# OLR Indices for ENSO Impacts on Seasonal Weather Anomalies

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ENSO Diversity Wkshp

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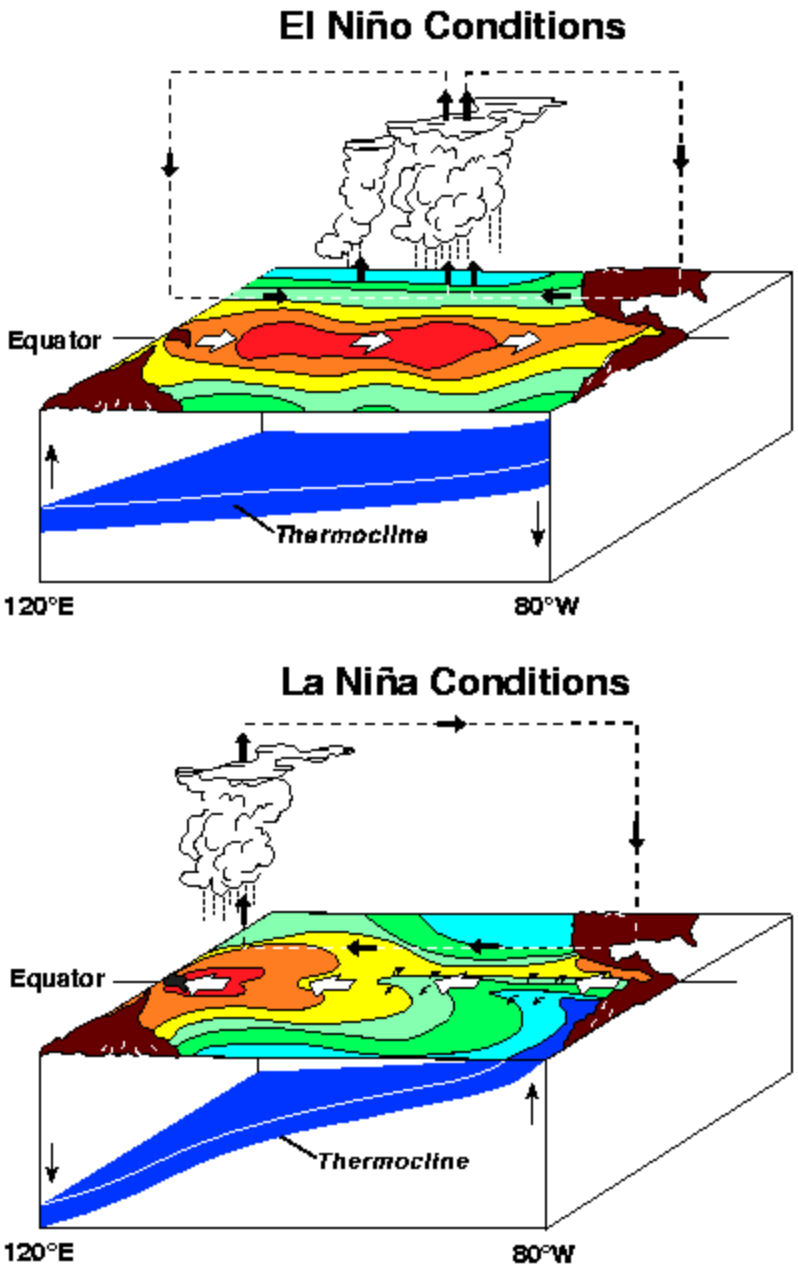
# *An OLR Perspective on ENSO seasonal weather associations*

- **SLP, SST and OLR all provide measures of coupled-system anomalies during ENSO, but OLR provides best look at atmospheric heating anomalies which drive temp. and precip. anomalies elsewhere**

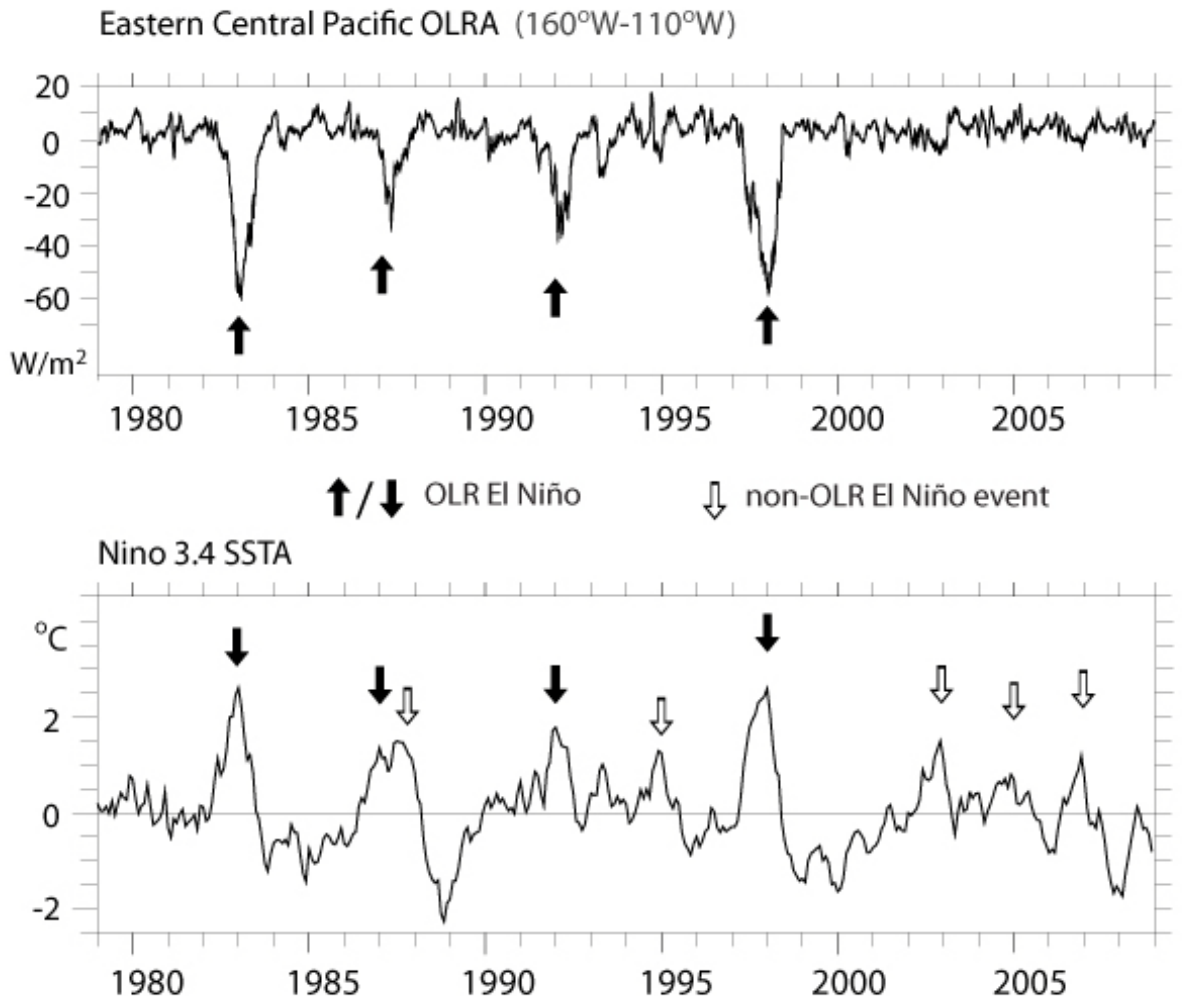
- ***Most of the statistically significant seasonal weather anomalies around the globe result from a handful of events which can be identified by their OLR features***

