El Niño and La Niña: Scoundrels or Scapegoats?

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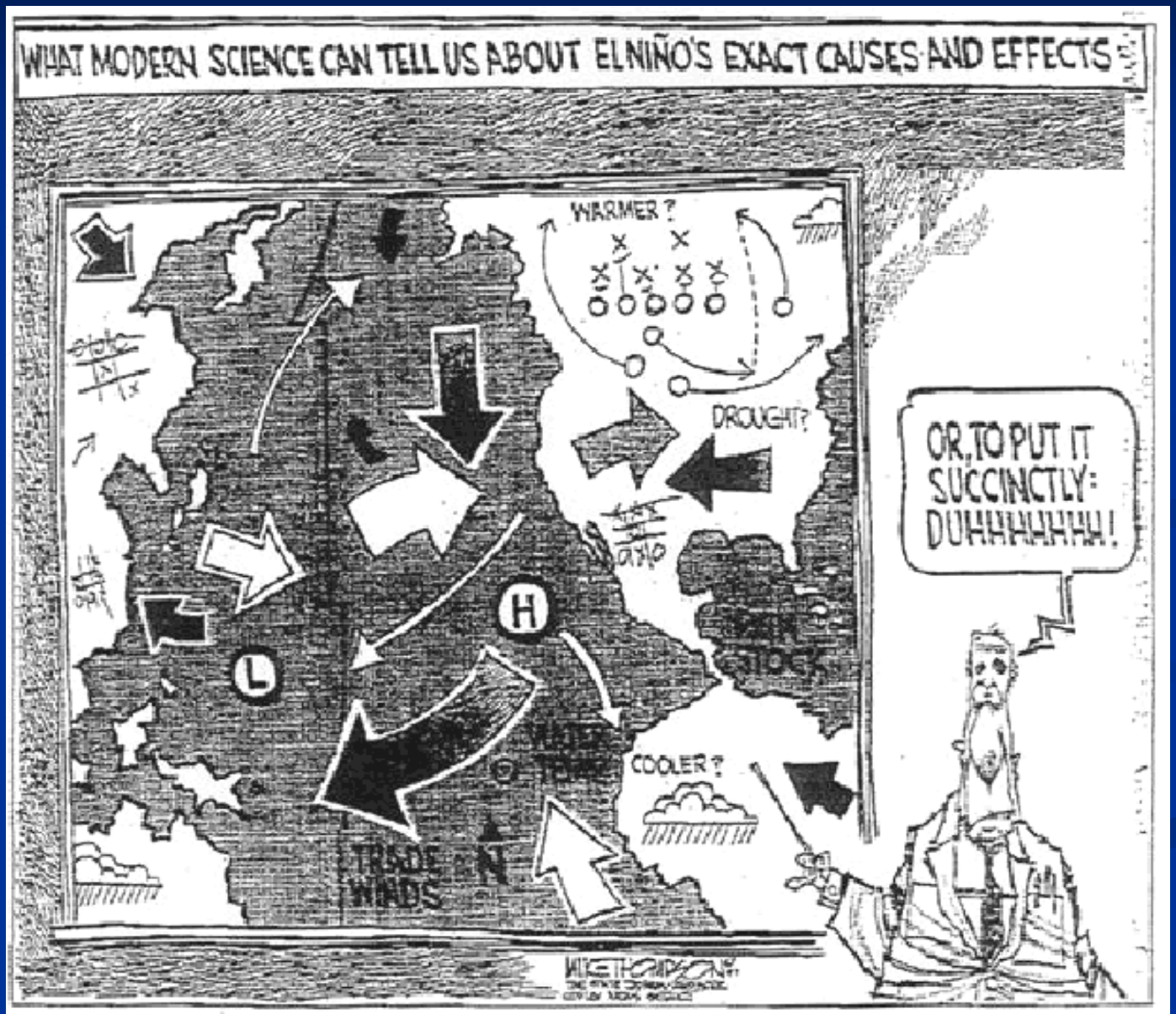
National Weather Service, Southern Region
Melbourne, Florida

CLOUDY WITH A CHANCE OF ANNIHILATION

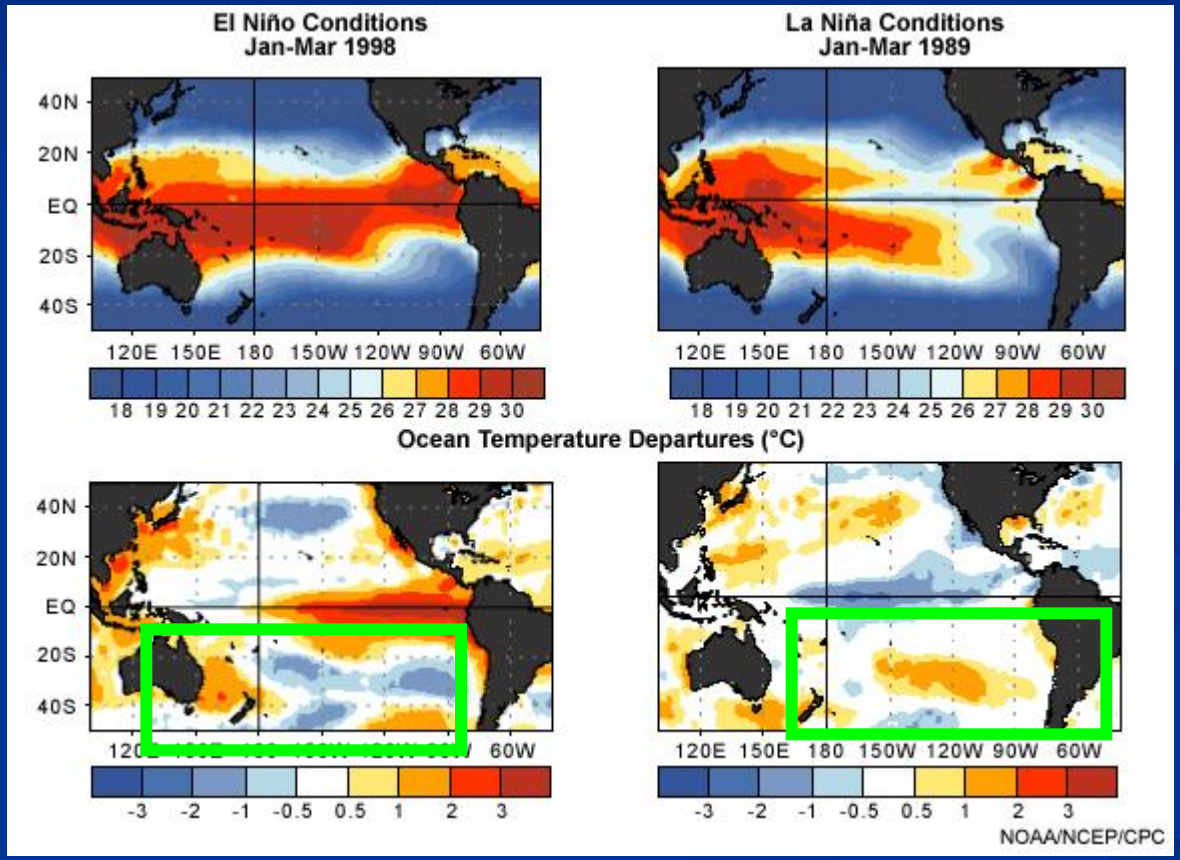
(New York Times 9/16/97)



Simple Definitions:

El Nino – Periodic increase in Sea Surface Temperature (SST) in Central and/or Eastern Equatorial Pacific Ocean.

La Nina – Periodic decrease in Sea Surface Temperature (SST)…..



