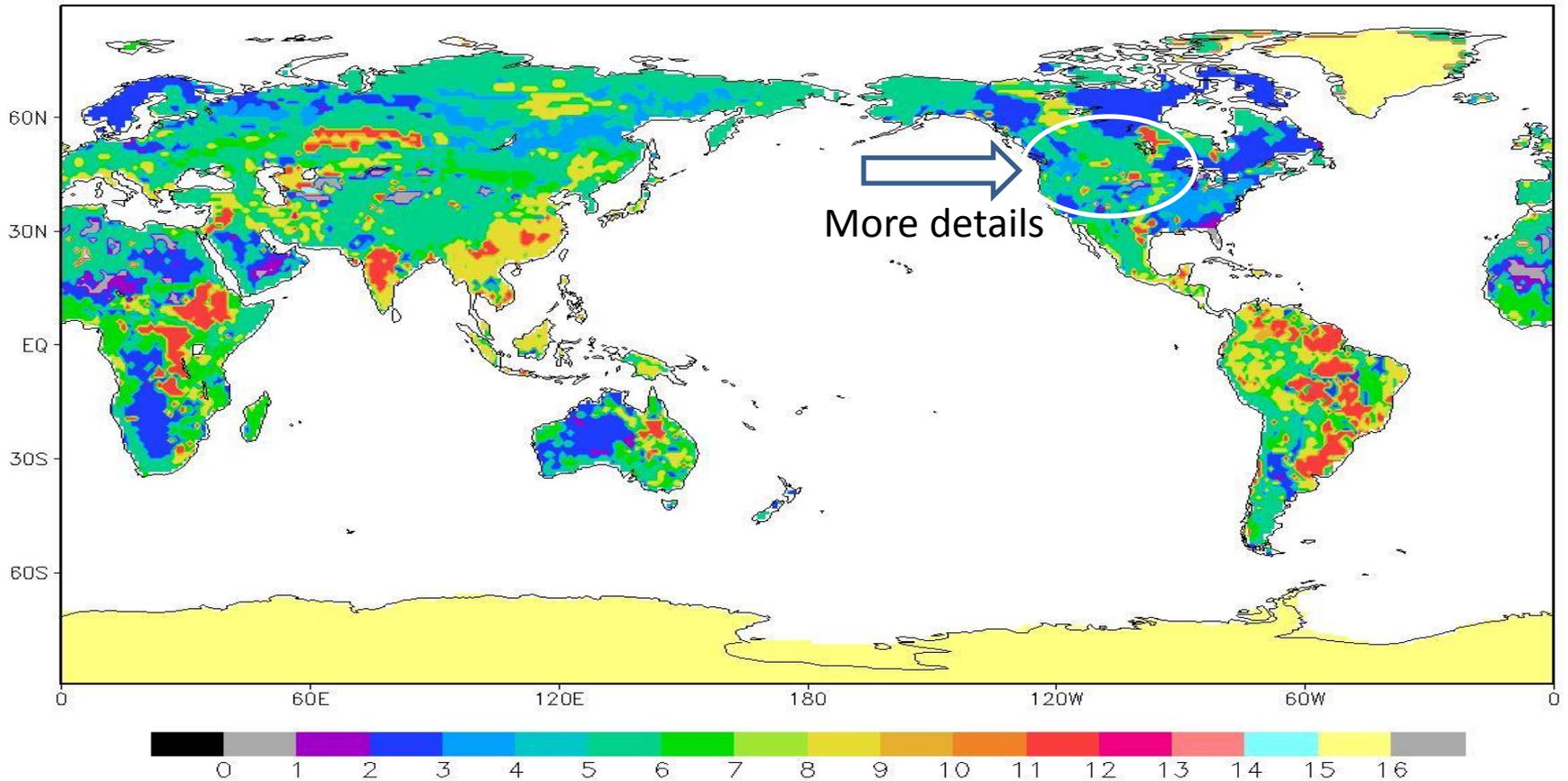
Old Soil



Zobler (9)

- | | | |
|---------------------------|-----------------------------|------------------------------------|
| 1. coarse loamy sand | 4. coarse-medium sandy loam | 7. coarse-med-fine sandy clay loam |
| 2. medium silty clay loam | 5. coarse-fine sandy clay | 8. organic loam |
| 3. fine light clay | 6. medium-fine clay loam | 9. glacial land ice loamy sand |

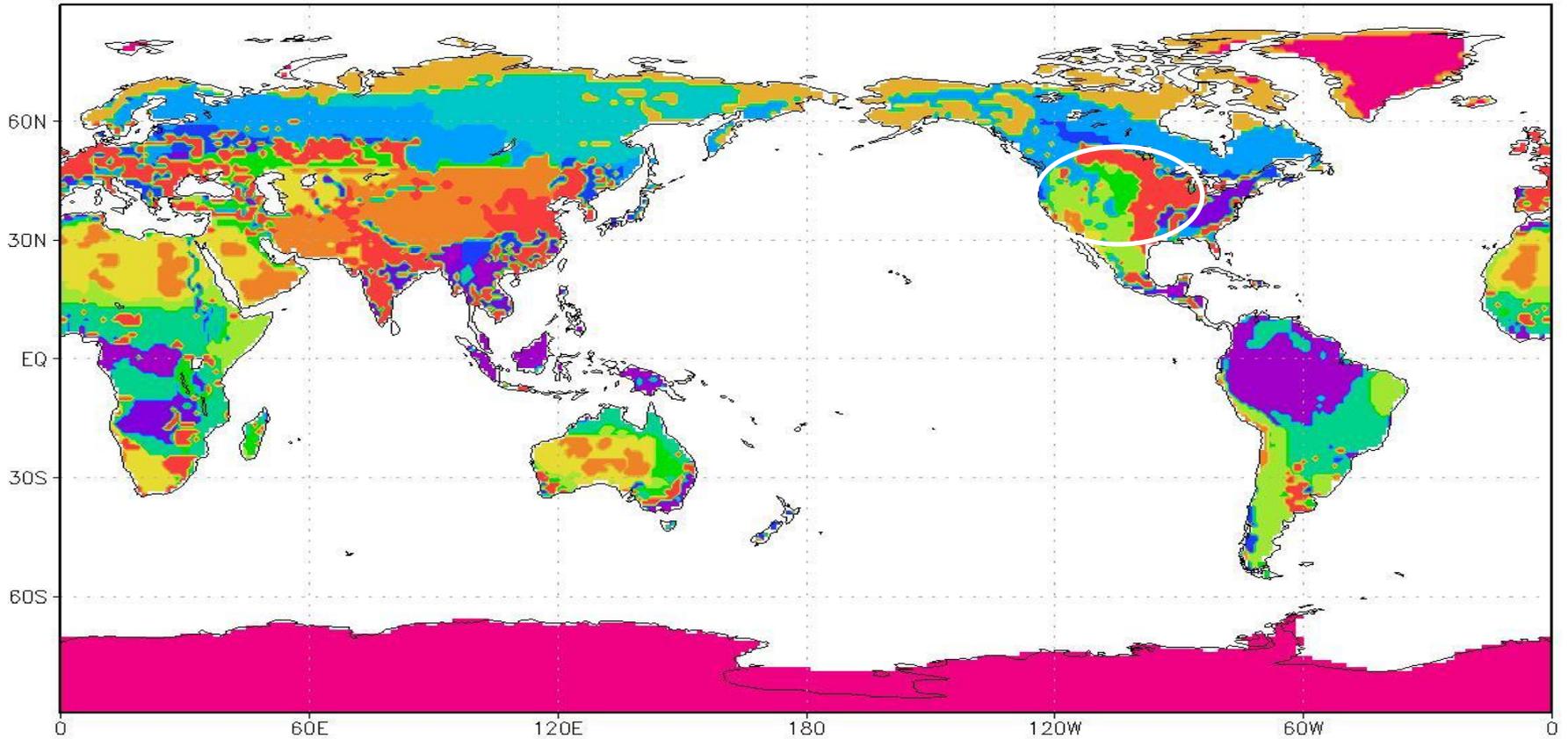
New Soil



Statsgo (16)

- | | | | |
|----------------------|----------------|--------------------|---------------------|
| 1. SAND | 2. LOAMY SAND | 3. SANDY LOAM | 4. SILT |
| 5. SILT | 6. LOAM | 7. SANDY CLAY LOAM | 8. SILTY CLAY LOAM |
| 9. CLAY LOAM | 10. SANDY CLAY | 11. SILTY CLAY | 12. CLAY |
| 13. ORGANIC MATERIAL | 14. WATER | 15. BEDROCK | 16. OTHER(land-ice) |