- *Chiodi and Harrison (2013a), in this month's J. Climate and Chiodi and Harrison 2013b (in revision)*




***OLR approach motivated initially by our familiar ENSO Cartoons***

# Eastern Central Pac. OLR and El Niño

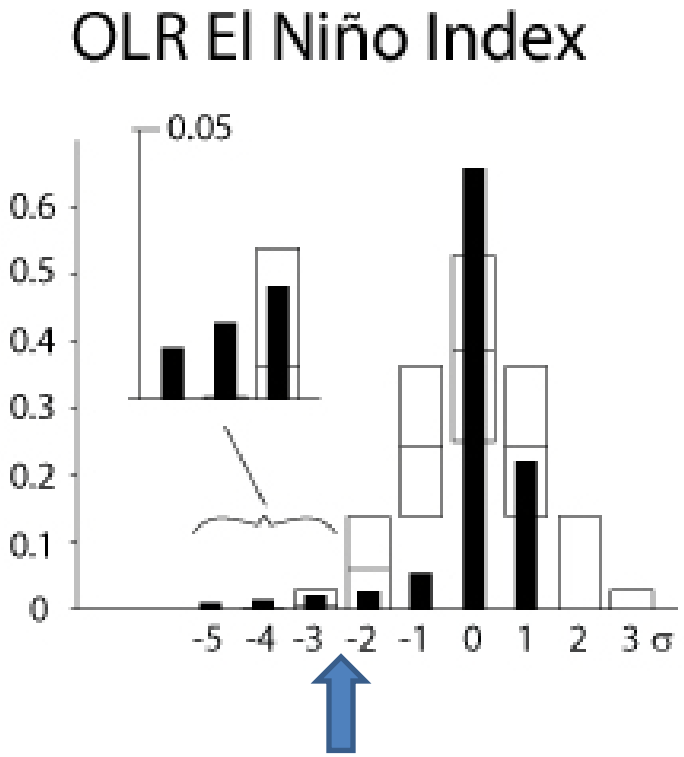


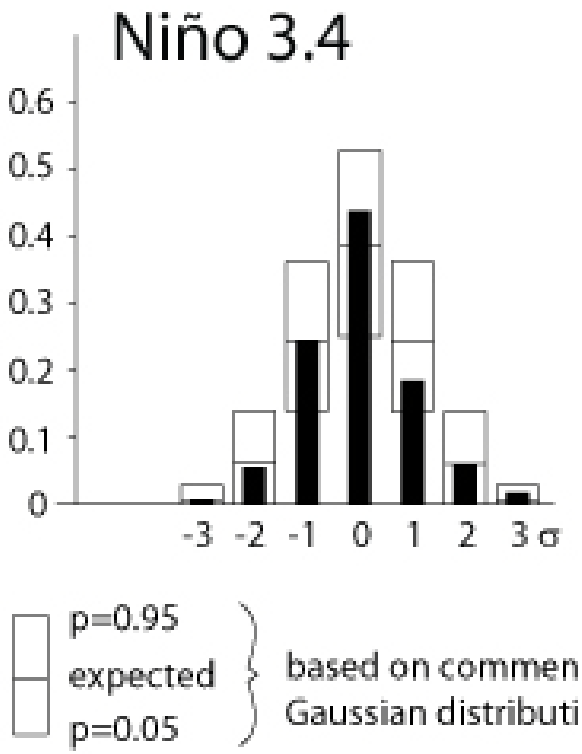

Monthly OLR Anom. 160°W:110°W and 5°S-5°N

NINO3.4 SSTA

OLR from NOAA Interpolated (Liebmann and Smith, 1996)

# *OLR behavior is more event-like than SSTA, SLP*




Only in the 4 large events does the index cross the -1.5σ boundary, and it does so before winter in 3 of 4 cases.

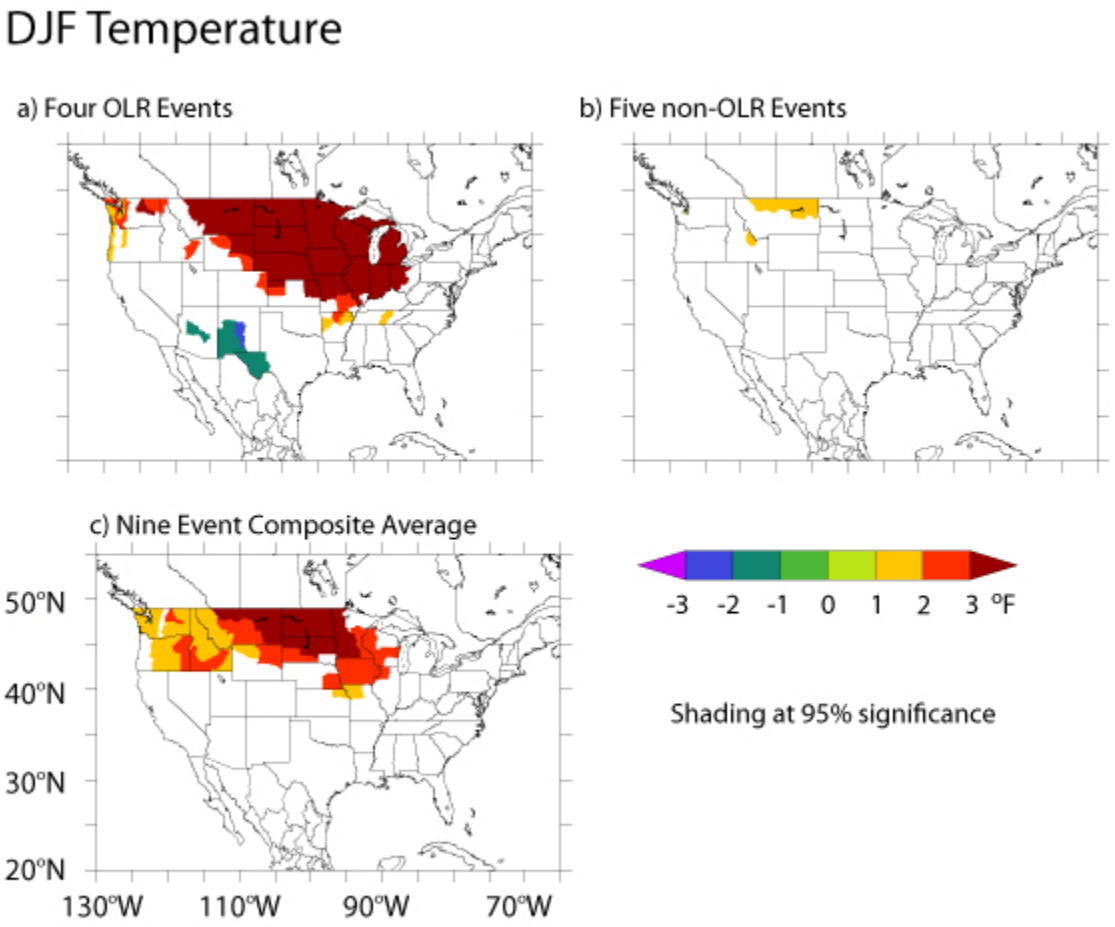
# *Seasonal Weather Associations*

- It is easier to examine seasonal weather anomalies in one region first.
- The U.S. is one strongly affected region, but similar results are obtained elsewhere.

