

Dry Season 2015-2016 Outlook: El Niño and Potential Impacts

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1997 and 2015 El Niño Sea Surface Temperature Anomalies

Water Conditions Summary

South Florida Water Management District Governing Board Meeting October 8, 2015

Paul Linton, PE, Section Administrator,
Water Management Section

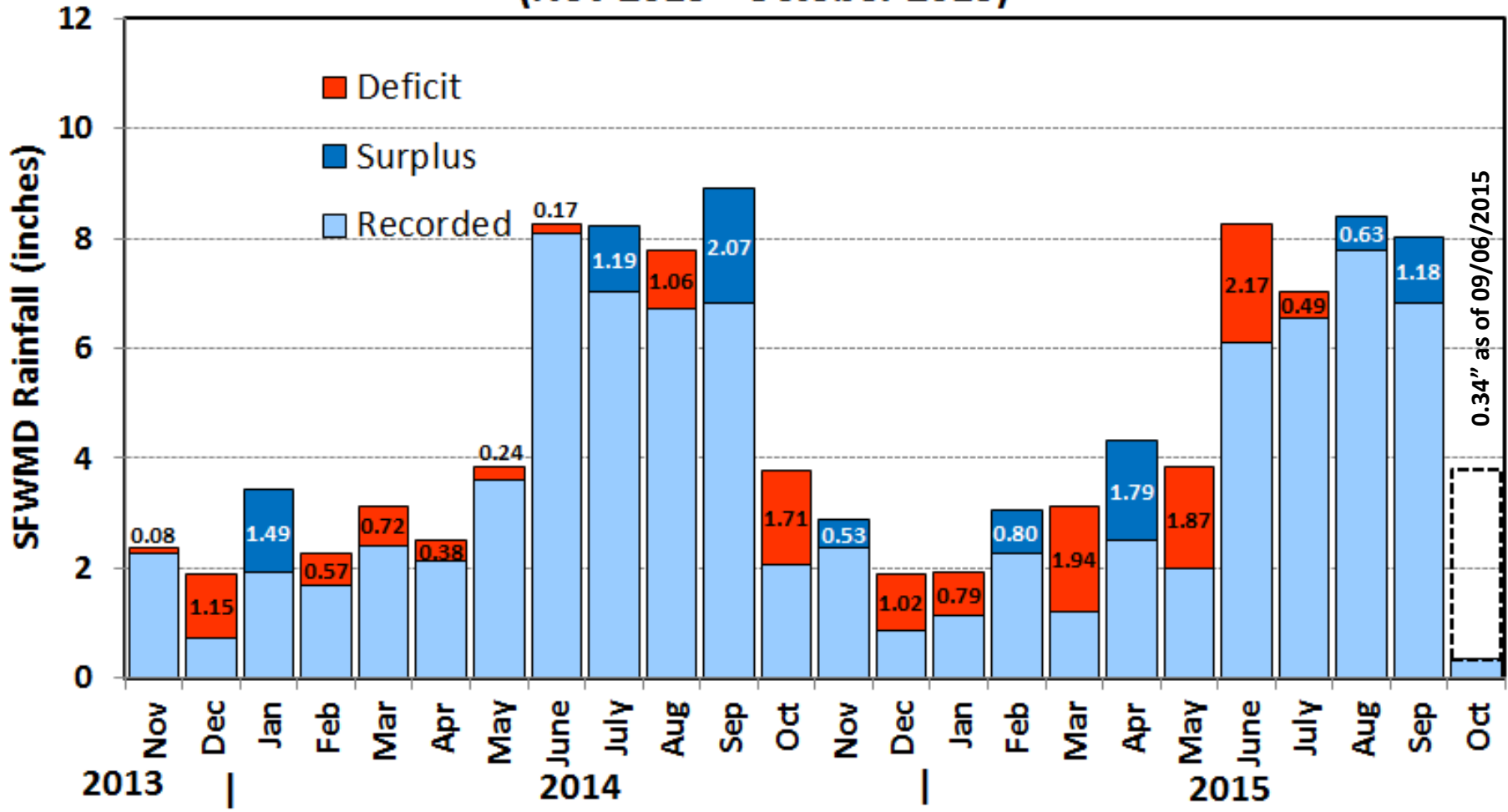
South Florida Water Management District

Aug 03 1997

Aug 03 2015

SFWMD Rainfall Distribution Comparison

(Nov 2013 - October 2015)



2013-14 DRY SEASON:

- Only January above average
- Dry Season ended 92% of average

2014 WET SEASON:

- May 26th – Oct 4th
- Near average (108%)

2014-15 DRY SEASON:

- May was 51% below average
- Dry Season 86% of average

2015 WET SEASON:

- Driest May-July since 2004
- Slightly below average

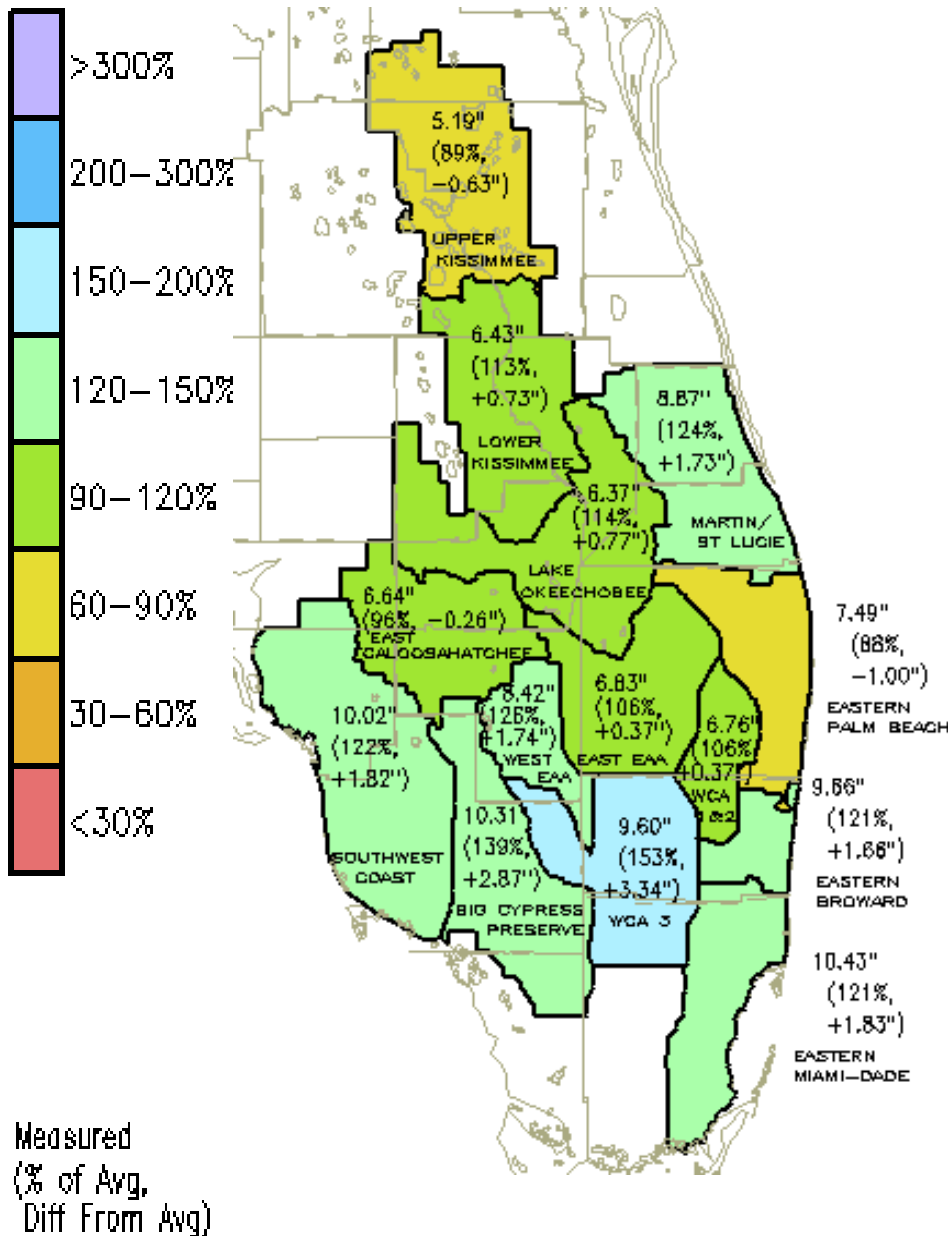
SFWMD

September 2015 Rainfall

(02-Sep to 01-Oct)

**DISTRICT-WIDE: 8.01"
(117% of Avg, or +1.18")**

- Above average but with an uneven spatial distribution of rainfall
- Largest surplus was for the WCA 3 (153%)
- Largest deficits appear for Upper Kissimmee (89%) and for Eastern Palm Beach (88%)



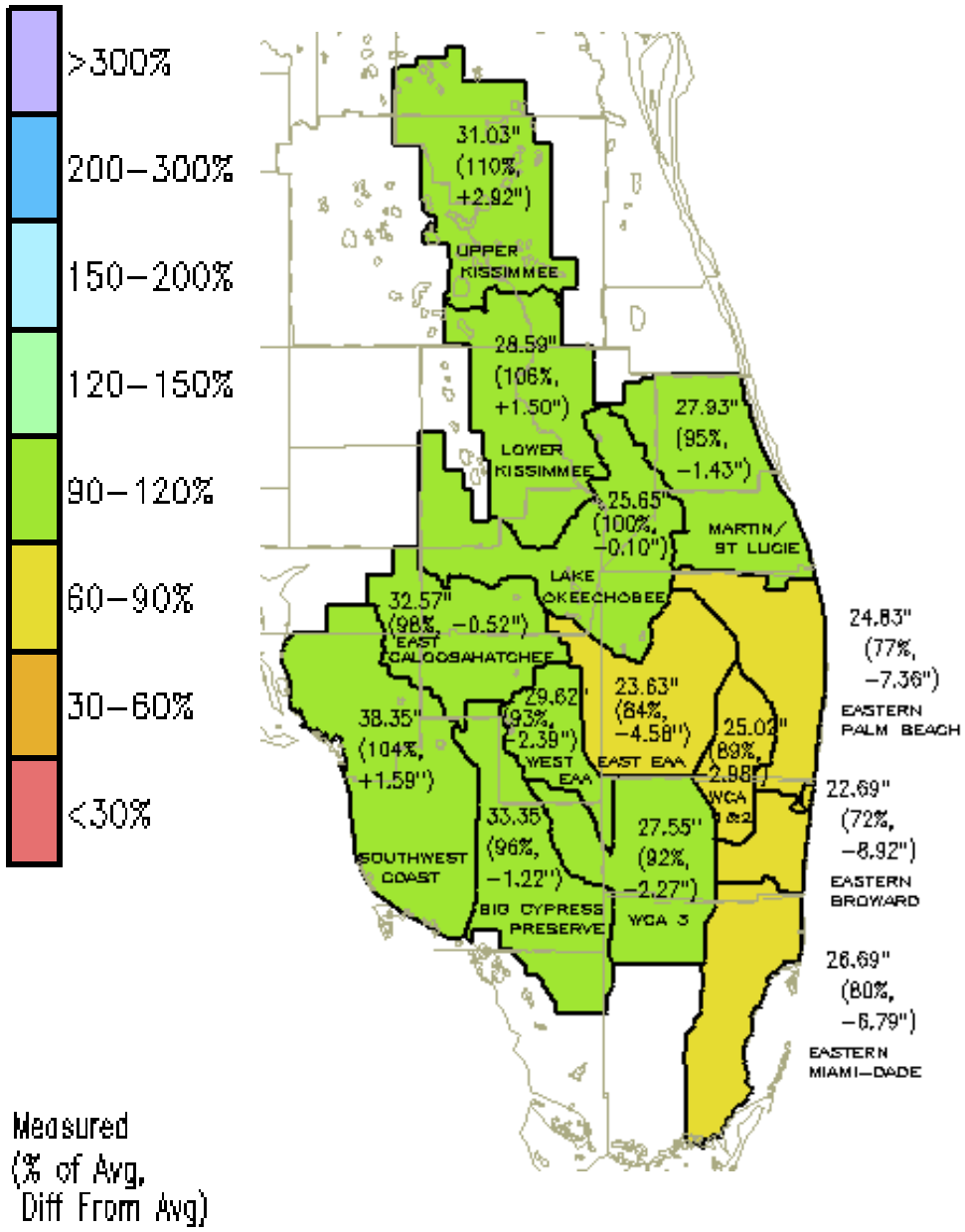
SFWMD

Wet Season Rainfall

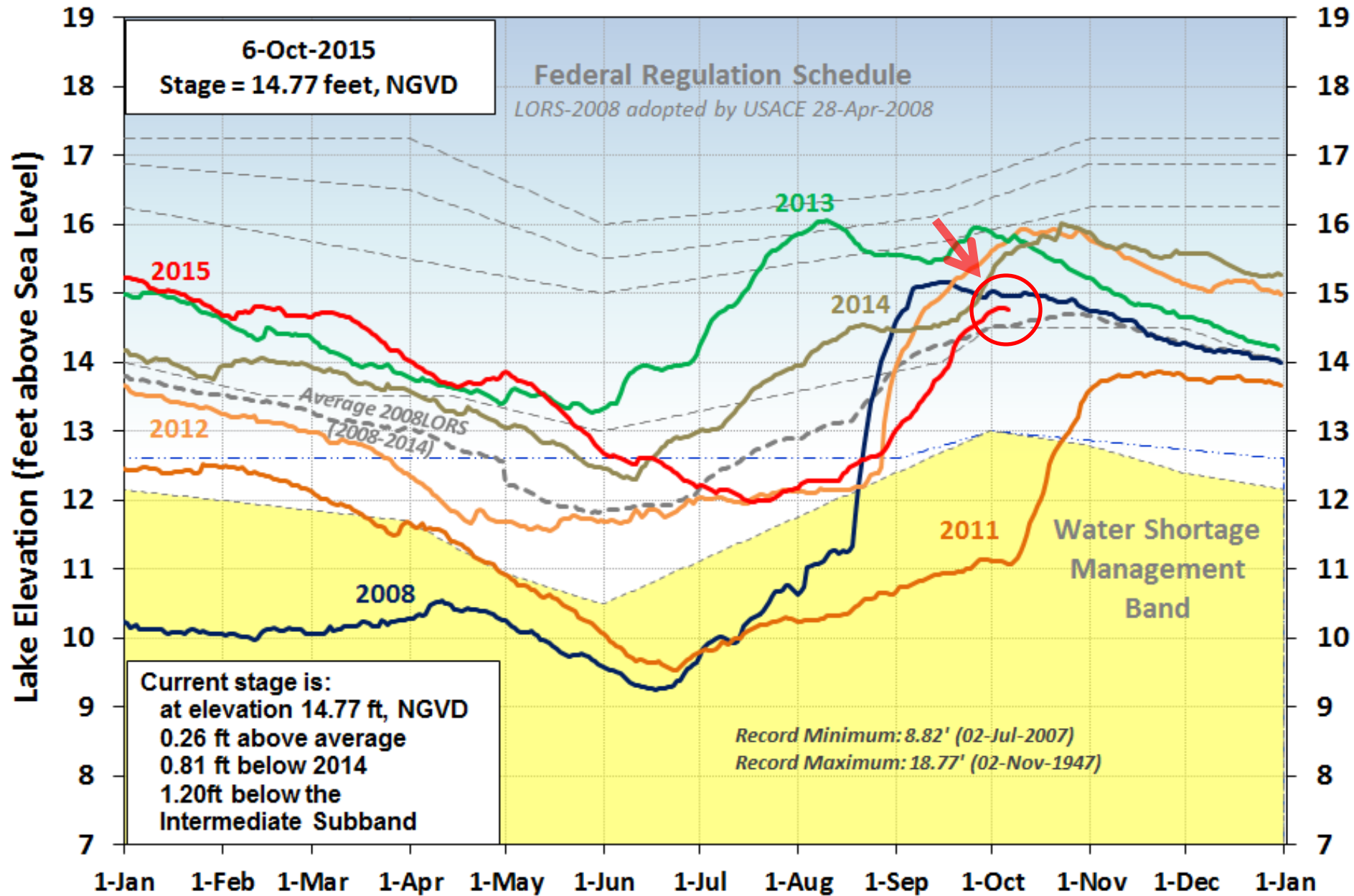
(02-Jun to 06-Oct 2015)