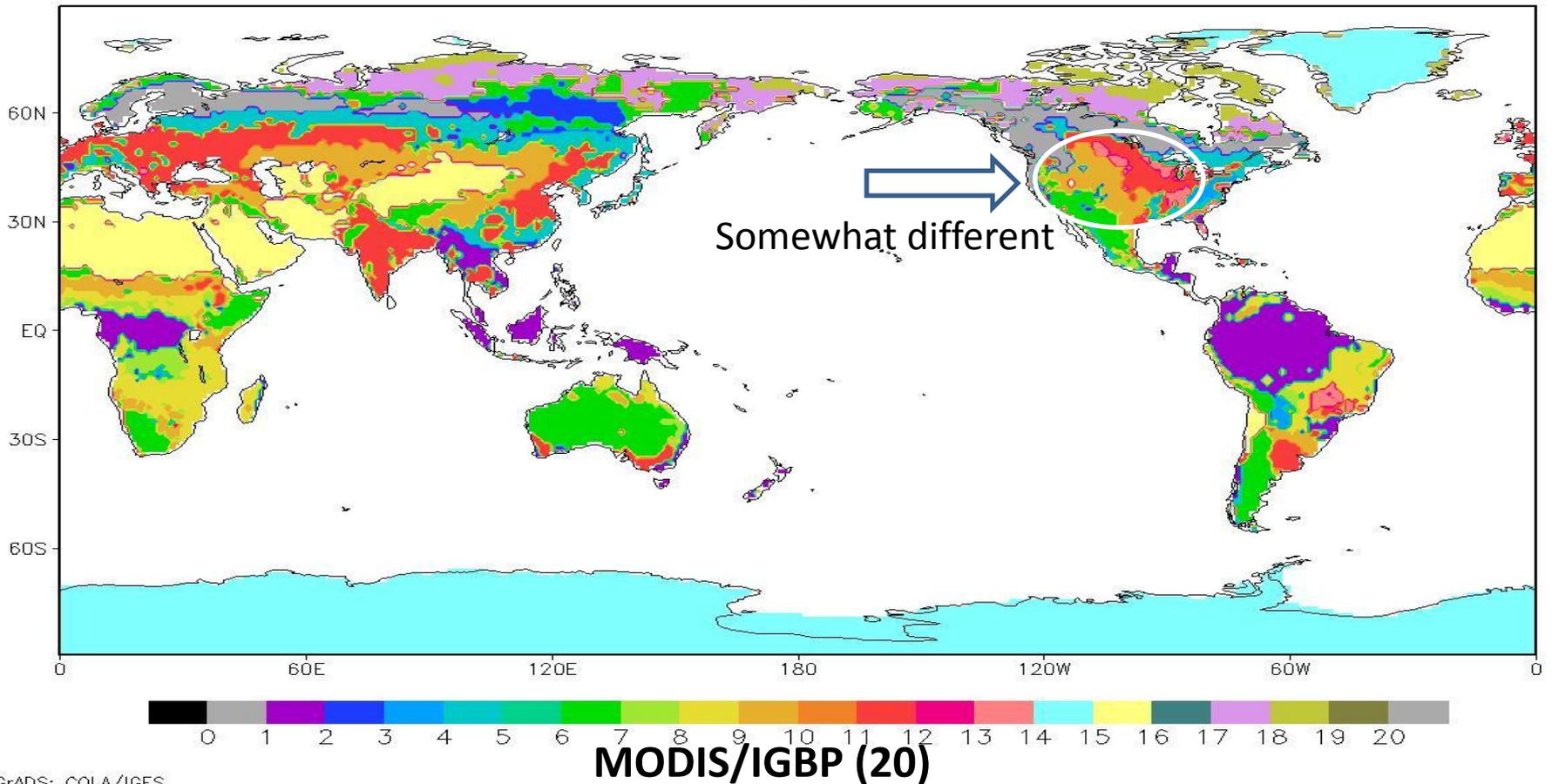
Old Veg



Ssib (13)

- | | | |
|-----------------------------------|--|--|
| 1: broadleaf-evergreen trees | 5: needleleaf-deciduous trees (larch) | 9: broadleaf shrubs with bare soil |
| 2: broadleaf-deciduous trees | 6: broadleaf trees with groundcover (savanna) | 10: dwarf trees and shrubs with groundcover (tundra) |
| 3: broadleaf and needleleaf trees | 7: groundcover only (perennial) | 11: bare soil |
| 4: needleleaf-evergreen trees | 8: broadleaf shrubs with perennial groundcover | 12: cultivations (the same parameters as for type 7) |
| 13: glacial-ice | | |

New Veg



- | | | | |
|---------------------------------|-----------------------|---------------------------------------|------------------|
| 1. Evergreen Needleleaf Forest' | 7 Open Shrublands | 13 Urban and Built-Up | 19 Mixed Tundra |
| 2. Evergreen Broadleaf Forest | 8 Woody Savannas | 14 cropland/natural vegetation mosaic | 20 Barren Tundra |
| 3 Deciduous Needleleaf Forest | 9 Savannas | 15 Snow and Ice | |
| 4 Deciduous Broadleaf Forest | 10 Grasslands | 16 Barren or Sparsely Vegetated | |
| 5 Mixed Forests | 11 Permanent wetlands | 17 Water | |
| 6 Closed Shrublands | 12 Croplands | 18 Wooded Tundra | |

Experiments

Cntrl CFS : Ops GFS + Noah 2.7.1 with old veg/soil types
Exp CFS : Ops GFS + Noah 3.4.1 new veg/soil parameters

1. Use **4** ensemble members with Initial Conditions from 00z of May 1-4 over
2. Selected **9** years: 82,86,87,88,91,96,99,00,07 (MJJ, Niño 3.4)
3. Including **warm**, **cold** and **neutral** ENSO indices

- GPCP Pentad Precipitation Analysis for precipitation (Xie et al.,2003).
- GHCN/CAMS (land only) T2m Analysis for T2m (Fan and Van den Dool, 2008).
- NOAA Optimum Interpolation (OI) SST for SST (Reynolds, 1988).

Anomaly Correlation (**AC**) is used as a measure of the skills for months from May to August and June-July-August (JJA) avg for **SST, Precip and T2m**

COST: (352 CPUs) 12Hrs * 2exp * **36** membs = 864 Wall Clock Hrs (**36 days**)

SST AC (Cntrl: May-August)

May

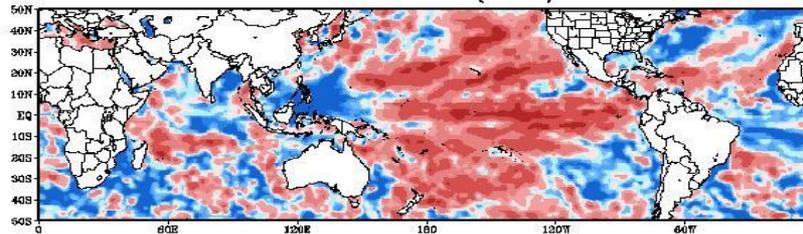
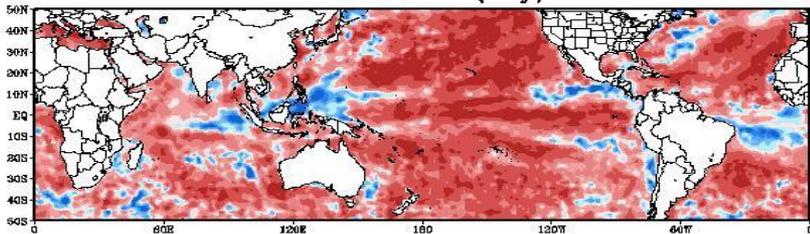
June

50N

SST AC Skill (May)

SST AC Skill (June)

50S

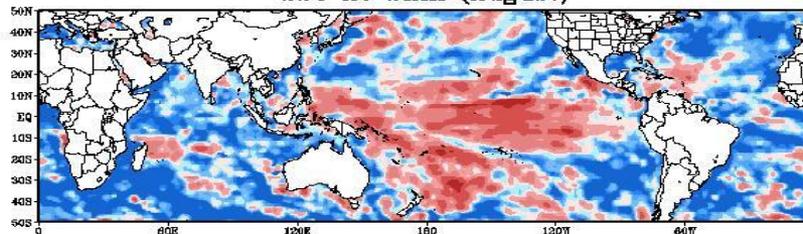
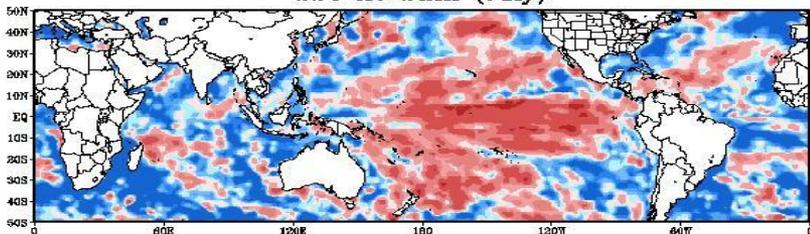