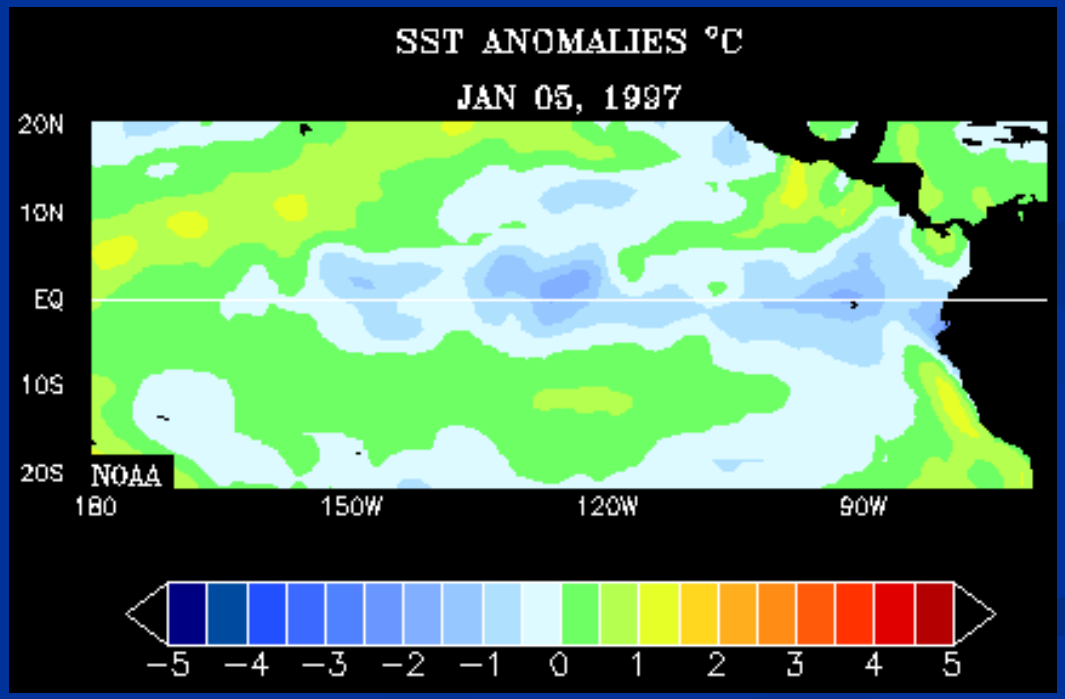
Warm Event

Cool Event

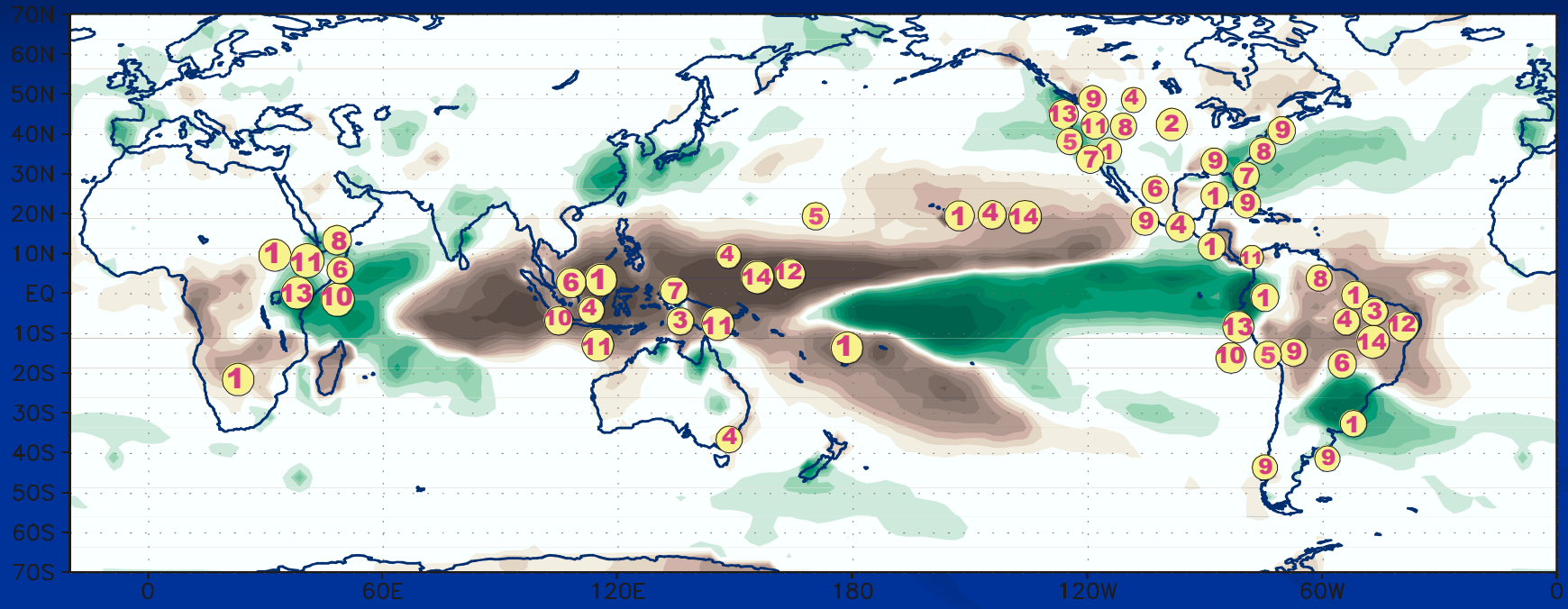
Example of the Development of a Strong El Nino and Transition to Strong La Nina as Measured in Sea Surface Temperature.

(January 97 – December 98)

El Nino and La Nina are both parts of the El Nino/Southern Oscillation system (ENSO)

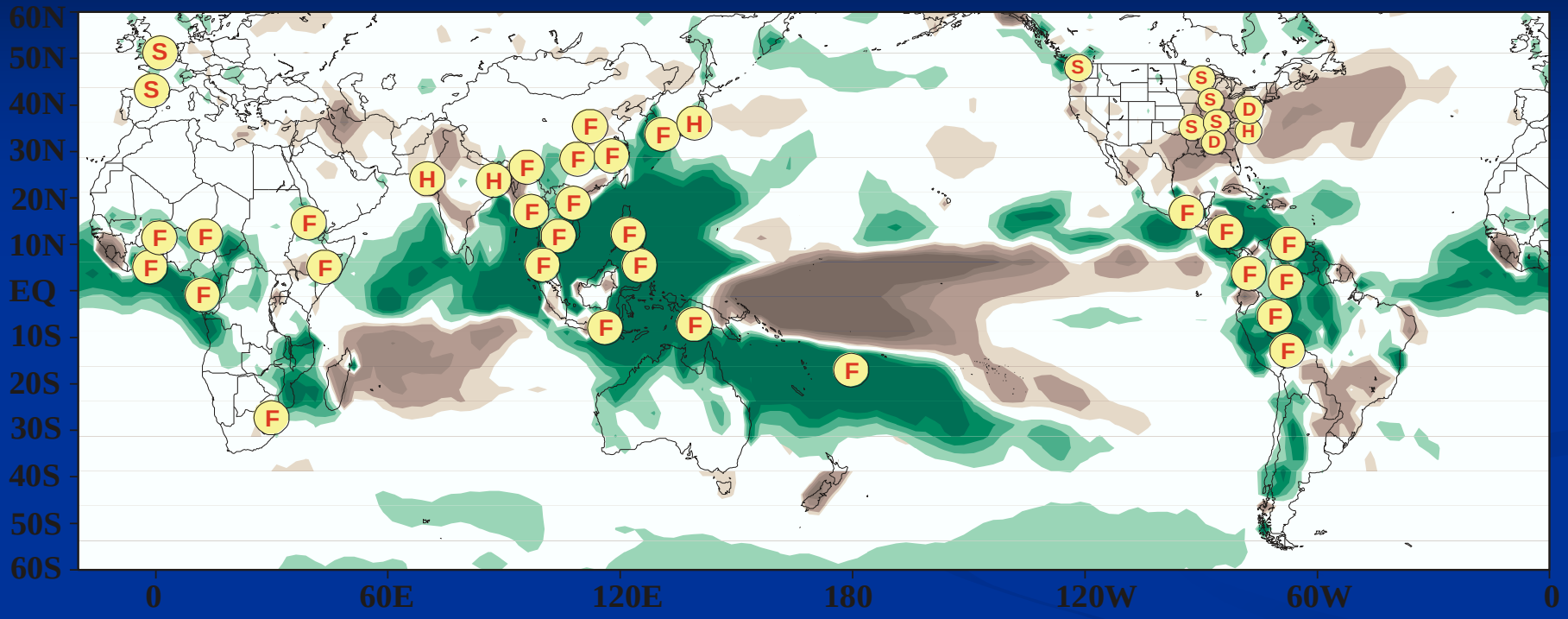


El Nino Global Impacts Related to 1997-98 El Nino



1. Crop/Stock Damage
2. Energy Savings
3. Famine
4. Fires
5. Fisheries Disruption
6. Health Risks
7. Human Fatalities
8. Pests Increased
9. Property Damage
10. Tourism Decreased
11. Transportation Problems
12. Social Disruptions
13. Wildlife Fatalities
14. Water Rationing

La Nina Global Impacts Related to 1998-99 La Nina



- S Storms, Hail, Tornadoes
- F Floods, Landslides
- H Hurricanes, Typhoons
- D Drought

	Victims	Insured Losses
Flood	55,360	$1.3B
Storms	16,863	$17.0B
Droughts	404	-.-
Cold Waves	409	$1.3B

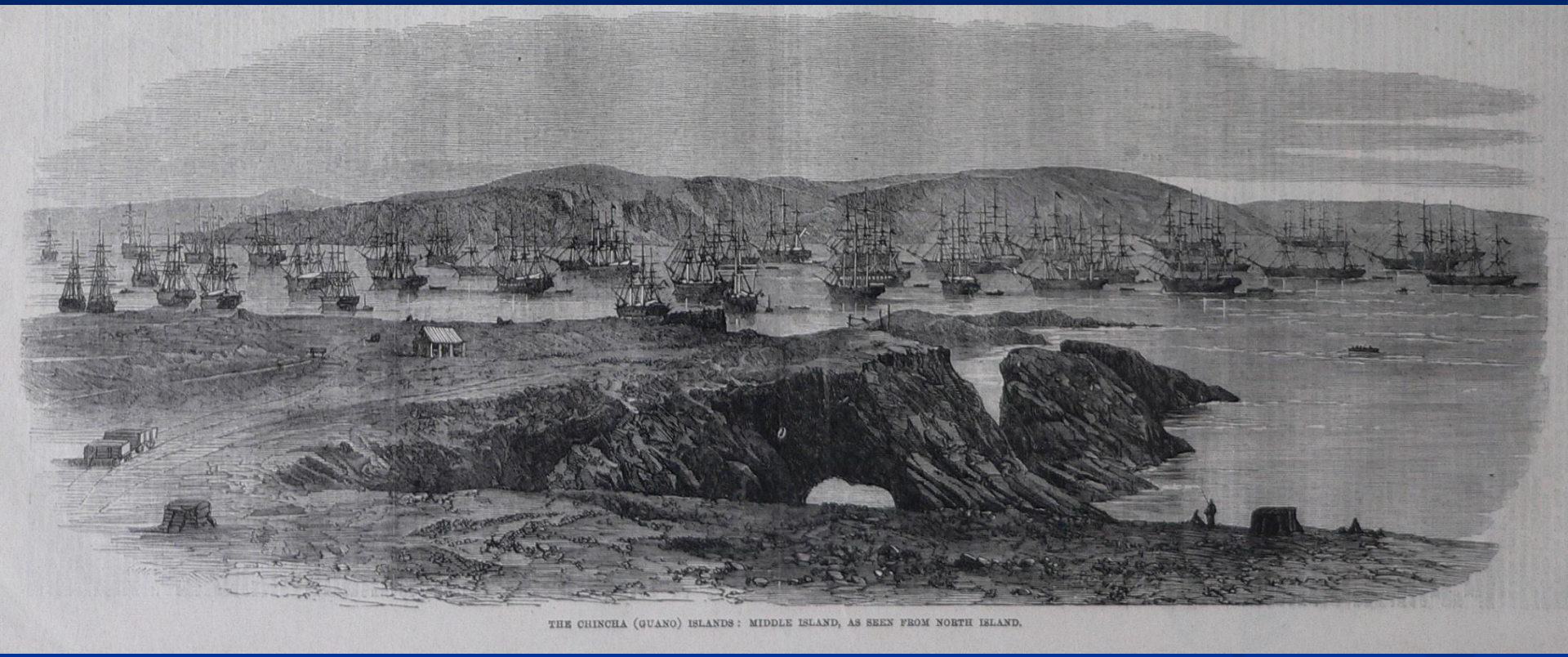
History of El Niño

Late 19th century

Peruvian fishermen begin referring to the periodic warming of the sea at Christmas as **El Niño**, meaning "The Child," or "The Little One." Frequently, the Child chases the fish away --but causes the desert to bloom. The term "El Niño" appears in print for the first time in 1892 in a Peruvian scientific journal.