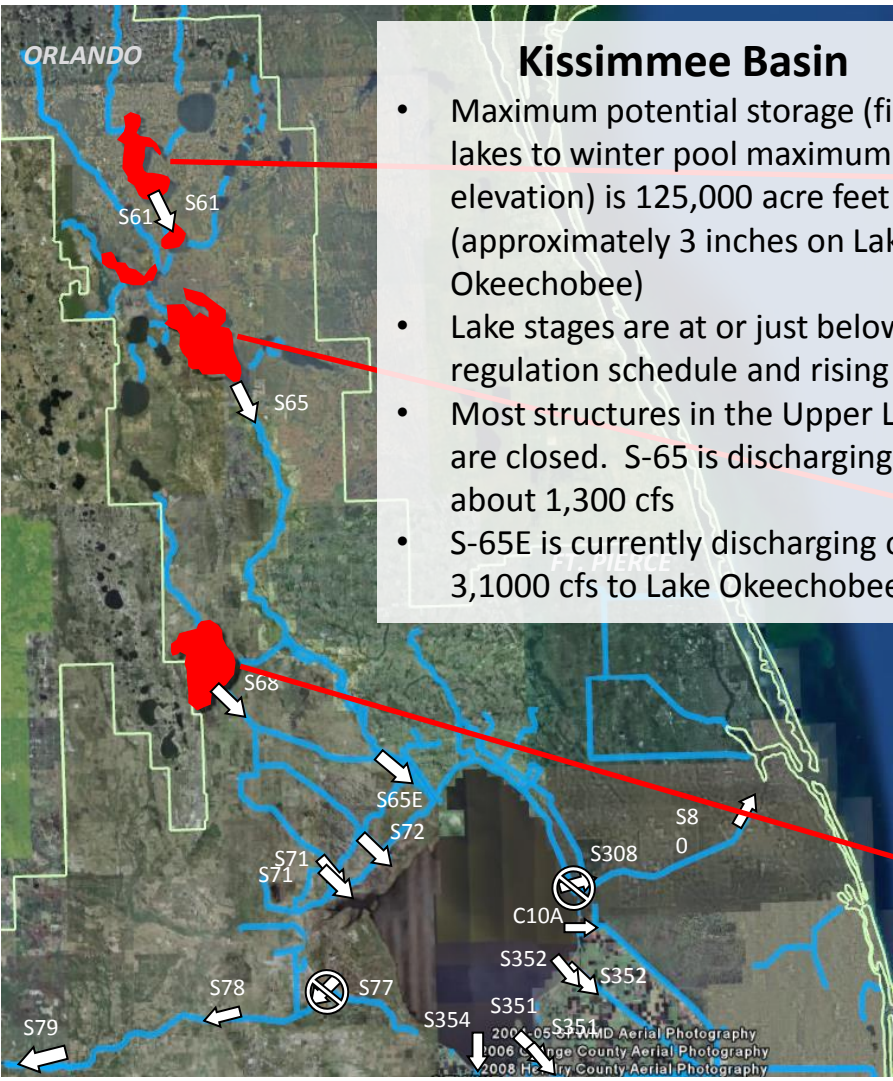
DISTRICT-WIDE: 29.39"
(96% of Avg, or -1.12")

- Upper Kissimmee, Lower Kissimmee, Lake Okeechobee and Southwest Coast are at or above average
- All other District basins exhibit large rainfall deficit for the wet season up to date
- Lower East Coast and EAA show largest deficits



Lake Okeechobee Water Level Comparison

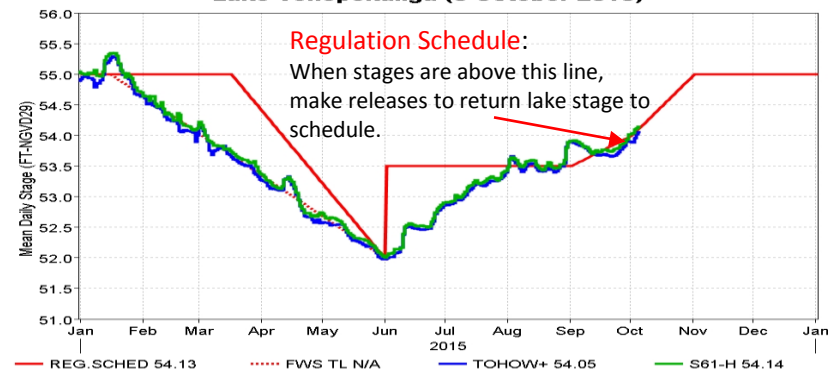




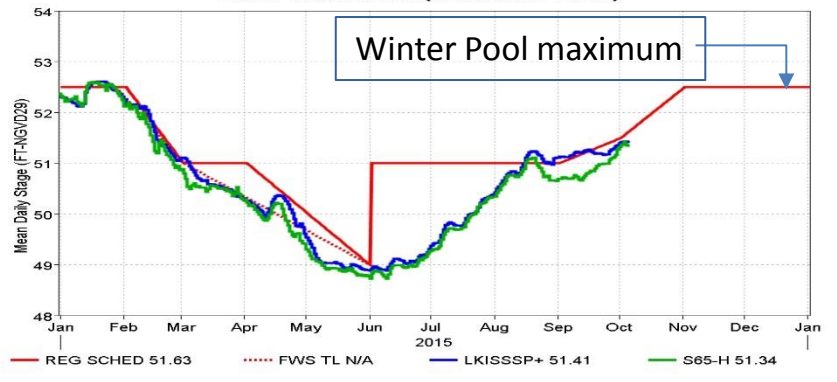
Kissimmee Basin

- Maximum potential storage (filling lakes to winter pool maximum elevation) is 125,000 acre feet (approximately 3 inches on Lake Okeechobee)
- Lake stages are at or just below regulation schedule and rising
- Most structures in the Upper Lakes are closed. S-65 is discharging about 1,300 cfs
- S-65E is currently discharging over 3,100 cfs to Lake Okeechobee

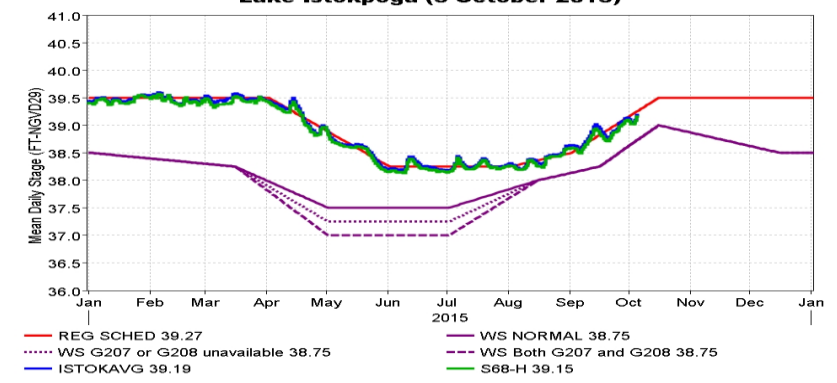
Lake Tohopekaliga (5 October 2015)

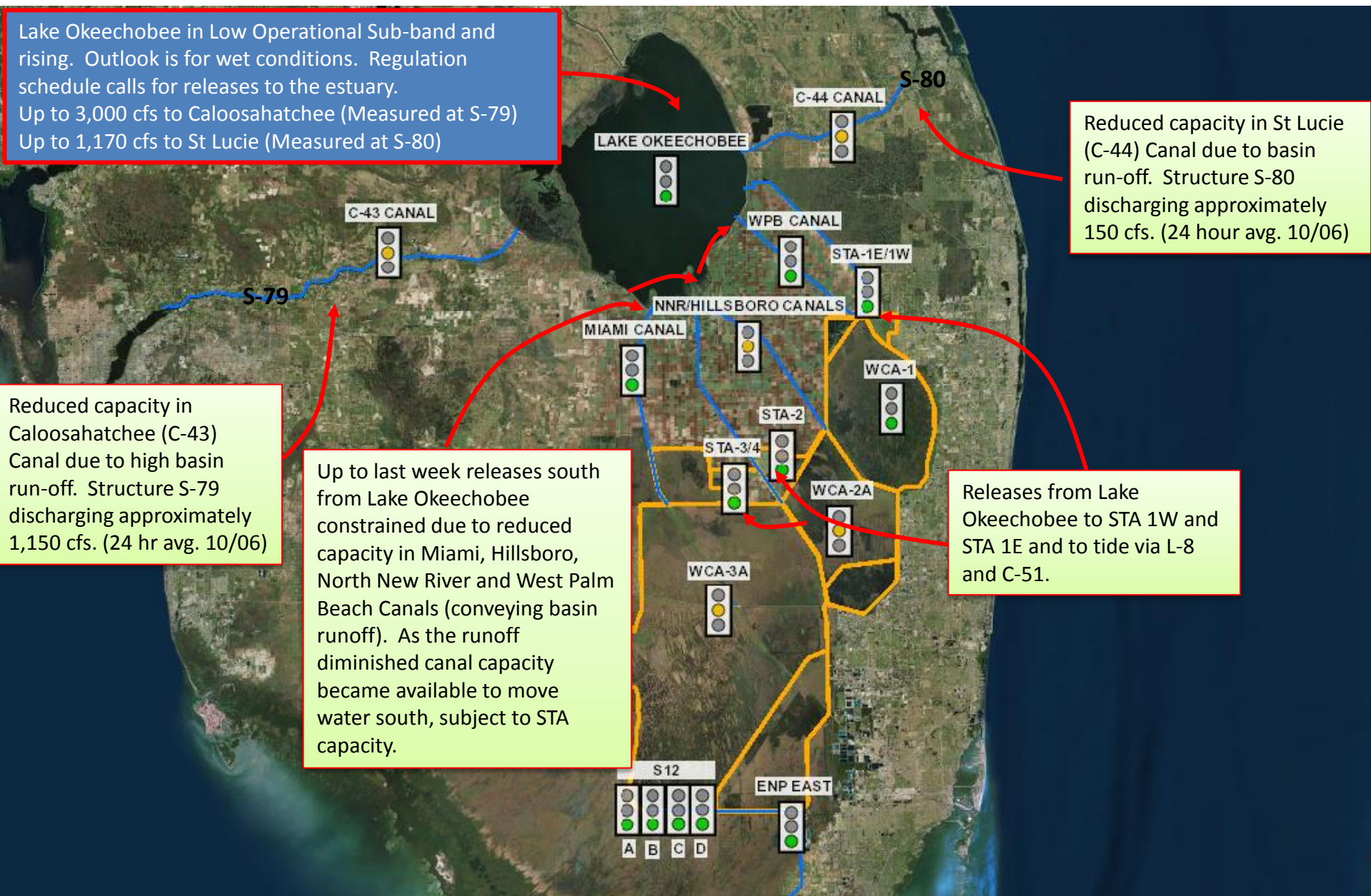


Lake Kissimmee (5 October 2015)



Lake Istokpoga (5 October 2015)



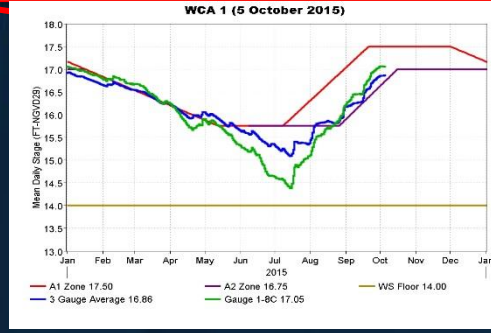
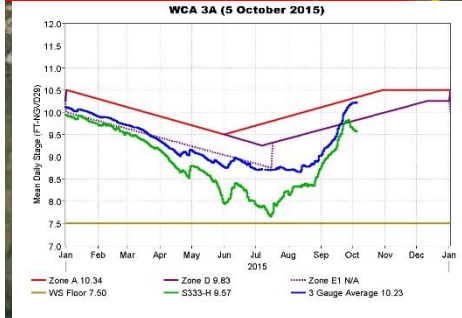
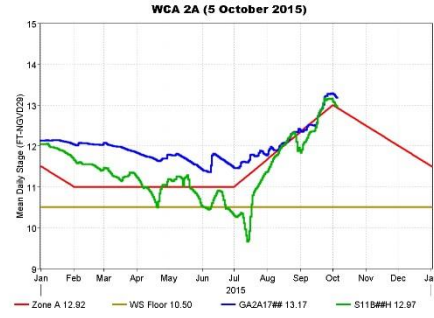


System Constraints for sending water south for period 09/29 to 10/05 2015

Lake Okeechobee in Low Operational Sub-band and rising. Outlook is for wet conditions. Regulation schedule calls for releases to the estuary.
 Up to 3,000 cfs to Caloosahatchee (Measured at S-79)
 Up to 1,170 cfs to St Lucie (Measured at S-80)

There is low to moderate capacity to receive or pass through lake water in WCA-2A and WCA-3A. Conveyance capacity of the EAA canals is available. STA 2 and STA3/4 also have some capacity available to move water from the Lake to the WCAs.

There is some capacity in WCA 1. Lake releases to STA 1W and 1E and to tide via L-8 and C-51.



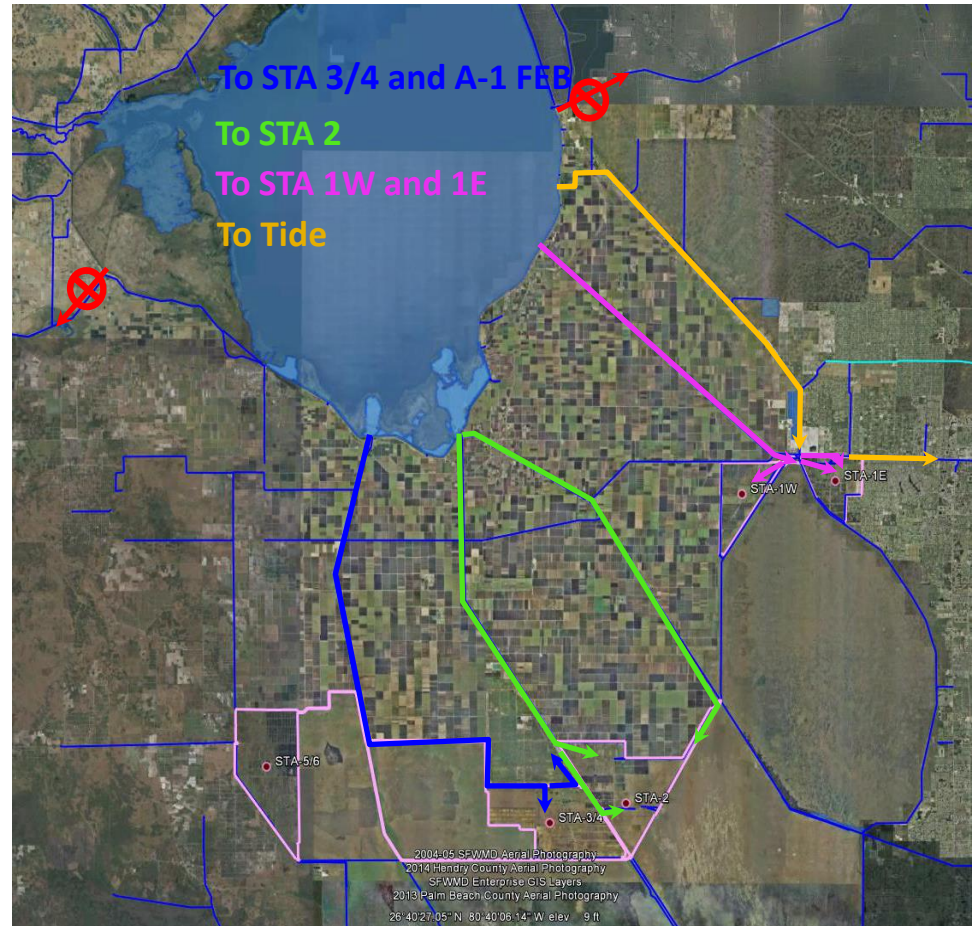
- Regulation Schedule summarize WCA water level thresholds throughout the year
- Current objective is to keep water level between the red and purple lines
- If water levels rise above the red line, mandatory regulatory releases are made to return to the red line and no additional lake water can be sent to the WCA

Rainfall Plan releases to ENP started again 3 weeks ago. Currently, about 2,600 cfs is being sent south to the Everglades National Park through S-12s and S-333.