July

August

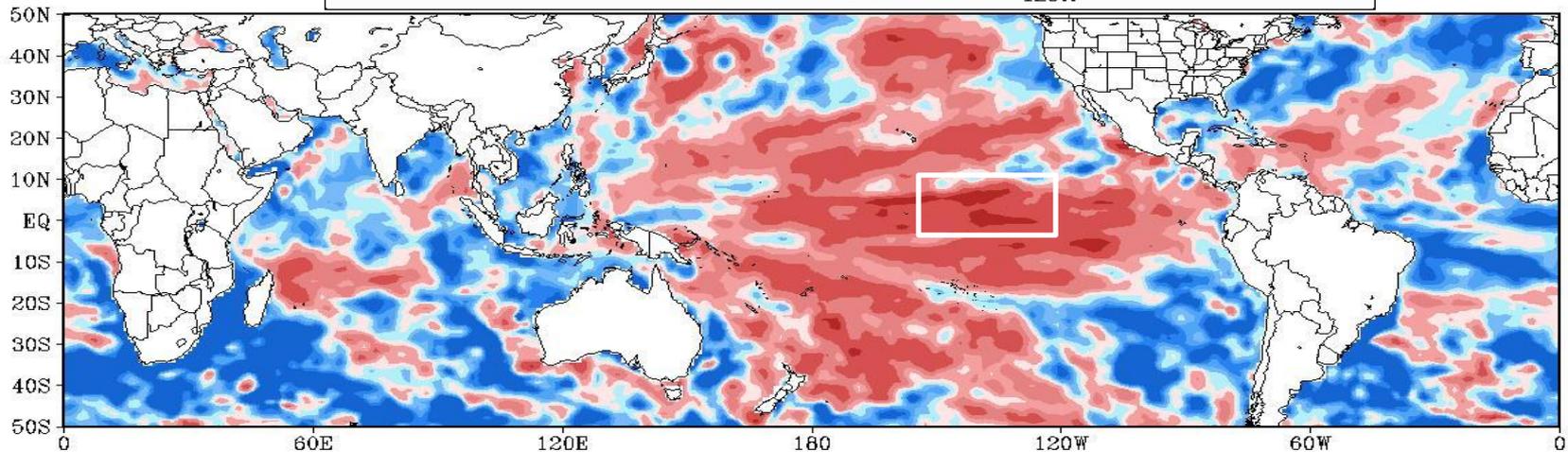
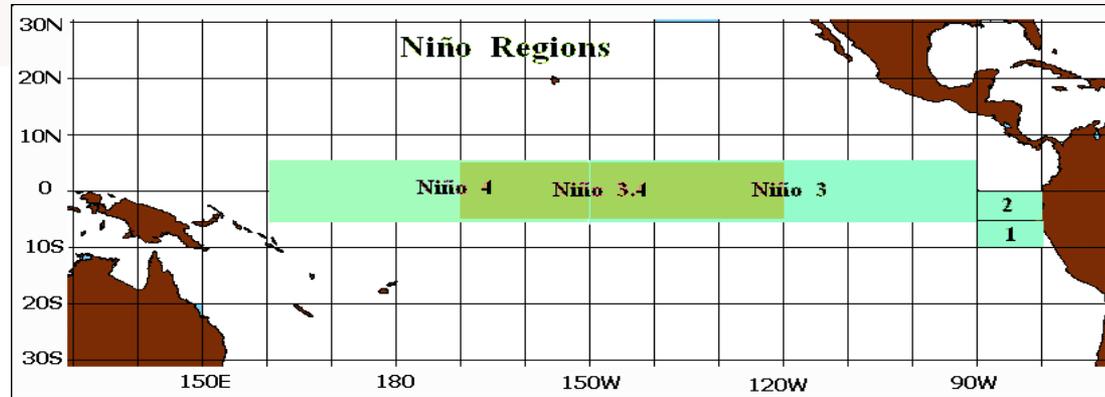
SST AC Skill (July)

SST AC Skill (August)

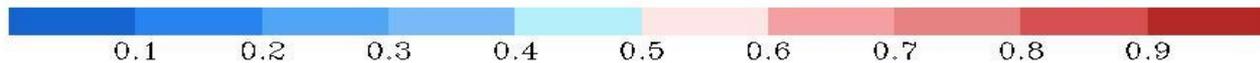


Decreases with longer lead, still maintain good skill in the eastern Pacific Ocean regions

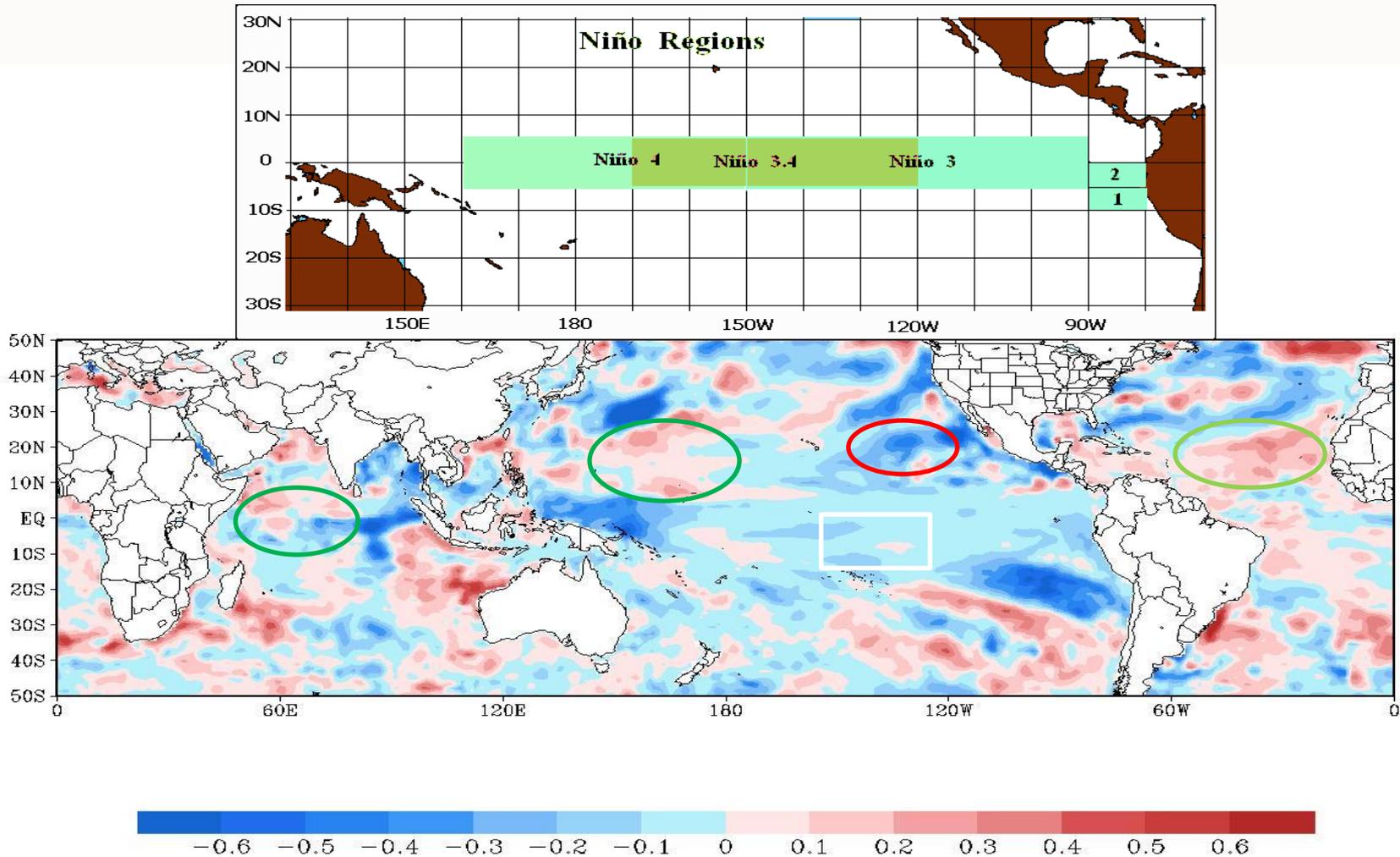
SST AC (Cntrl: JJA)



Good skill in the Niño 3.4 region



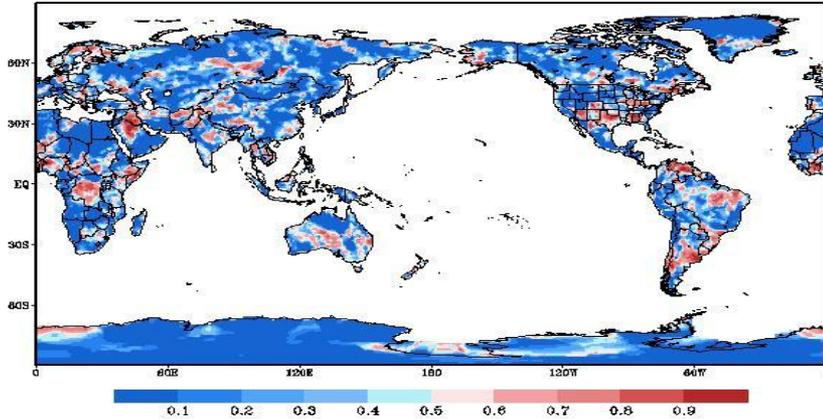
SST AC DIFF (JJA: Exp - Cntrl)



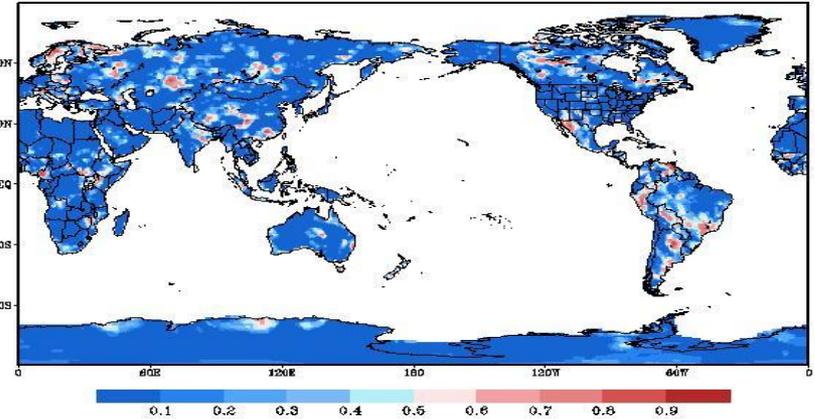
Small difference in the Niño 3.4 region
Some differences in other parts of the world