Traditional El Nino/La Nina Area

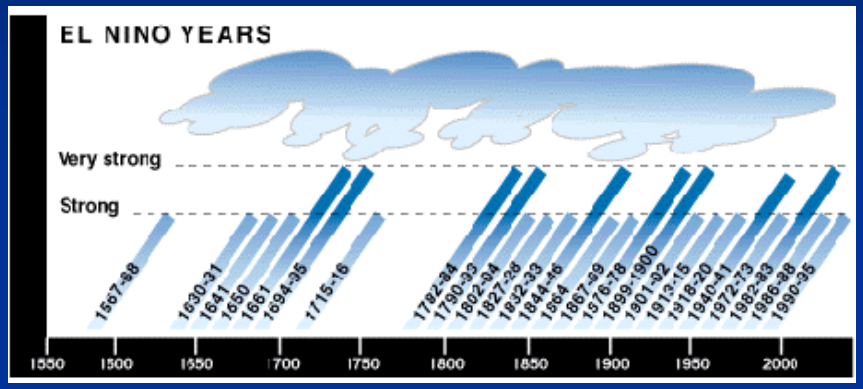
Fisherman Very Aware of SST – Cold Water – Good Fish Harvest

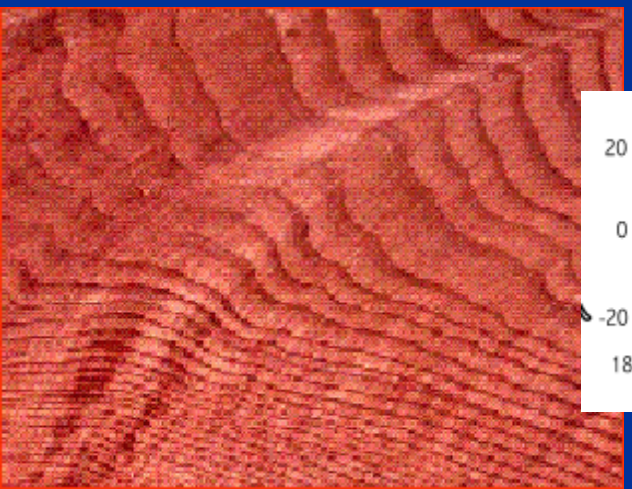


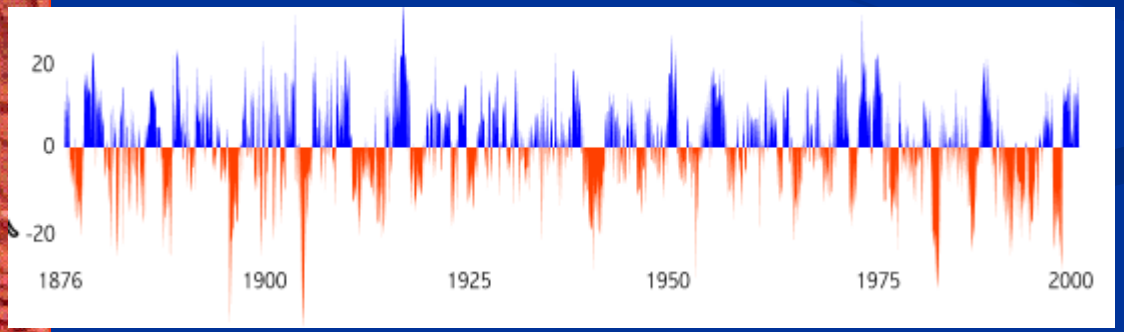
THE CHINCHA (GUANO) ISLANDS: MIDDLE ISLAND, AS SEEN FROM NORTH ISLAND.

More Fish – More Birds – These Boats are Not Catching Fish!

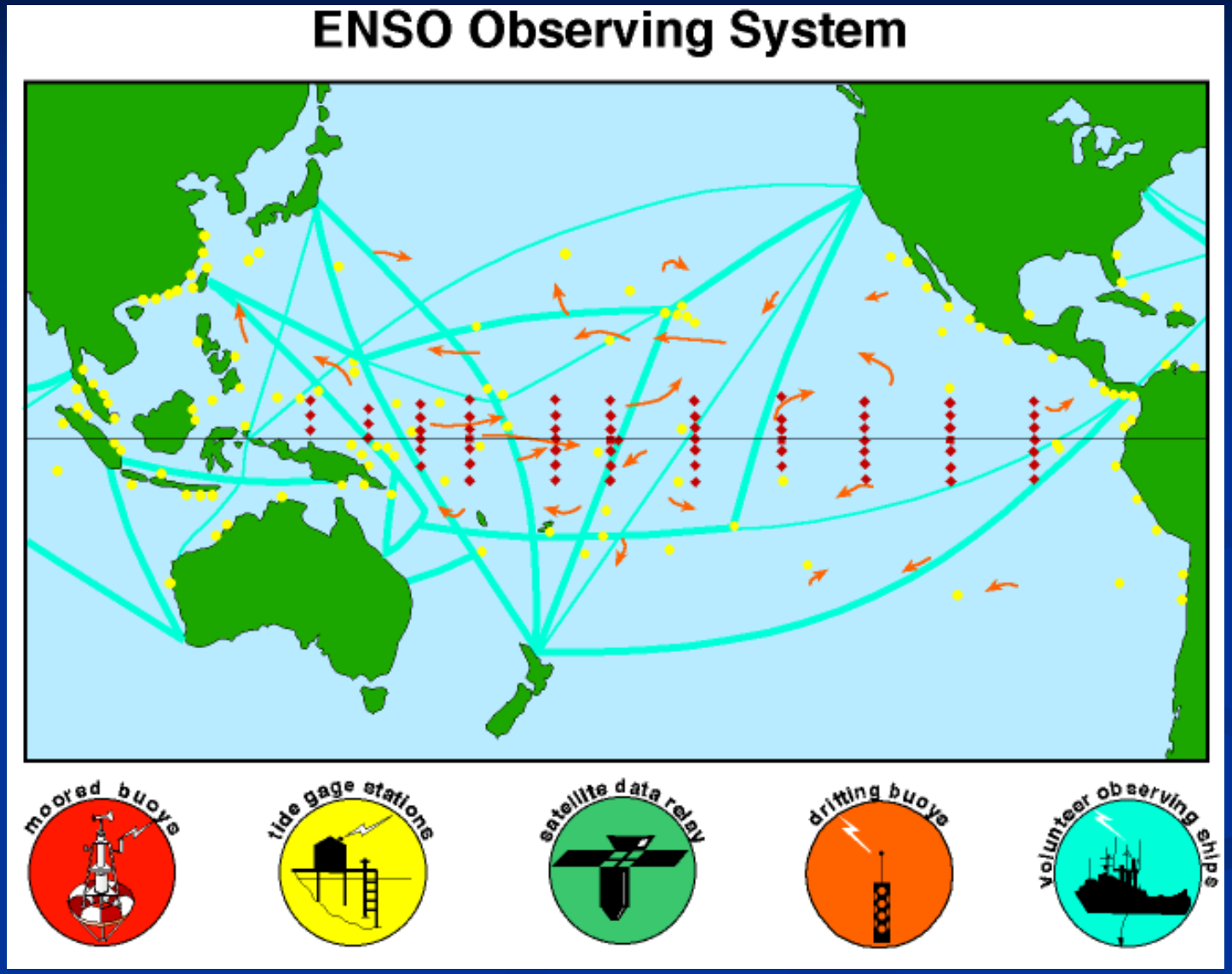
Research in recent decades has found that El Nino/La Nina are nothing new – They have had a profound effect on the course of human events for thousands of years!

