Attribution of Extreme Variability of Storminess, Rainfall and Temperature in the Florida Dry Season

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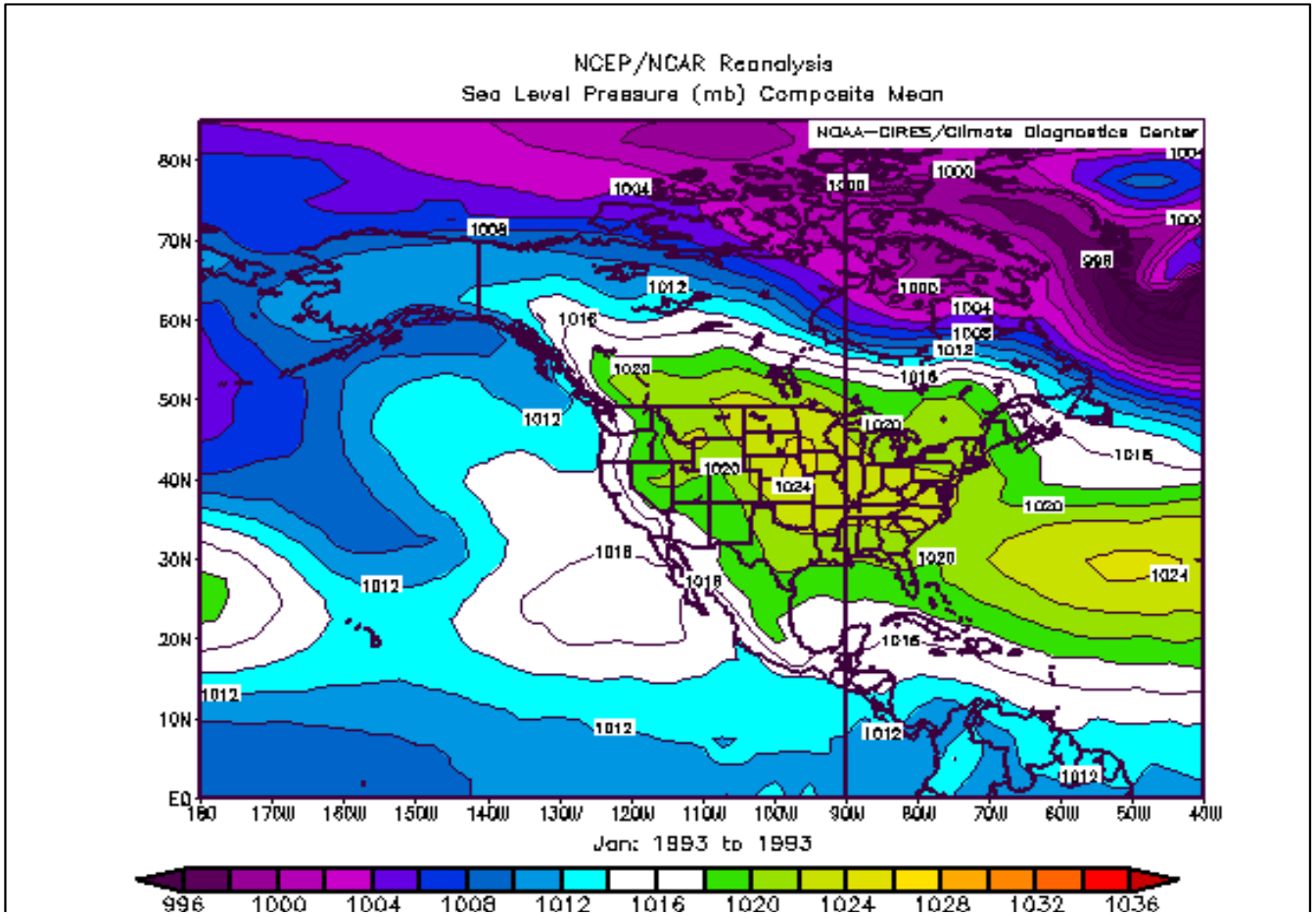


Consider Extreme Events in the Florida Dry Season and their Relationship to ENSO, PNA, AO and NAO

- Major Extratropical (ET) Storms
- Severe Weather (Tornadoes)
- Excessive Rainfall and Flooding
- Drought and Wildfire
- Severe Cold Outbreaks

Attribution of Extreme Variability

•Extreme seasonal variability is often due to the occurrence of a few extreme weather events.

•Extreme impacts result from intersection of a extreme weather event with customer vulnerability.

•Critical to relate climate to weather in a physically meaningful way.

•The goal is to predict the probability of occurrence of extreme events on a seasonal basis from major teleconnections.

Examples will be given for severe weather, rainfall, and extreme cold using logistic regression.

Logistic Regression

•Probabilistic results for decision support

•Customer Involvement in setting critical variables and exceedance thresholds

•Assists in calibrating teleconnection strength by impact to user

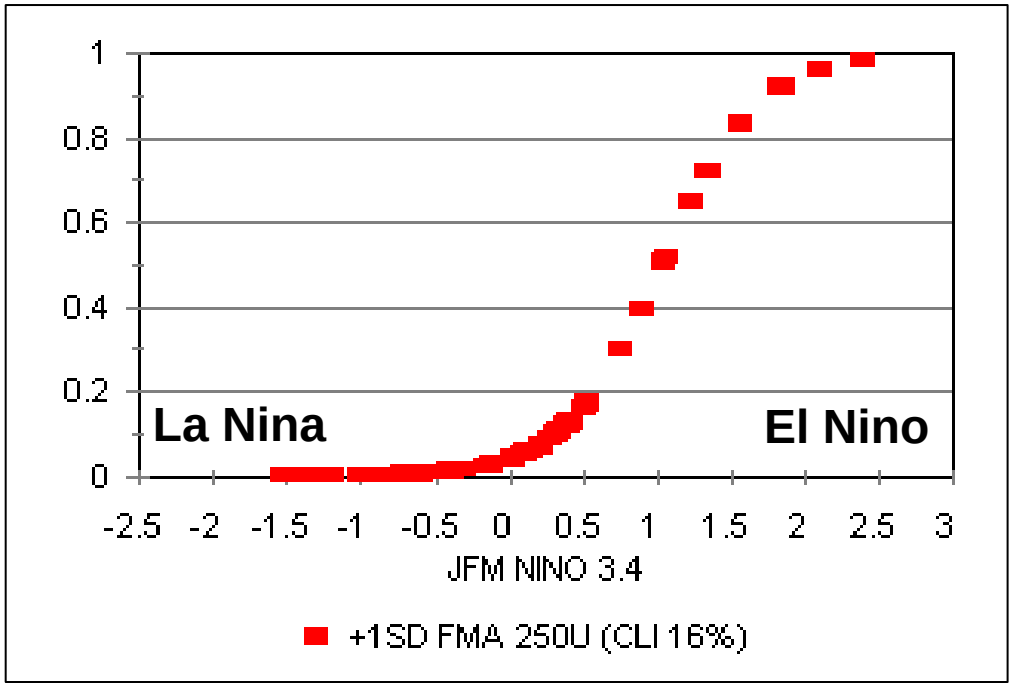
•Results can help prioritize research on potential highest payoff

Will look at examples of Florida and single station (Daytona Beach) logistic regression results

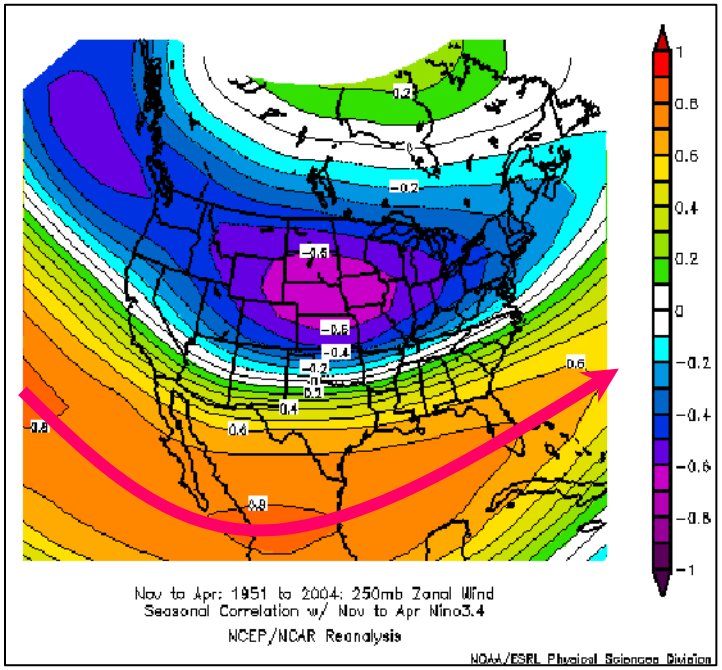
Biggest Challenge – Database development for specific customer location and critical variable.