# *USA Winter Surface Temp Anomaly for different subsets of El Nino events.*

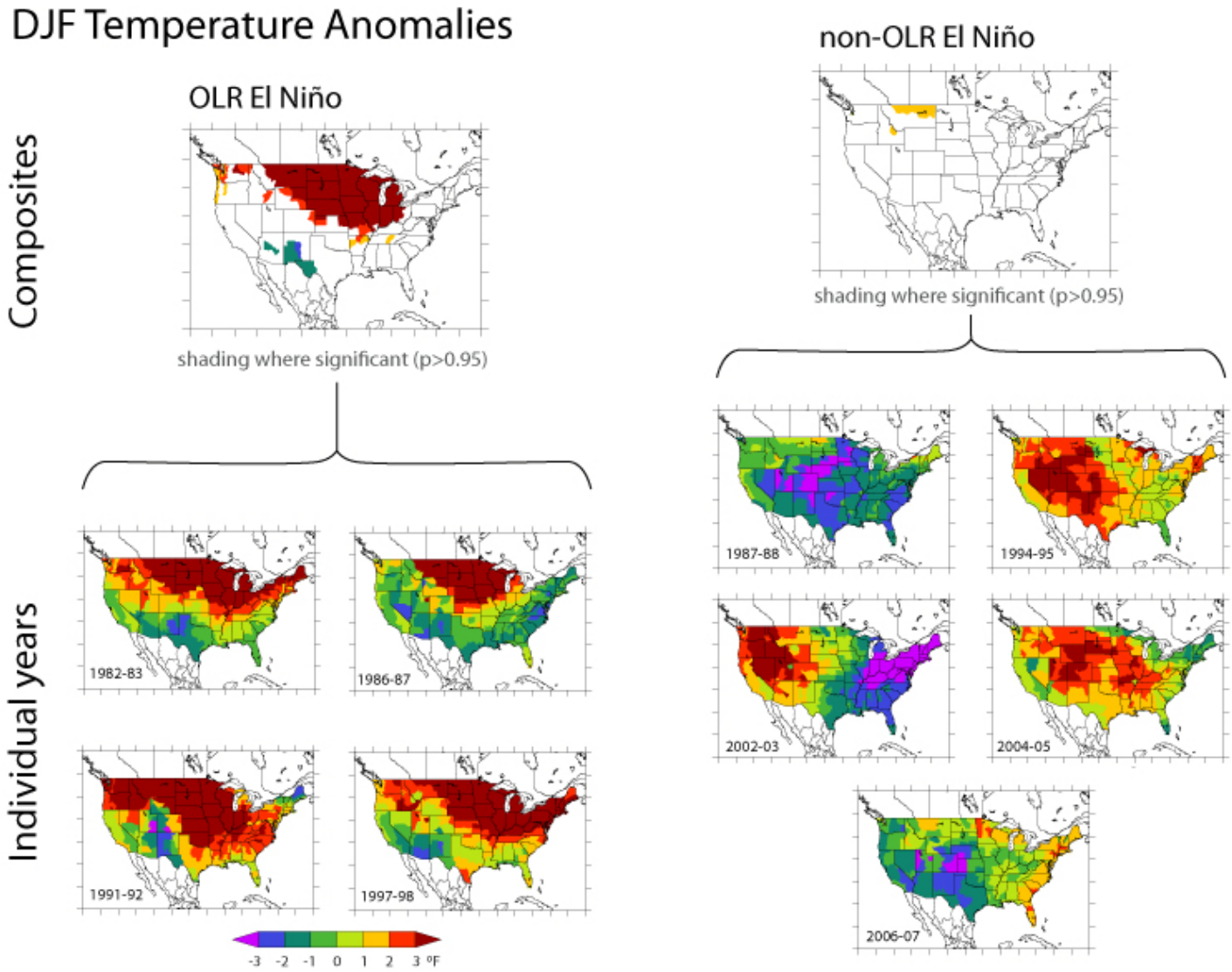
OLR-El Nino Event Composite

All-Event Composite



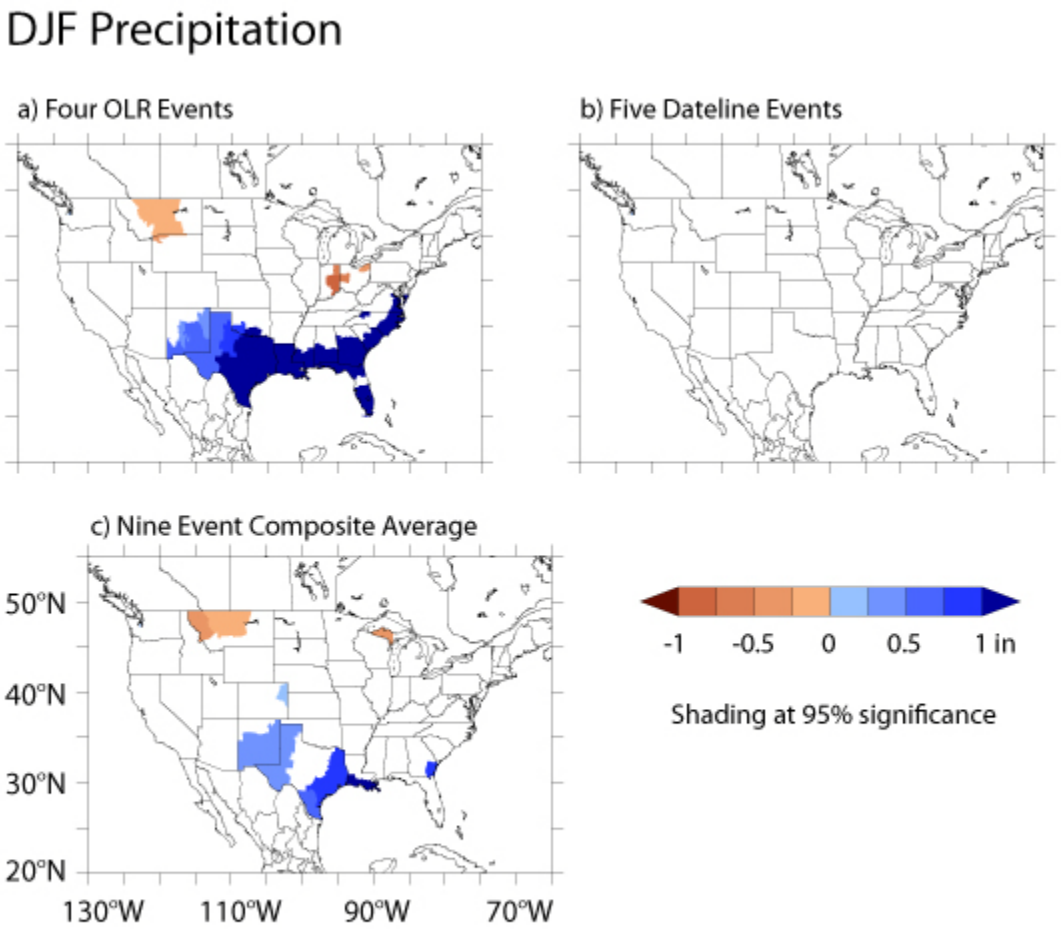

Non-OLR El Nino Event Composite