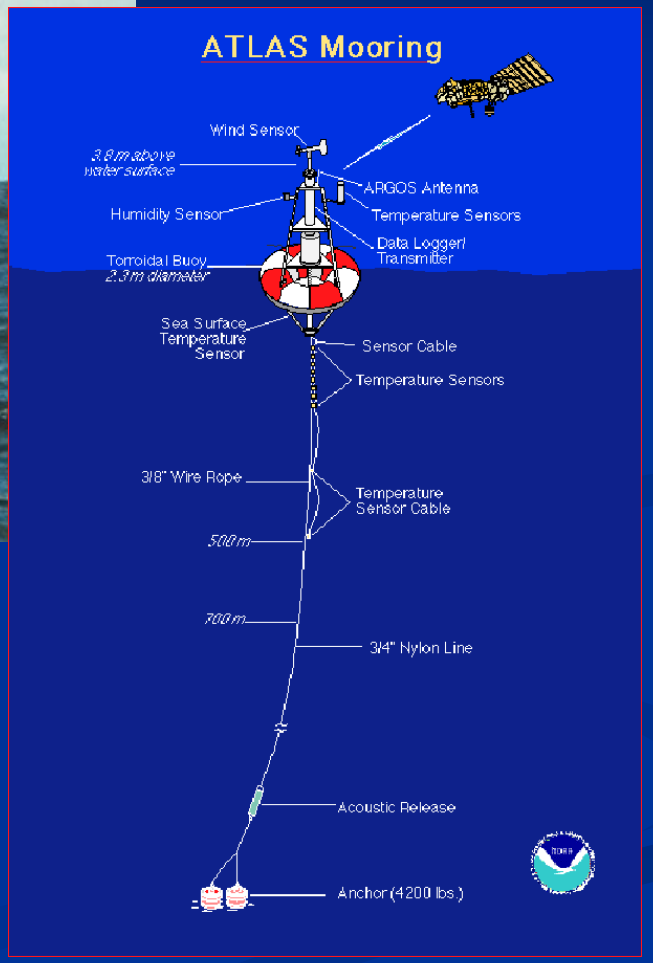




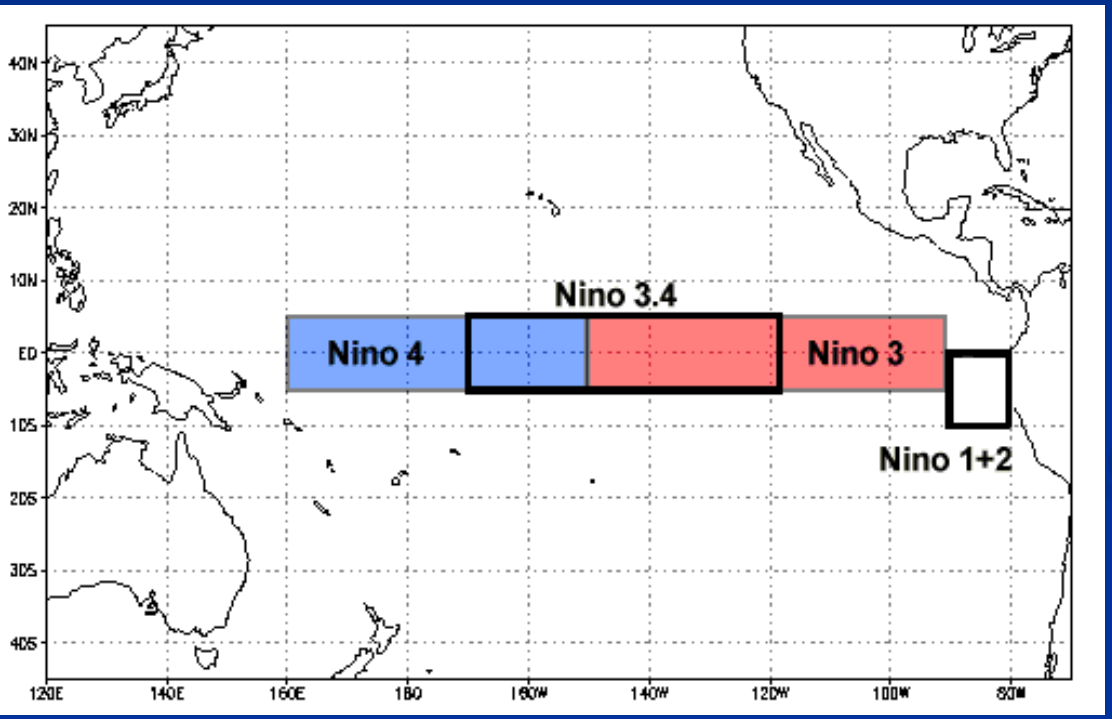


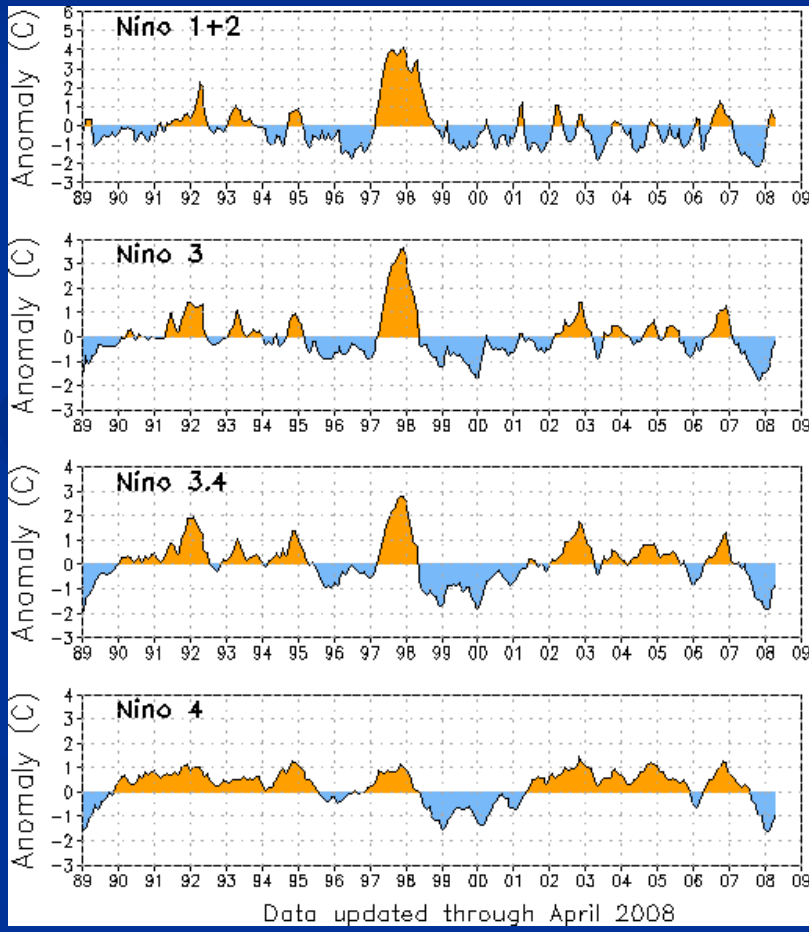
El Nino and La Nina Don’t Arrive Without Warning Anymore!

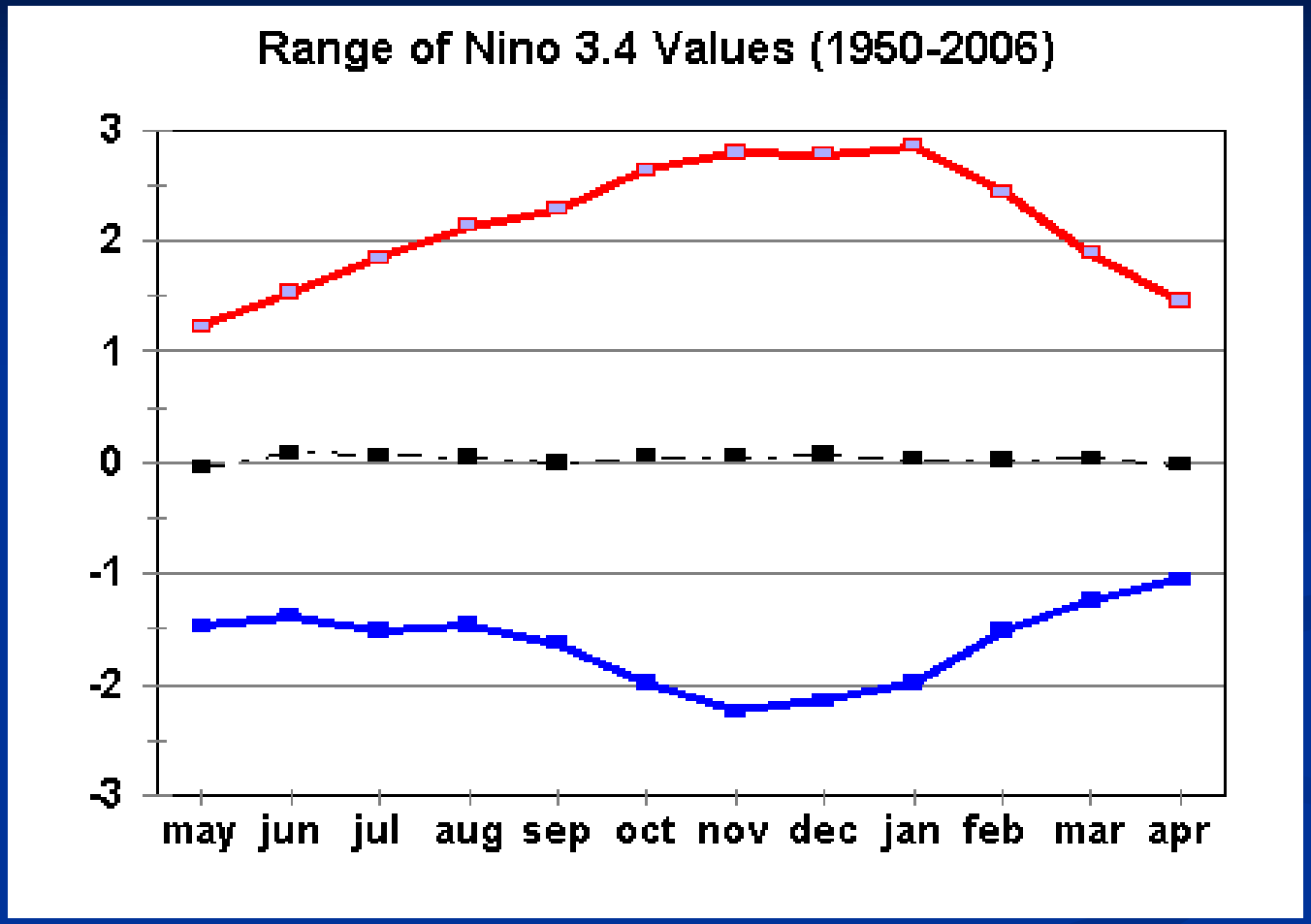



ATLAS Mooring
Wind Sensor
3.8 m above water surface
ARGOS Antenna
Humidity Sensor
Temperature Sensors
Data Logger/ Transmitter
Toroidal Buoy 2.3 m diameter
Sea Surface Temperature Sensor
Sensor Cable
Temperature Sensors
3/8" Wire Rope
Temperature Sensor Cable
500 m
700 m
3/4" Nylon Line
Acoustic Release
Anchor (4200 lbs.)

Sea Surface Temperature Measurement are Taken Over a Variety of Areas in the Tropical Pacific to Monitor the State of ENSO






Range of Nino 3.4 Values (1950-2006)
3
2
1
0
-1
-2
-3
may
jun
jul
aug
sep
oct
nov
dec
jan
feb
mar
apr

NOAA Operational Definitions for El Niño and La Niña

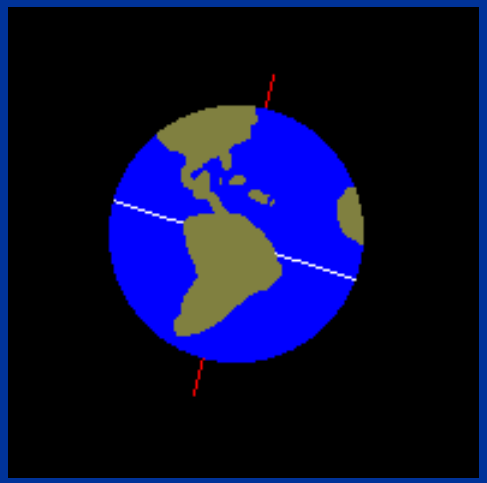
El Niño: **characterized by a *positive* ONI greater than or equal to +0.5 C.**

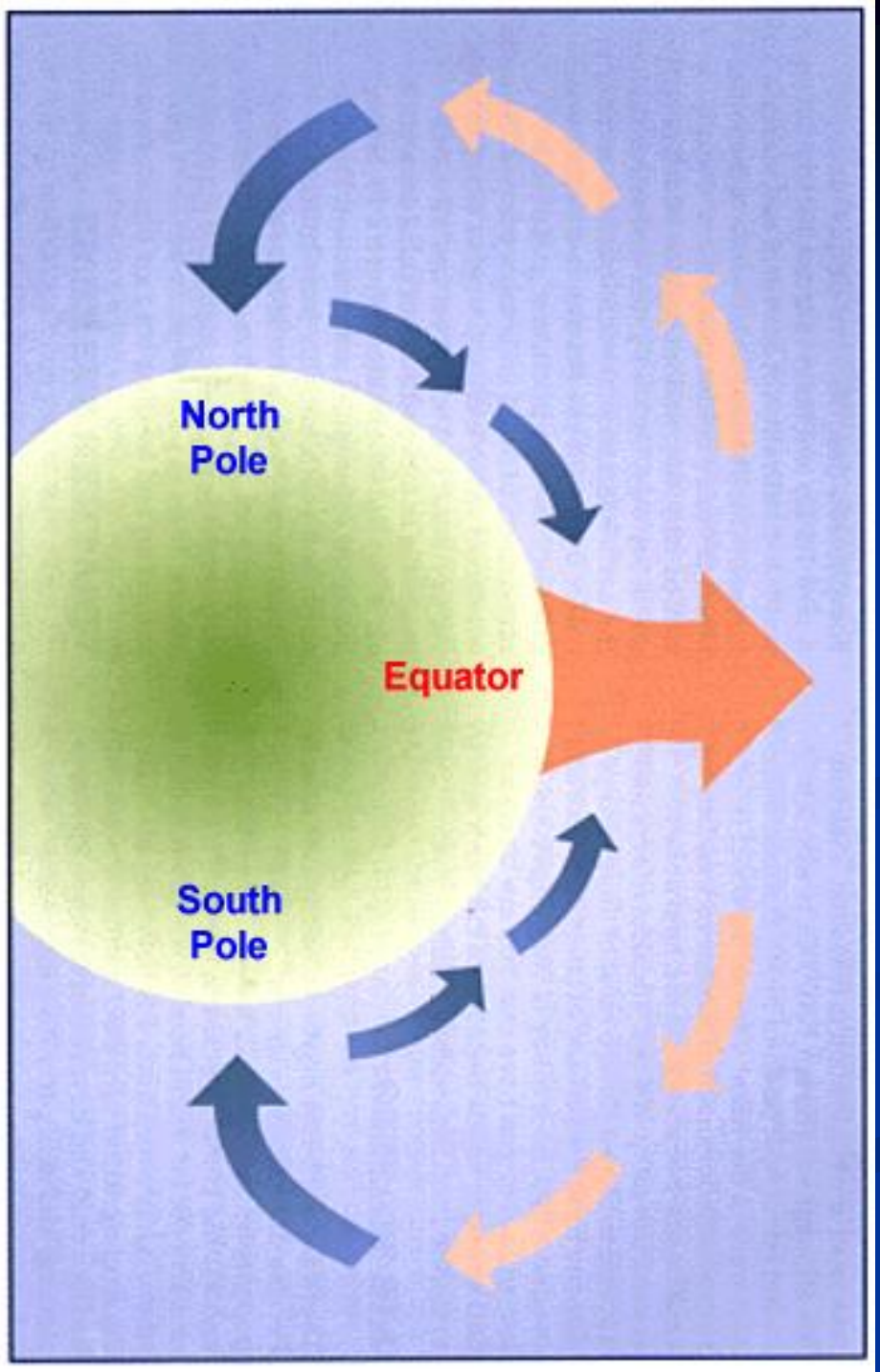
La Niña: **characterized by a *negative* ONI less than or equal to -0.5 C.**

To be classified as a full-fledged El Niño or La Niña episode these thresholds must be exceeded for a period of at least 5 consecutive months.

