



**IBERDROLA**  
**RENEWABLES**

**Summer 2010-2011**

*Will the “West Pacific-North America” Pattern Prevail?*

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April 5, 2011

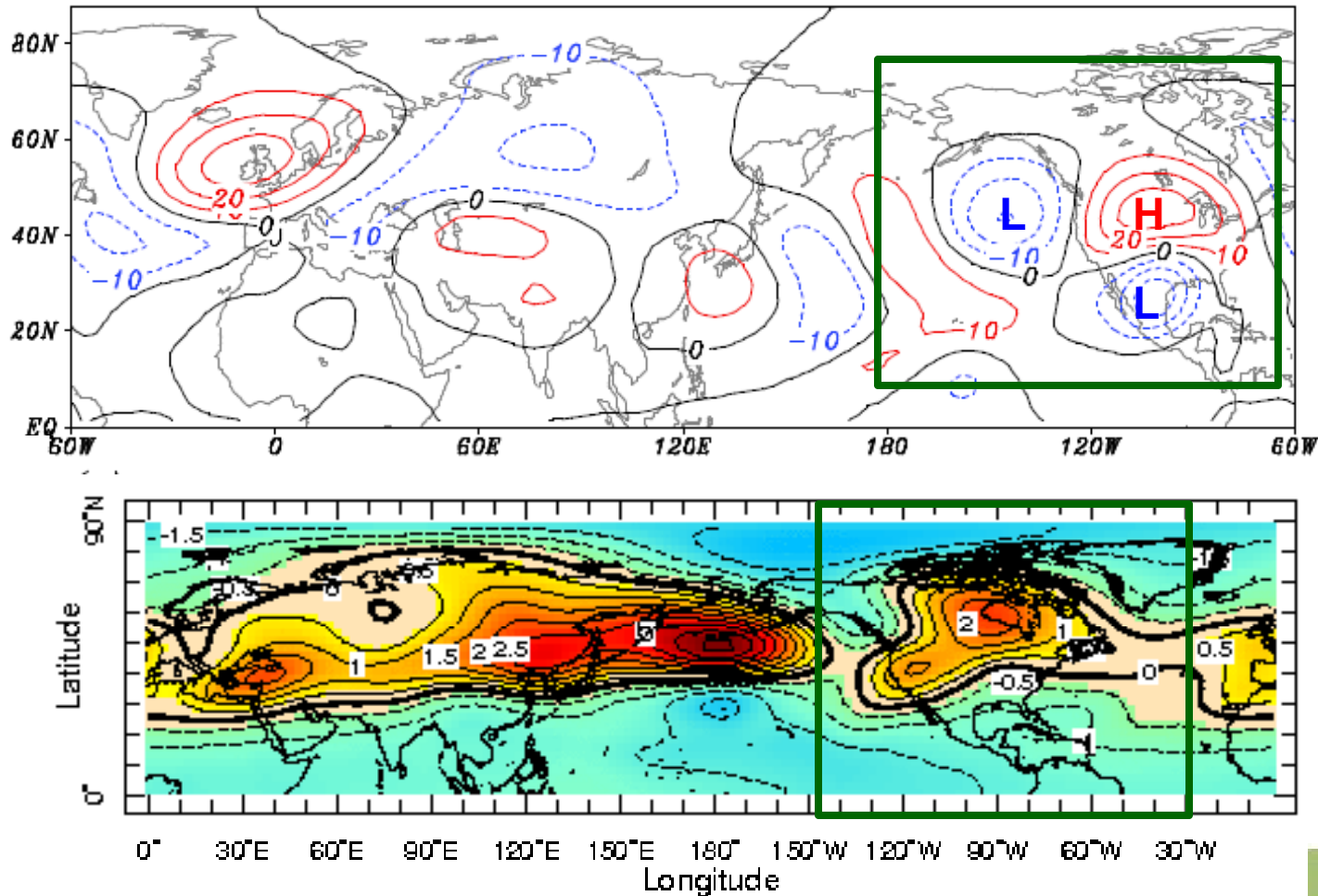
# Outline



- The dominant unforced summer pattern
- ENSO/monsoon influences on summer pattern → two leading patterns
  - 2010: Indian Ocean-dominant monsoon/strengthening Nina → *circumglobal pattern dominated*
  - 2011: more likely to see West Pacific-based monsoon and Nina is decaying → *more wave-like Pacific pattern (WPNA) in store?*
- Analog composites...similar to the WPNA
- Biggest risk to summer outcome...stronger lingering Nina background forcing?