System Constraints for sending water south for period 09/29 to 10/05 2015

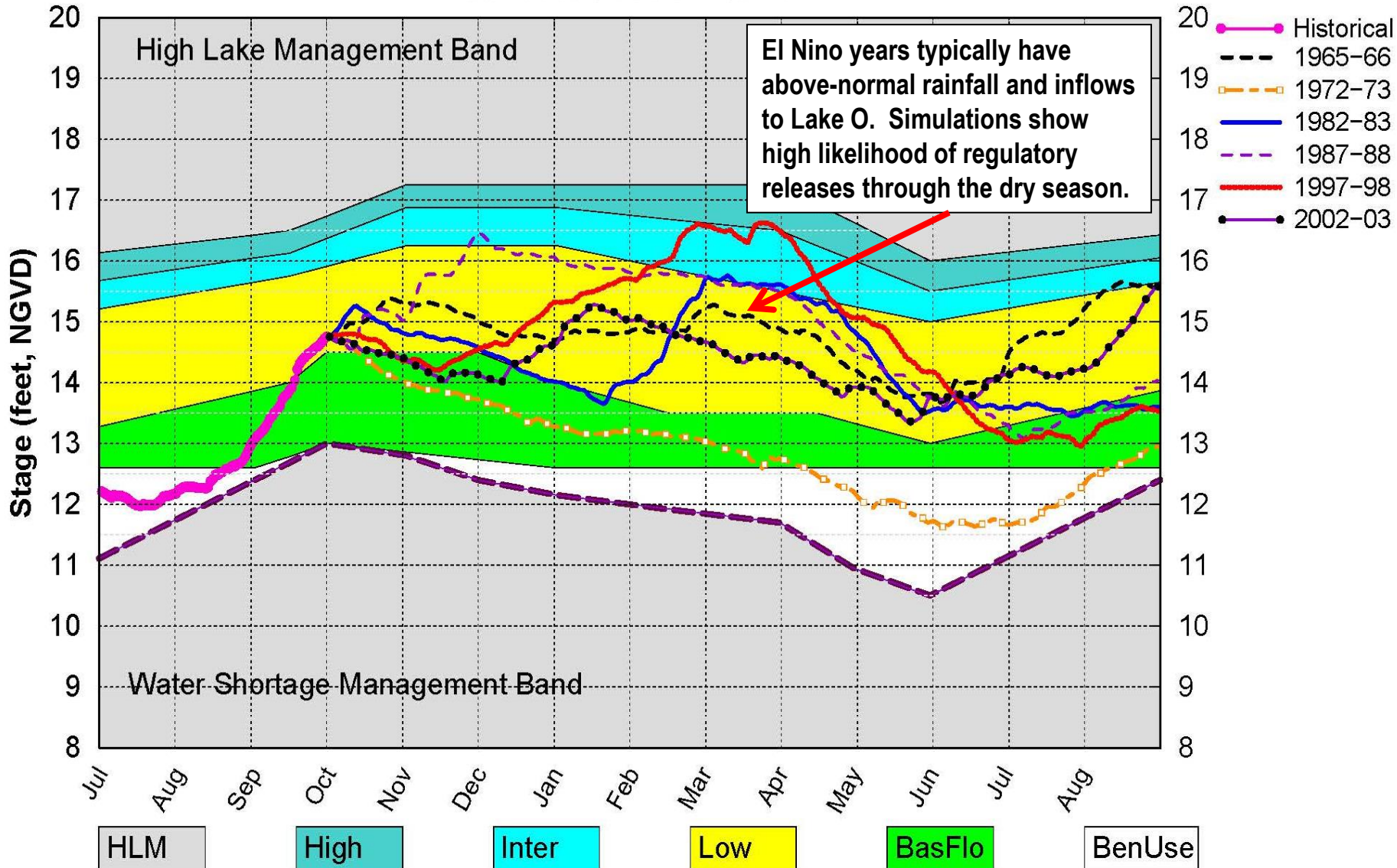
Lake Okeechobee Flood Control Operations

- Lake stage has been rising since mid August
- LORS recommending releases by last week August
- Runoff hindered releases to estuaries
- Runoff in EAA using most canal and STA capacities
- Releases south to WCAs are being increased



Lake Okeechobee SFWMM Oct 2015 Dynamic Position Analysis

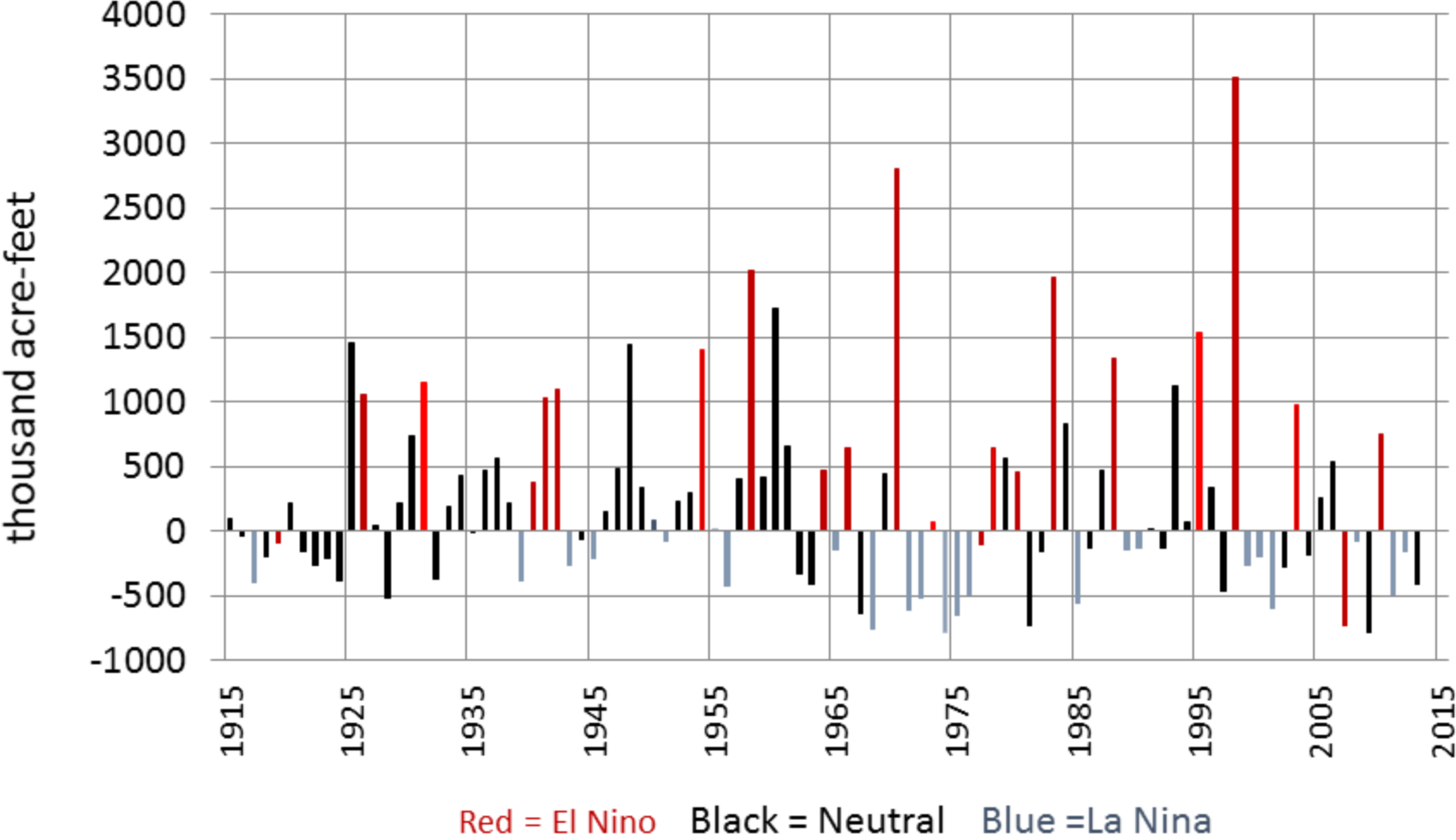
All El Nino Years Plot PA

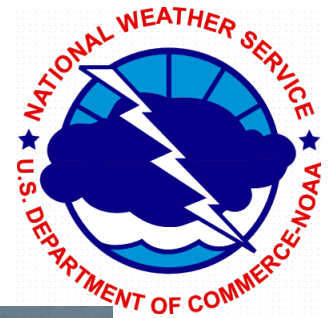


(See assumptions on the Position Analysis Results website)

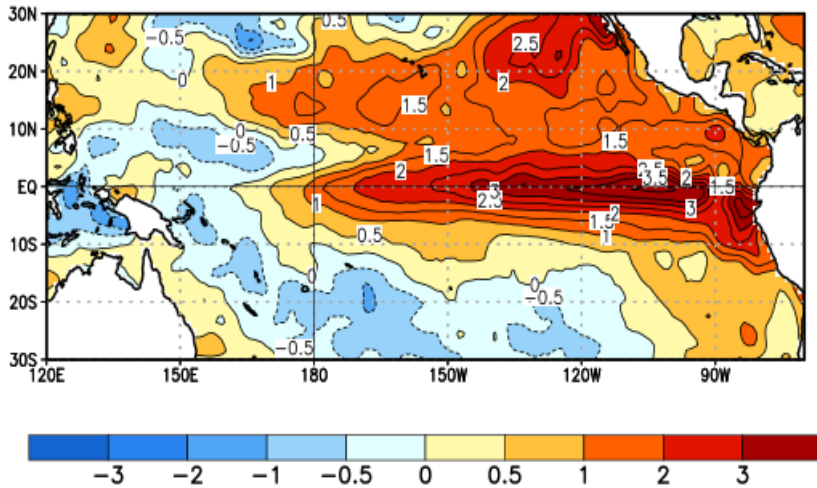
DRAFT

Lake Okeechobee Dry Season Net Inflow November-April





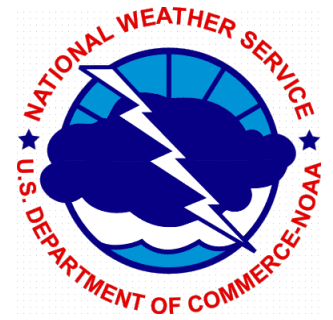
Average SST Anomalies
13 SEP 2015 – 10 OCT 2015



El Niño is Here: What Does It Mean For South Florida This Winter?



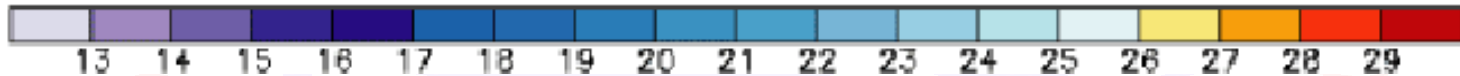
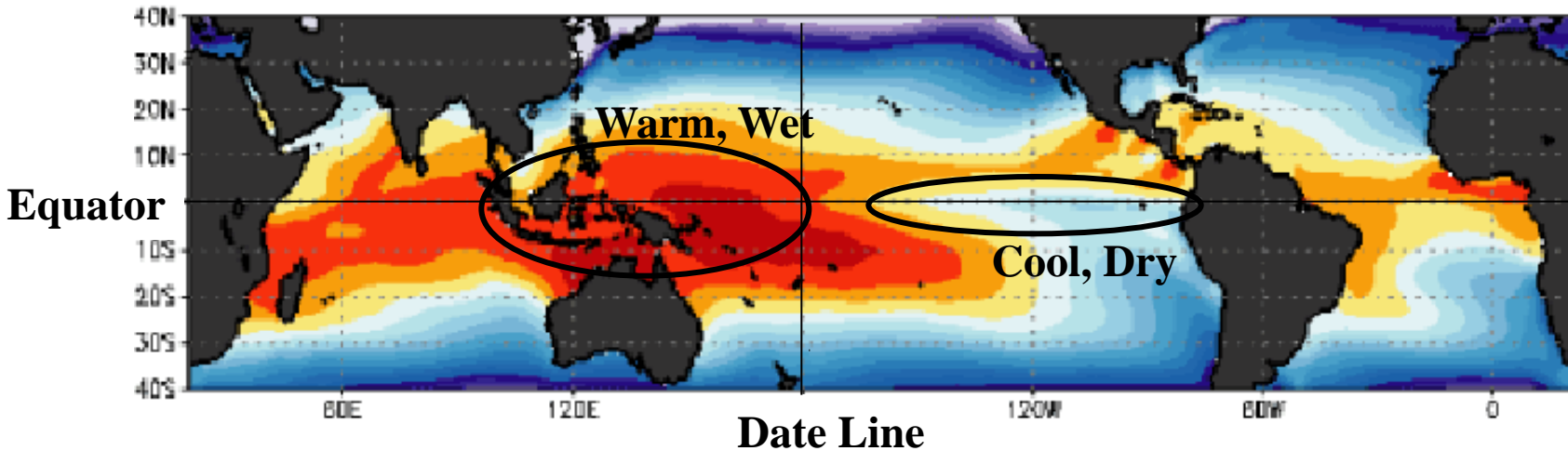
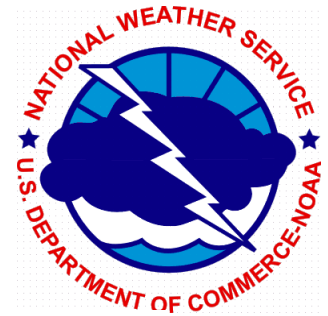
El Niño Primer



- El Niño is part of natural ENSO (El Niño Southern Oscillation)
- Occurs every 3-6 years on average
- Variations in surface pressure cause Pacific trade winds to weaken, leading to warming of eastern Pacific sea temperatures, which then leads to changes in atmospheric patterns
- Ocean temperatures not all...need to see atmospheric “coupling” for true El Niño



Normal Ocean Surface Temperatures (°C) January



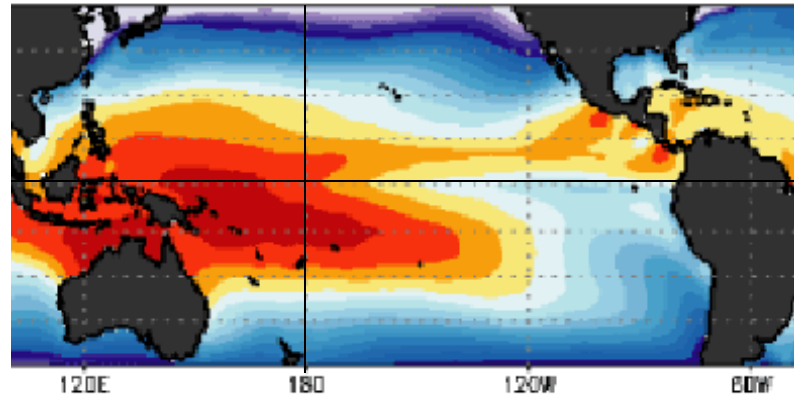
Equatorial ocean temperatures are normally warmest in the western Pacific and coolest in the eastern Pacific.

In the central and eastern Pacific, there is a lot of year-to-year variability. Some years are much warmer and wetter (El Niño) and some years are much cooler and drier (La Niña).

January Ocean Temperatures (°C)

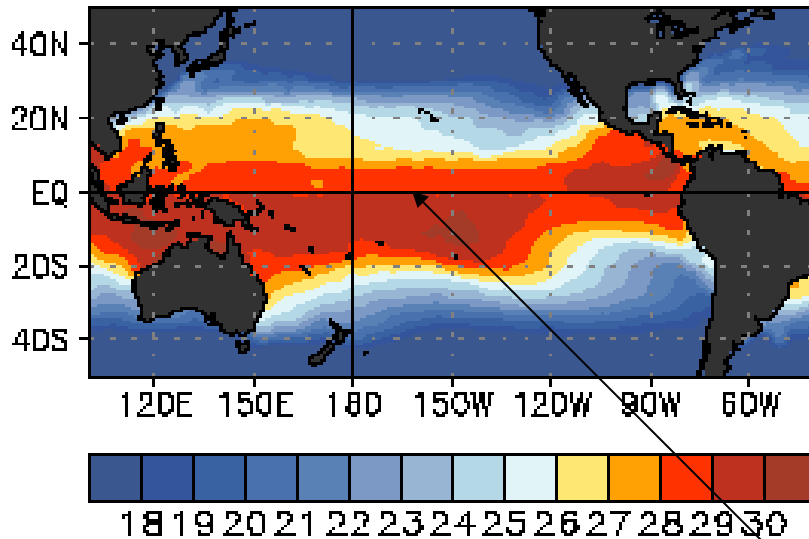
Comparing Normal to **El Niño**

Normal

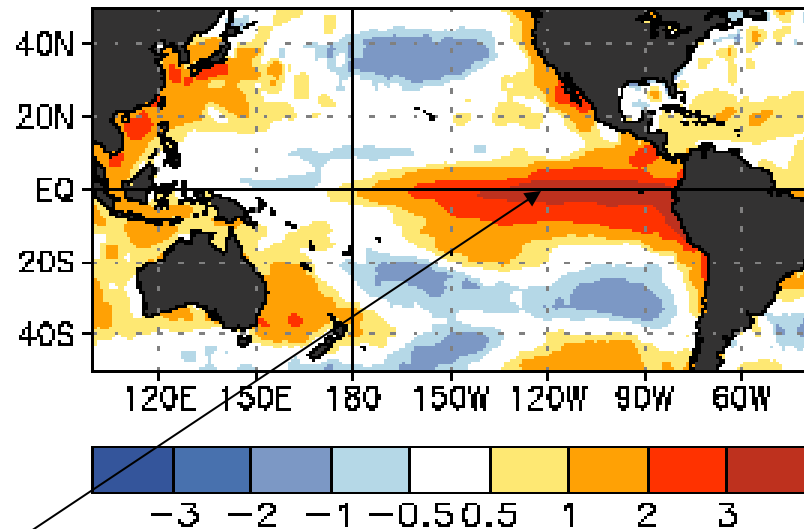


El Niño

Temperatures

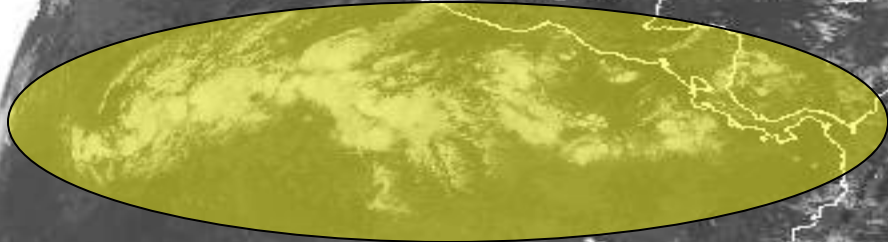


Temperature Departures



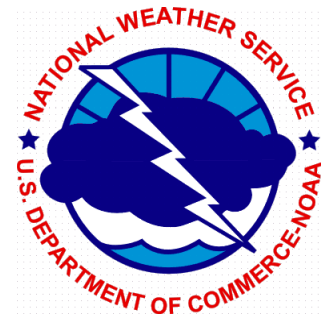
•El Niño: a periodic warming (every 3-6 years) of the central and eastern equatorial Pacific