# *Temp patterns are consistent among the OLR-EN years; different patterns seen in other years*



# *As before, only for seasonal surface precipitation anomaly*

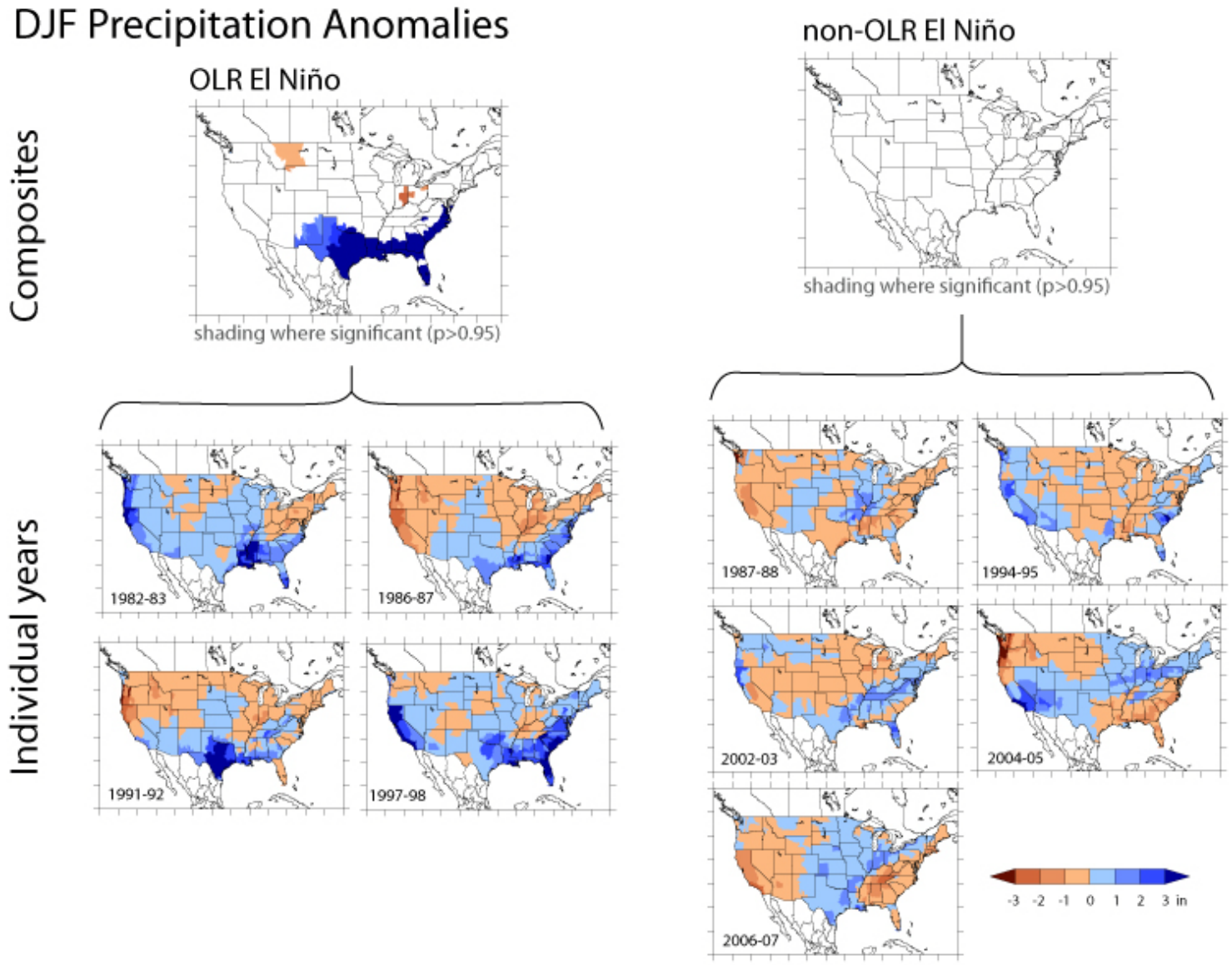
For OLR-El Nino Events



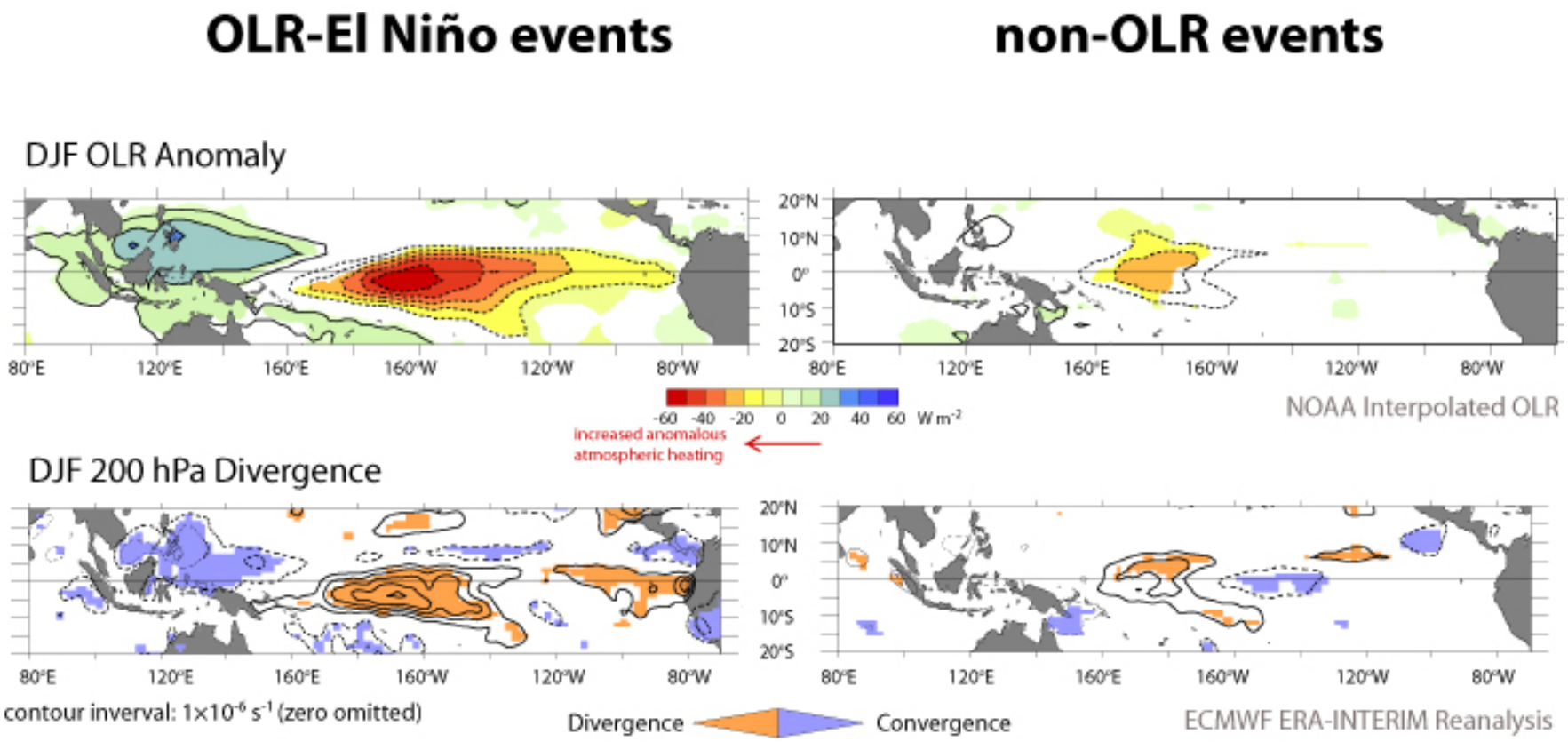