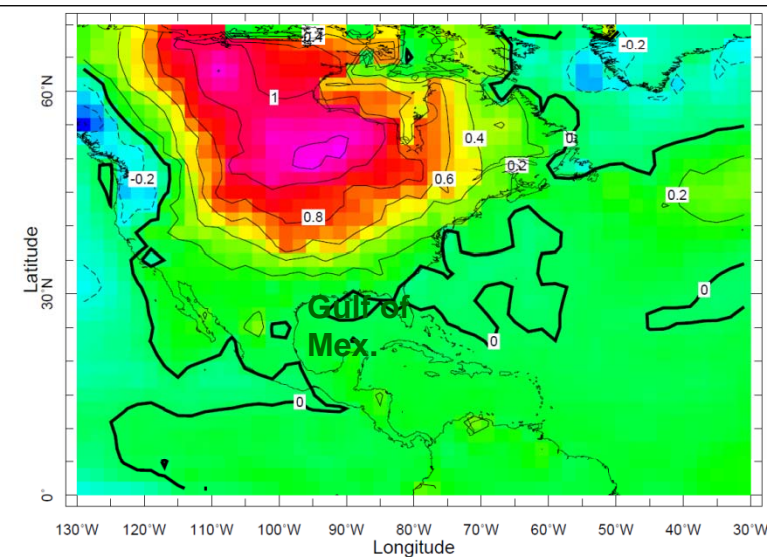
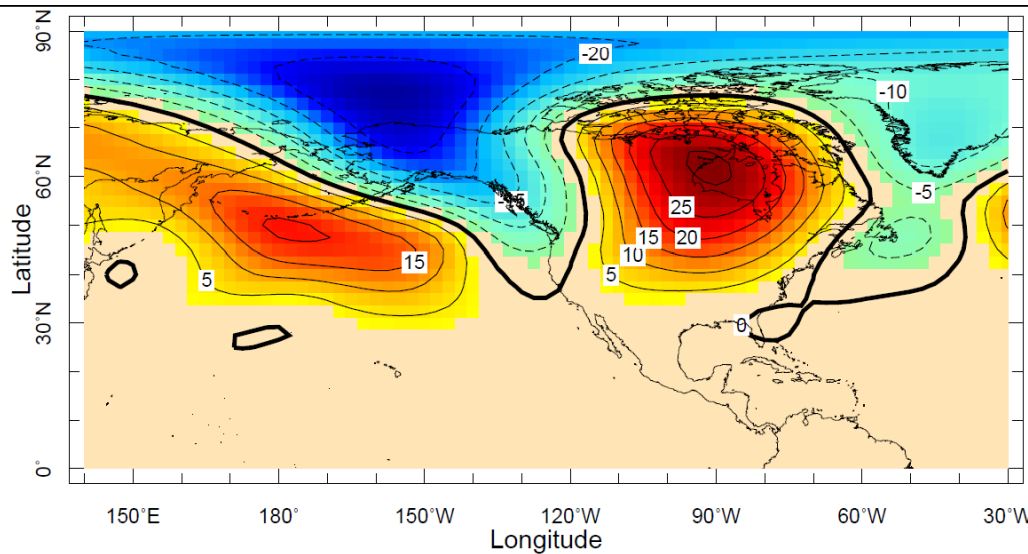
# Unforced Variability: Dominant Internal Mode of NH Summer



Leading  
“normal mode”