Storminess and Severe Weather

The Strength of the Jet Stream Over Florida is the Fundamental Relationship with ENSO that Controls Storminess

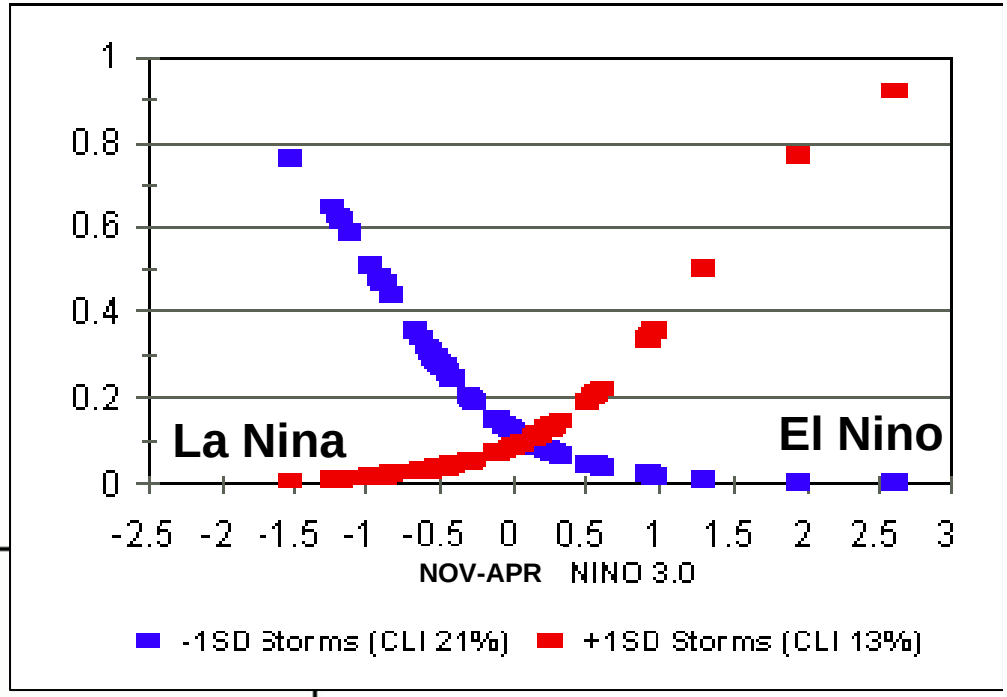


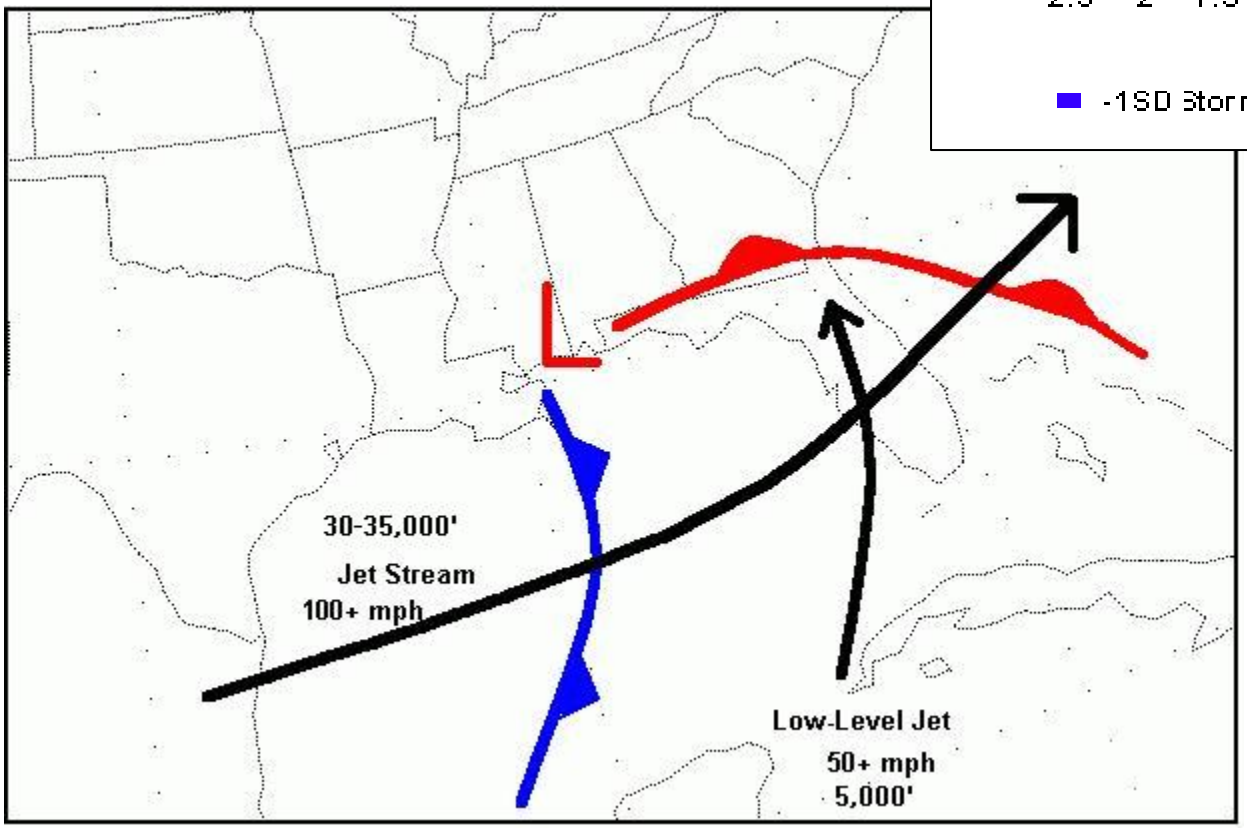
Probability of FMA 250 mb U over Florida > 1 SD above normal given JFM Nino 3.4.