Precipitation AC (Cntrl: May-August)

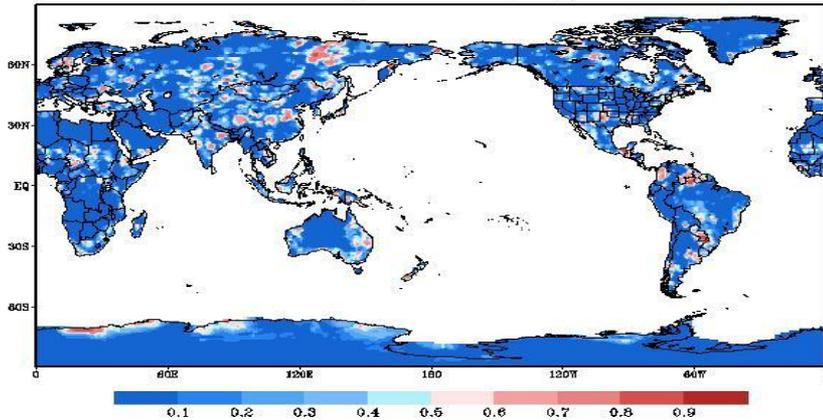
May
Precip AC Skill (May)



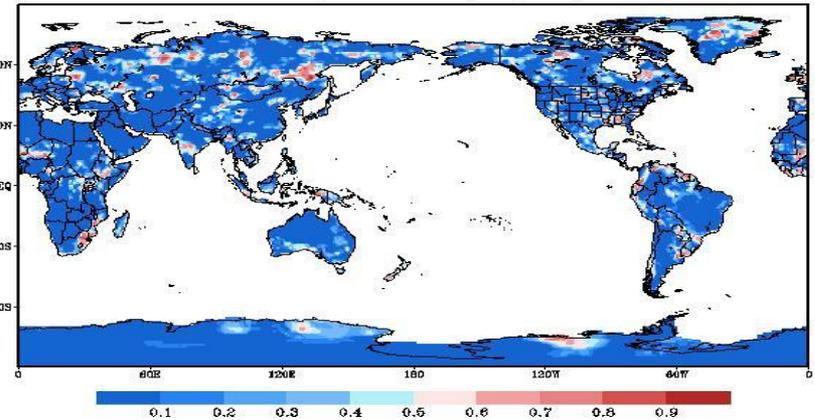
June
Precip AC Skill (June)



July
Precip AC Skill (July)



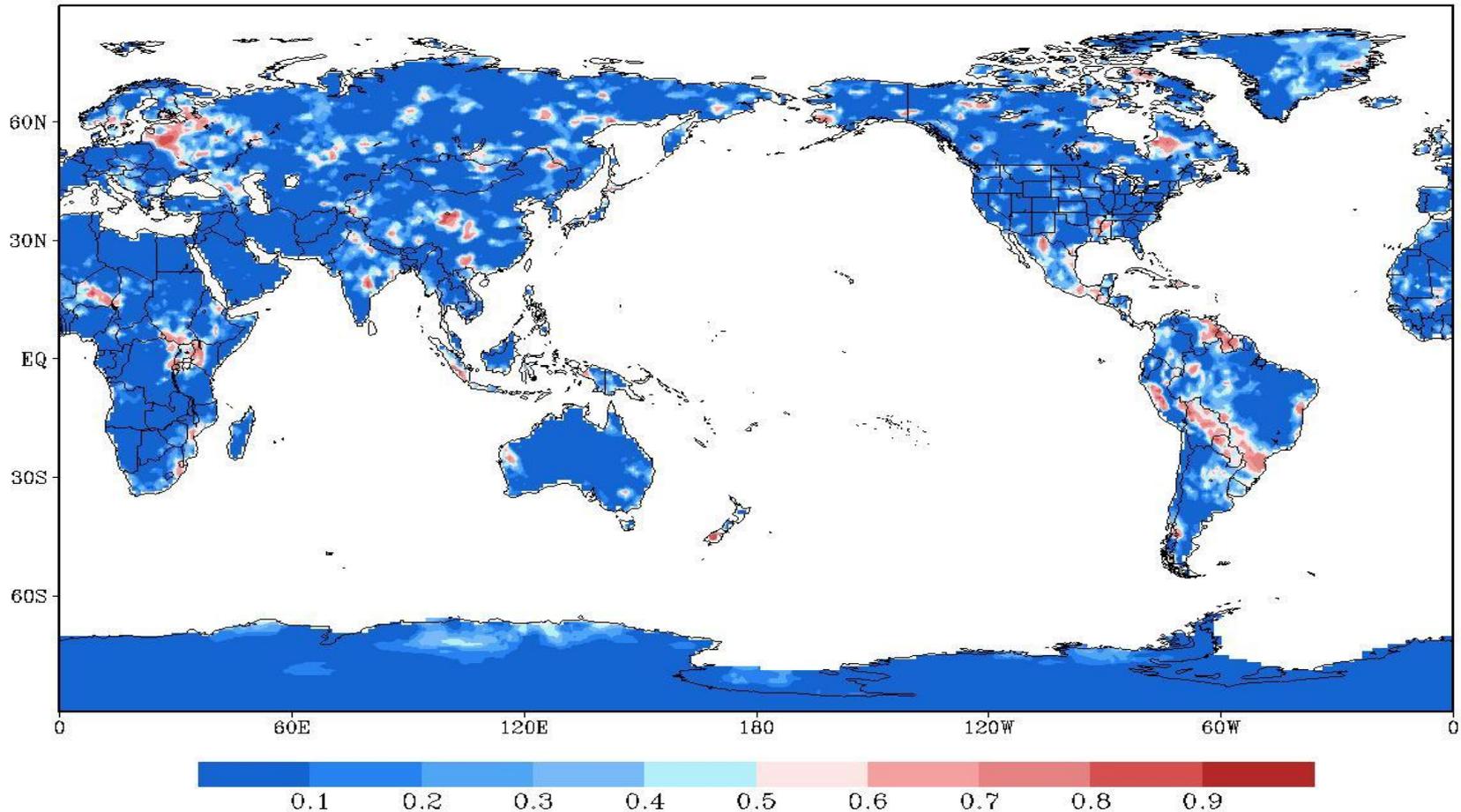
August
Precip AC Skill (August)



Low skill everywhere, slightly higher in lead 0, SST signal is relatively weak

Precipitation AC (Cntrl: JJA)

Precip AC Skill (JJA)

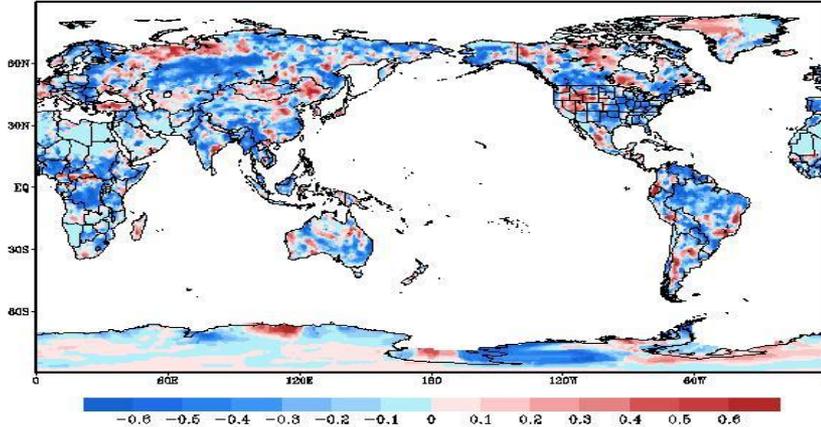


Generally less than 0.5 over the N.H.