2<sup>nd</sup> EOF

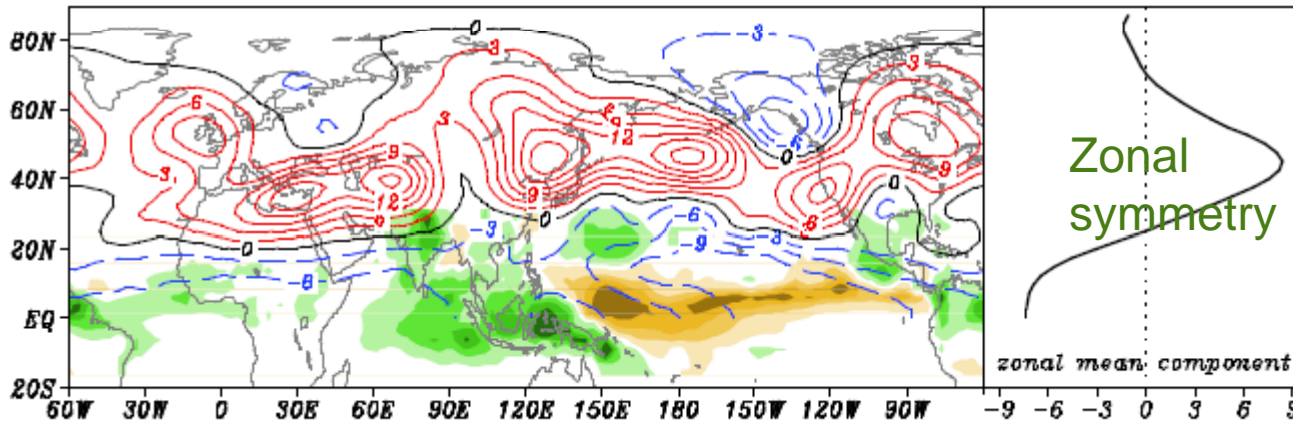
# Dominant Summer Mode of Joint Correlation for Heights and Temps



Summer (JJA) 500 mb Z structure (left) that is best correlated with North American sfc temp anomaly (right)...***shows strong similarity to the leading unforced mode over the PNA sector...***warm (cool) summers tend to be warmest (coolest) over Canada-Midwest-upper Plains

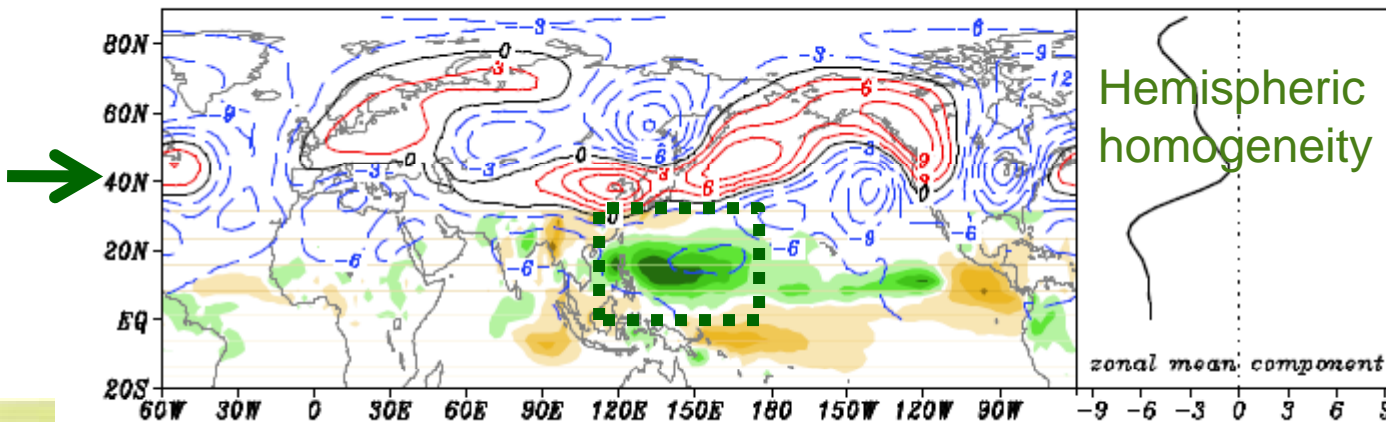
# Forced Variability: Two ENSO/Monsoon-Related Summer Modes

(a) M1 (Z200 and PREC) SCF=47%  $r=0.78$



Circumglobal pattern (~EOF2)