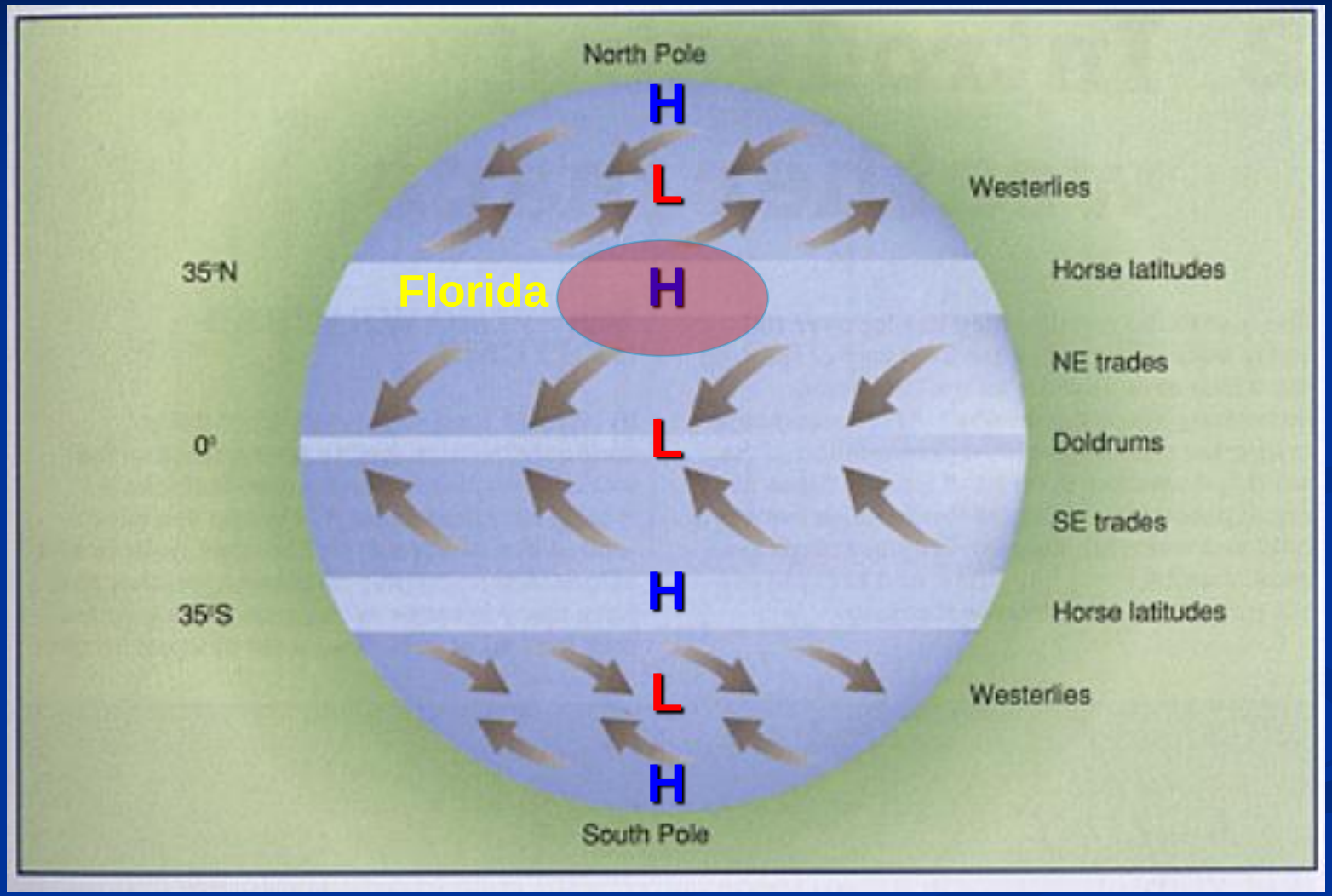
So How Does it all Work?