Correlation of NOV-APR 250 mb Zonal wind with NOV-APR NINO 3.4

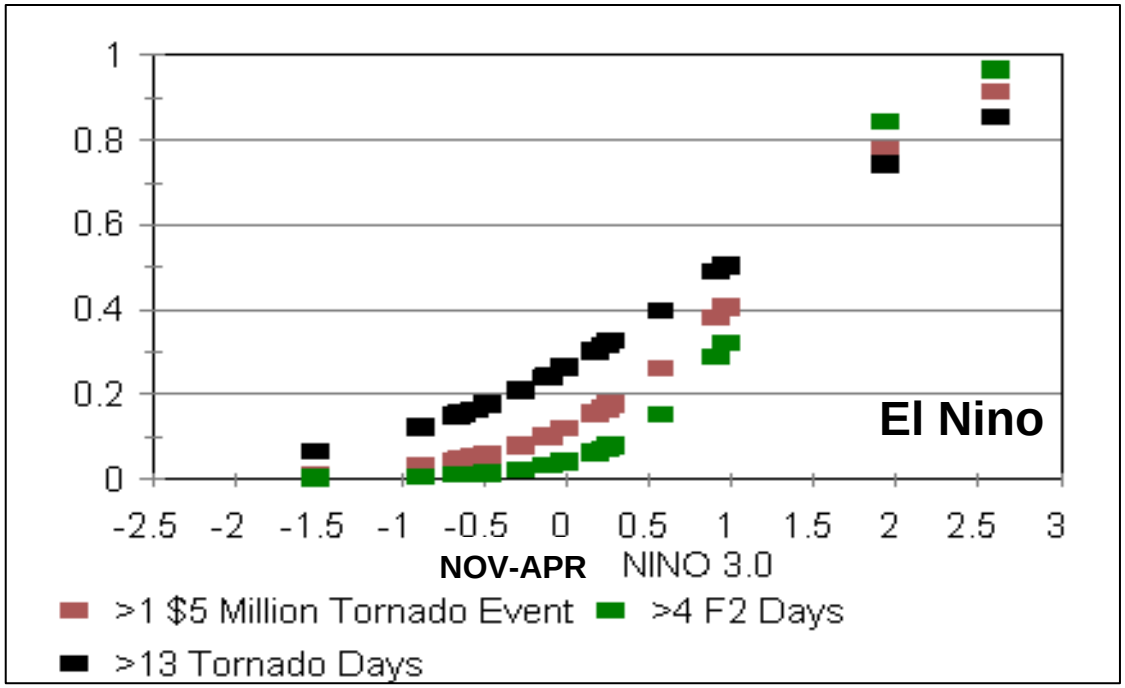
Major Dry Season ET Storms Are <u>always</u> Associated with Jet Stream Maxima!





Probability <1SD/>1SD Florida Dry Season Storms Given Mean Season NINO 3

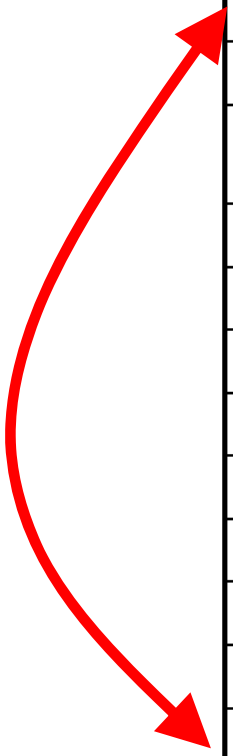
Take it a step further – Probability of Extreme Severe Weather -



Probability of Frequent and Strong Florida Tornadoes Given Dry Season NINO 3.0

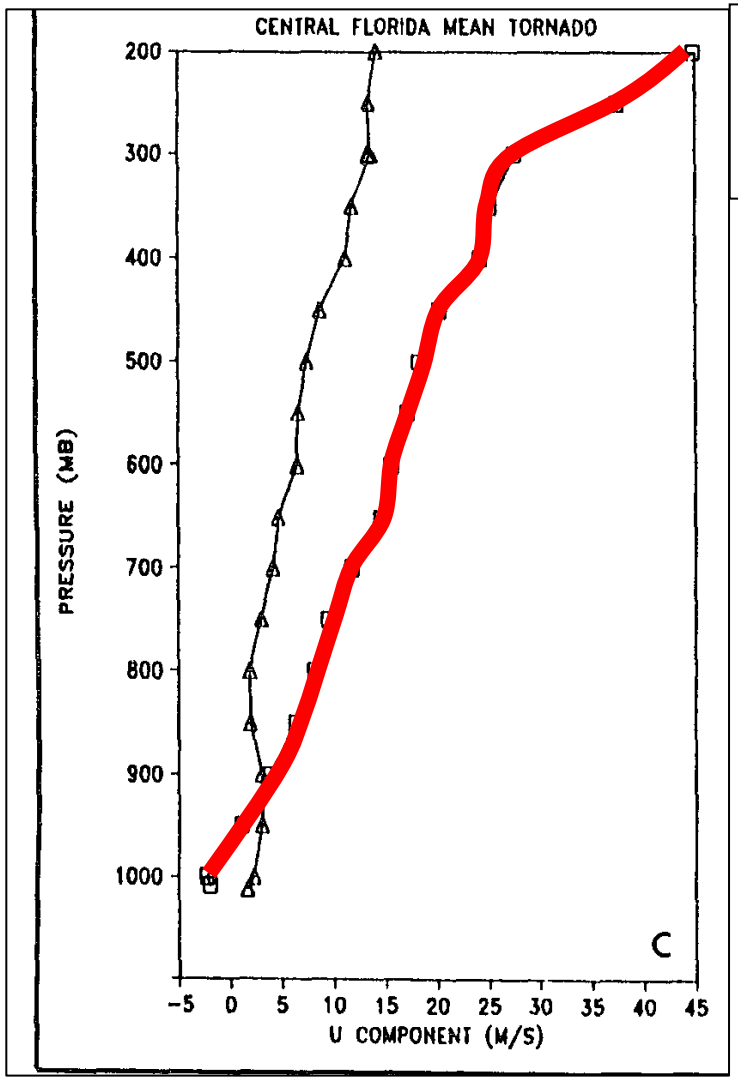
Strong Relationship – Is it Physically Realistic?

Simple conceptual consideration of the time and space scales relating to the attribution and predictability of various weather and climate phenomena.



Phenomena	Time Scale	Space Scale
Tropical Pacific SST	Months to seasons	Thousands of Km
PNA/NAO/AO	Weeks to months	Thousands of Km
Mean Storm Track/Jet Stream/LW Trough	Weeks to months	Thousands of Km
Short Wave Trough	Days to week	Hundreds to thousands of Km
ET Cyclone	Days to week	Hundreds to thousands of Km
Jet Streak	Days	Hundreds to thousands of Km
Severe Freeze/Cold Outbreak	Days	Hundreds to thousands of Km
MCC in Warm Sector	Hours to days	Hundreds of Km
Thunderstorms	Minutes to hours	Tens of Km
Excessive Convective Rainfall	Minutes to hours	Tens of Km
Mesocyclone/Super Cell	Minutes to hour	5 to10 Km
Tornado	Seconds to minutes	Hundreds of Meters

Violent Dry Season Tornadoes Occur in the Warm Sector of ET Cyclones with Jet Stream Maxima

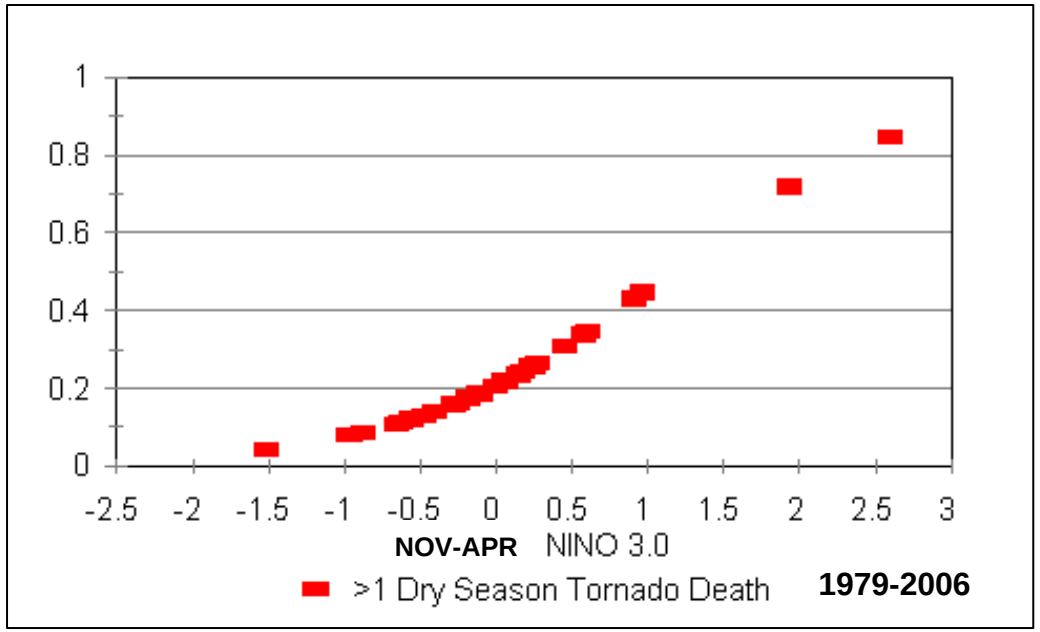


Mean Tornado Outbreak Environment
Vertical Profile of U
Hagemeyer and Schmocker 1993