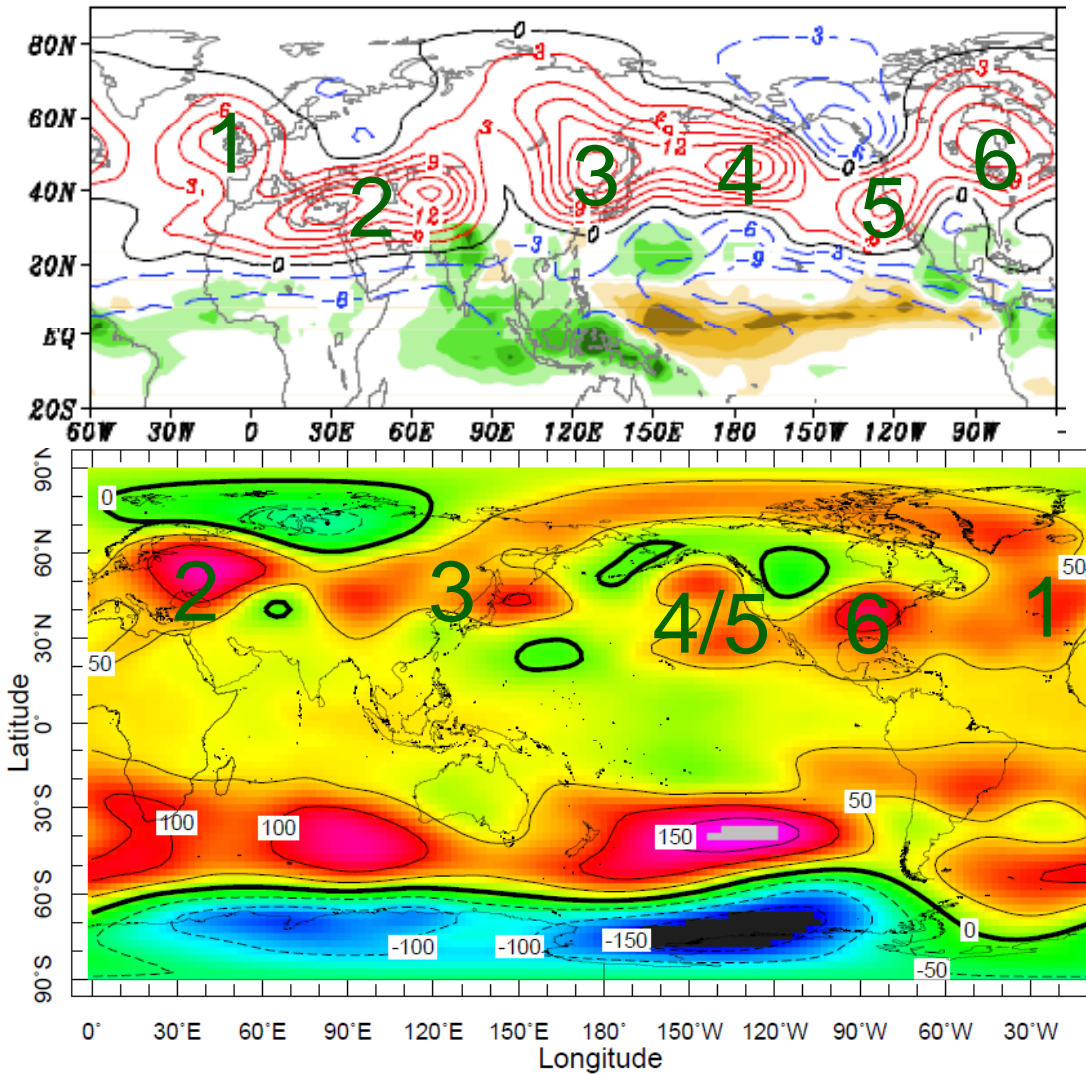
(b) M2 (Z200 and PREC) SCF=25%  $r=0.73$



Hemispheric homogeneity

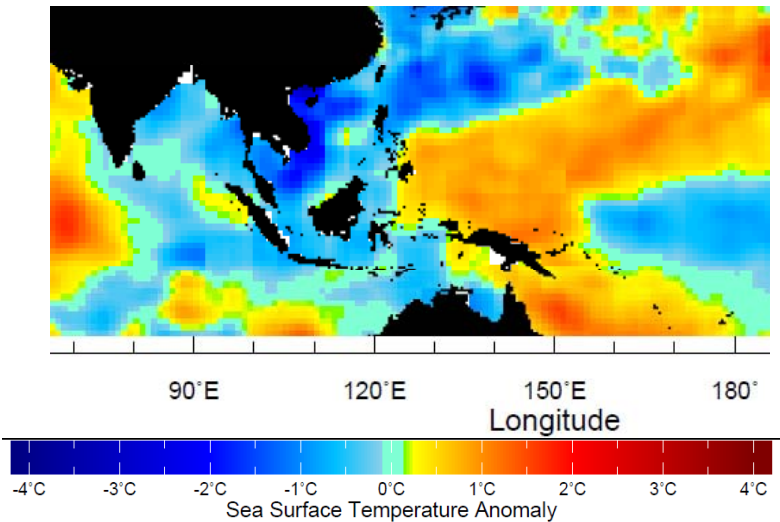
PNA-type pattern (WPNA; ~EOF1)