Precipitation AC Diff (Exp – cntrl: May - Aug)

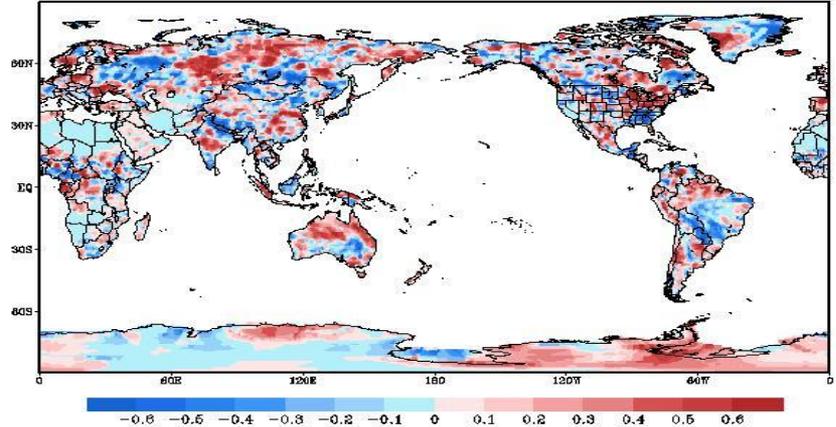
May

Precip AC Skill Diff (May: Exp – Cntrl)



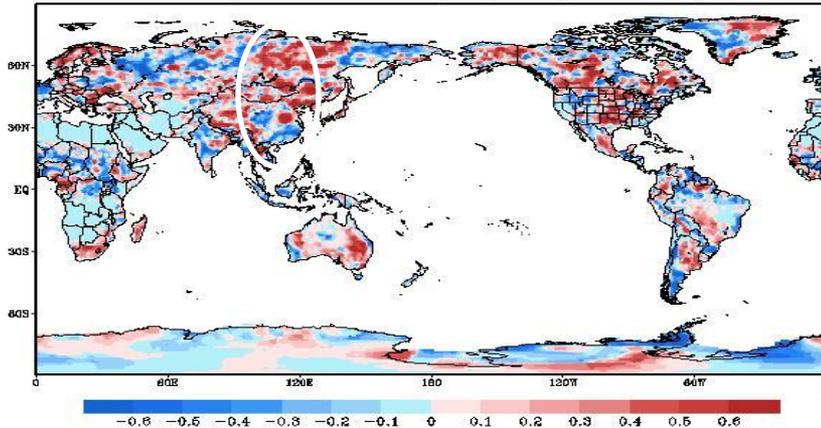
June

Precip AC Skill Diff (June: Exp – Cntrl)



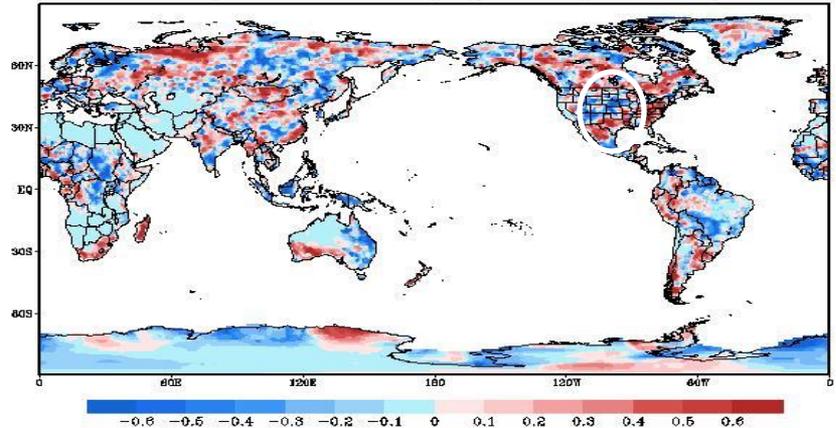
July

Precip AC Skill Diff (July: Exp – Cntrl)



August

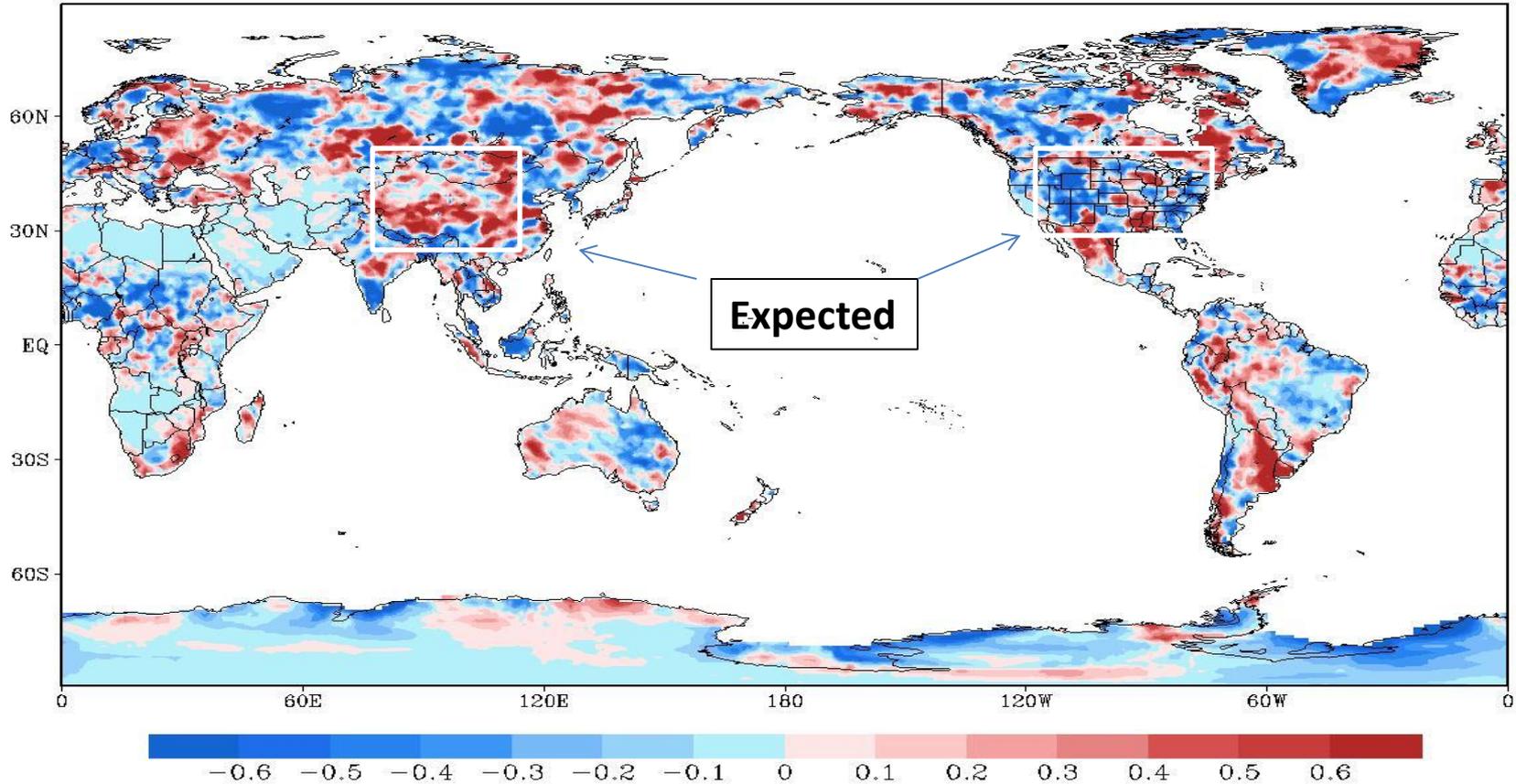
Precip AC Skill Diff (August: Exp – Cntrl)



Mixed picture in lead 0 and over the N.A.
Starts to pick up over the Asian Continent

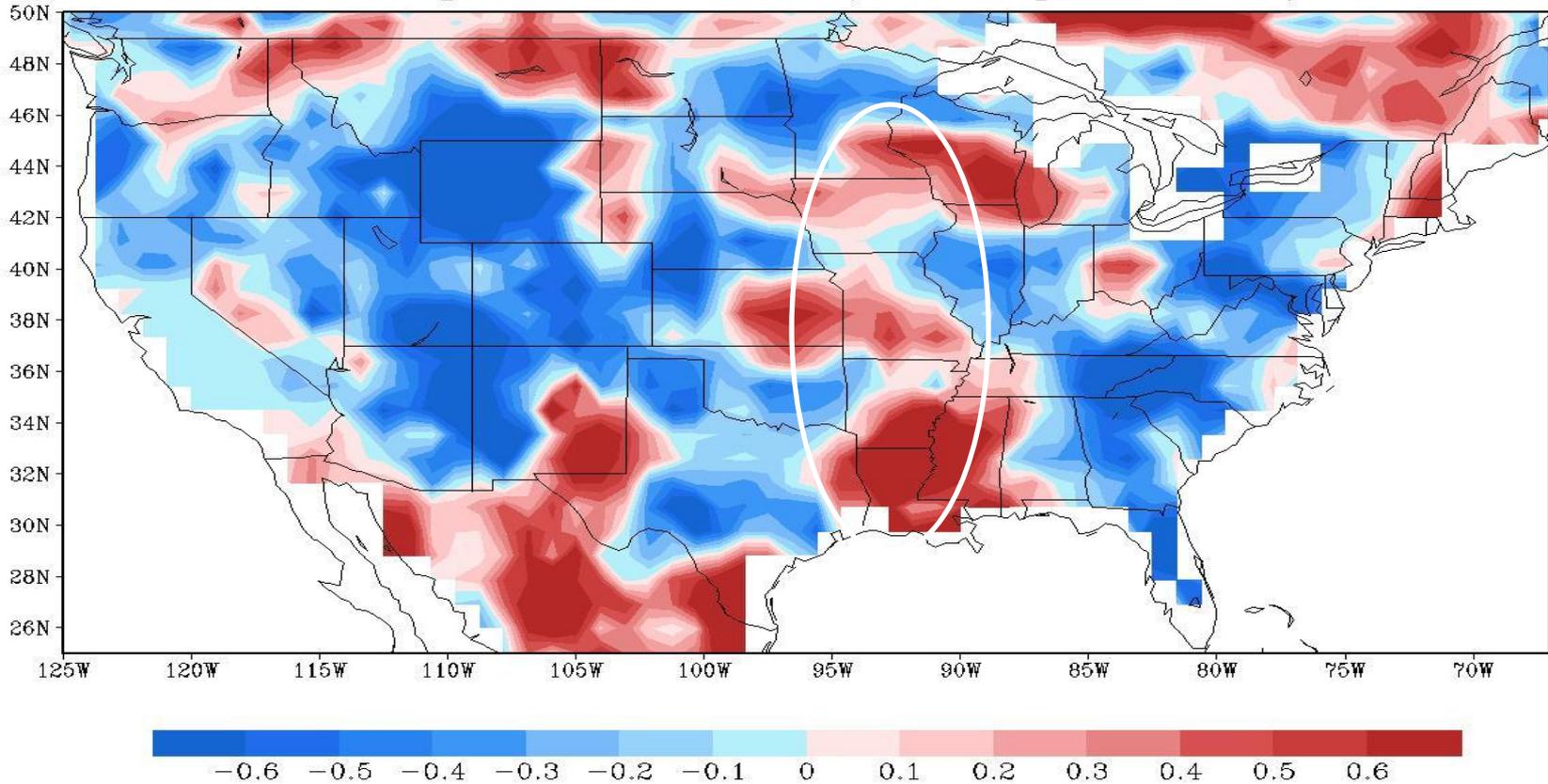
Precipitation Diff (Exp – Cntrl: JJA)