For Non-OLR El Nino Events

Including all El Nino Events

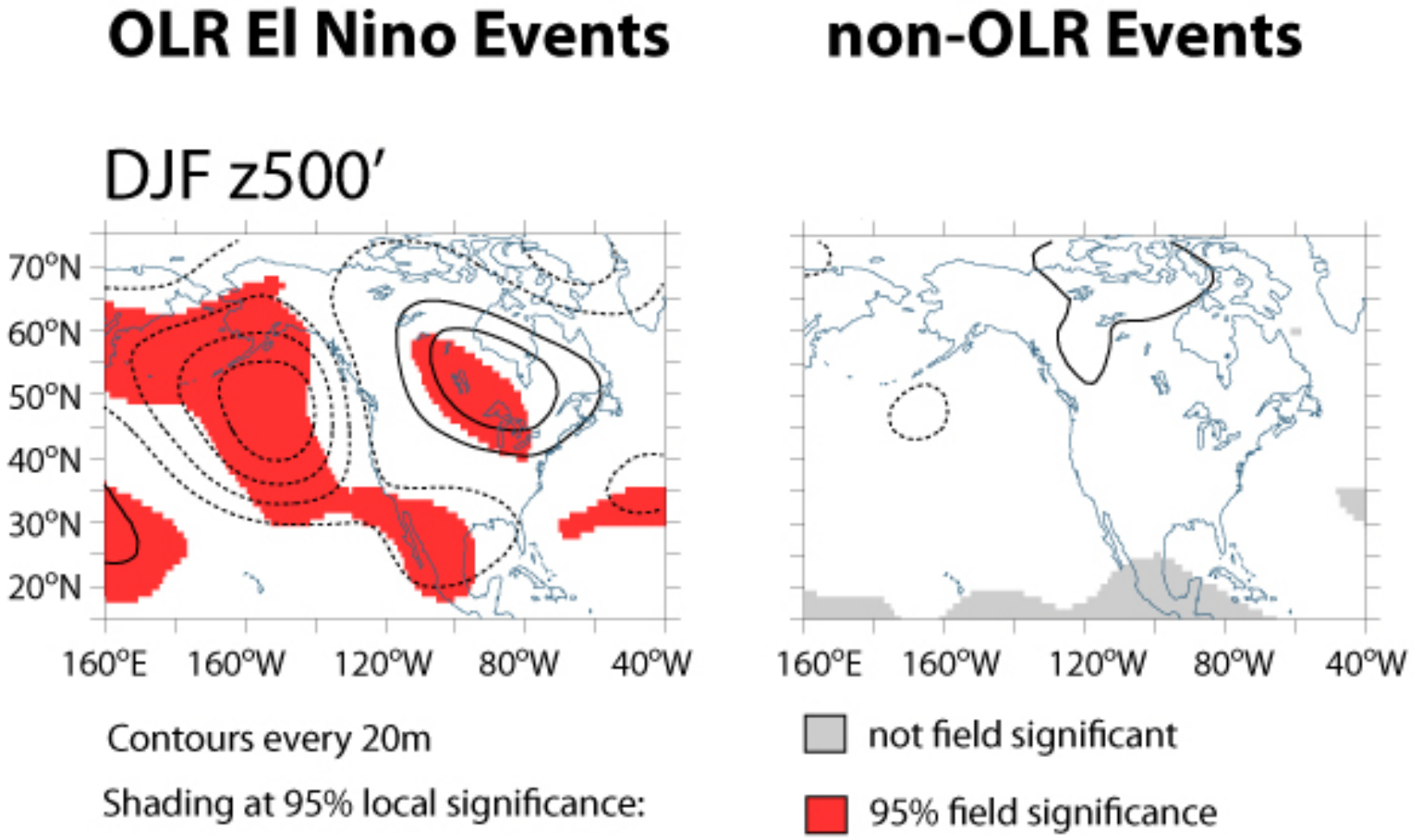
# *Again, as before, only for seasonal surface precipitation anomaly*



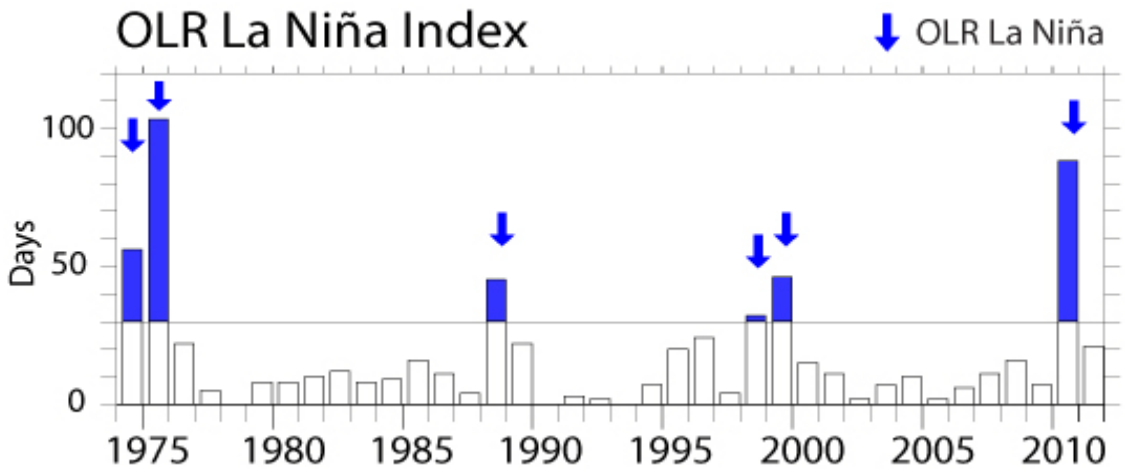
# *Seasonal Tropical Anomaly Conditions*