Basic General Circulation

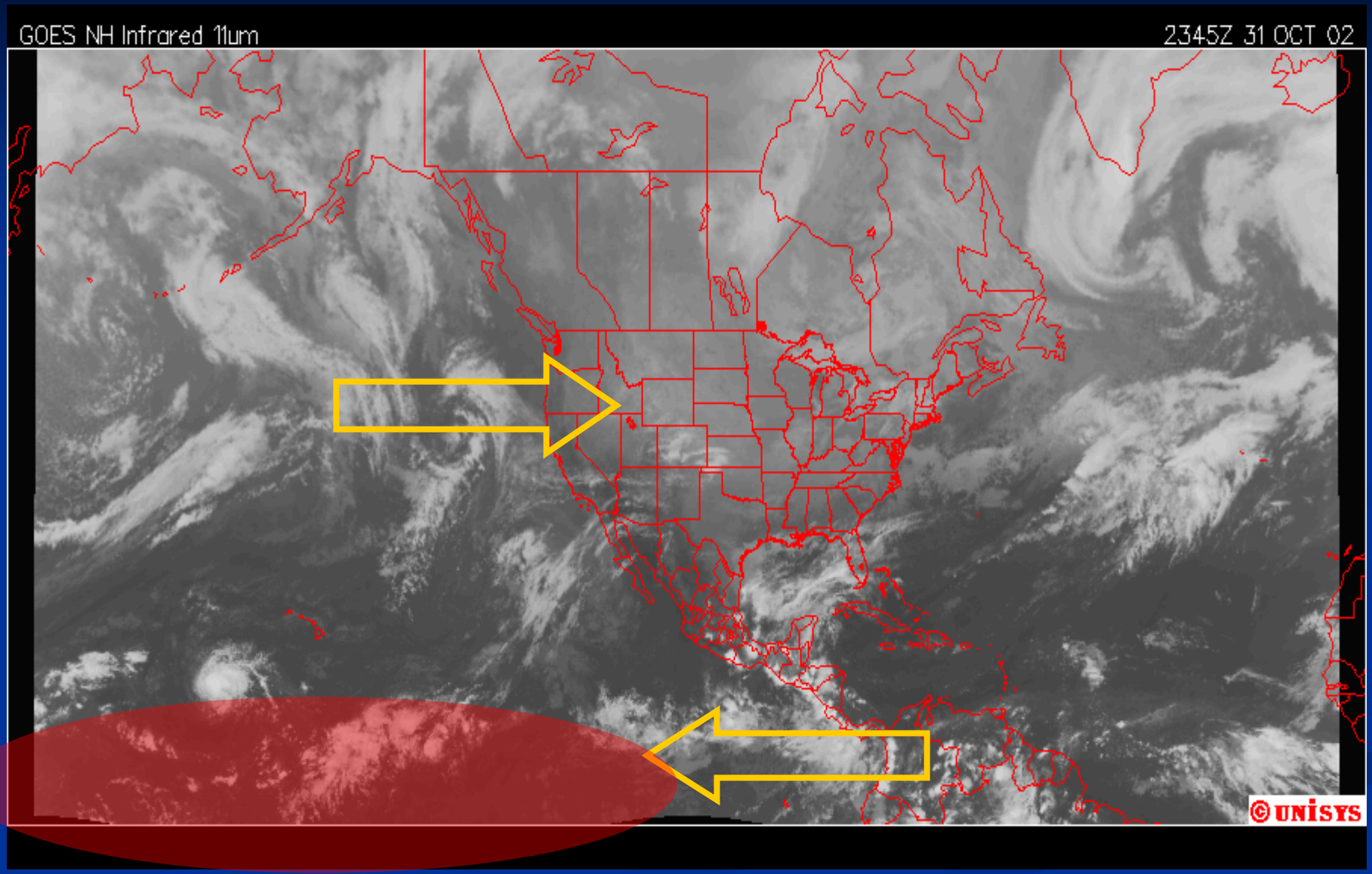


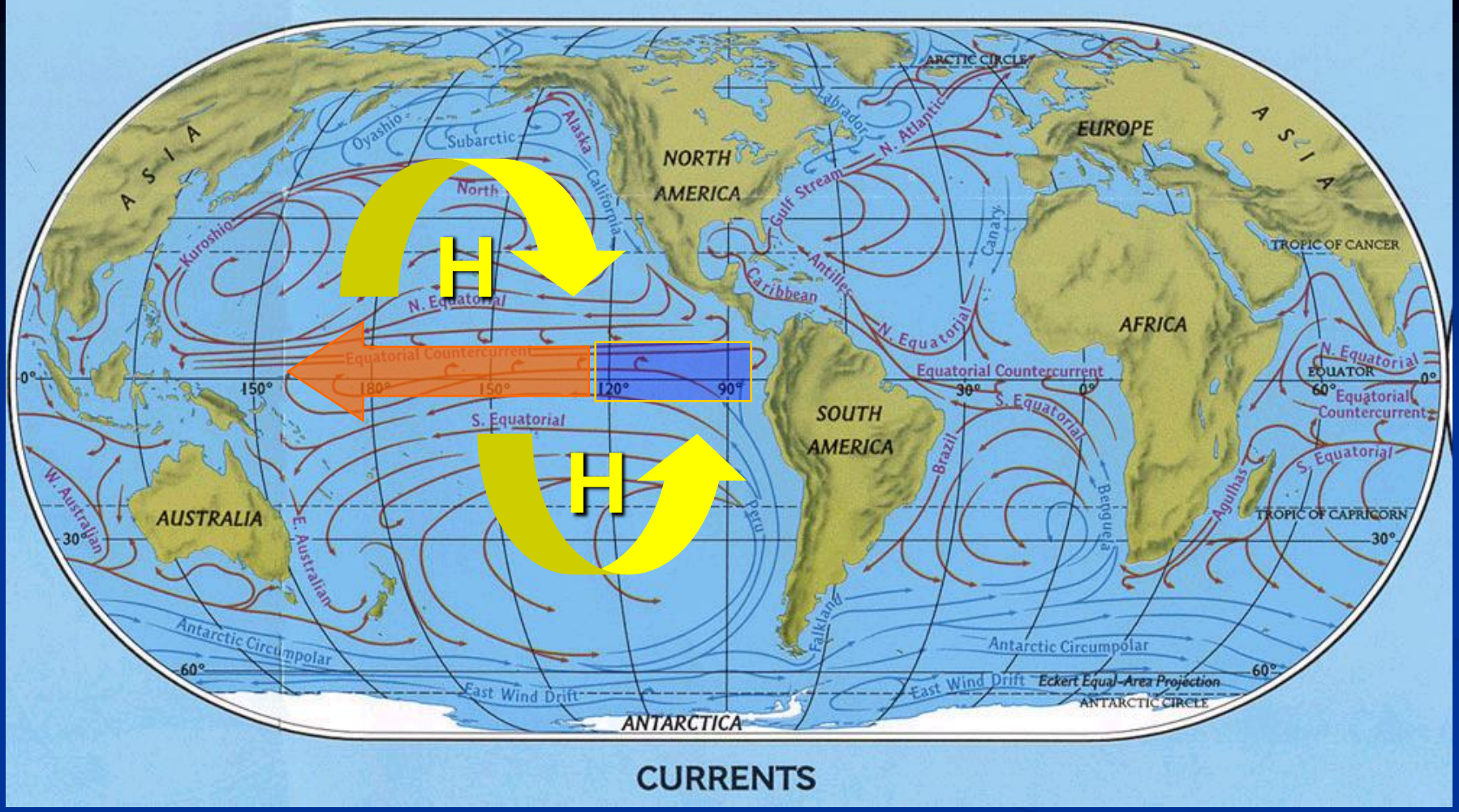


Idealized General Circulation



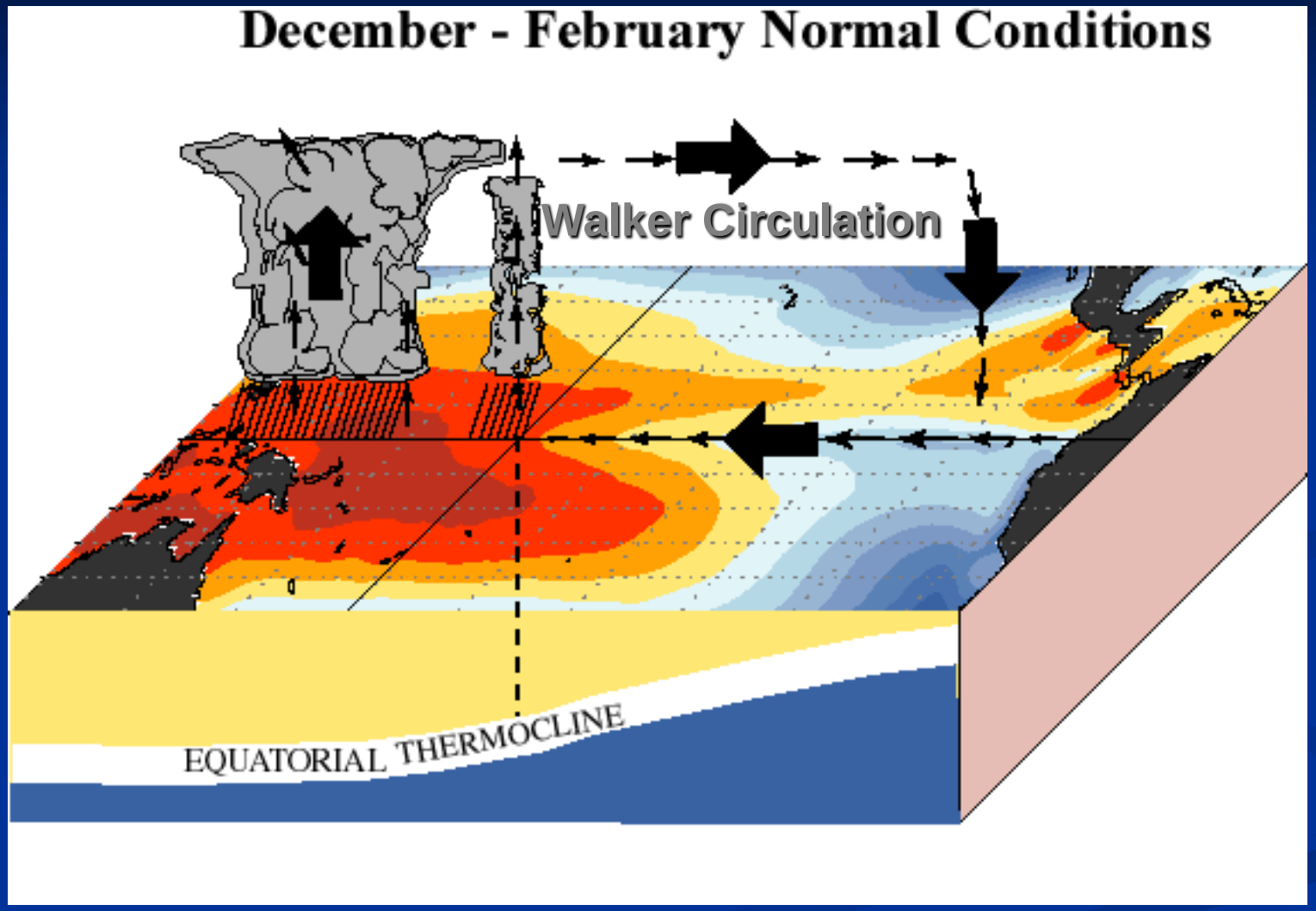
Real Atmosphere – Winter Case





Surface Ocean Currents – Upper 400 Meters of Ocean – Primary Forces are:
Solar Heating, Winds, Gravity and Coriolis

Normal



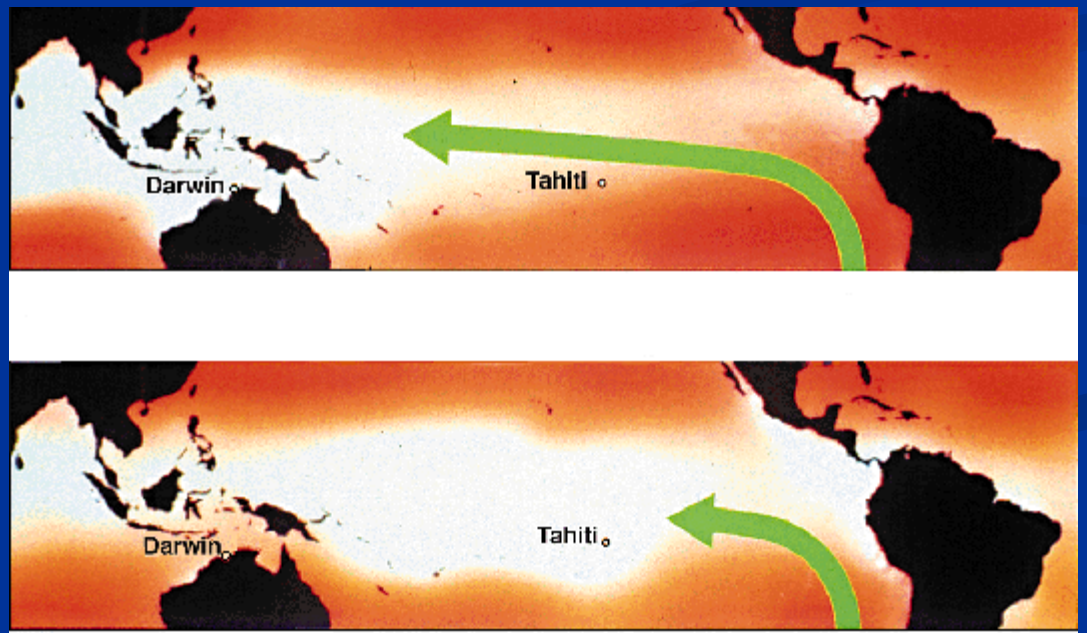
As you might imagine ENSO is “Neutral” about half the time

1920s

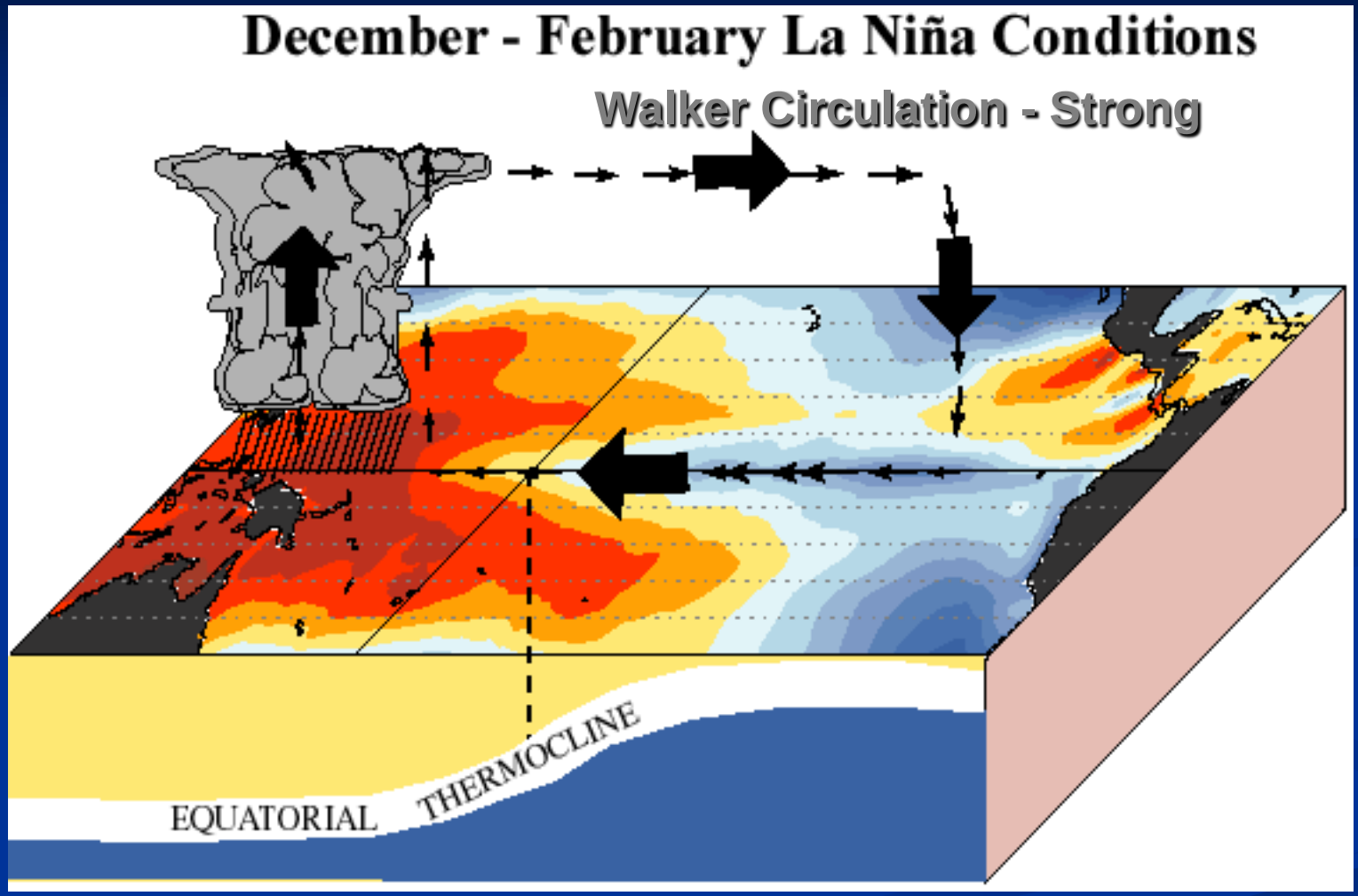
- Sir Gilbert Walker correlates rainfall in South America with periodic changes in ocean temperatures. He also finds a near-perfect mirror-image connection between barometer readings at stations on Tahiti and Darwin, Australia; as pressure rises in the east, it falls in the west. He coins the term **Southern Oscillation** to dramatize the ups and downs in this east-west seesaw effect.