Precip AC Skill Diff (JJA: Exp – Cntrl)



Precipitation AC Diff (Exp – Cntrl: JJA CONUS)

Precip AC Skill Diff (JJA: Exp – Cntrl)

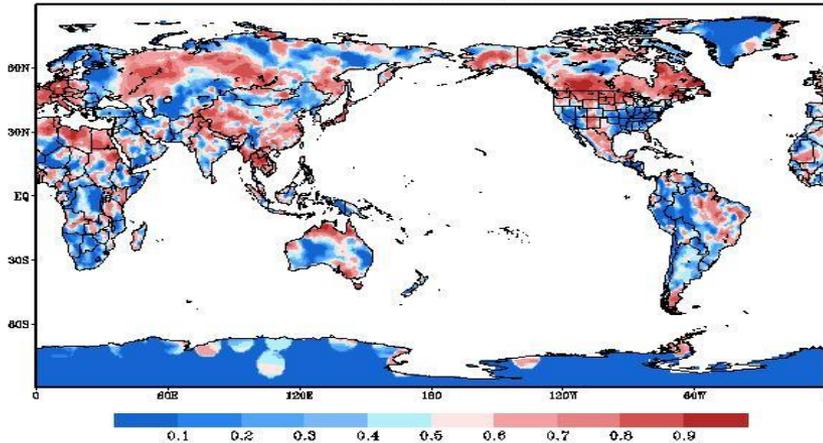


Positive impact over the “hot spot”

T2m AC (Cntrl: May-August)

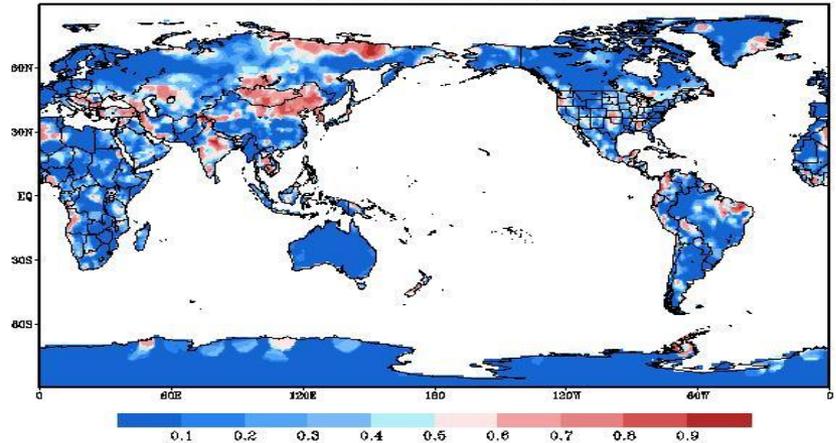
May

T2m AC Skill (May)



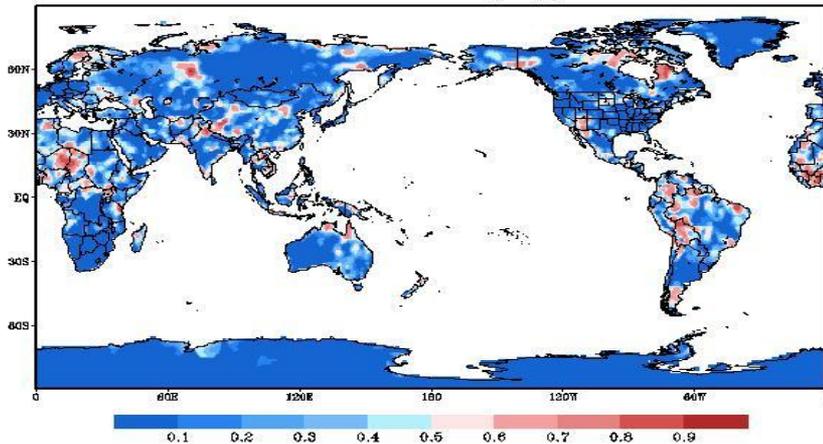
June

T2m AC Skill (June)



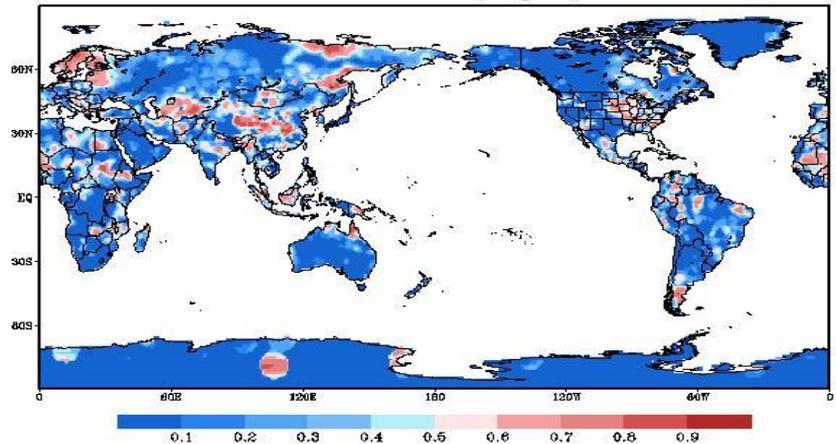
July

T2m AC Skill (July)



August

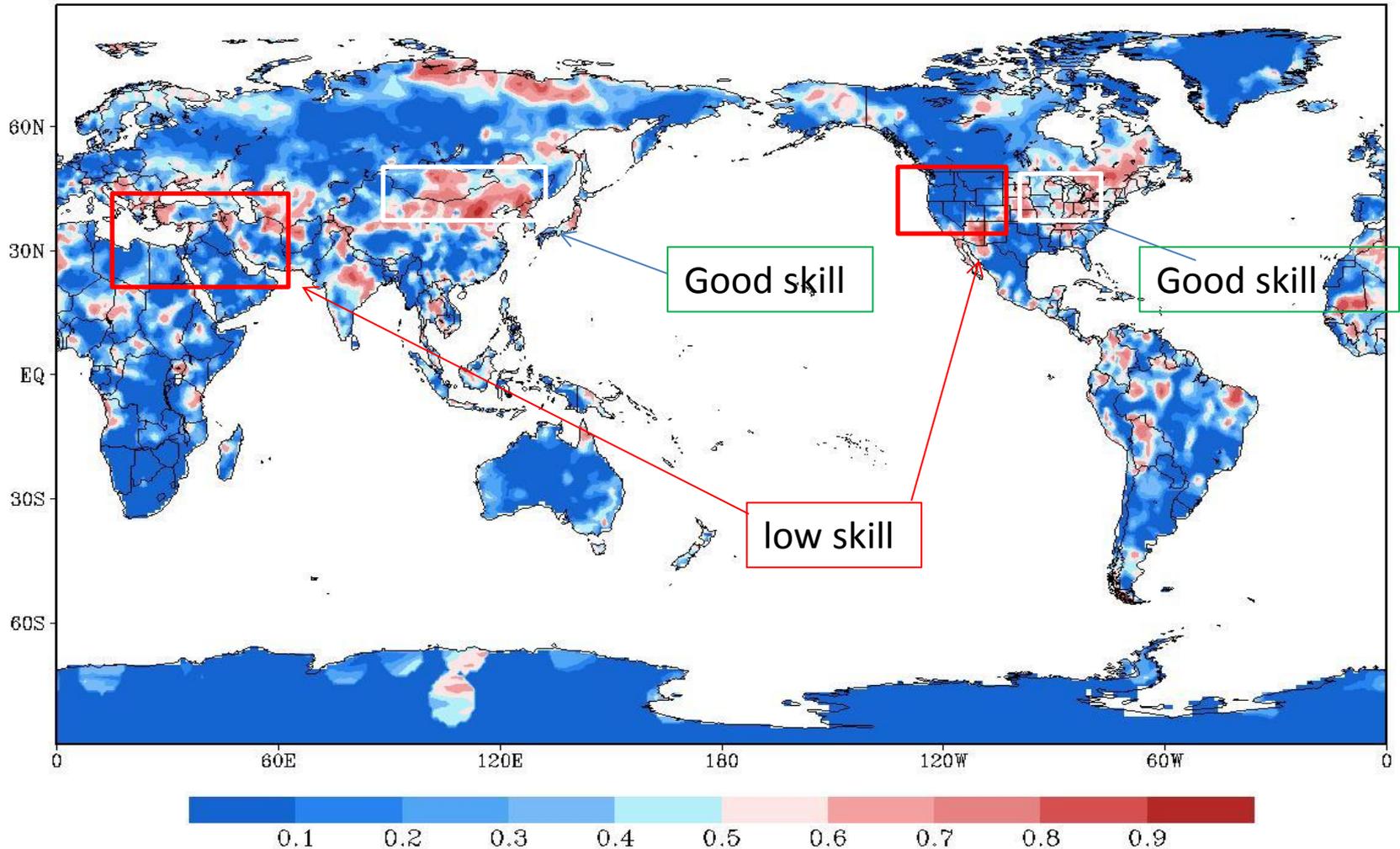
T2m AC Skill (August)