# Summer 2010: Variant of Circumglobal Pattern



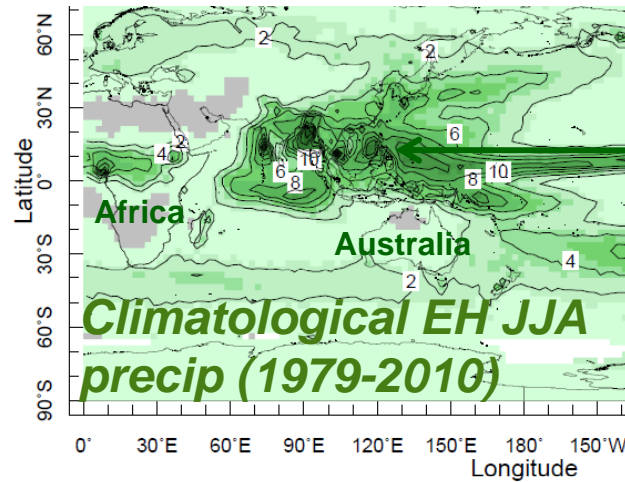
Pressure 200. mb Time Jun-Aug 2010

# Spring 2011 setup: warm WPAC/ cooler C-E Indian Ocean → active WPAC likely

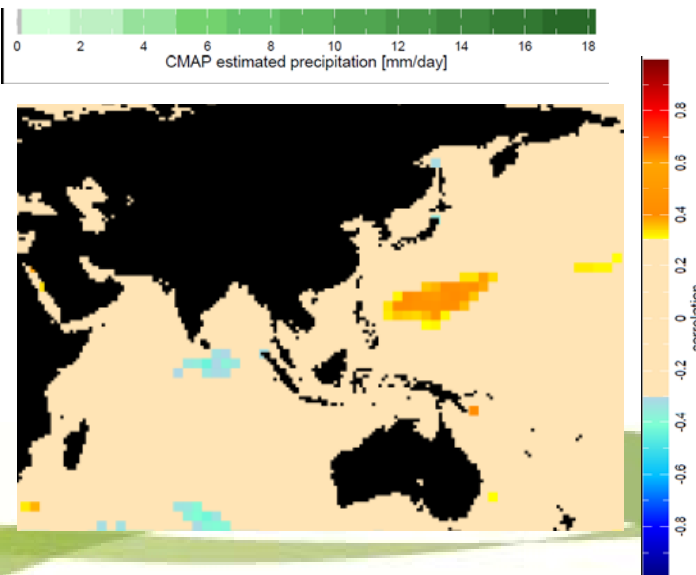


WPAC is the hotspot going into summer

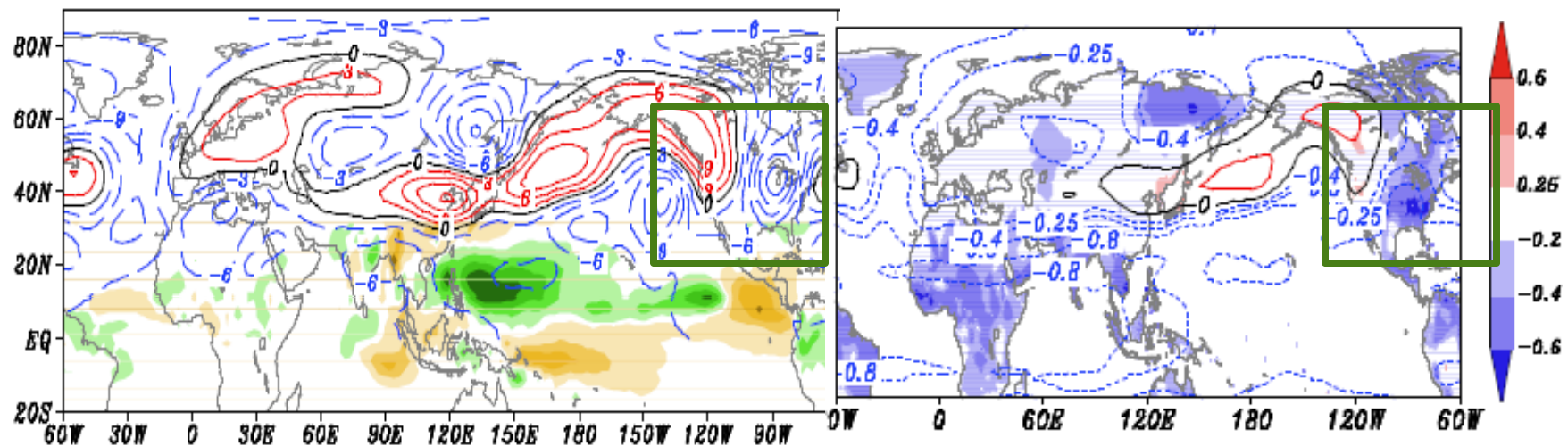
**RIGHT: Correlation b/w OLR anomaly and Northeast USA temps JJA (90% significance); enhanced Indian Ocean/suppressed WPAC correlate with warmer than normal Northeast (and vice versa)**