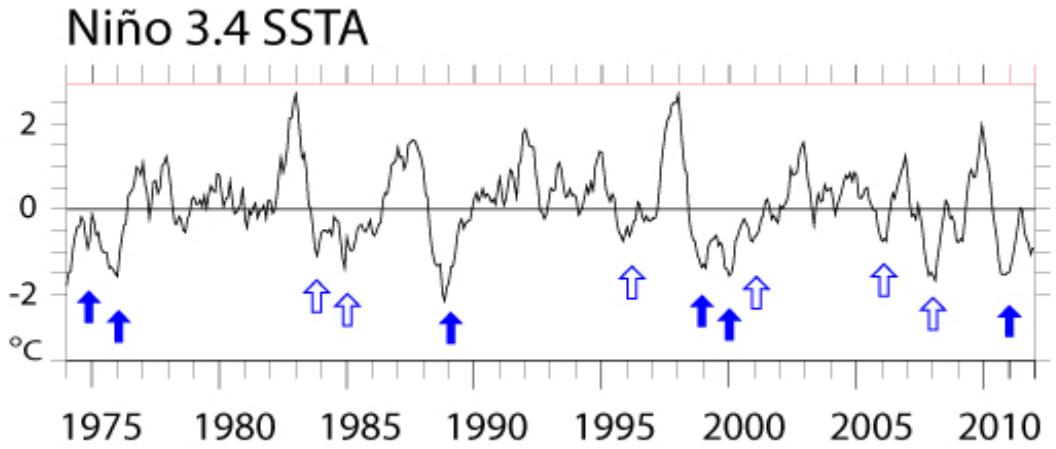


# *Seasonal Atmospheric Circulation Anomaly*



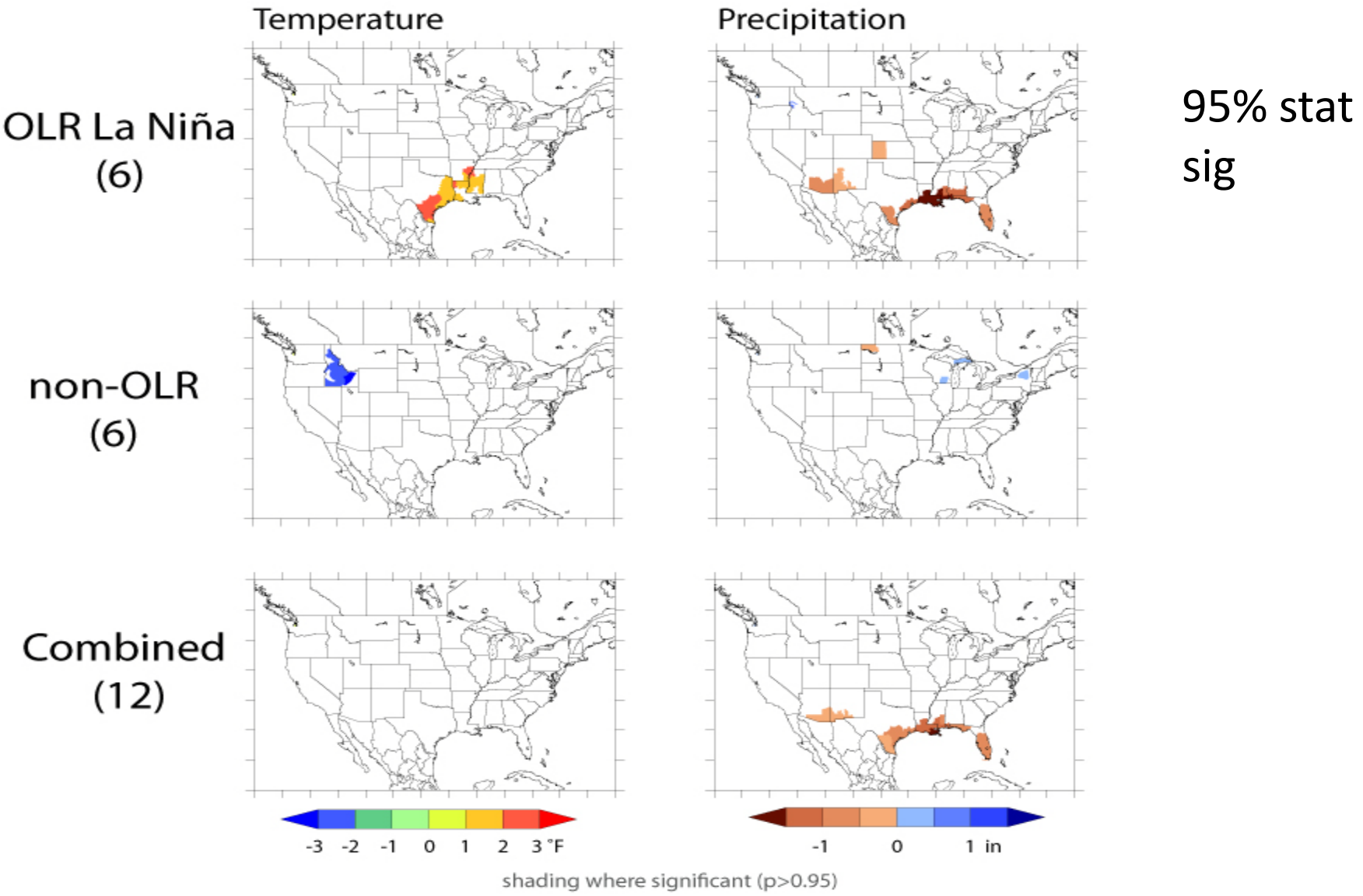
# *An OLR index for La Nina*



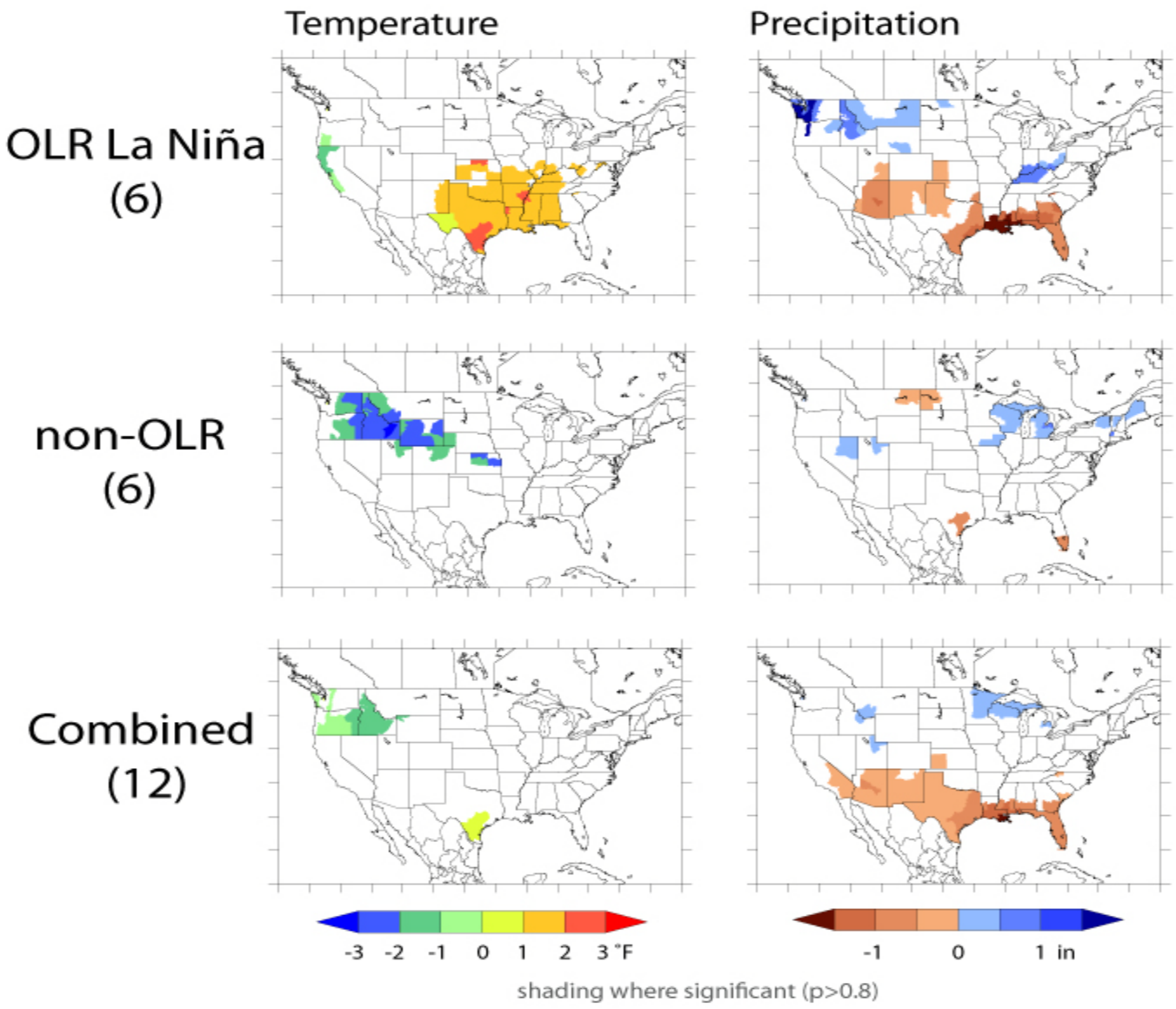

***OLR-La Nina Index counts days of clear sky from 1 April to 31 Dec over 150E:180x5S:5N***

# DJF Composite Anomalies




95% stat sig

# DJF Composite Anomalies

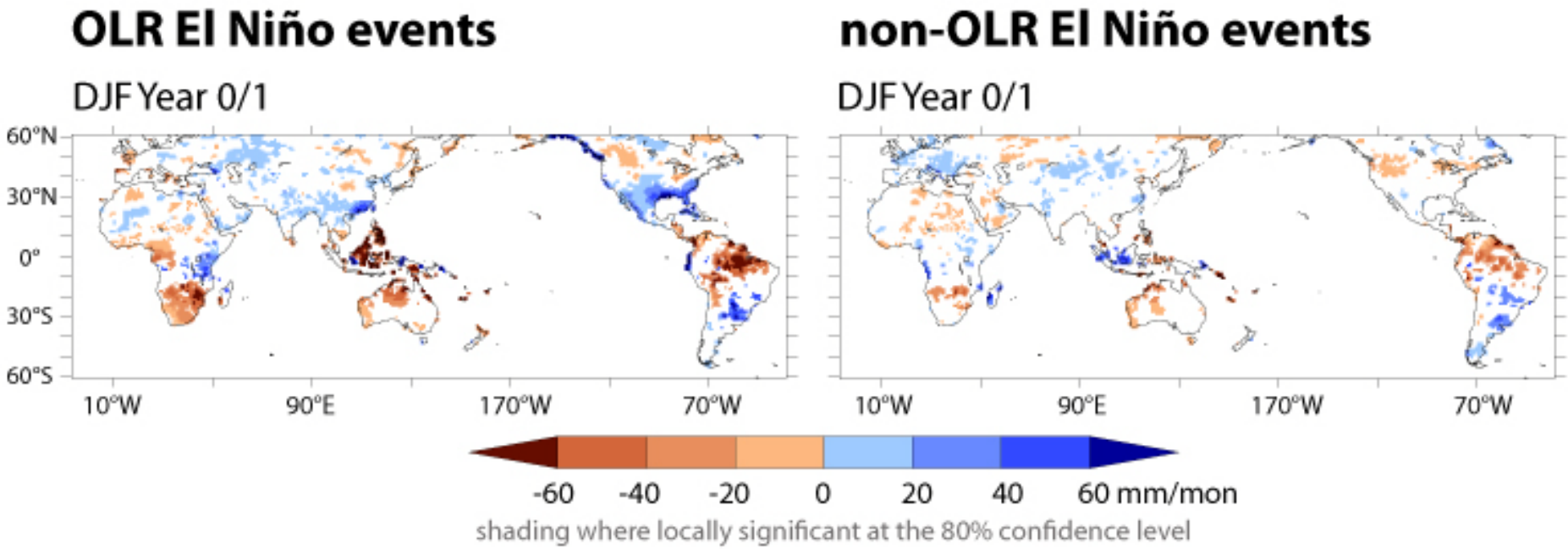



80% stat sig

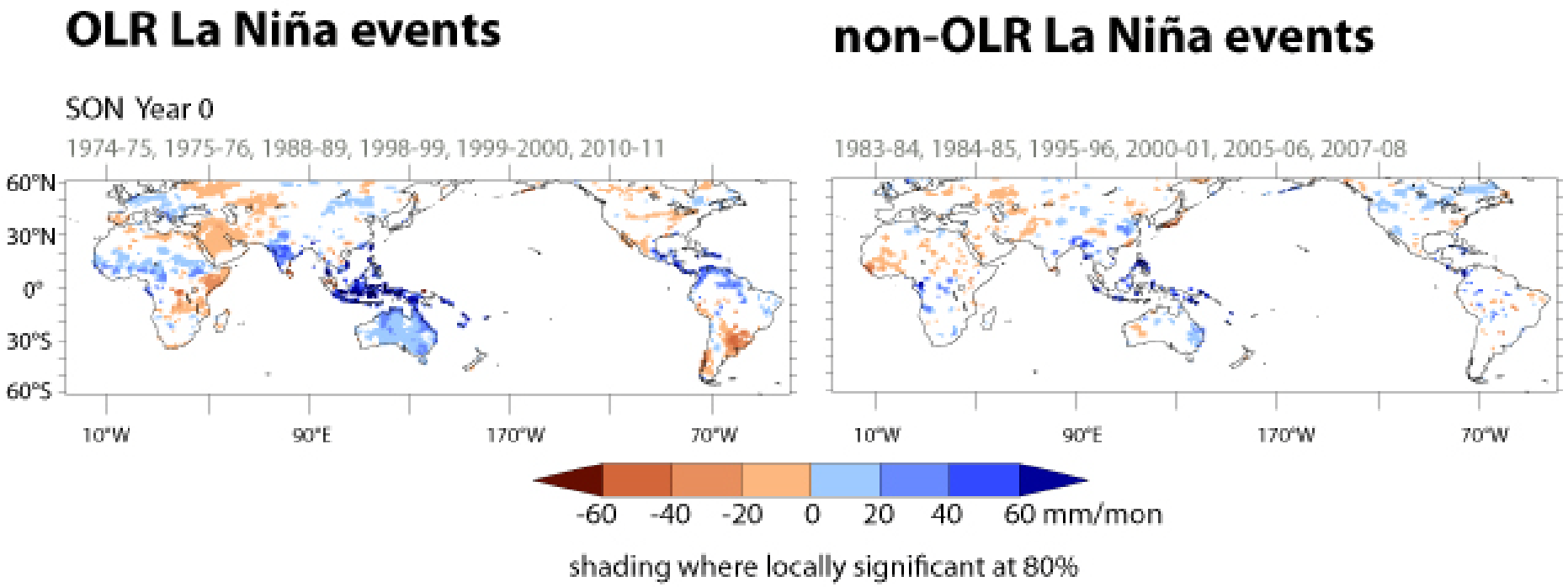
# *Global Seasonal Weather Associations*

- We have performed global, or “field significance” tests on precip. and found that only OLR EN (DJF) and OLR LN (SON) years pass at p=0.95
- Other seasons reach p=0.9 in the OLR-case (EN: SON,MAM, LN:DJF)
- All non-OLR cases considered are ***not*** field significant (p<0.66), except EN-SON (p=0.84, Australia?)