Better than precip, higher skill in lead 0,
gradually decreases over the time

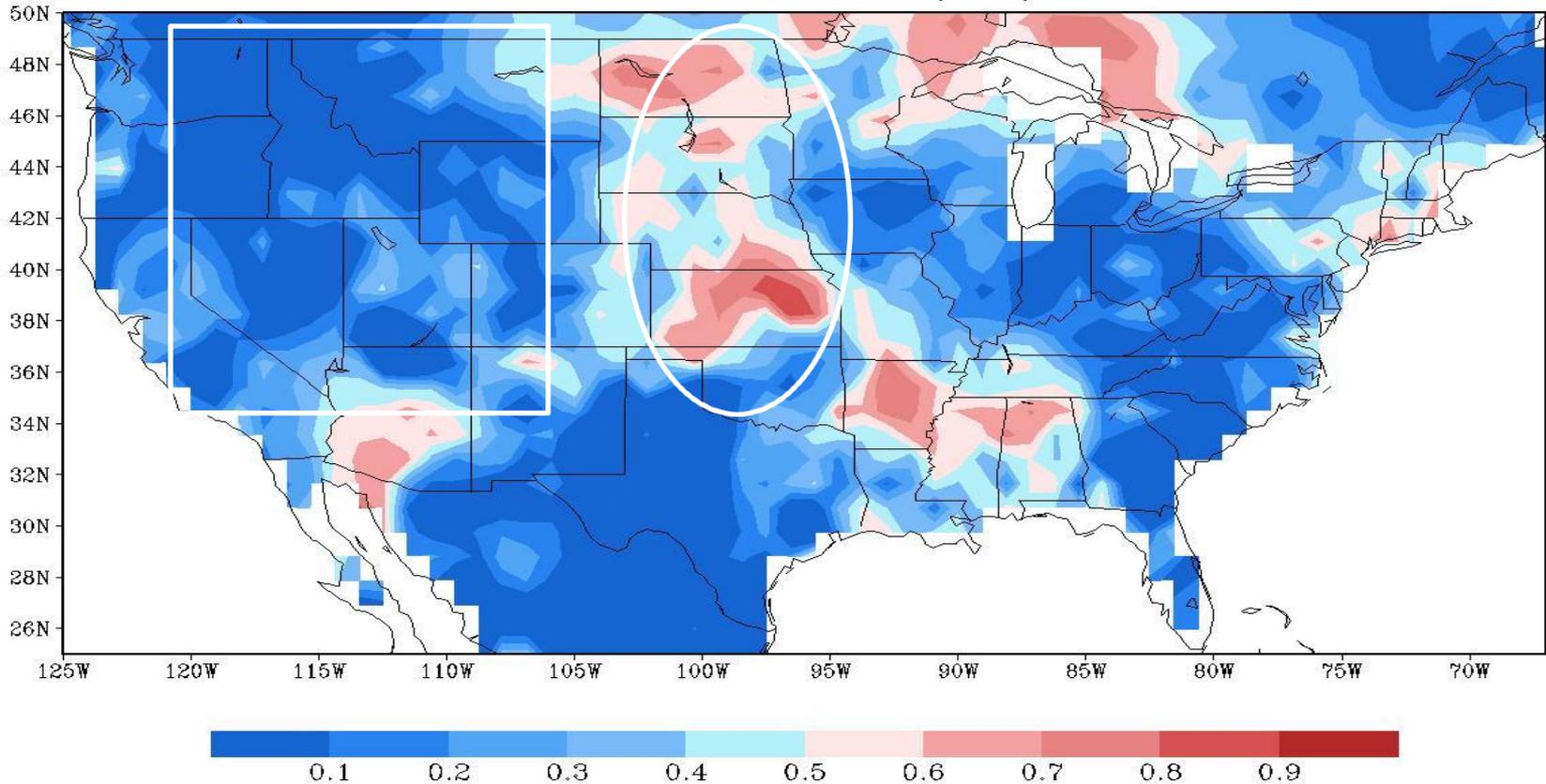
T2m AC (Cntrl: JJA)

T2m AC Skill (JJA)



T2m (Cntrl : JJA CONUS)

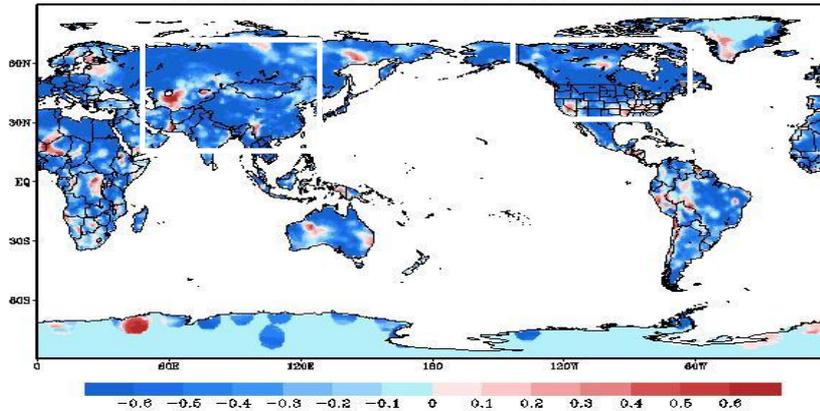
T2m AC Skill (JJA)



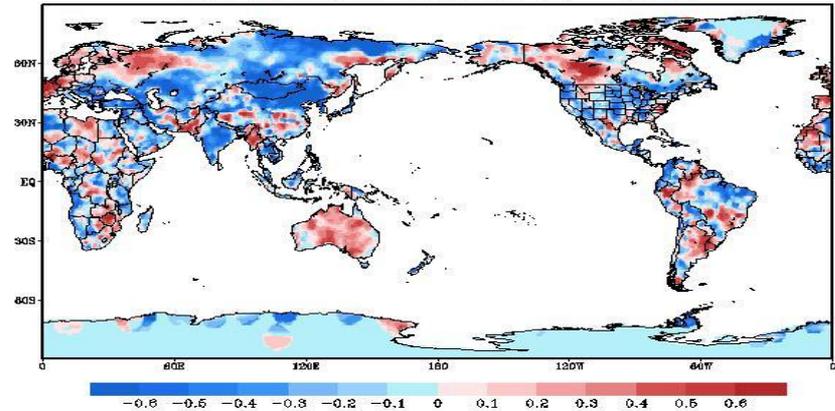
**Good skill over the “hotspot”,
low skill over the northwest**

T2m AC DIFF (Exp – Cntrl: May - Aug)

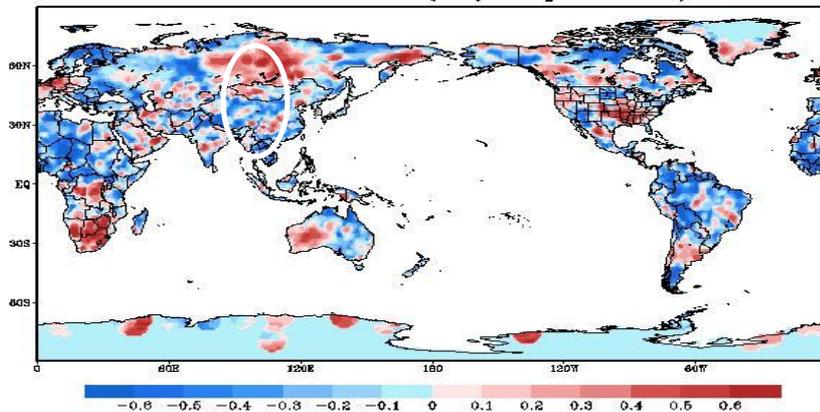
T2m AC Skill Diff (May: Exp – Cntrl)