Tropical NW Pacific



## Post Nina Summers w/ Active WPAC Convection: WPNA Favored...Cooler Risk in Eastern USA

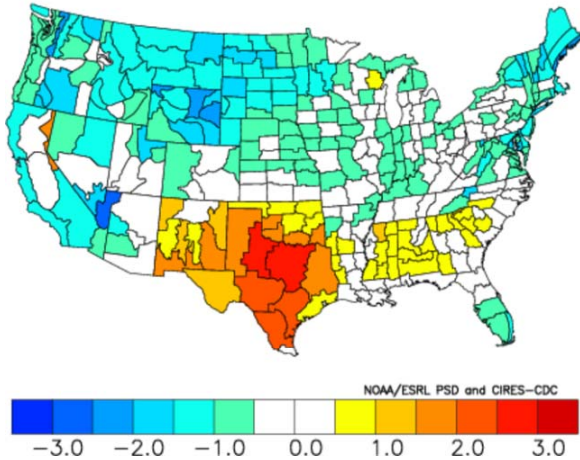


The positive phase of the “WPNA” favored in post-Nina summers (with active WPAC-biased monsoon)...generally cooler east of Rockies

# Analog: Small Samples but Consistent with WPNA

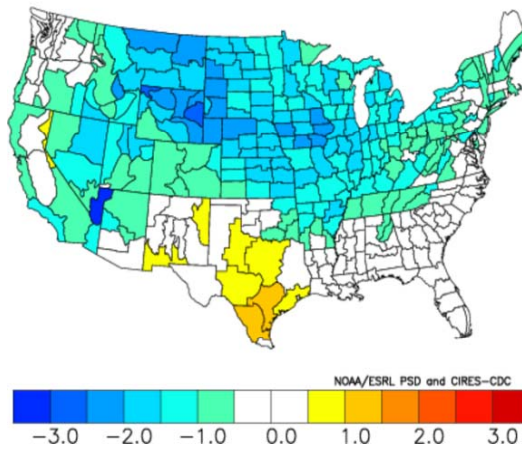


Composite Temperature Anomalies (F)  
Jun to Aug 1910,1951,1956  
Versus 1971-2000 Longterm Average



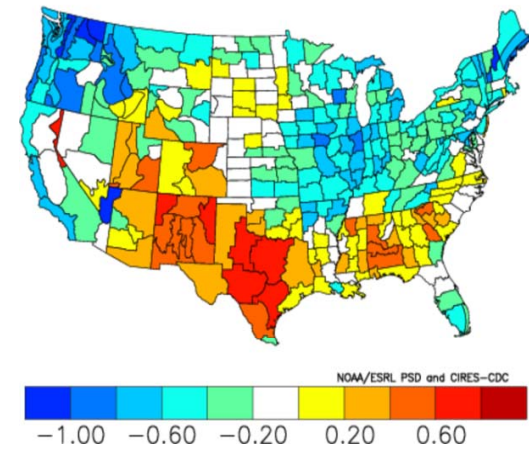
JJA (1) showing best retrospective fit for DJF (0)

Composite Temperature Anomalies (F)  
Jun to Aug 1951,1976,2009  
Versus 1971-2000 Longterm Average