Not easy to see effect of El Nino on U.S. in a given weather Map or satellite picture



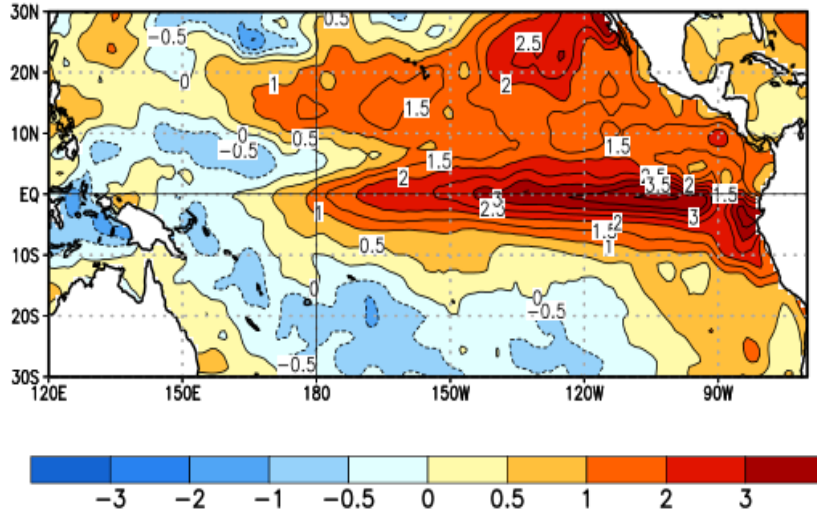
Slide





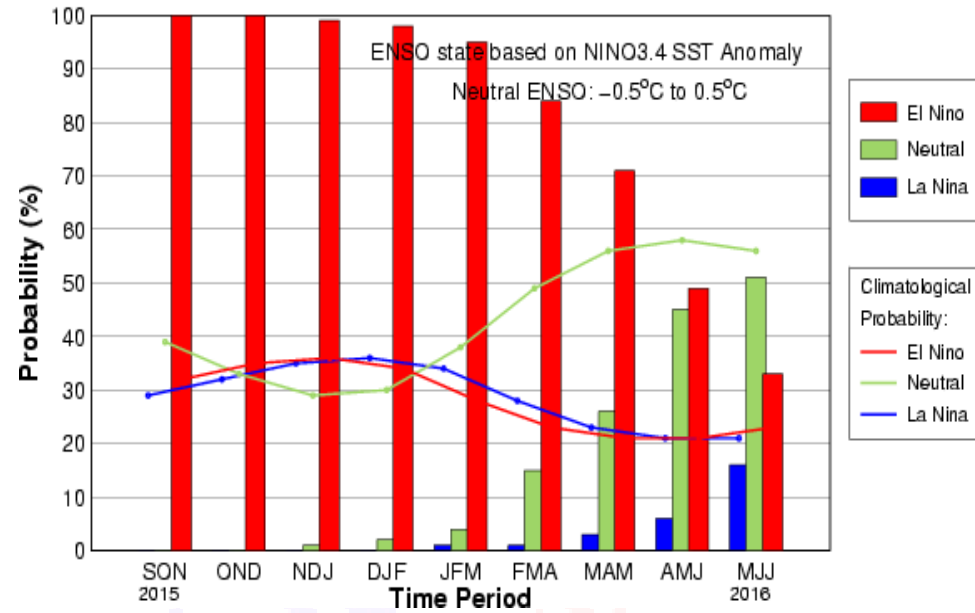
Current and Forecast ENSO Conditions

Average SST Anomalies
13 SEP 2015 – 10 OCT 2015



Current

Early-Oct CPC/IRI Consensus Probabilistic ENSO Forecast

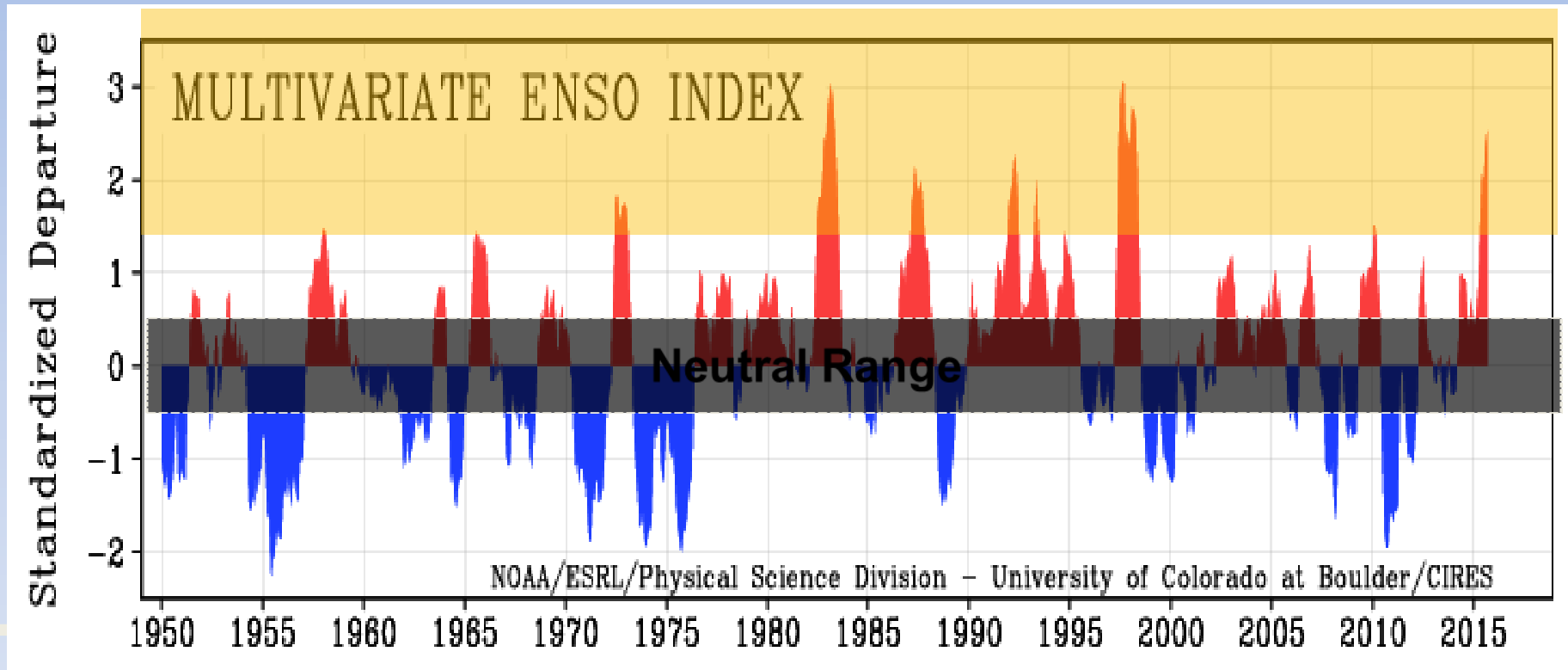


Forecast:

El Niño virtually guaranteed through early 2016

El Nino and La Nina have the greatest impact when they are strong

—
About 50% time Neutral/Near Normal

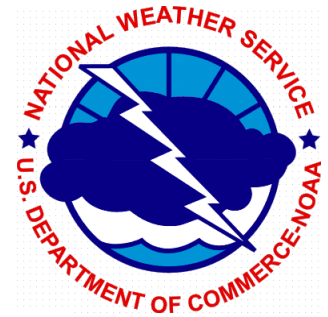


Slide Courtesy:
NWS Melbourne, FL

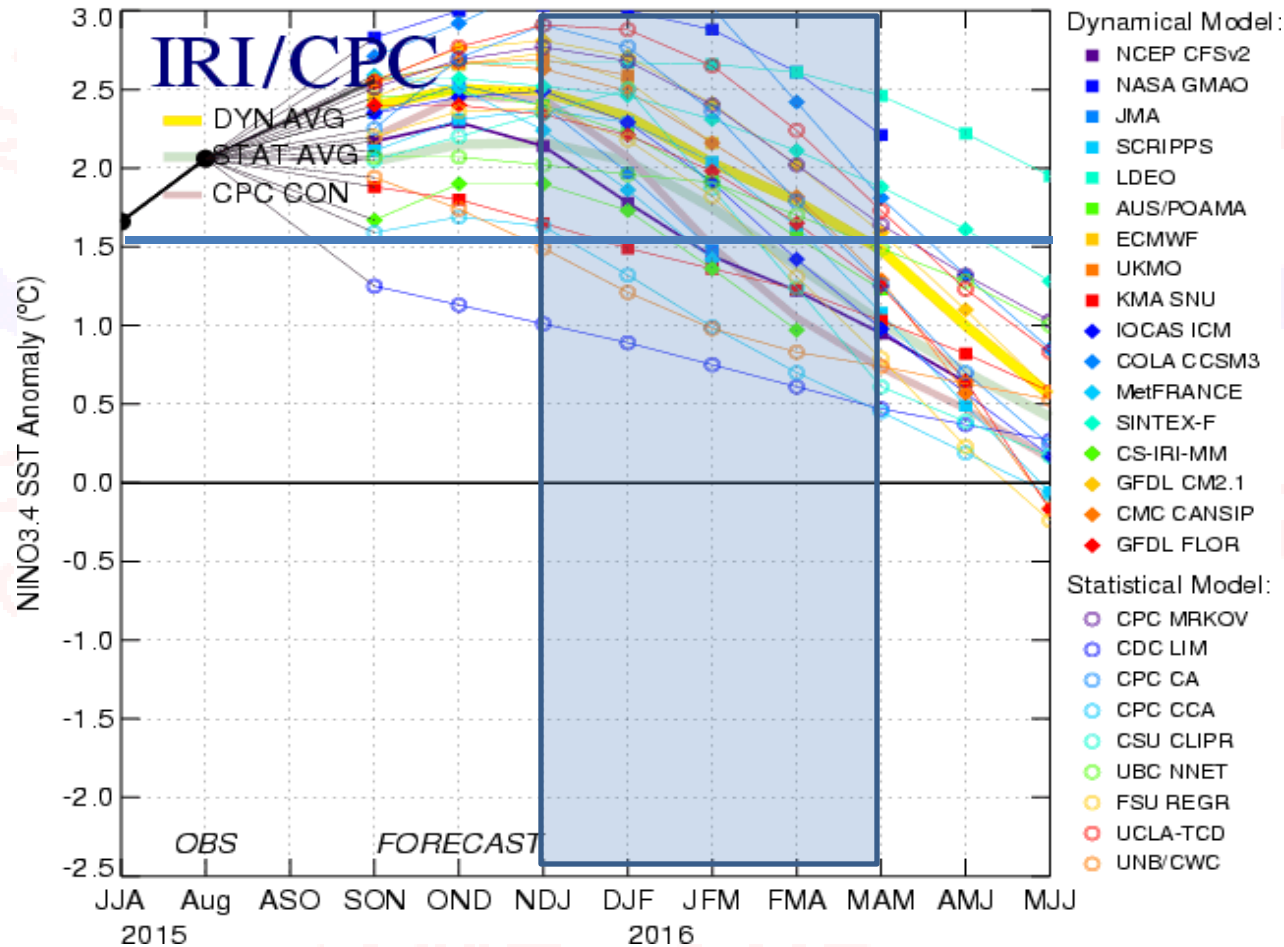




Strength Matters: Strong El Niño



Mid-Sep 2015 Plume of Model ENSO Predictions

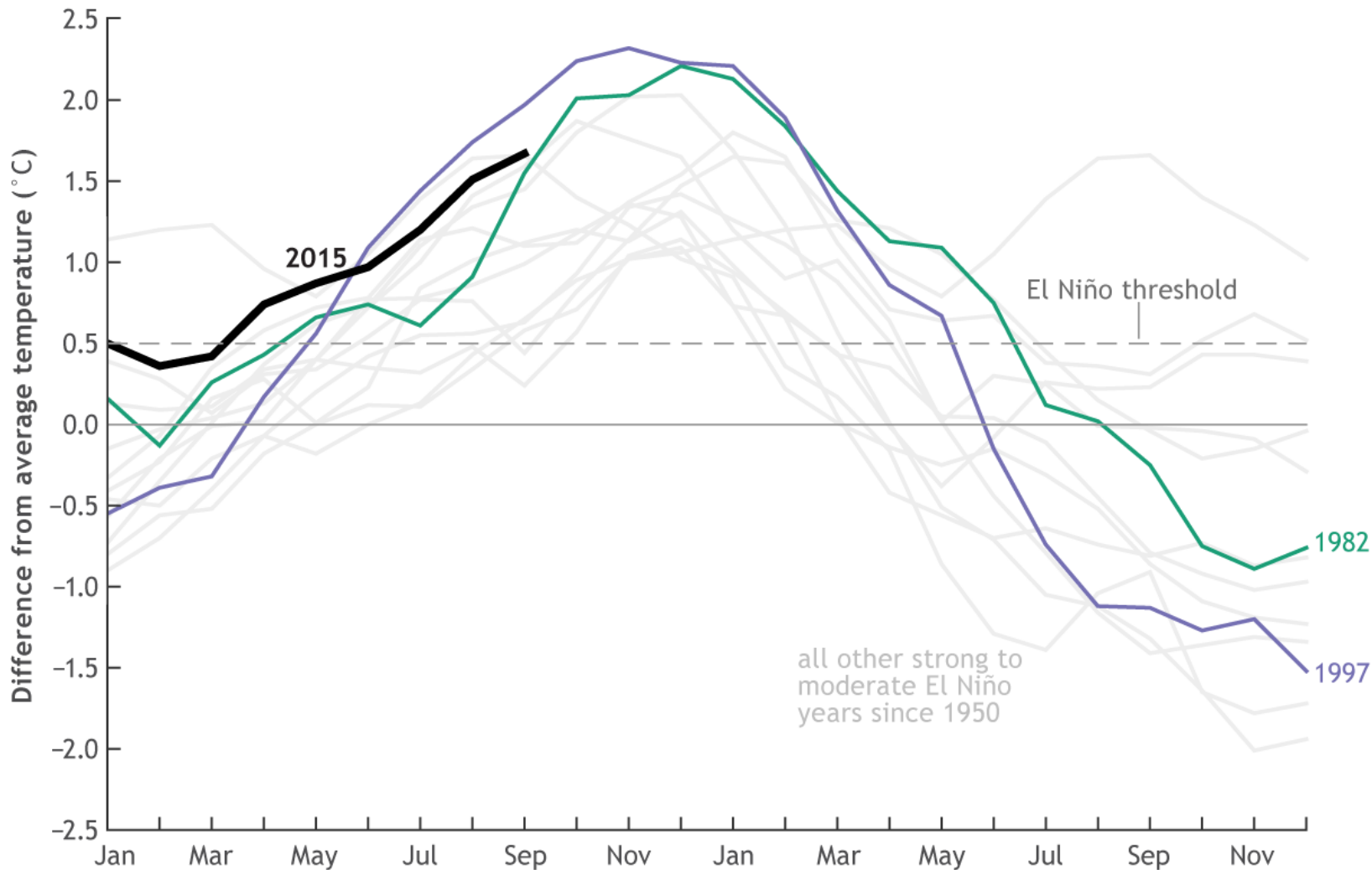


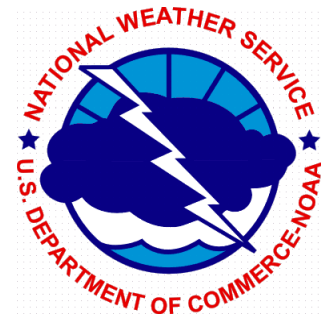


Comparison to Strongest El Niños on Record

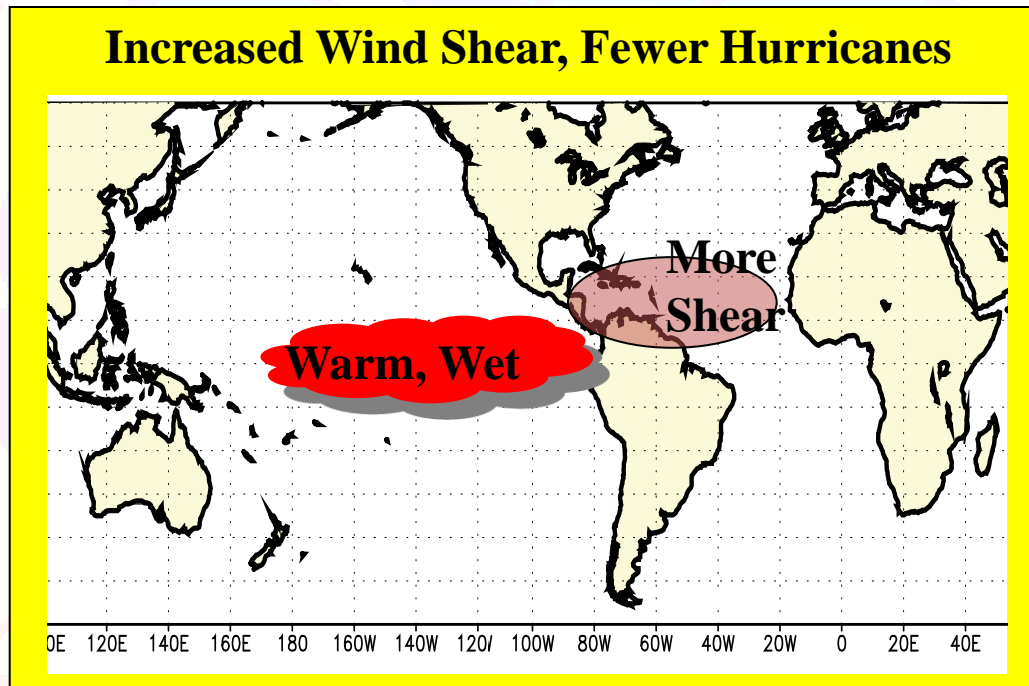


Monthly sea surface temperature Niño 3.4 Index values





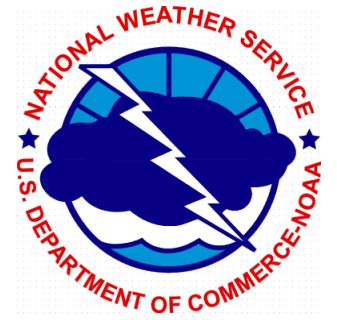
El Niño's influence on Atlantic hurricane activity is well known