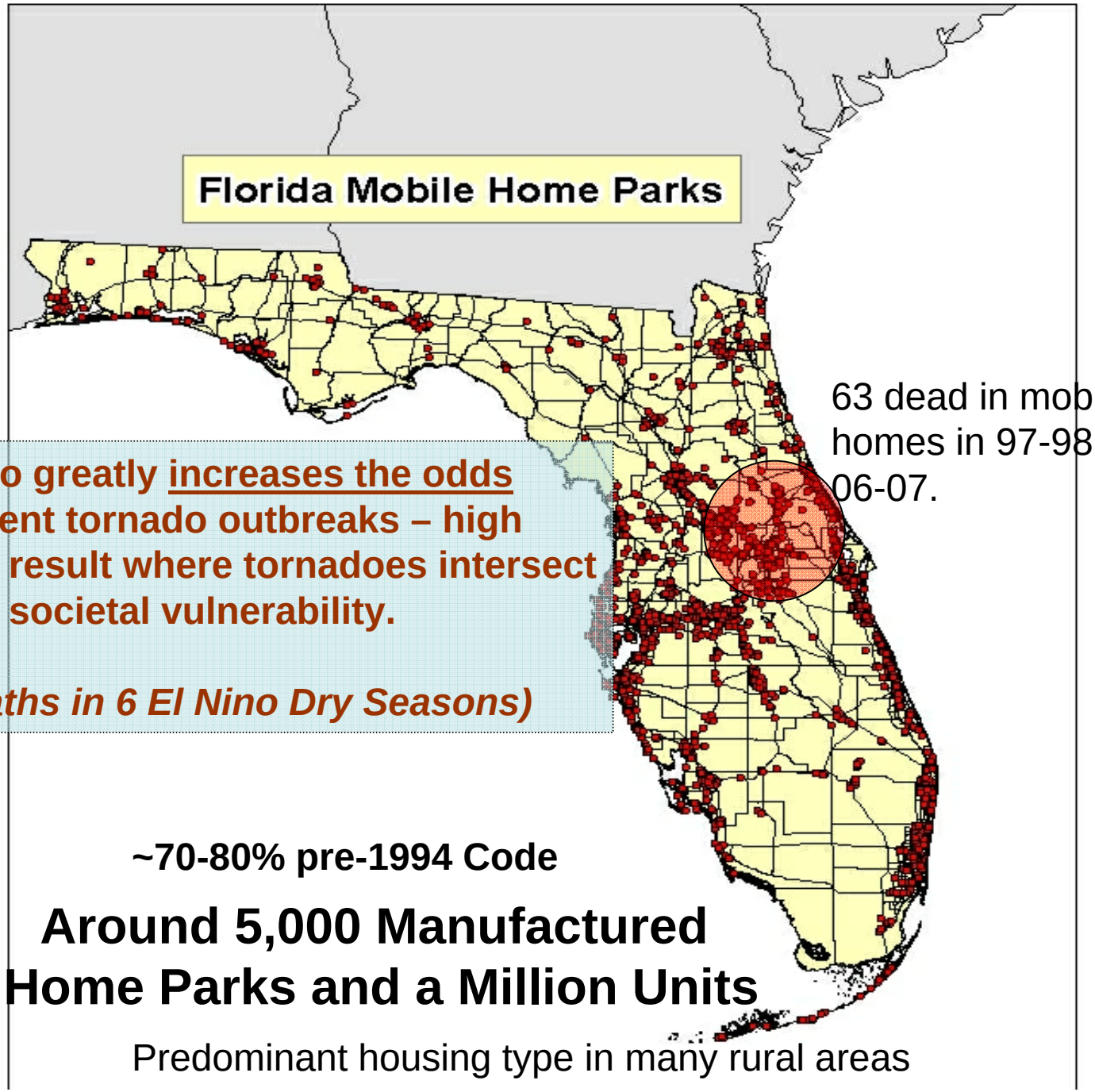
Florida Tornado Outbreak Mean F-Scale Has the highest correlation with Bulk Mean Environmental Wind. $R^2 = 0.74$
Hagemeyer and Matney 1993

EL Nino doesn't *cause* violent tornadoes in Florida it *enables* them!

Attribution of Tornado Deaths?



Probability of >1 Tornado Death in Florida Dry Season Given Mean NINO 3.0



63 dead in mobile homes in 97-98 and 06-07.

El Nino greatly increases the odds for violent tornado outbreaks – high death tolls result where tornadoes intersect societal vulnerability.

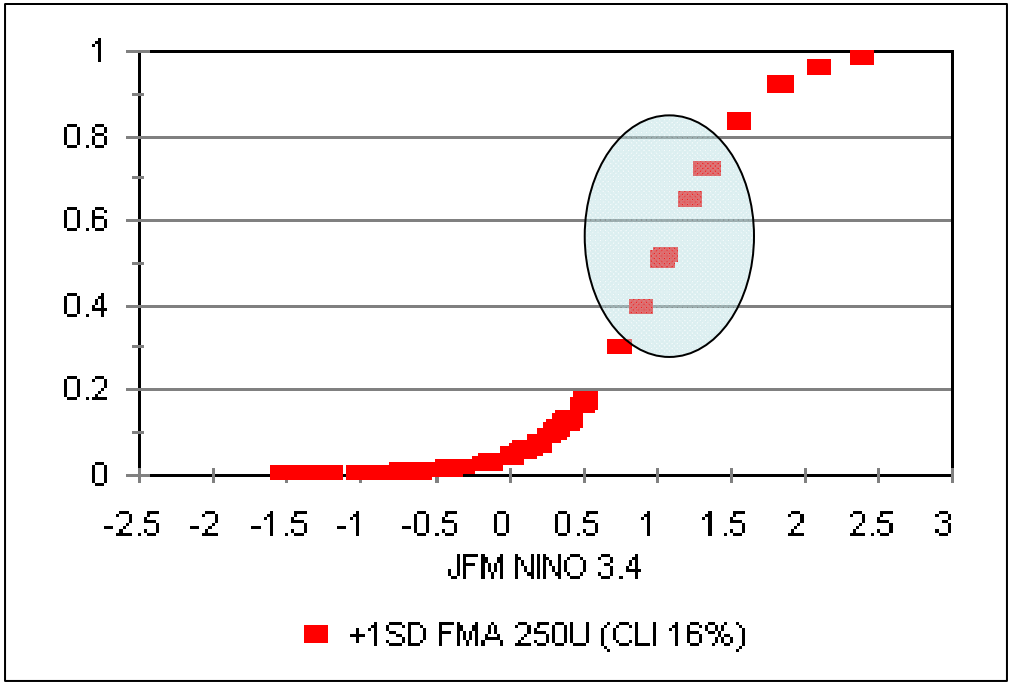
(84 deaths in 6 El Nino Dry Seasons)