JJA (1) for decaying MEI and at least weakly neg Jan NAO

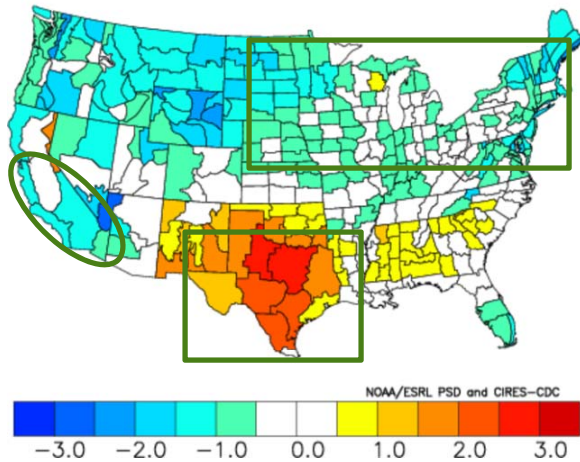
Composite Temperature Anomalies (F)  
Jun to Aug 1951,1956,1976,1989,2000,2008  
Versus 1971-2000 Longterm Average



JJA (1) for decaying MEI only (DJ value at least -1 SD)

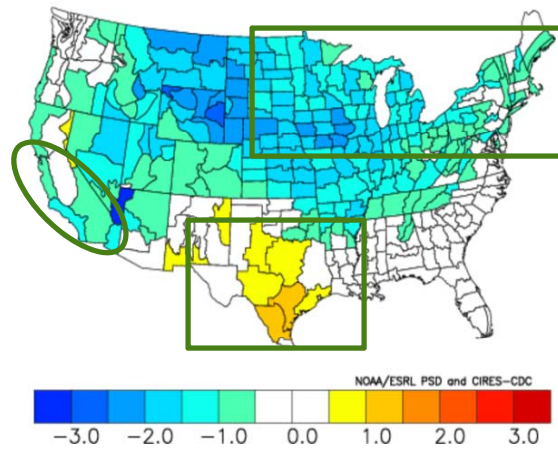
# Analogs – limited samples, similar themes!

Composite Temperature Anomalies (F)  
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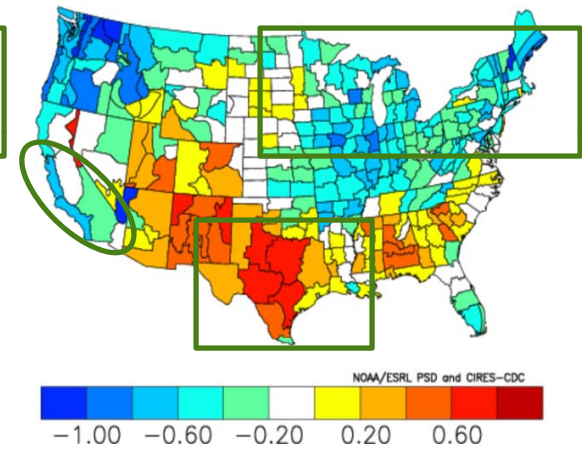
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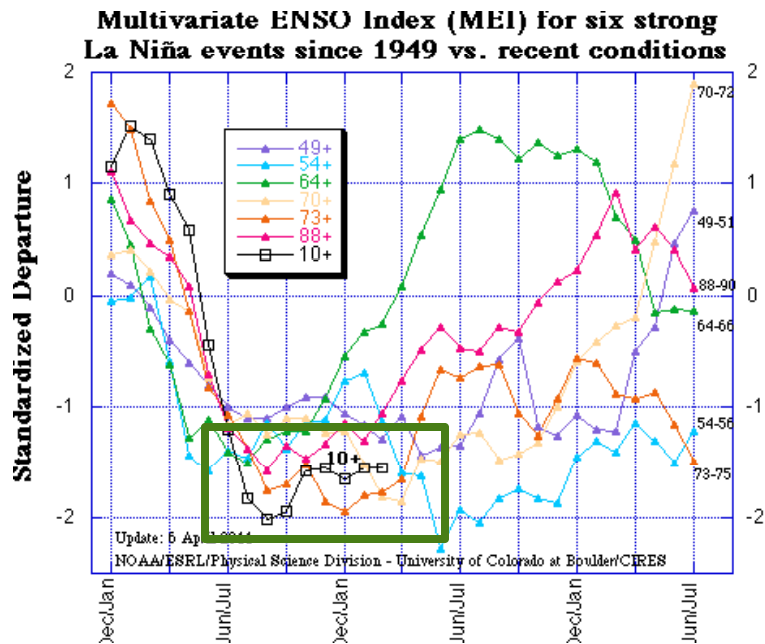