# *El Nino Seasonal Precipitation Anom.*



# *La Nina Seasonal Precipitation Anom.*



We find that using OLR indices for El Nino and La Nina identifies the subset of commonly considered events that most strongly account for the familiar winter seasonal temp and precip anomalies over the US.

**There is little high statistical significance weather anomalies associated with the non-OLR events.**

There is no simple mapping from Nino3.4 SSTA to the list of OLR events.

**This suggests that paying more attention to the OLR behavior of the tropical Pacific may result in higher-confidence seasonal weather predictions.**

Agenda Questions:

2. How well do climate models reproduce the “observed” characteristics of ENSO diversity?

We suggest it may be useful to look at how well the observed OLR behavior is reproduced in these models

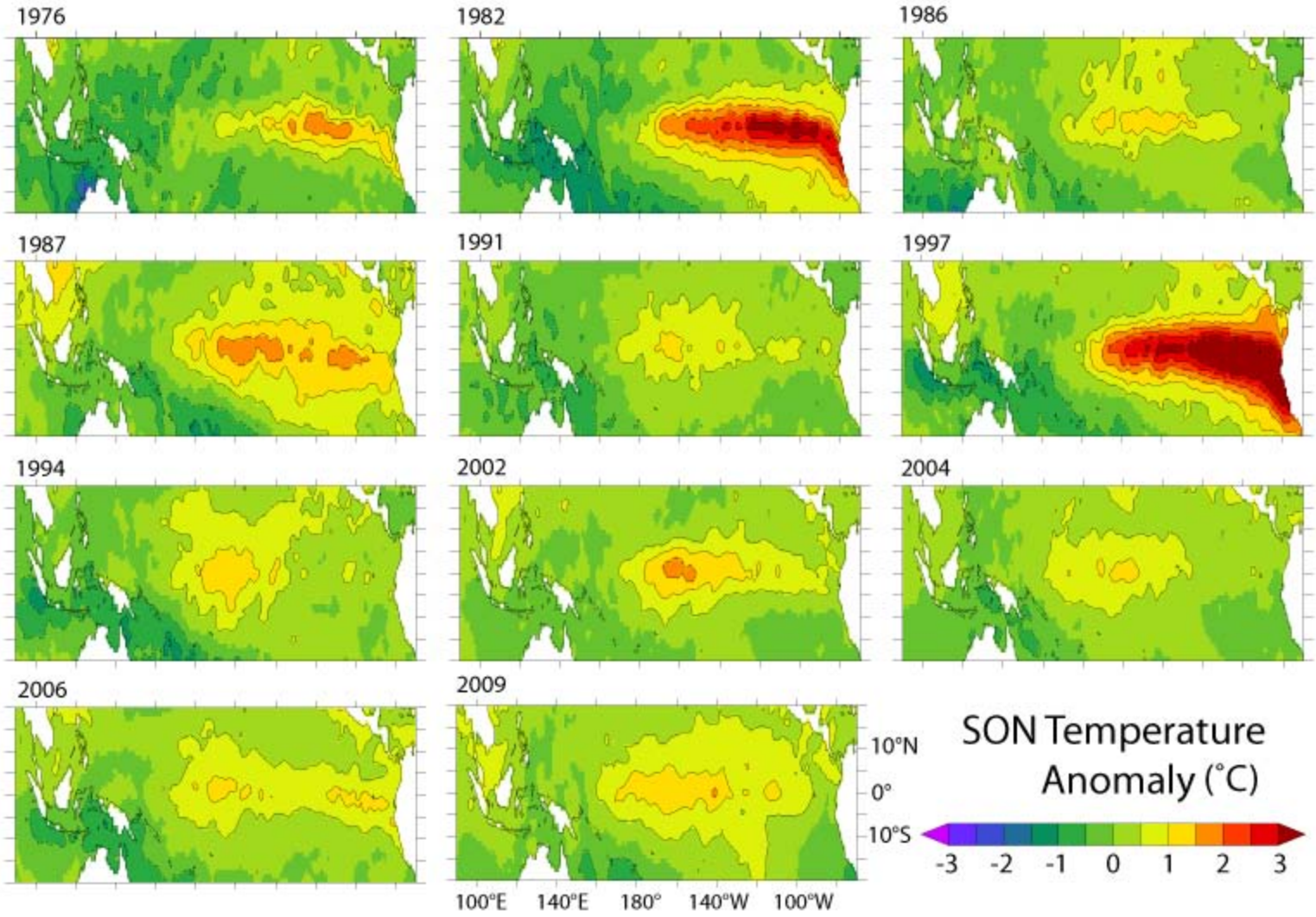
3. Do discrete classes of ENSO events emerge from observations and models, or is ENSO diversity better described as a continuum with some interesting extremes?

OLR features suggest an event-like nature that may help identify the events most likely to influence seasonal weather conditions in the U.S. and other affected regions.

4. Are oceanic indices sufficient to characterize ENSO diversity, or indices/metrics accounting for the atmospheric state are necessary?

We think that keeping track of the tropical Pacific deep convection conditions is key.

# El Nino Seasonal SSTA patterns



# El Nino Seasonal SSTA patterns