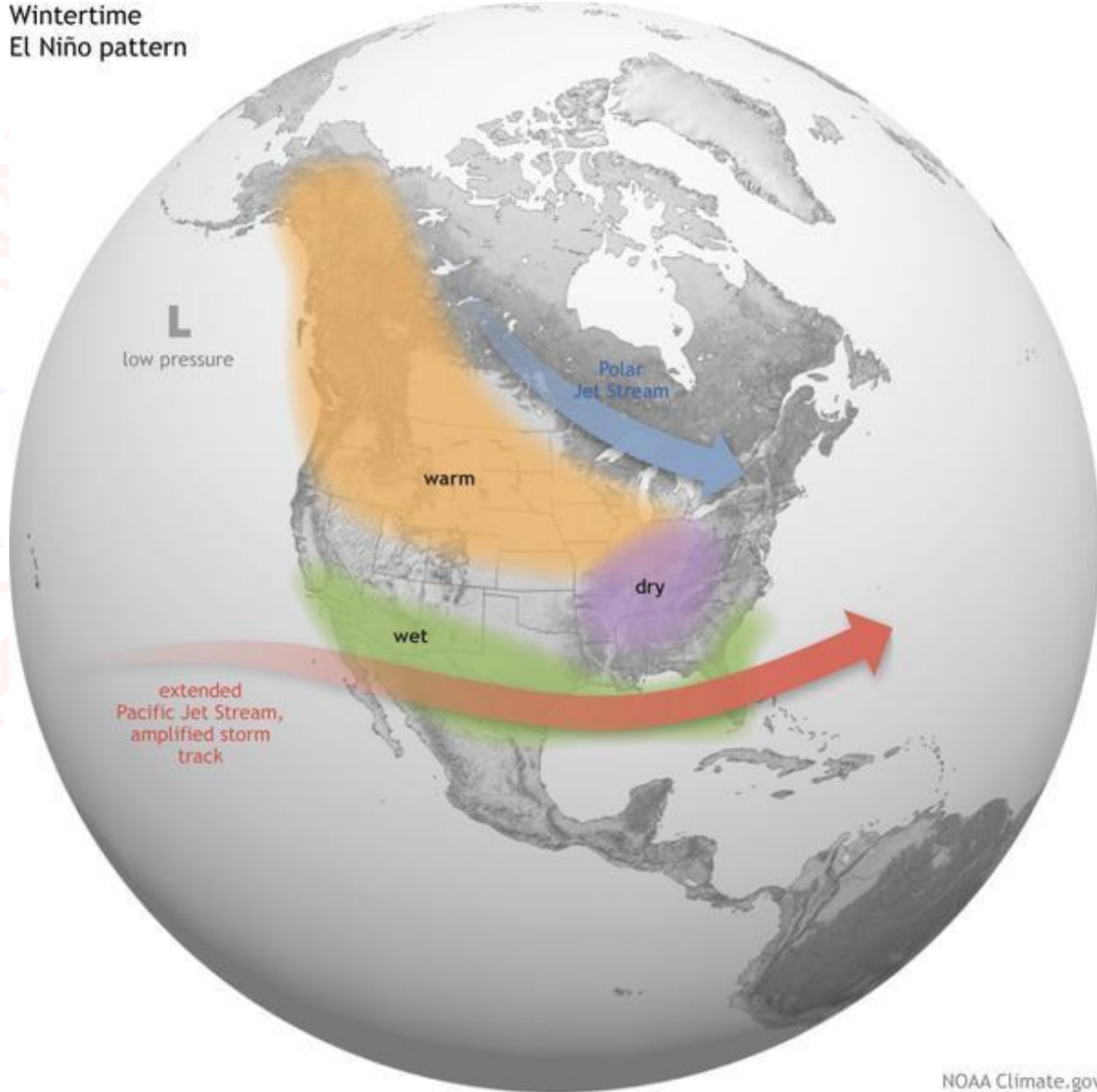
El Niño increases the vertical wind shear over the Atlantic, suppressing hurricane activity.



Wintertime El Niño Impacts in North America



Wintertime El Niño pattern



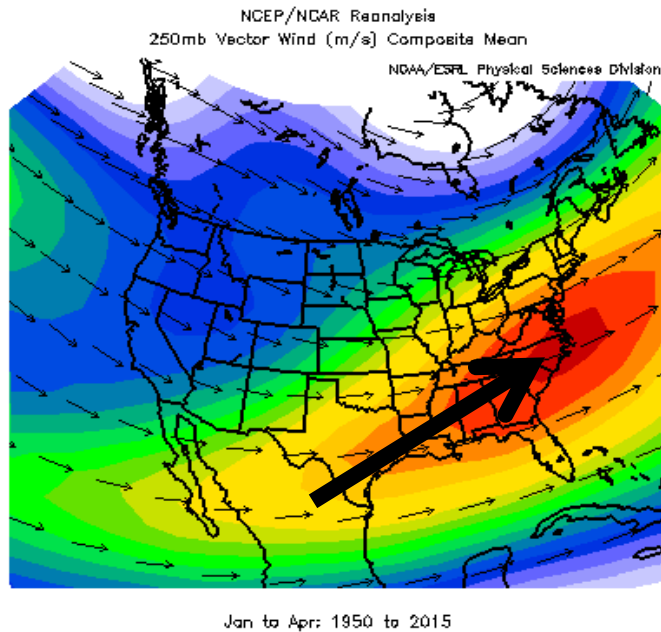


January-April Jet Stream

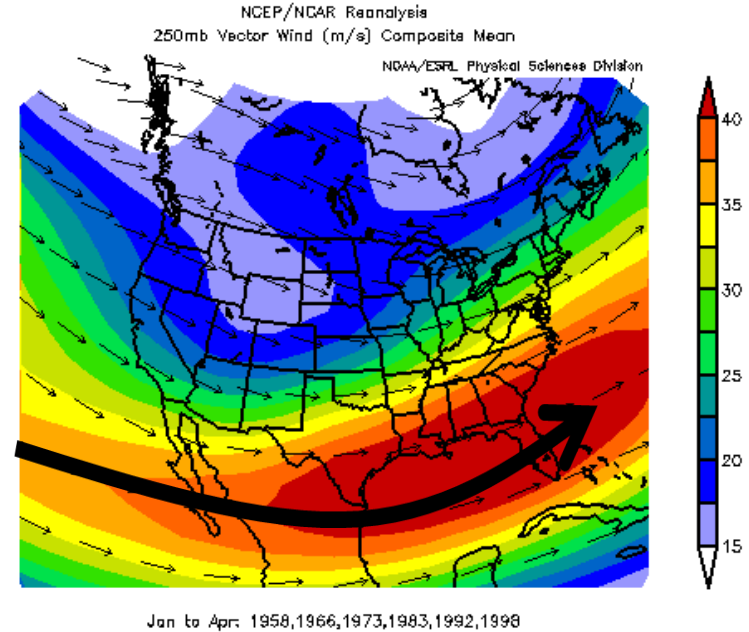


1950-2015 Mean

Strong El Niños



Jan to Apr: 1950 to 2015



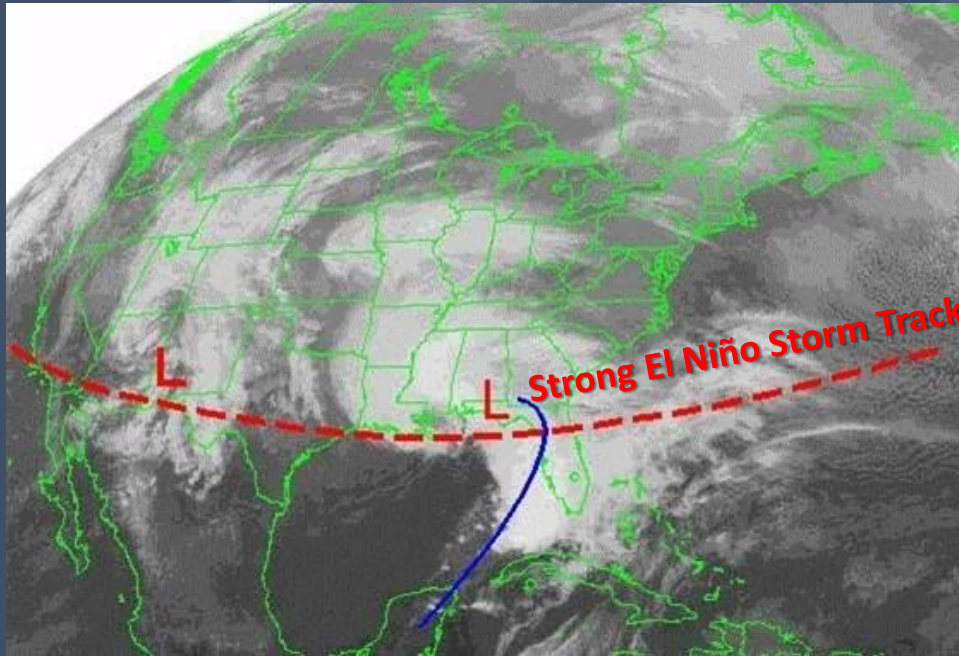
Jan to Apr: 1958, 1966, 1973, 1983, 1992, 1998

- **Direct relationship between strong El Niño and increased winter storminess in Florida, mainly due to a southward shift in the position of the jet stream over North America**
- **Increased storminess brings a greater potential for severe weather with significant societal impacts**

Florida El Niño Severe Weather Awareness

El Niño Sets the Large-Scale Environmental Stage!

- Strong jet stream winds present much of winter/spring (generates enhanced lift)
- Low Pressure Systems track farther south reaching lower-latitudes (more frequent frontal passages; associated pre-frontal warm/moist air masses, squall lines, etc.)
- More opportunities for instability, moisture, and wind shear to come together across the peninsula to create environments favorable for severe thunderstorms



Key Points

- **El Niño doesn't cause strong/violent tornadoes in Florida, but SETS THE STAGE!**
- ✓ **Environmental conditions become more favorable, more often**



Melbourne

WEATHER FORECAST
OFFICE

<http://www.weather.gov/melbourne>

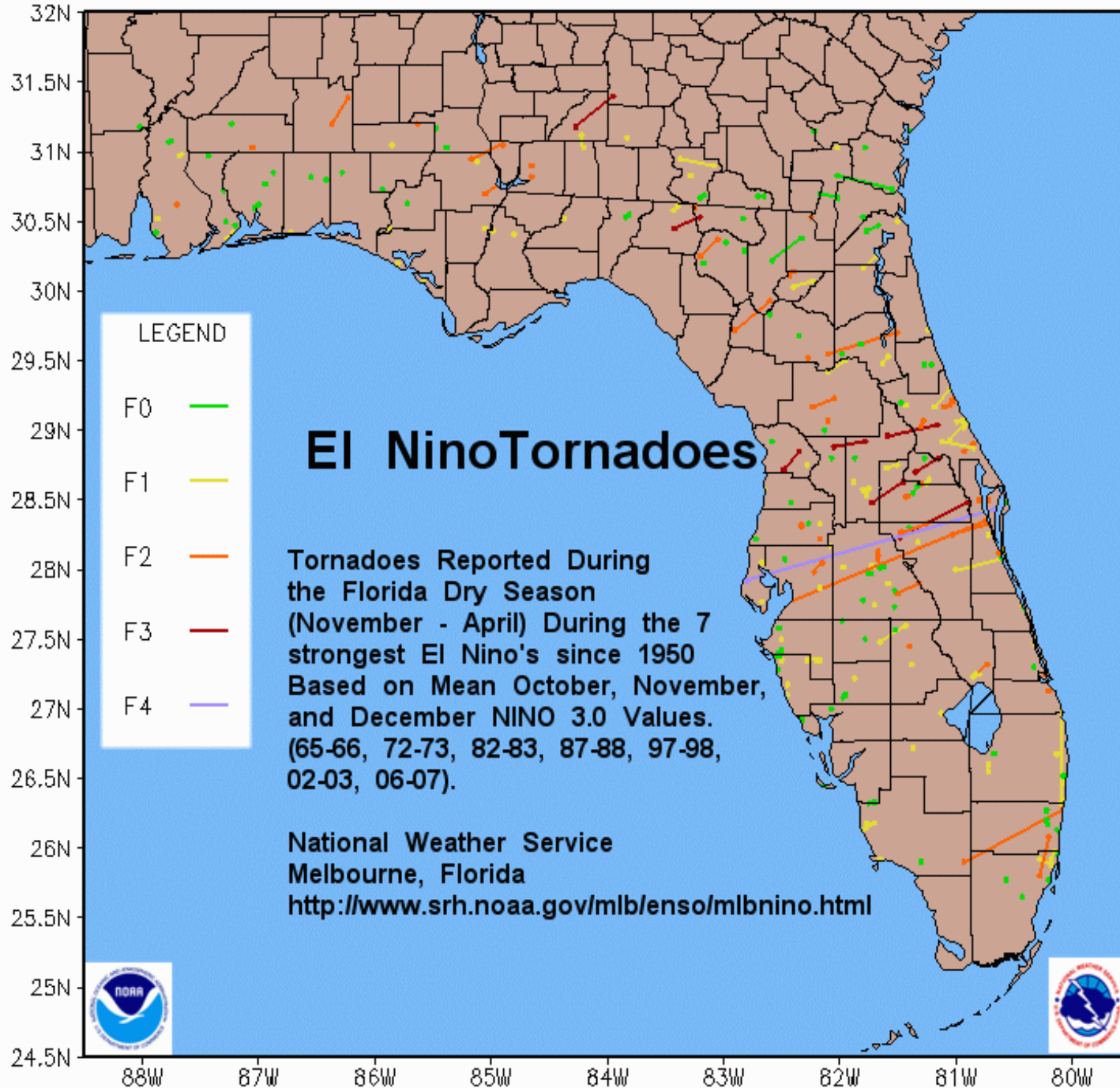


[facebook.com/NWSMelbourne](https://www.facebook.com/NWSMelbourne)

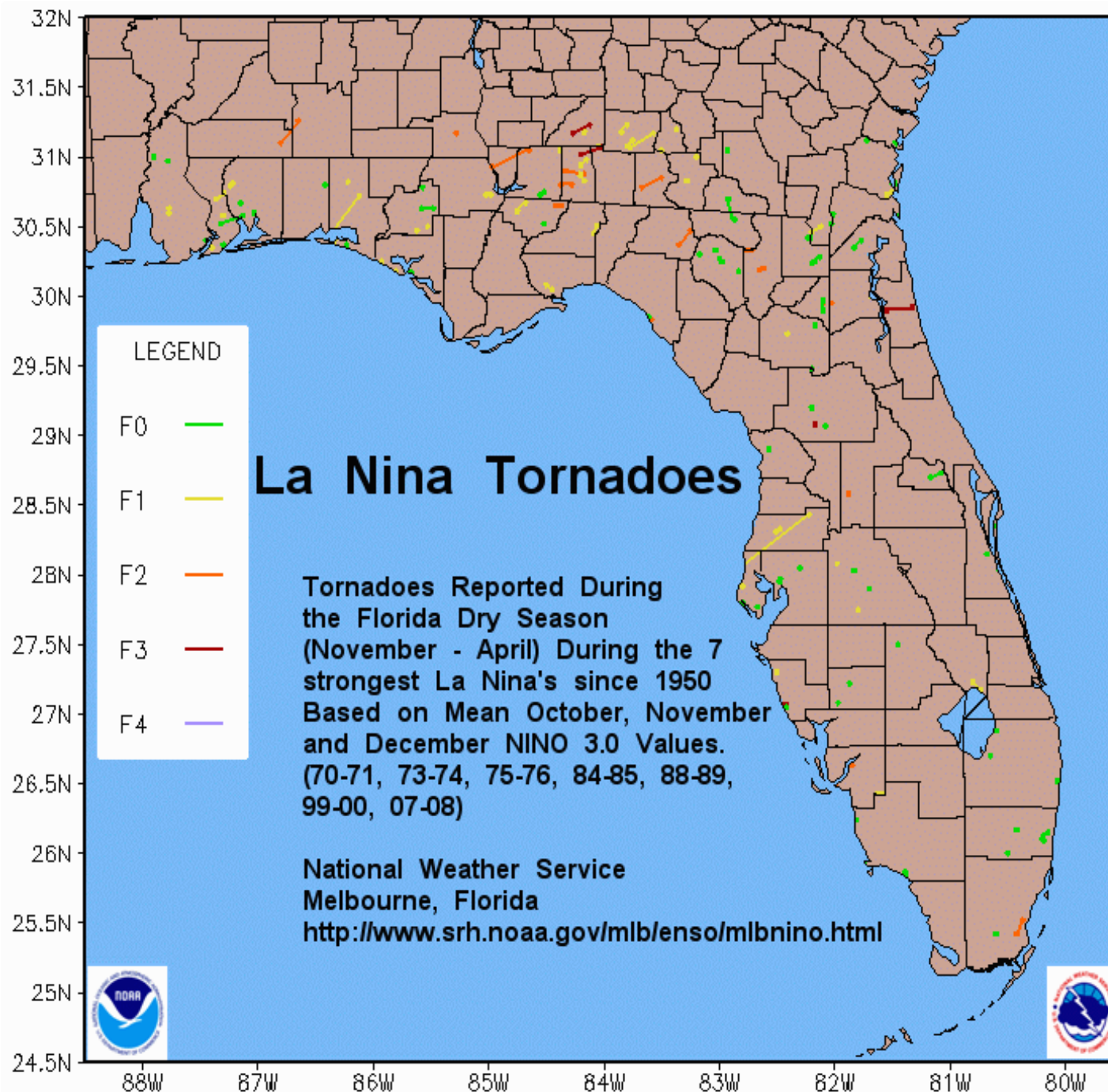


[@NWSMelbourne](https://twitter.com/NWSMelbourne)