La Nina

El Nino

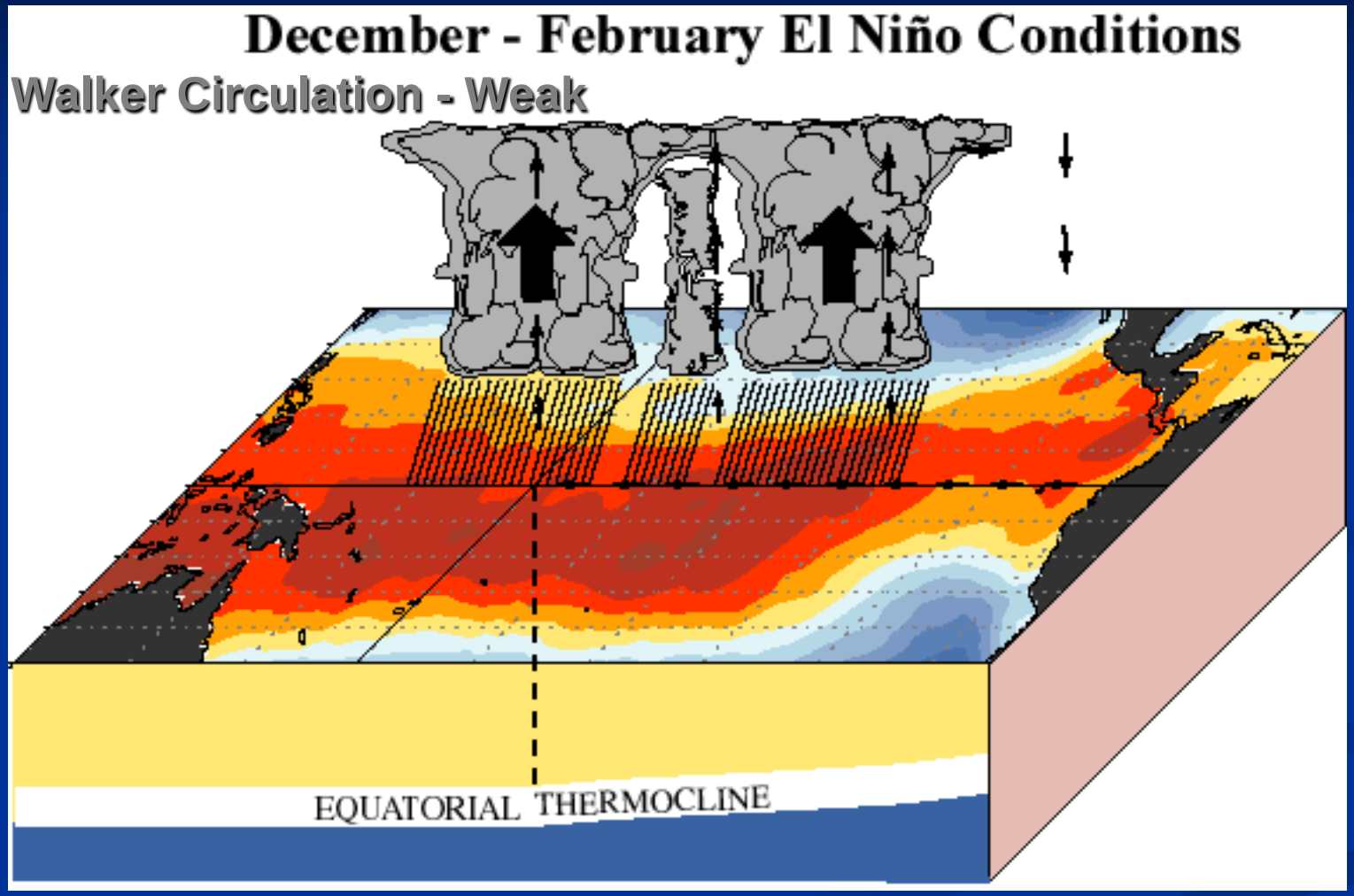


La Nina



About 25% of the time

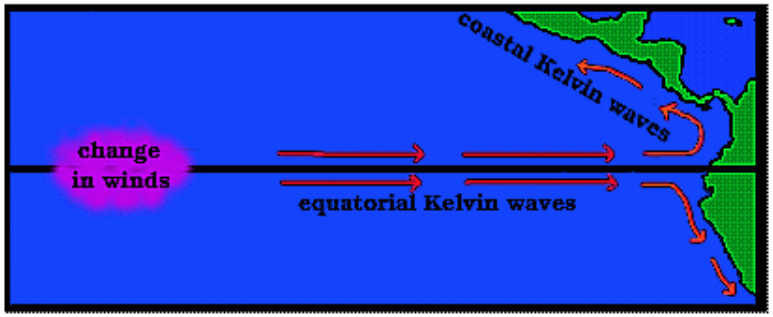
El Nino



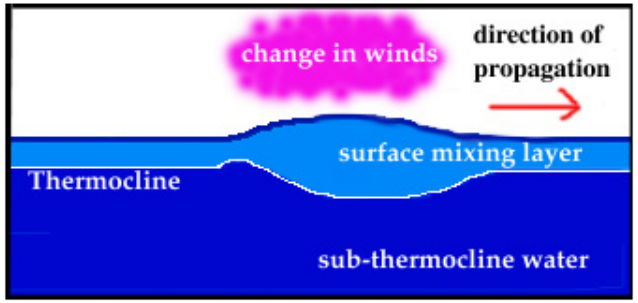
About 25% of the time

What Might Trigger EL Ninos: Equatorial Kelvin Waves

Kelvin Waves

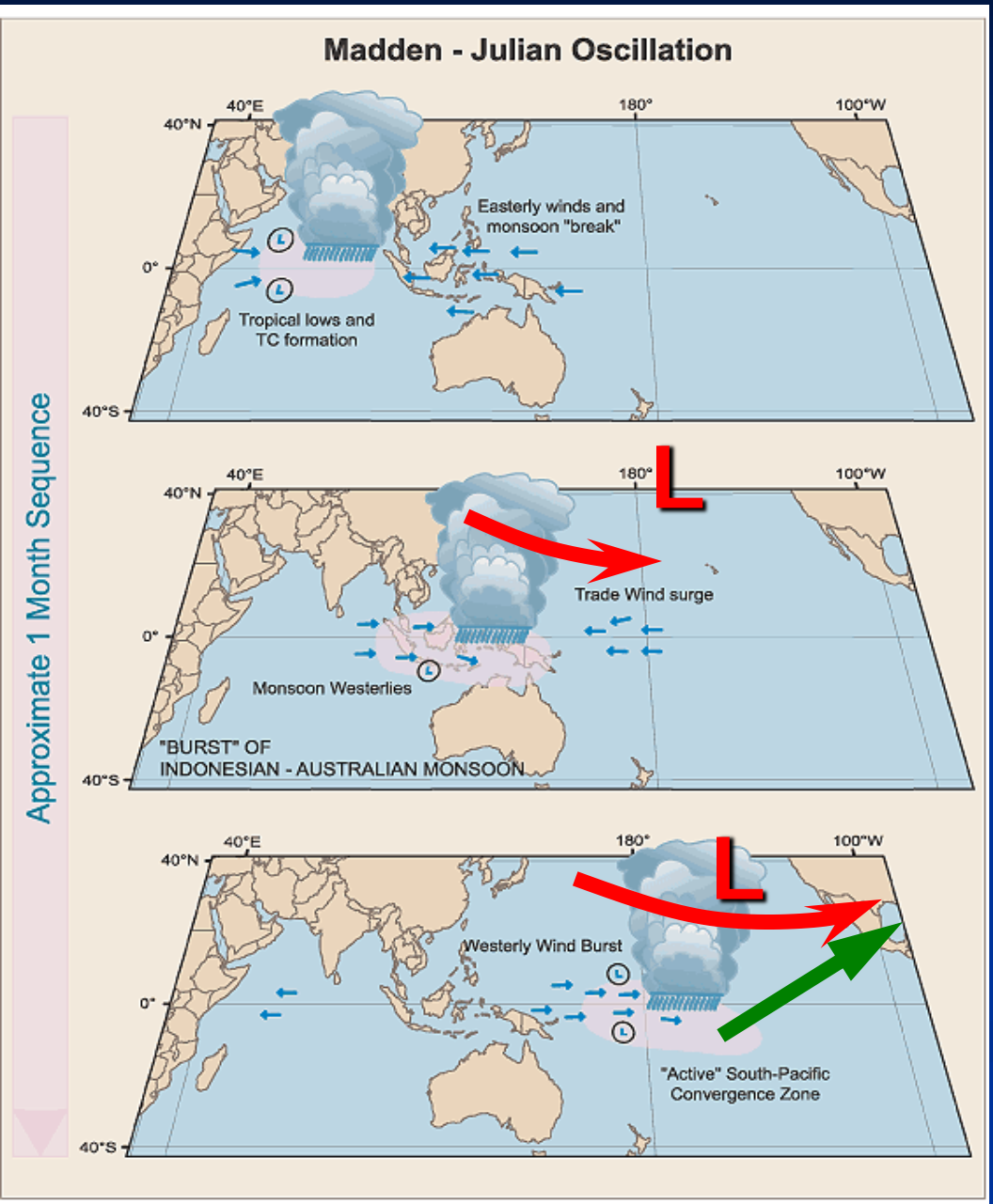


There are two types of Kelvin waves, coastal and equatorial, and they are both gravity driven and non-dispersive. They are often excited by an an abrupt change in the overlying wind field, such as the shift in the trade winds at the start of El Niño.