~70-80% pre-1994 Code

Around 5,000 Manufactured Home Parks and a Million Units

Predominant housing type in many rural areas

Calibrating The Teleconnection for Decision Makers



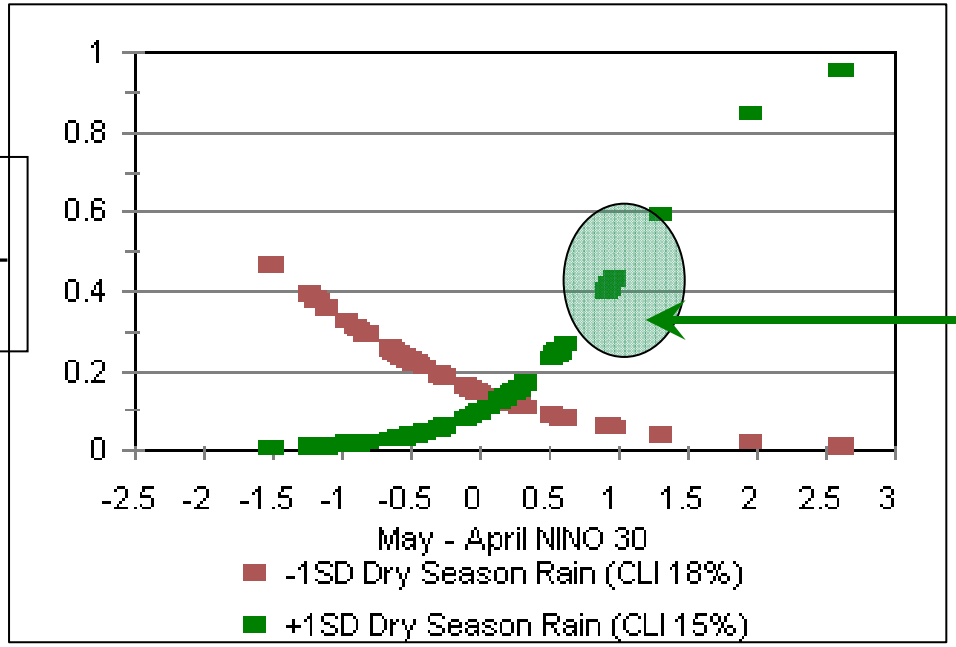
It does not take an extreme El Nino to skew the odds towards extreme Increase in storminess – a “Moderate” El Nino will do just fine.

Rainfall Extremes

ENSO has the strongest relationship to Florida rainfall

Only the strongest El Nino are locks for extreme wetness

Not all La Nina's are extremely dry – case in point 88-89



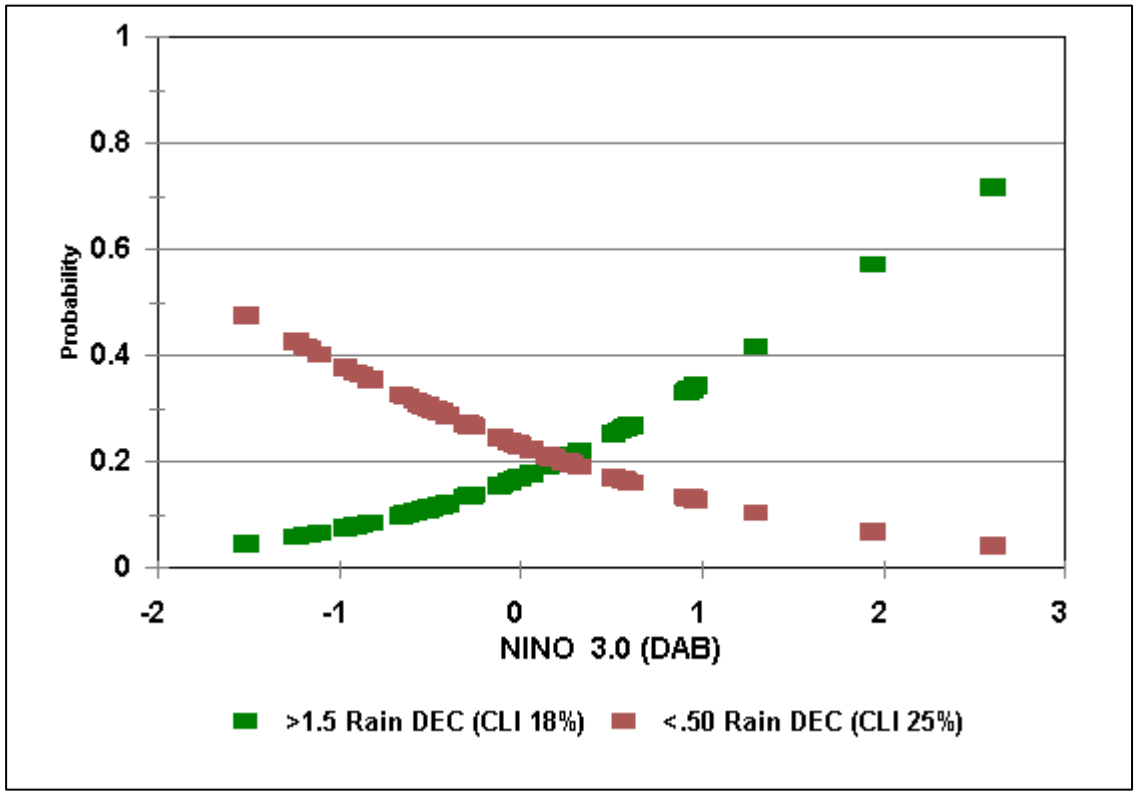
LR results – 06-07 El Nino Only ~40% of Very wet

Nov-Apr Nino 3.0 on rainfall

Extreme Weather Event Example

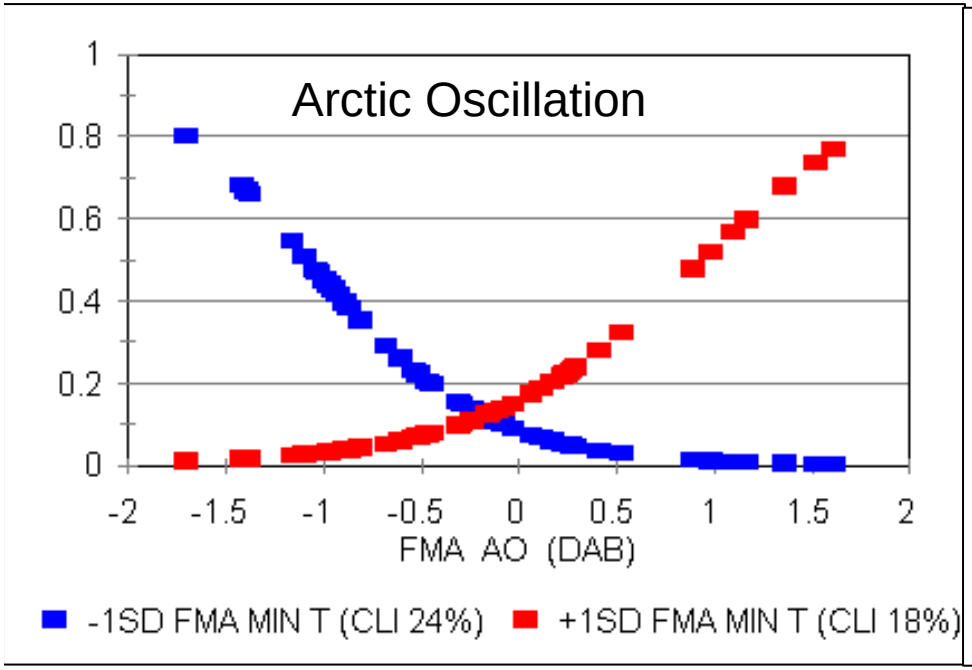
Unique Extreme Rainfall Concerns - Maximum daily rain in Daytona Beach in December > 1.5” or < 0.50”