October 14,
2015



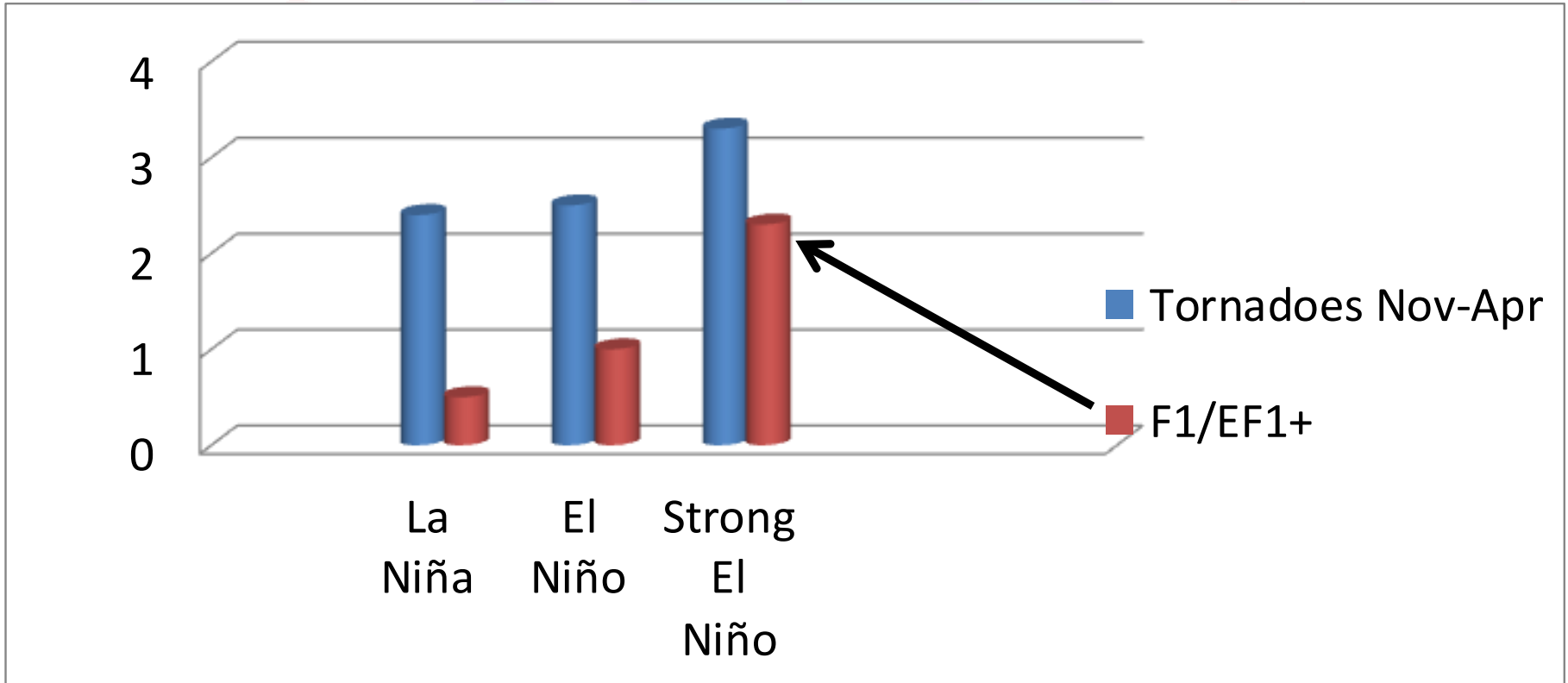
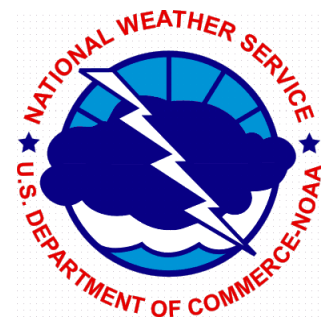
El Niño pattern translates to increased risk of tornadoes across the Florida Peninsula.



La Nina pattern produces much lower risk for tornadoes across the Florida Peninsula compared with El Nino years.



More than Double EF1+ Tornadoes in Strong El Niños

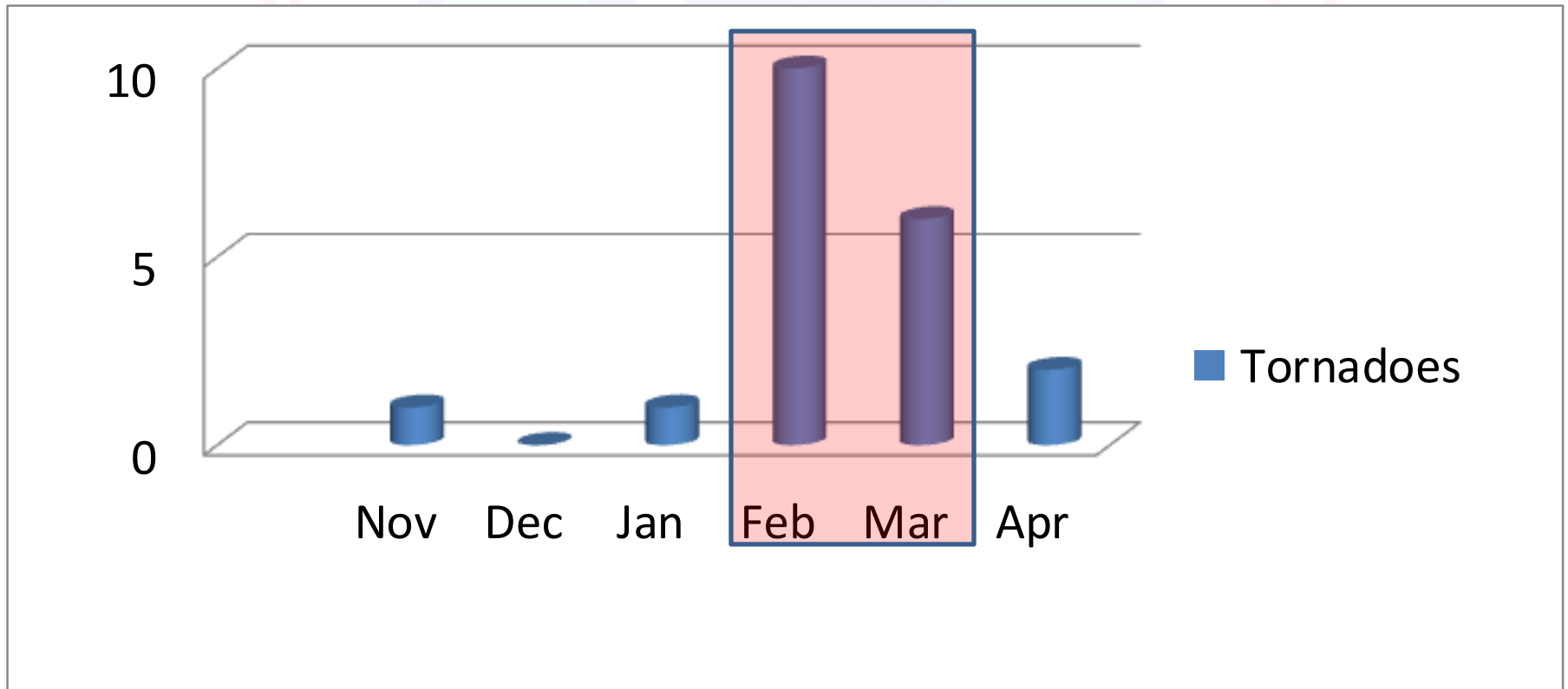
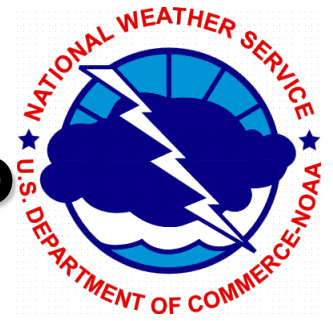


Key point:

- ✓ **1983 and 1998 accounted for most of the EF+1 tornadoes**



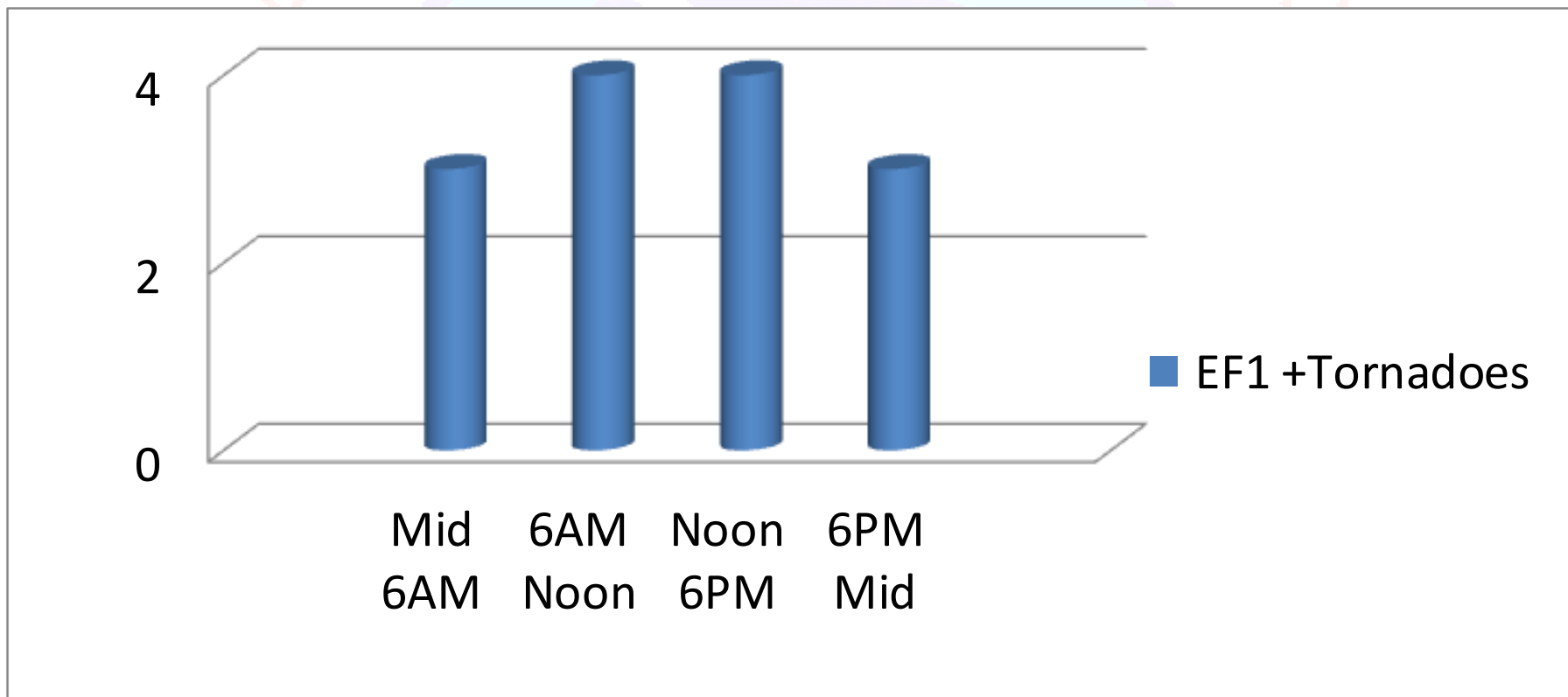
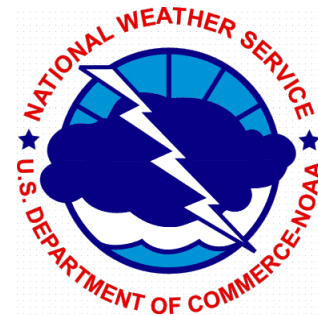
South Florida Strong El Niño Tornadoes by Month



Late winter/early spring favored period for
tornado-spawning low pressure systems



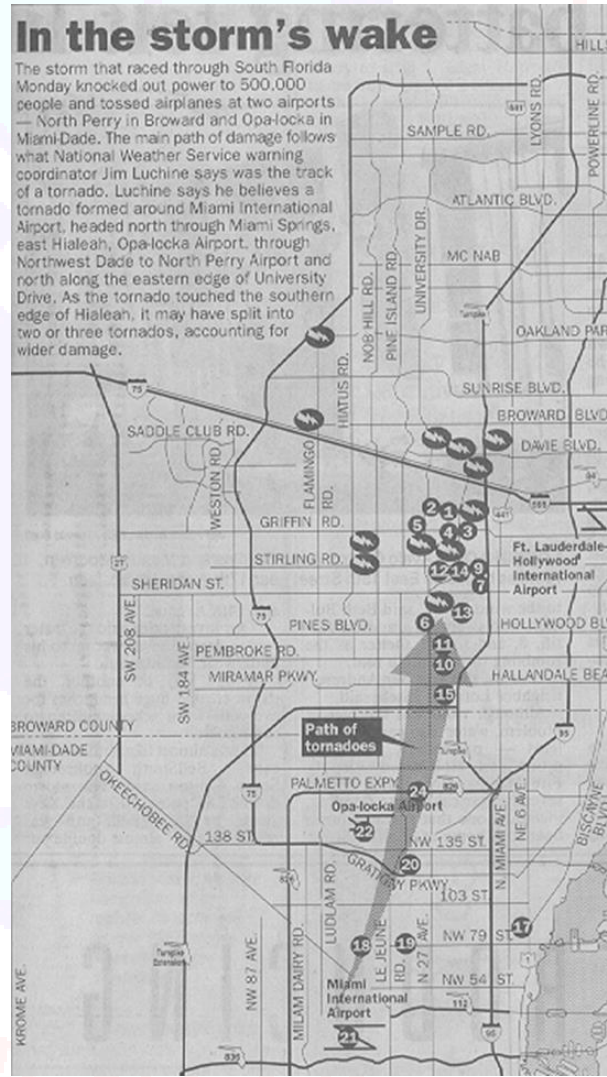
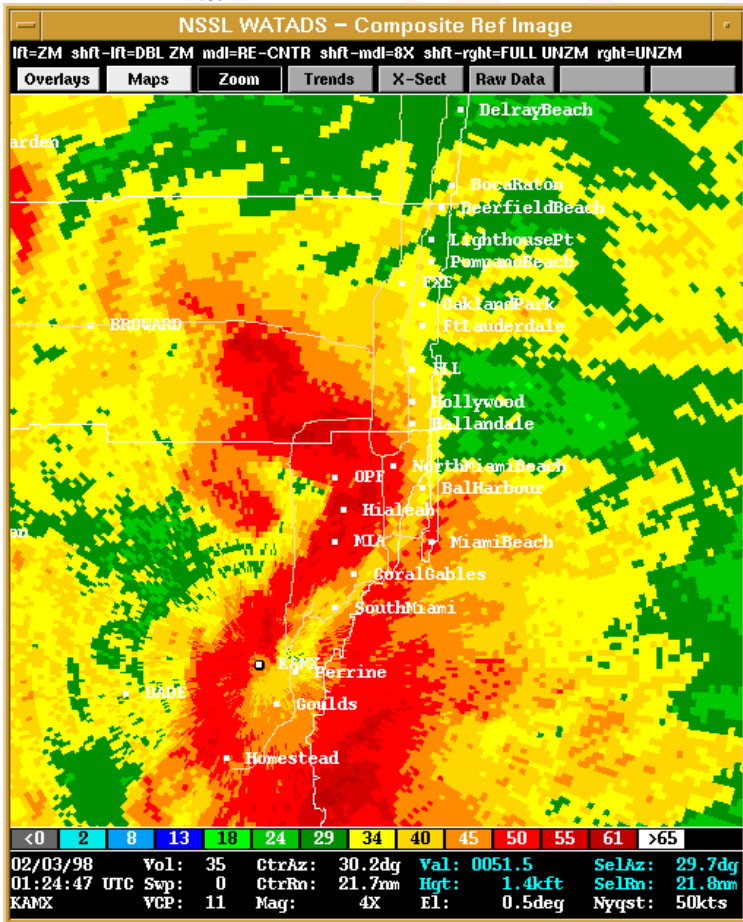
South Florida Time of EF1+ Tornadoes



No clear trend – can happen any time of day or night!