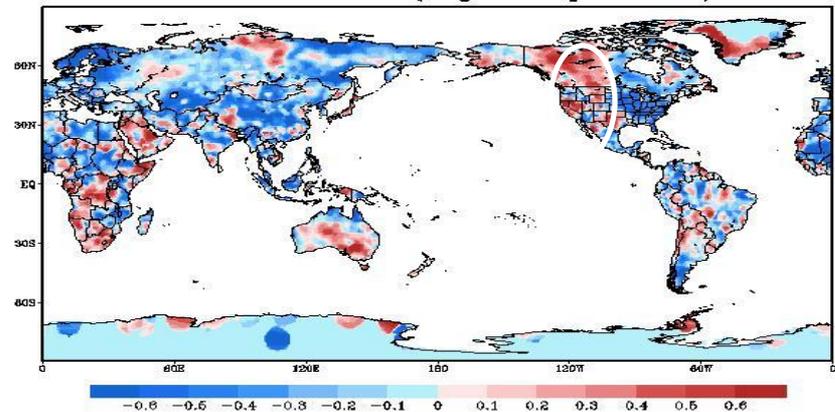
T2m AC Skill Diff (June: Exp – Cntrl)



T2m AC Skill Diff (July: Exp – Cntrl)



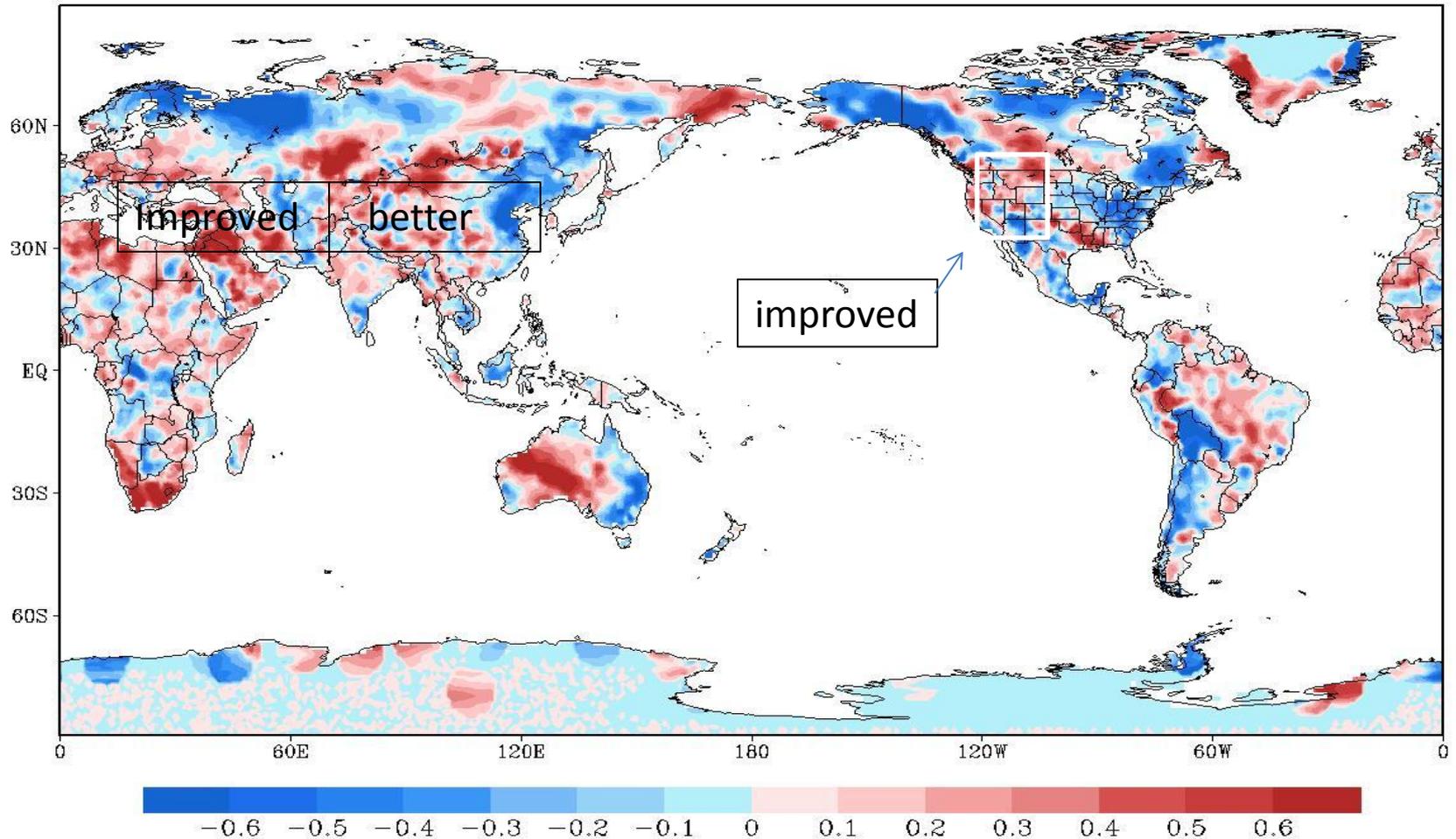
T2m AC Skill Diff (August: Exp – Cntrl)



Negative impact in lead 0,
gradually better over different regions

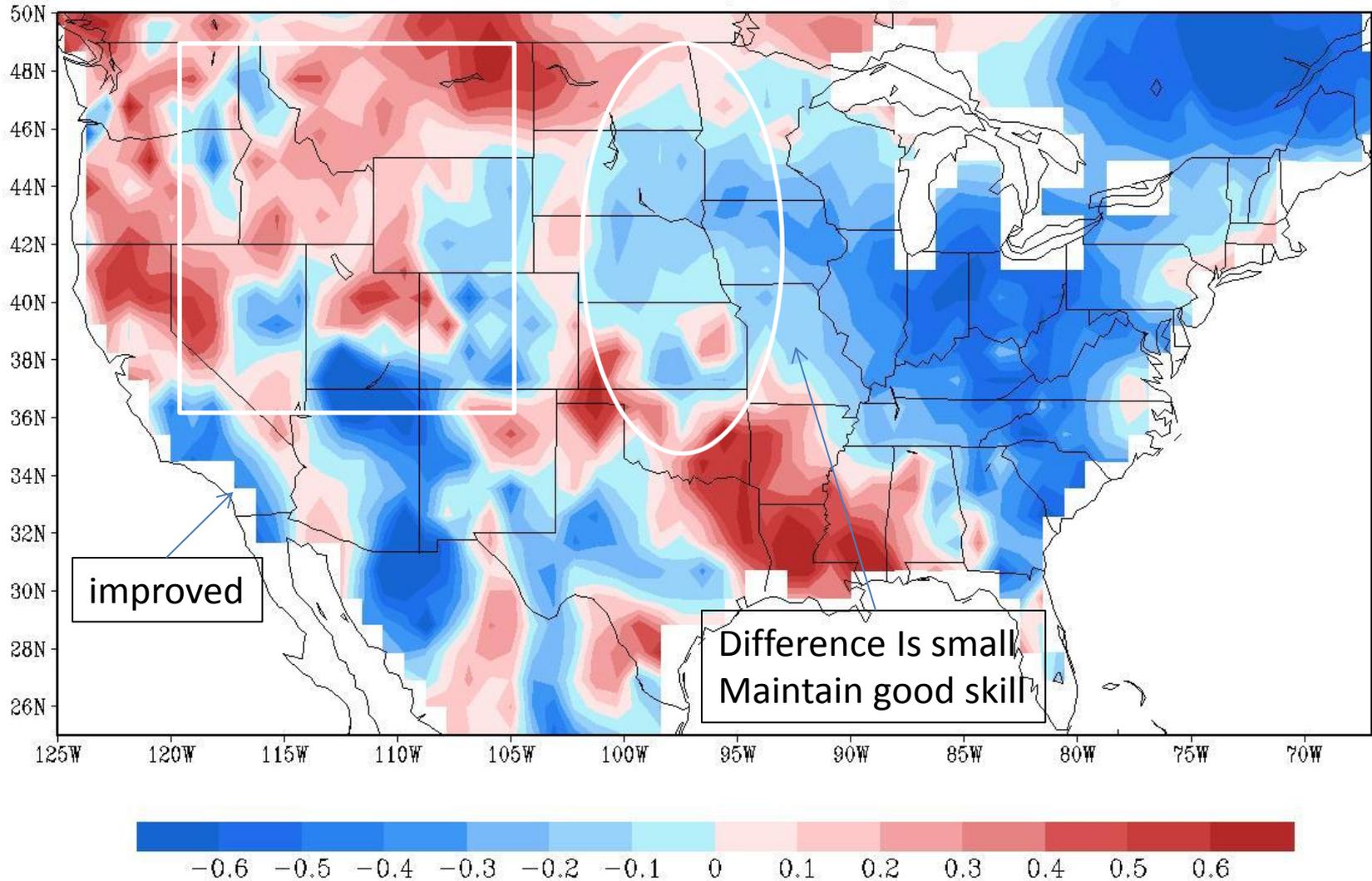
T2m AC DIFF (Exp – Cntrl: JJA)

T2m AC Skill Diff (JJA: Exp – Cntrl)



T2m AC DIFF (Exp – Cntrl: JJA CONUS)

T2m AC Skill Diff (JJA: Exp – Cntrl)



Conclusions/Discussions

- 1. Land surface does make a difference.**
- 2. Positive impact on precipitation over transition zone.**
- 3. More positive impact on the T2m.**
- 4. More ensemble members/years?**
- 5. Parameter tuning towards climate + better initialization.**

Thank you !

Questions ?