JJA (1) for decaying MEI only (DJ value at least -1 SD)

**Common themes:** cool Lakes-NE, warm TX, cool Cali

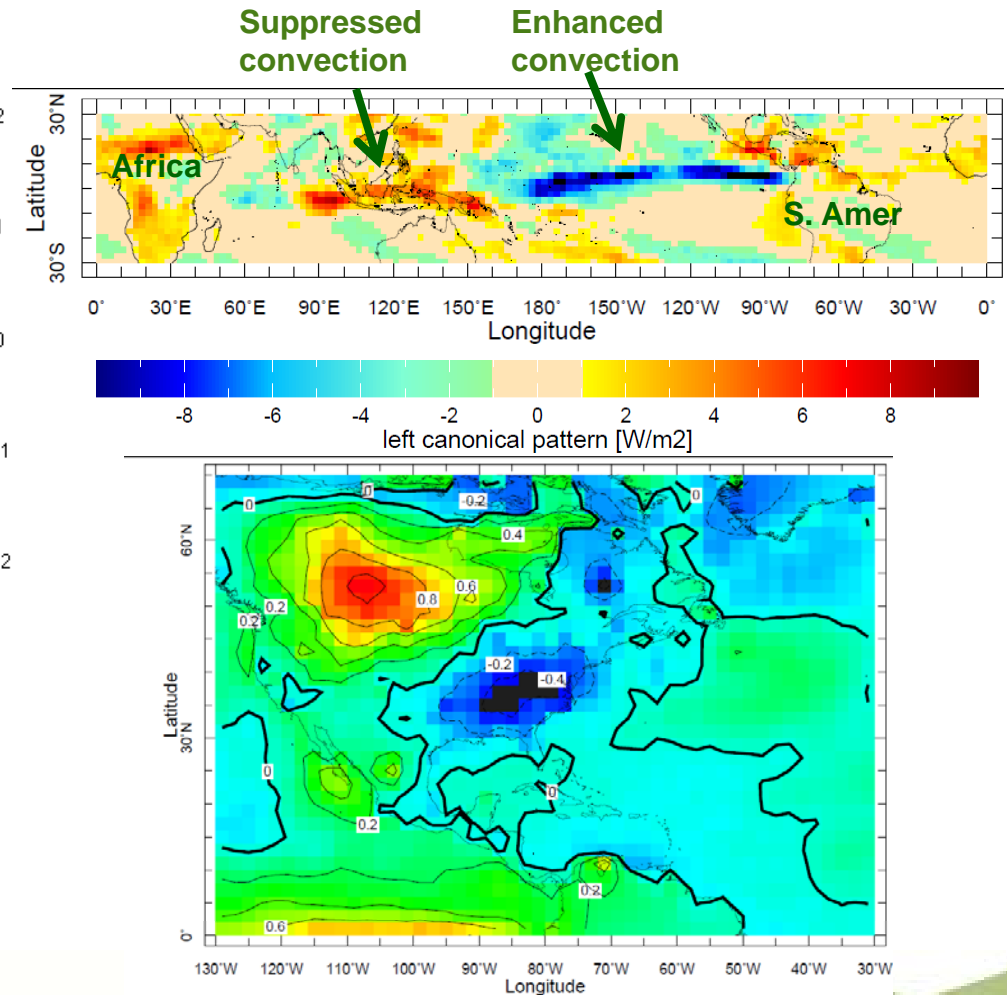
**Neg PDO years:** 1951, 1956, 2000, 2008

# Biggest Wildcard: ENSO Remains Stronger Through Summer?



**ABOVE: MEI remains impressively negative**

**RIGHT: Nino-like (Nina-like) summer OLR anomaly pattern tends to be well-correlated with below (above) normal temps Southeast USA...could see cold risk confined to central US with warmer South/East this summer**



## Summary

- Absent any forcing, most dominant mode appears to feature Gulf of Alaska low (or ridge) and downstream ridge (or trough) over northern U.S./Canada → tends to produce “Midwest-anchored” warm (or cold) summers
- Given decaying Nina and likelihood of enhanced WPAC convection, the WPNA pattern may prevail this summer → if so cooler risk in East
- Stronger Nina coupled with WPNA type pattern may shift cooler risk back in central USA with corresponding warmer risk on southern/eastern peripheries of nation.