Dade/Broward Counties February 2, 1998



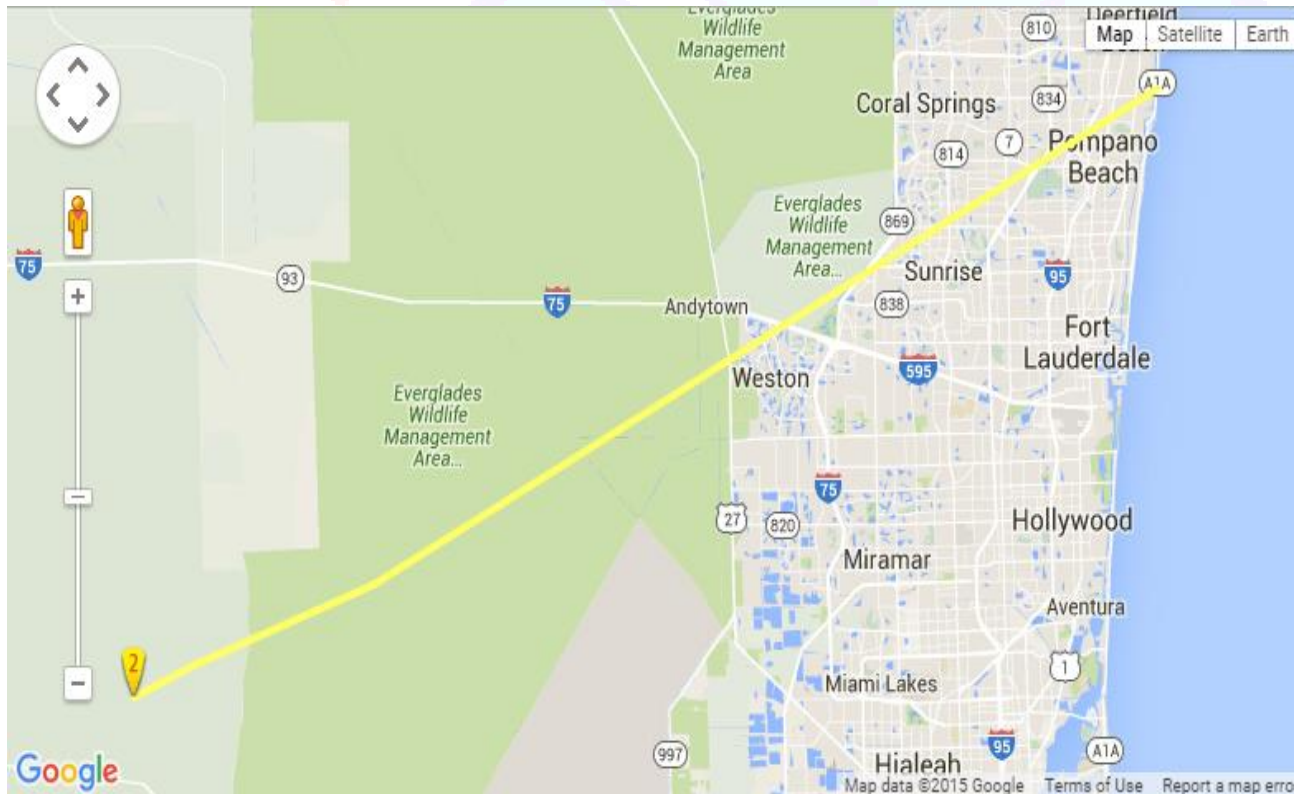
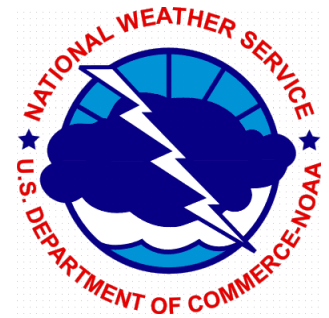
- 21 miles
- 500,000 customers without power
- \$205 million in damage

Miami/Hialeah F2: Strong El Niño

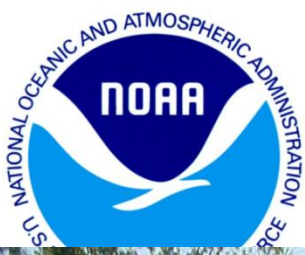
Miami Herald graphic



Collier/Dade/Broward March 17, 1983



- 53 miles
- \$2.5 million in damage
- 2nd longest tornado track south of Lake Okeechobee



March 27, 2003: Moderate El Niño

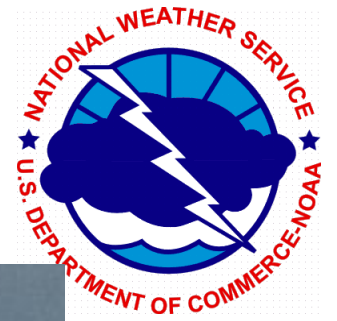


Liberty City/Brownsville section of Miami

One fatality



March 27, 2003

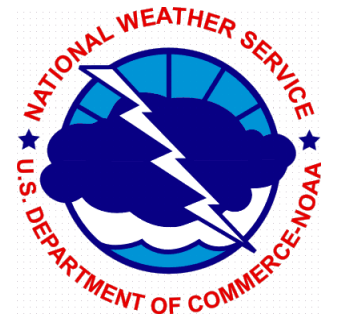


Everglades in Collier County

Photo by Paul Wilson/Ochopee Fire Rescue



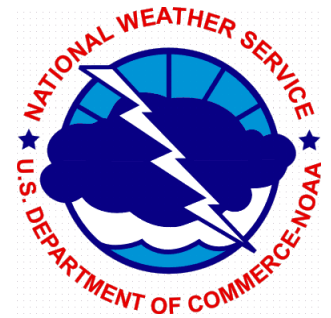
April 5, 1925: El Niño??



North Dade: 5 deaths



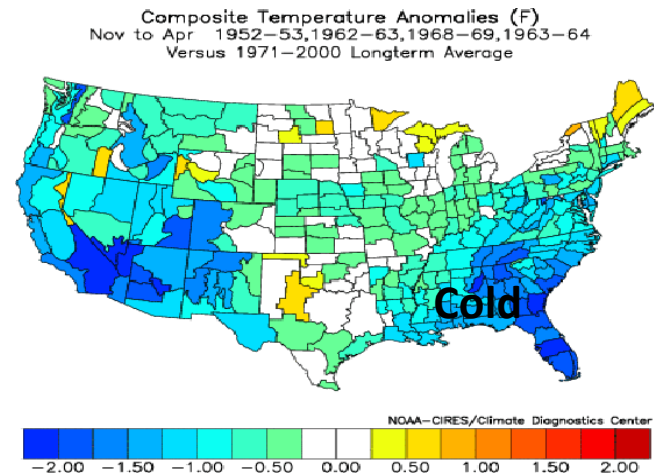
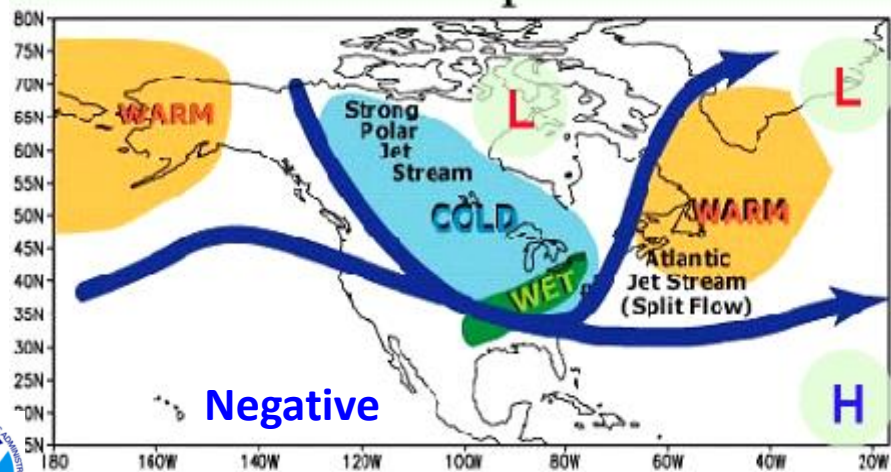
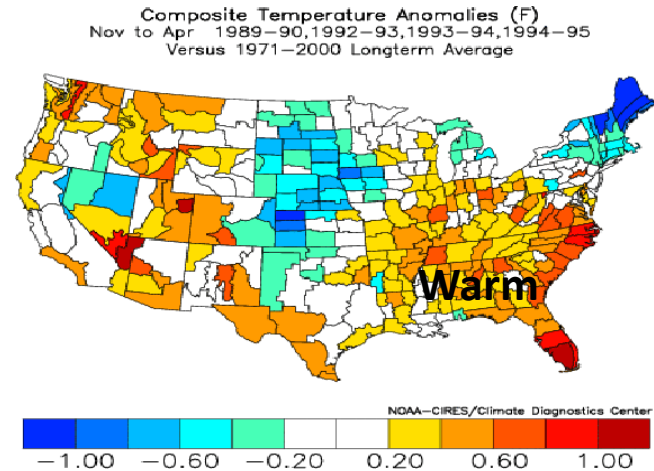
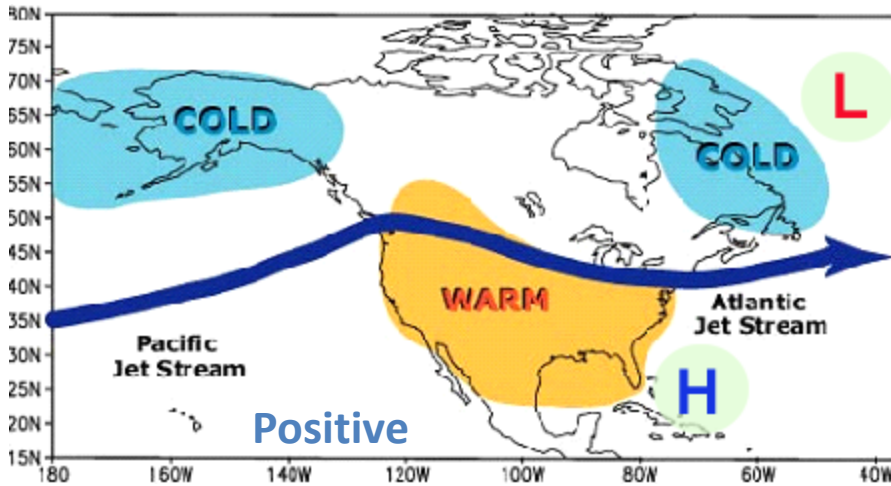
Caveats, Or “*Not What I Ordered*”



- Other intra-seasonal atmospheric cycles such as NAO, PNA and MJO can at least temporarily modulate El Niño effects
- Most intra-seasonal cycles are only reliably predictable up to **14 days in advance**
- Conflicting/overriding signals can disrupt expected atmospheric conditions
- **El Niño “sets the stage”, not a cause**
- 1965-1966 and 1972-1973 were strong El Niños with NO tornadoes in South Florida

North Atlantic Oscillation

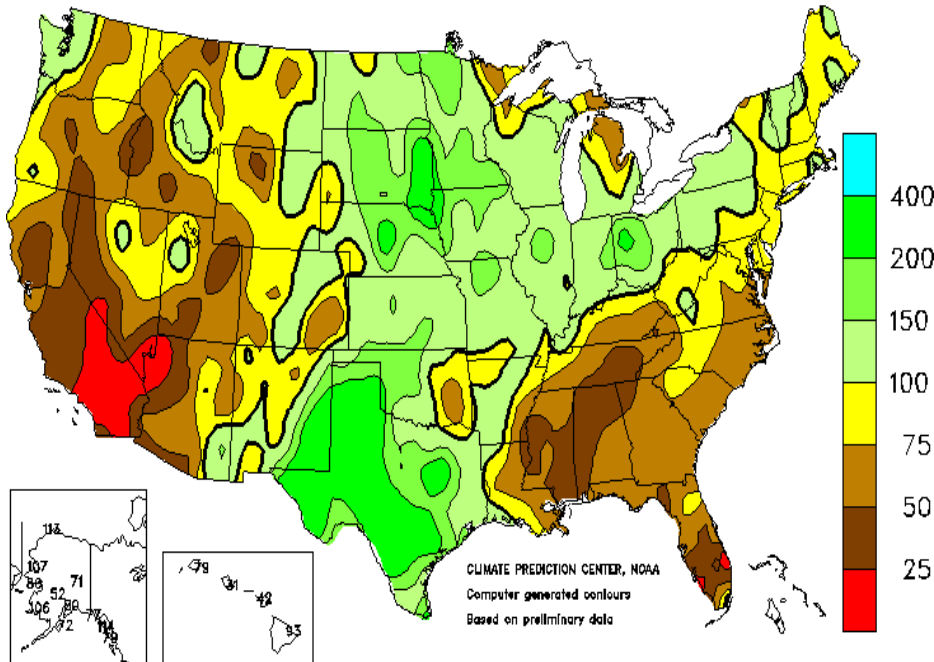
Periodic Fluctuation of Pressure Patterns over the North Atlantic Ocean – Scale of Weeks
 Primary Impact on Winter Temperature



2006-07 Moderate El Nino: Not What I Ordered

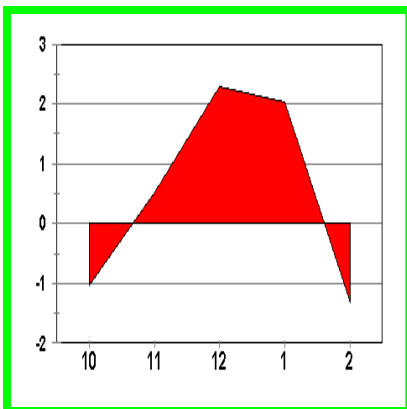
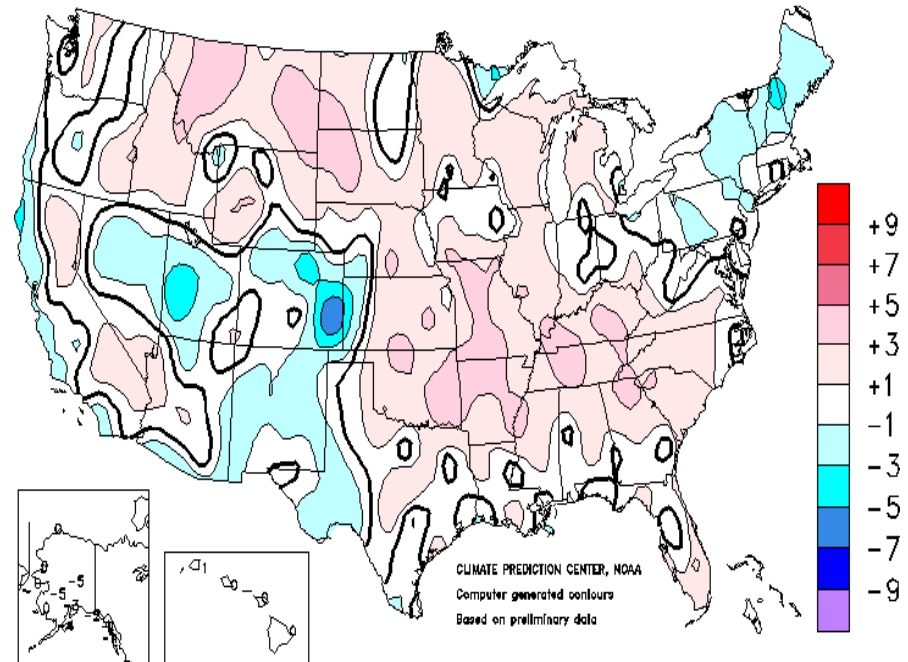
Percent Of Normal Precipitation

JAN - MAR 2007



Departure of Average Temperature from Normal (°F)