Predictor – Mean Dry Season NINO 3.0

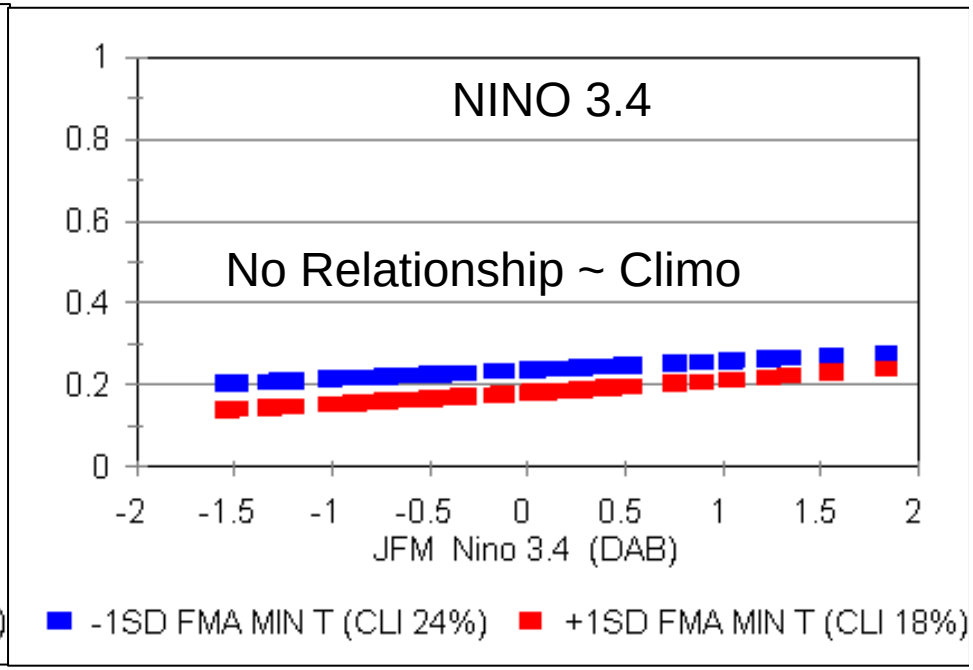


Temperature Extremes

ENSO Not Particularly Relevant to *Extremes* of Cold Temperature



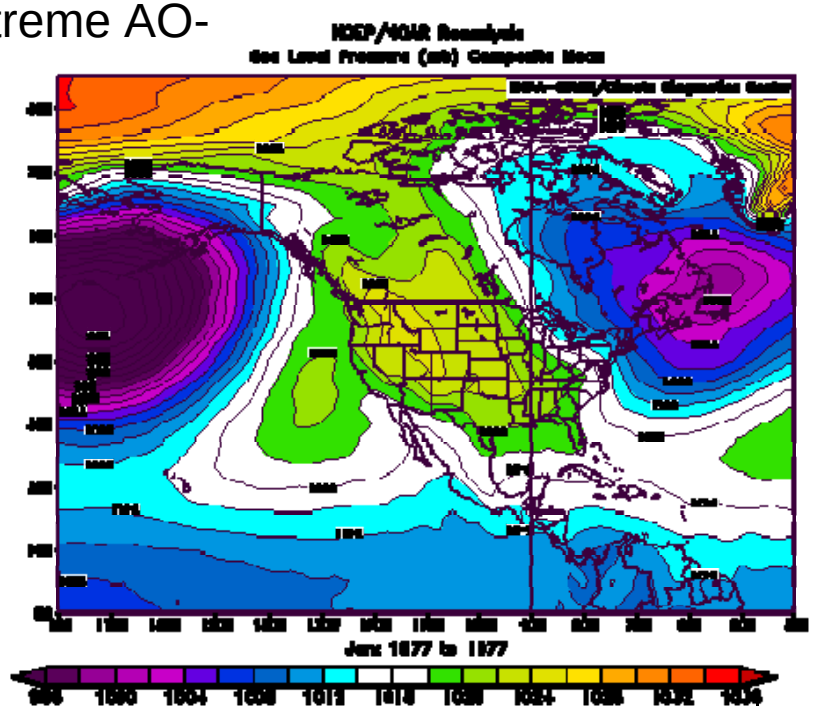
P DAB FMA MIN T +/- 1 SD FMA AO



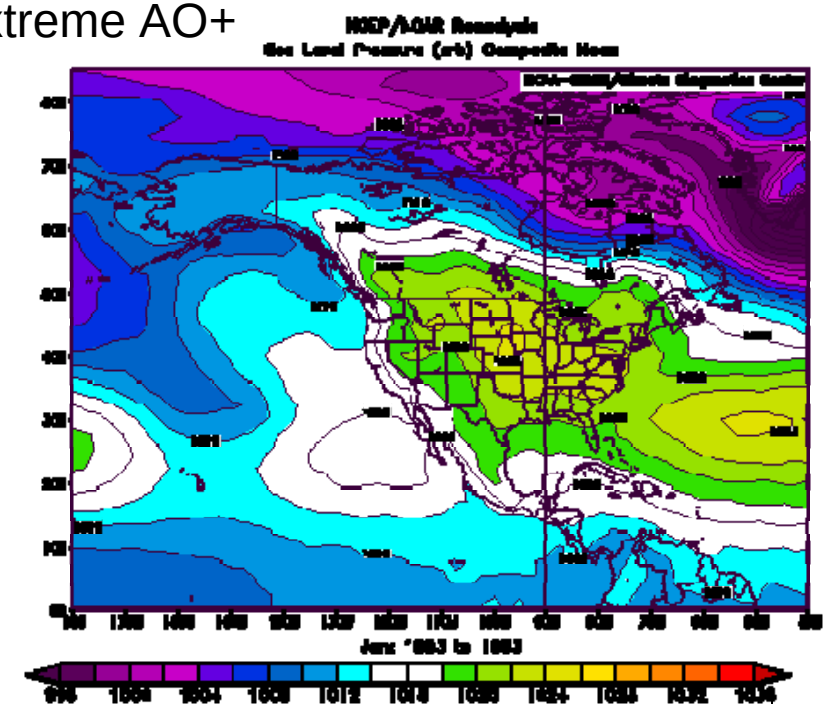