JAN - MAR 2007

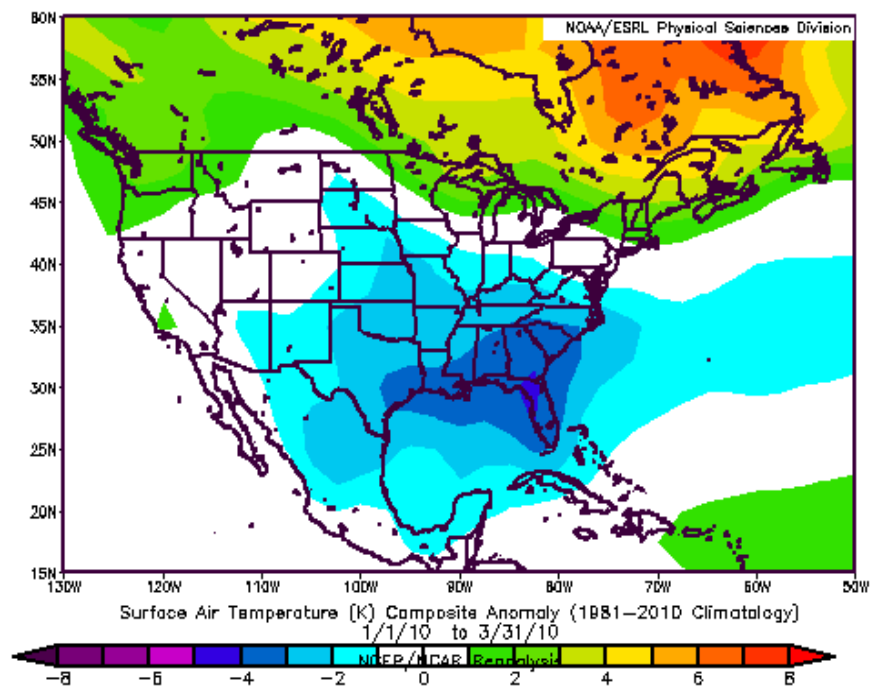
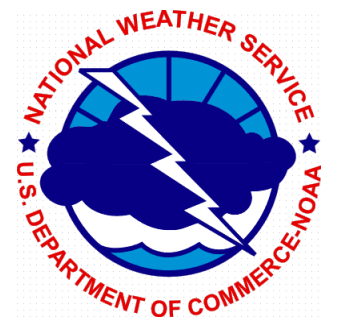


Strong AO+ Pattern

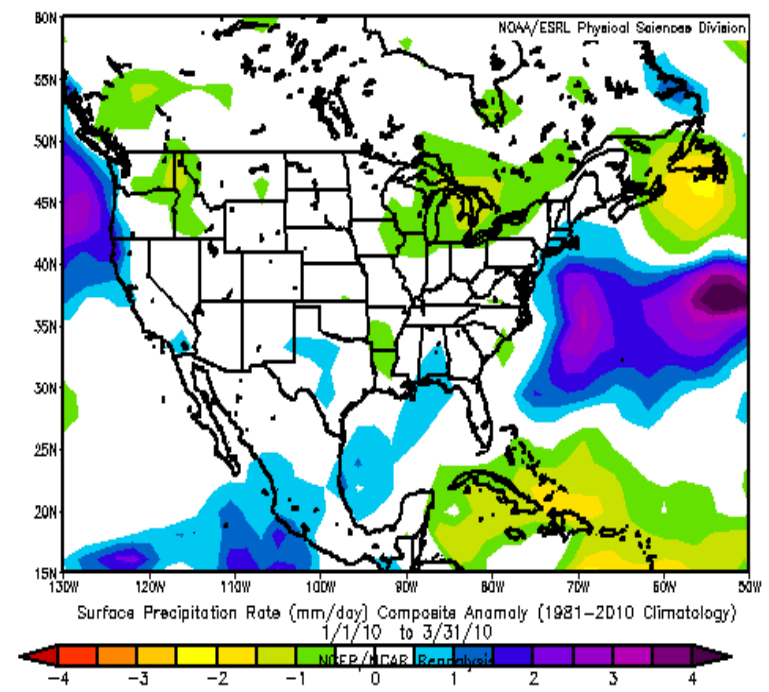
South Florida: Warm and Dry in El Niño Year



2009-2010: Cold Winter and Freeze in Moderate El Niño



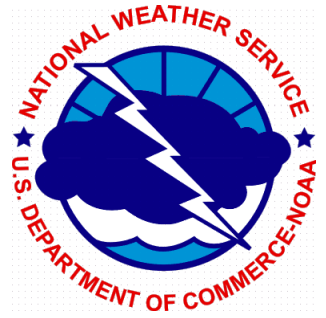
Heart of cold air across SE U.S. and Florida








Near normal precipitation



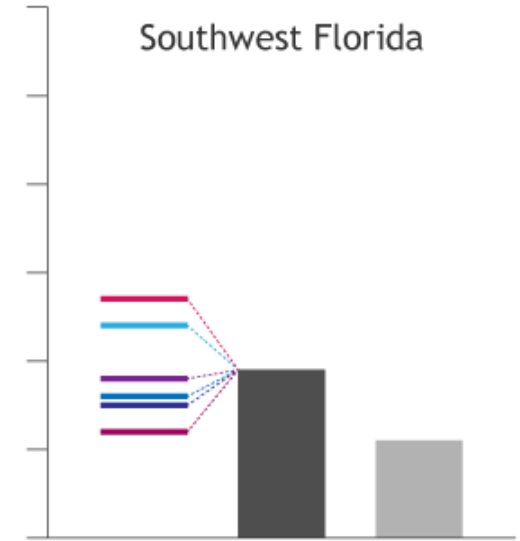
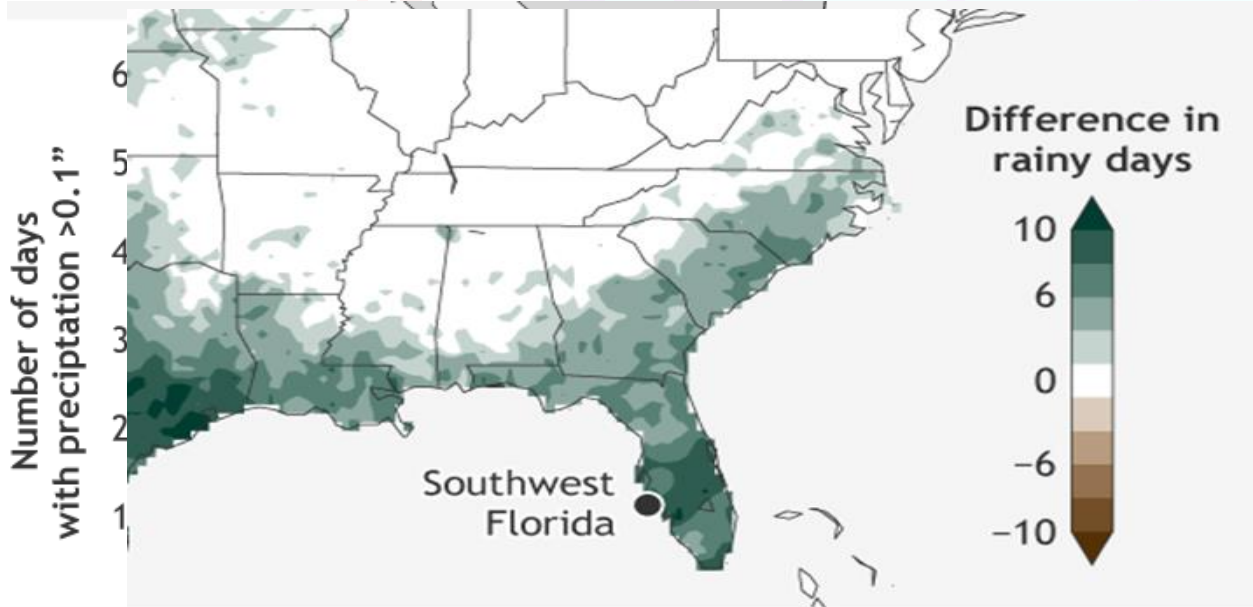
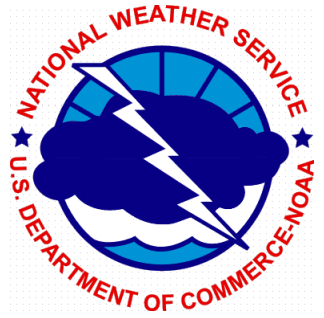
South Florida 2015-2016 Dry Season Outlook



Element	Outlook Nov-Apr	Long-Term Normal Values/Frequency
Temperature 	Below Normal	64-66F Interior/W 67-69F East
Precipitation 	Above Normal	12-15" Interior/W 15-21" East 32-41 precip days
Storminess/Severe Weather  	Above Normal	5-6 events per season (wind/hail/tornado/flood)
Freeze 	Below Normal	At least one per season



More Rainy Winter Days



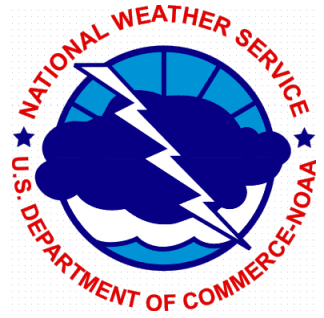
- 1957 El Niño
- 1965 El Niño
- 1972 El Niño

- 1982 El Niño
- 1991 El Niño
- 1997 El Niño

- El Niño average
- non-El Niño average



South Florida 2015-2016 Dry Season Outlook

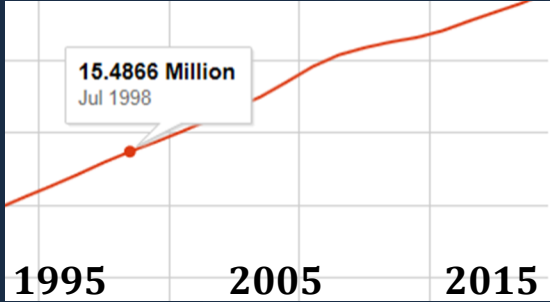


- Increased storminess (tornadoes, severe t'storms, hail, flooding)
- Below normal temperatures due in larger part to cooler daytime temperatures than cold night/morning temperatures. Source air masses tend to be of Pacific rather than Arctic origin. Also increased clouds keep days cooler & nights milder.
- Freeze likelihood lower
- Average of 5-10 more days with measurable precipitation

Florida El Niño Severe Weather Awareness

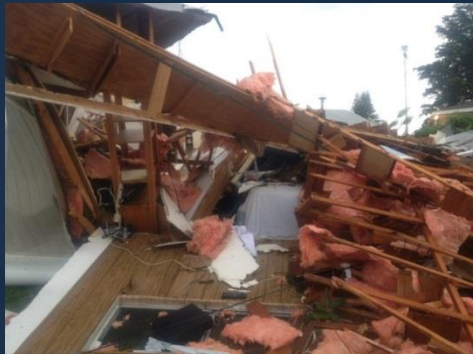
Are People Prepared?

Increasing Vulnerability



- 4.7 million new residents since 1998 outbreak!
- Many unaware of Florida (winter) severe weather risks

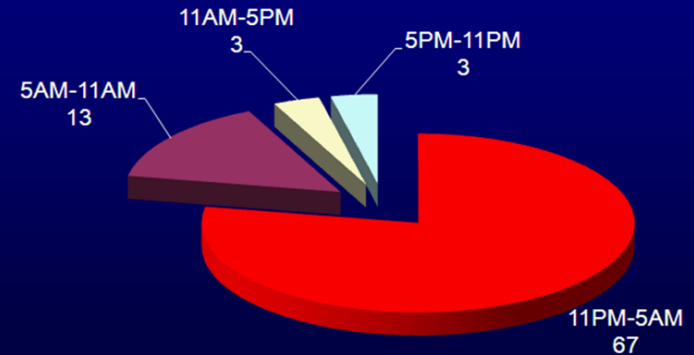
- High percentage of mobile homes
- Much lower threshold for damage
- High winter occupancy
- Greater casualty rate



**Plantation, FL October 2011
EF1 damage**

Time of Day

Most of The Tornado Deaths During El Niño Have Occurred Between 11PM and 5AM!



Hourly Distribution of 86 \geq F2 Tornado Deaths During 11 Strongest El Niño's Since 1950

Overnight Tornadoes

- Lower perception of threat
- Decreased Awareness (asleep)



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2015

Florida El Niño Severe Weather Awareness

Public Awareness & Safety



- **Monitor local television and radio for severe weather situations**
 - ✓ Such evolving threats are typically identified a few days in advance, with more specific information about the most likely time(s) and location(s) of impact provided one day in advance



- **Have the ability to receive timely weather warnings**
 - ✓ This can save lives, especially with dangerous, night-time tornadoes



- **Have a dependable alerting feature or device**
 - ✓ Ensure that you have a *NOAA Weather Radio* (programmed, with fresh batteries) and/or the *Wireless Emergency Alert* feature on your cell phone (or NWS warnings relayed by text message from Emergency Management or Media, or another reliable app)



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Preparation & Taking Action

IF A THREAT FOR DEADLY TORNADOES EXISTS FOR YOUR LOCATION (ESPECIALLY OVERNIGHT):

- ✓ If living in a mobile home, RV, or boat, make plans to stay with family or friends. Leave before the severe weather arrives. If you can't leave, identify the closest sturdy shelter such as a clubhouse or laundry room and go there immediately if a warning is issued for your location; [last resort \(link\)](#)
- ✓ Identify your shelter location and "safe place" in advance of a threat (i.e. small interior room on the lowest floor of your home or business, far from windows); ensure everyone is aware of the location
- ✓ Words of advice from those who have survived tornadoes include: "putting on your shoes, placing your (charged) cell phone in your pocket, making good use of any kind of helmet and/or pillow to protect your head, and holding tightly on to one another." These actions must be done quickly and prior to the arrival of the tornado

Emergency Alert
System

Tornado Warning

IF A TORNADO WARNING IS ISSUED FOR YOUR LOCATION:

- ✓ Take immediate action and move to your shelter, remain in place until the threat passes



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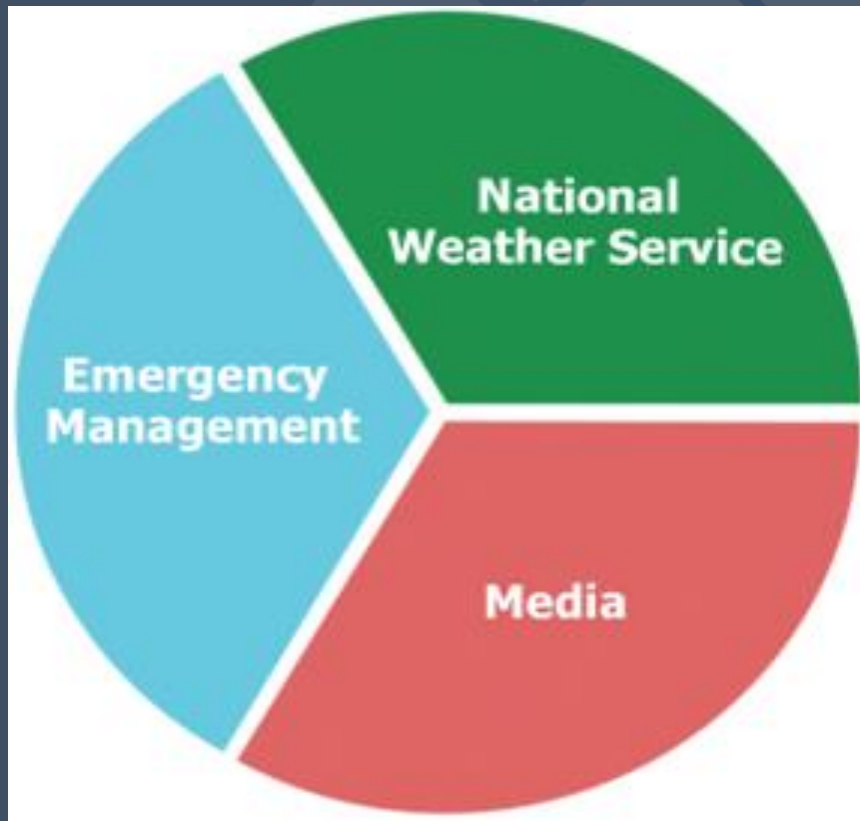


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Florida El Niño Severe Weather Awareness

Partnerships



- A strong partnership exists between the National Weather Service, Emergency Management, and Media
- ✓ By working together, these partners can deliver and share timely and accurate information ahead of, during, and after weather events to help minimize significant impacts to lives and property
- ✓ Unified messages (verbal, textual and via social media) are critical for evoking desired public responses



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Florida El Niño Severe Weather Awareness

Public Weather Outlook (24-hr prior); Watch (2-6 hr prior); Warning (20-min prior)



Understanding Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with all thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
<ul style="list-style-type: none"> Winds to 40 mph Small hail 	<ul style="list-style-type: none"> Winds 40-60 mph Hail up to 1" Low tornado risk 	<ul style="list-style-type: none"> One or two tornadoes Reports of strong winds/wind damage Hail ~1", isolated 2" 	<ul style="list-style-type: none"> A few tornadoes Several reports of wind damage Damaging hail, 1 - 2" 	<ul style="list-style-type: none"> Strong tornadoes Widespread wind damage Destructive hail, 2" + 	<ul style="list-style-type: none"> Tornado outbreak Derecho

* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.



- High visibility Storm Prediction Center (SPC) outlooks will be issued during times of increased overnight risk of strong tornadoes (“pre-watch” period)
- ✓ SPC will issue a **Public Severe Weather Outlook (PWO)** following the 3pm or 8pm EST Day 1 Convective Outlook when a **10 percent or greater probability of significant tornadoes is expected to occur at night** (“enhanced” threat or greater, with EF2 or greater)

NWS Miami Contact Information

Questions??



(305) 229 – 4525 (24 hours/7 days)



E-mail: sr-mfl.ops@noaa.gov



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