P DAB FMA MIN T +/- 1 SD JFM 34

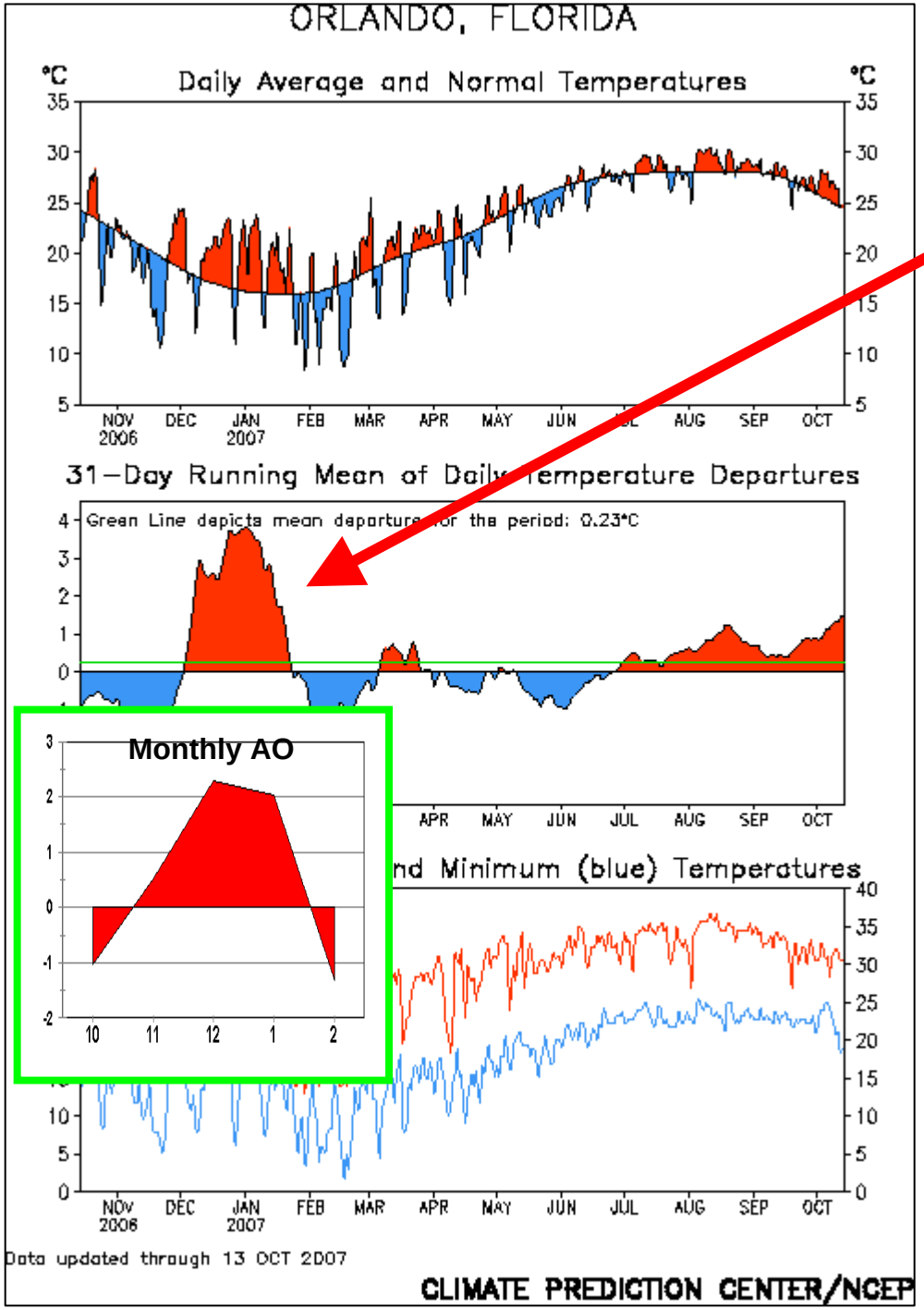
1950-2004 data

Extreme AO-

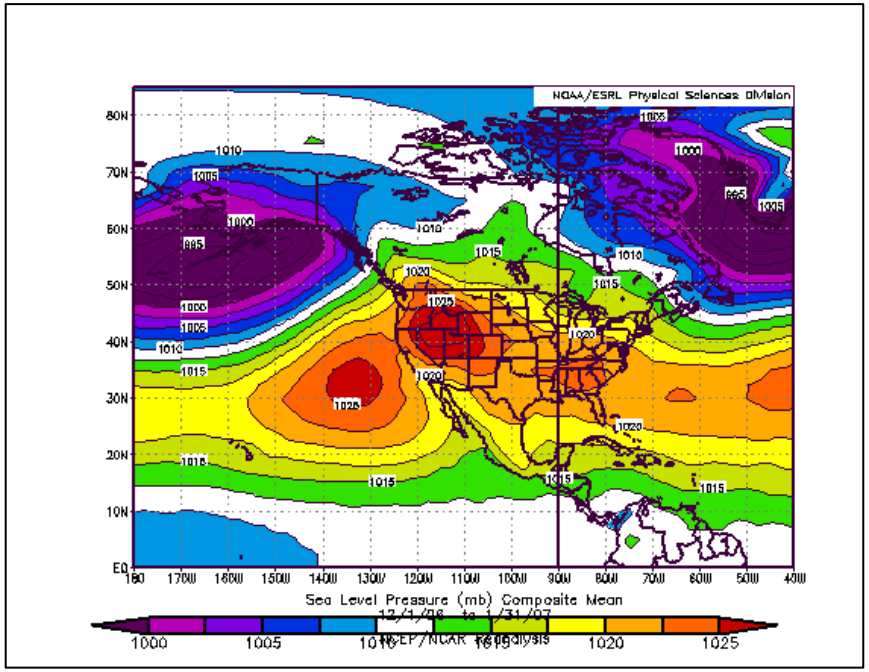


Extreme AO+





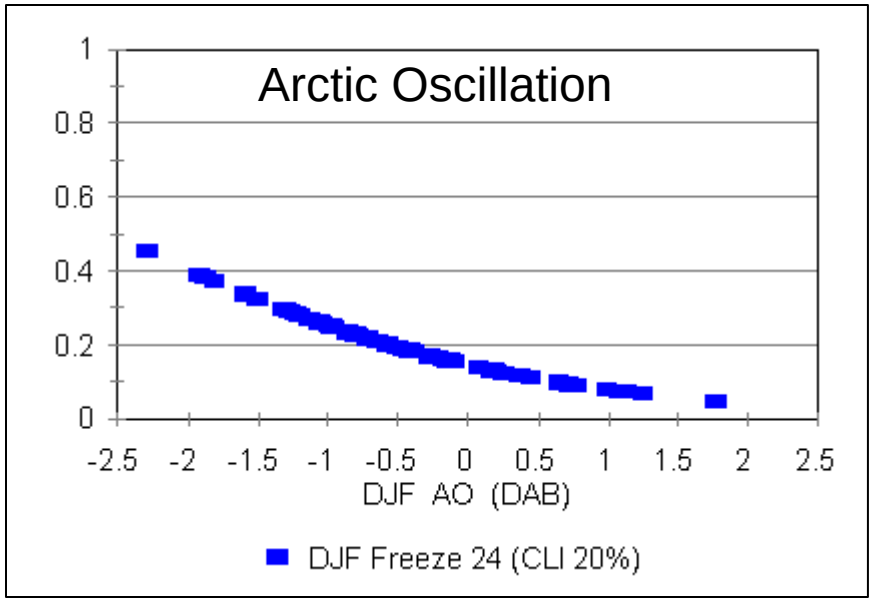
Noteworthy Warmth in Winter 06-07 – Not El Nino!

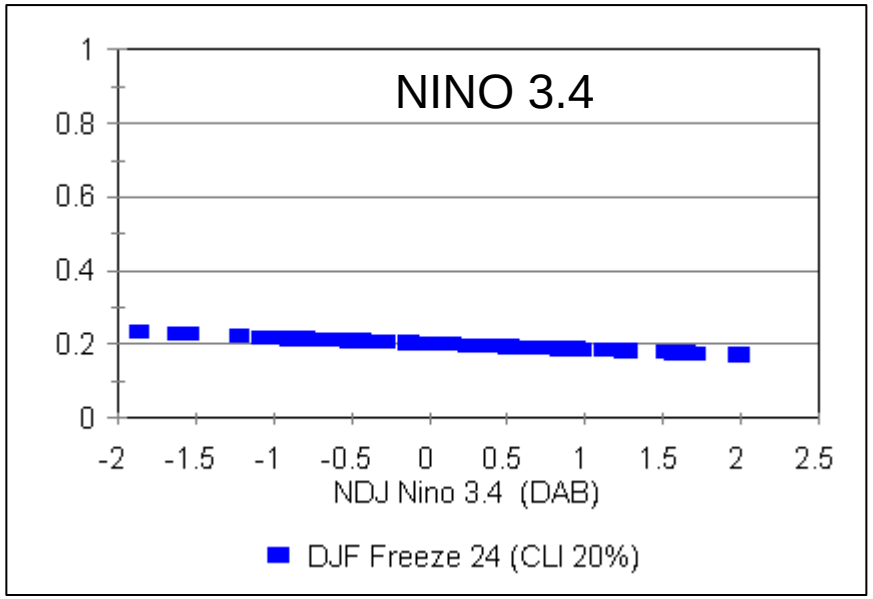


DEC-JAN Mean MSLP

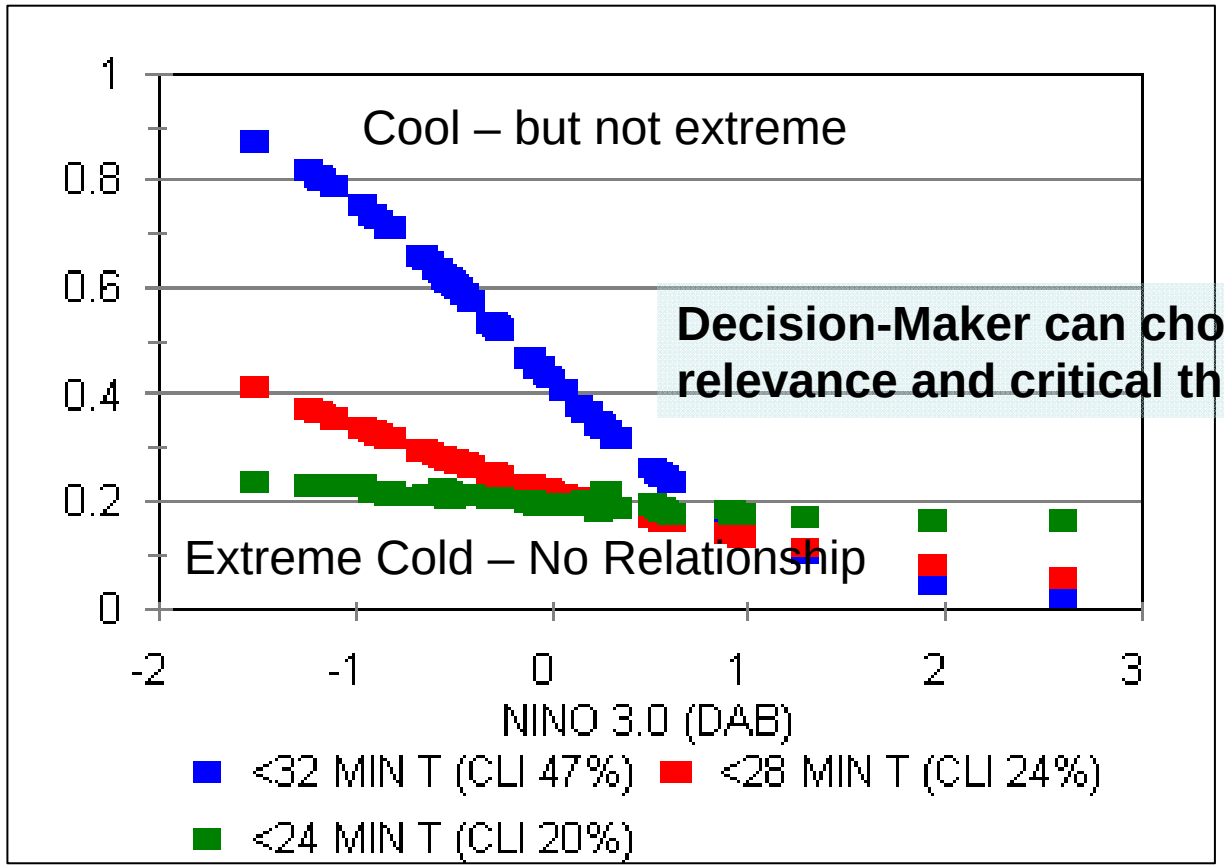
Extreme Weather Event Example

Probability of at Least One Devastating Freeze in Daytona Beach in DJF





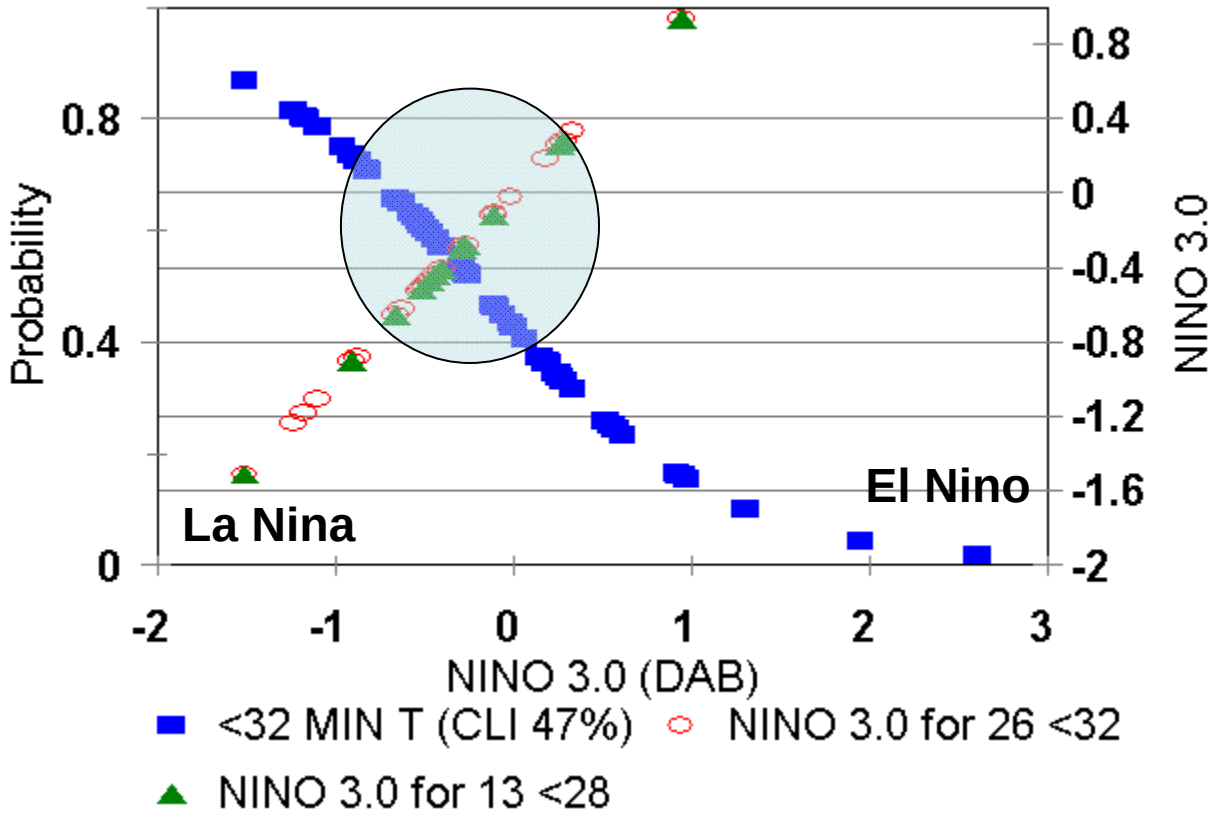
Extreme Weather Event Example: Insight into ENSO Impacts vs. Anecdotes



Decision-Maker can choose relevance and critical thesholds!

Probability of December Minimum Temperature at Daytona Beach < 32, <28. and <24 given dry season Nino 3.0

Generally Coldest in ENSO Neutral Years – NAO/AO Rule Extremes



ENSO Weak - AO/NAO and PNA Dominate
Critical Area for Research - Can't Continue to "Blame" ENSO

Thank You

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