Equatorial waves propagate to the east in the northern hemisphere, using the equator as a wave guide. Coastal Kelvin waves propagate around the northern hemisphere oceans in a counterclockwise direction using the coastline as a wave guide. These

Madden – Julian Oscillation



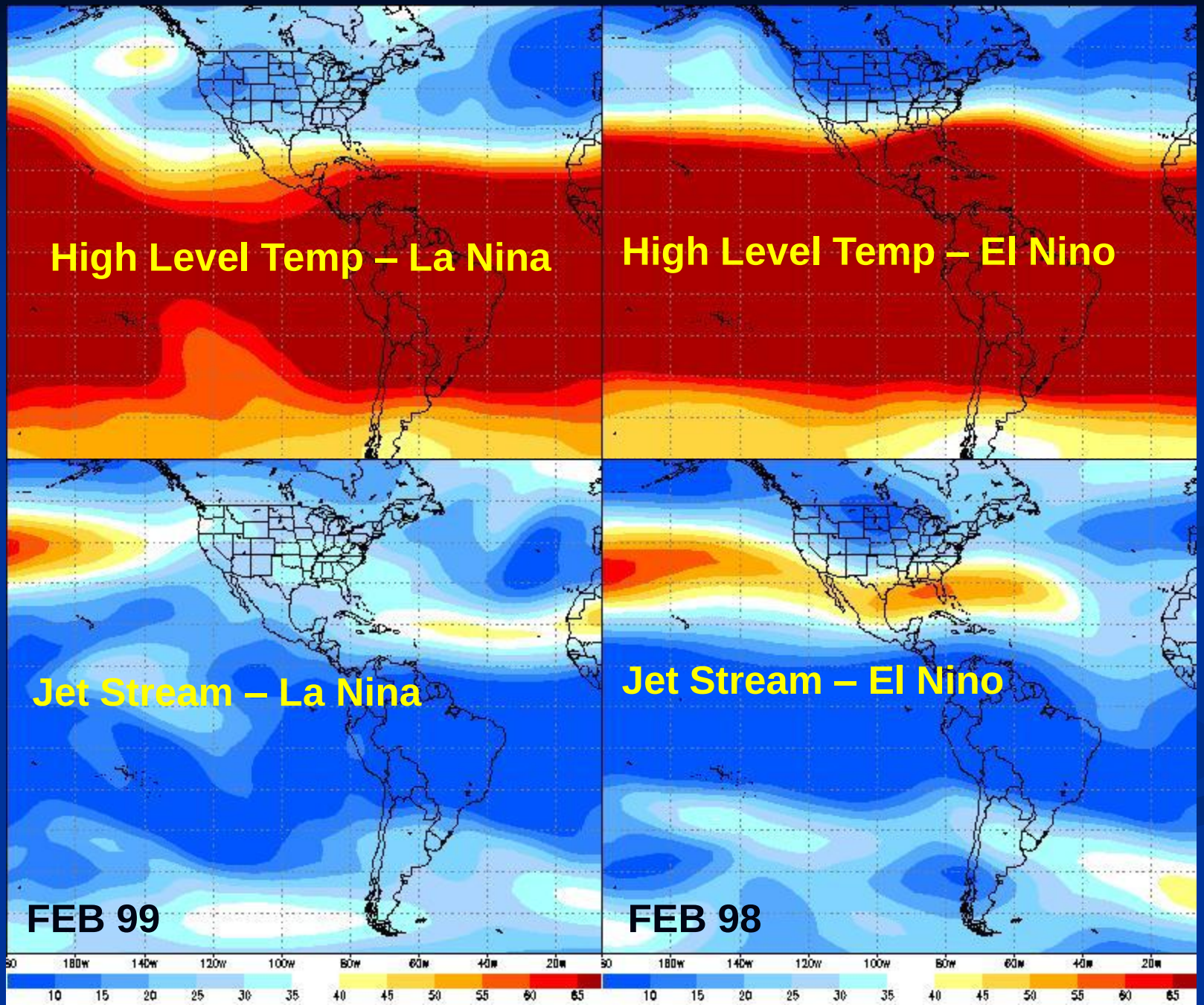
An equatorial traveling pattern of anomalous convection, rainfall and wind that moves from west to east with a period of 30 to 50 days

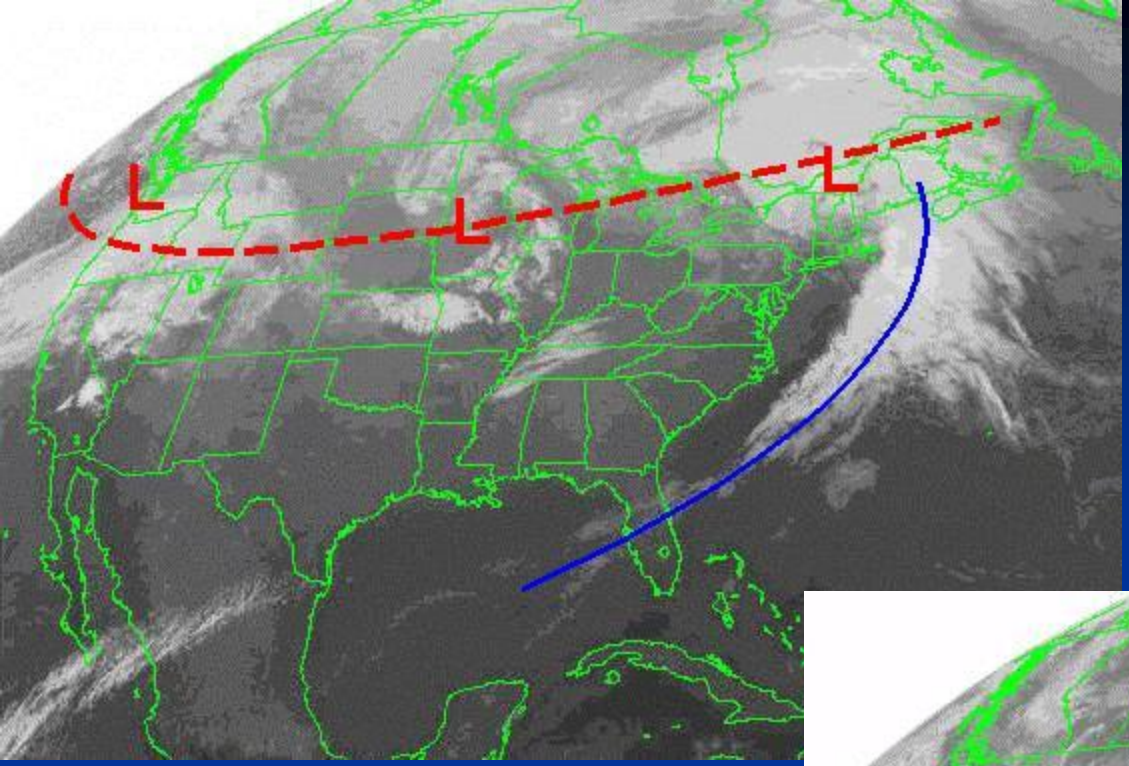
Acts to enhance El Niño –
Can have major impact on winter rainfall!

ENSO Impacts on Florida

- ENSO is the strongest predictor of Winter/Spring storminess across Florida
- Winter storms can sometimes have as great an impact as Hurricanes – *Most Storm Surge Deaths - March 1993*
- *Can Have Significant impact on wildfire/drought*
- ENSO can have major impact on Hurricane Season

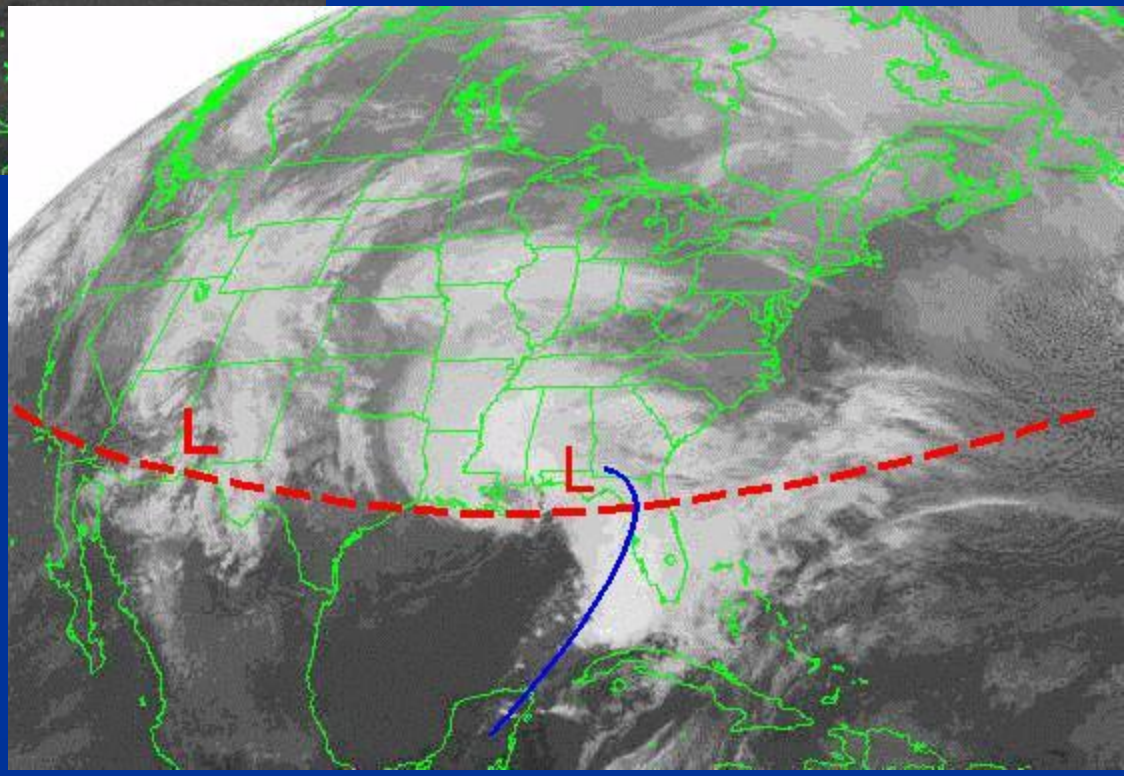
These Impacts can be both good and bad – and ENSO neutral are under-researched.


High Level Temp – La Nina
High Level Temp – El Nino
Jet Stream – La Nina
Jet Stream – El Nino
FEB 99
FEB 98
180W
140W
120W
100W
80W
60W
40W
20W
10
15
20
25
30
35
40
45
50
55
60
65

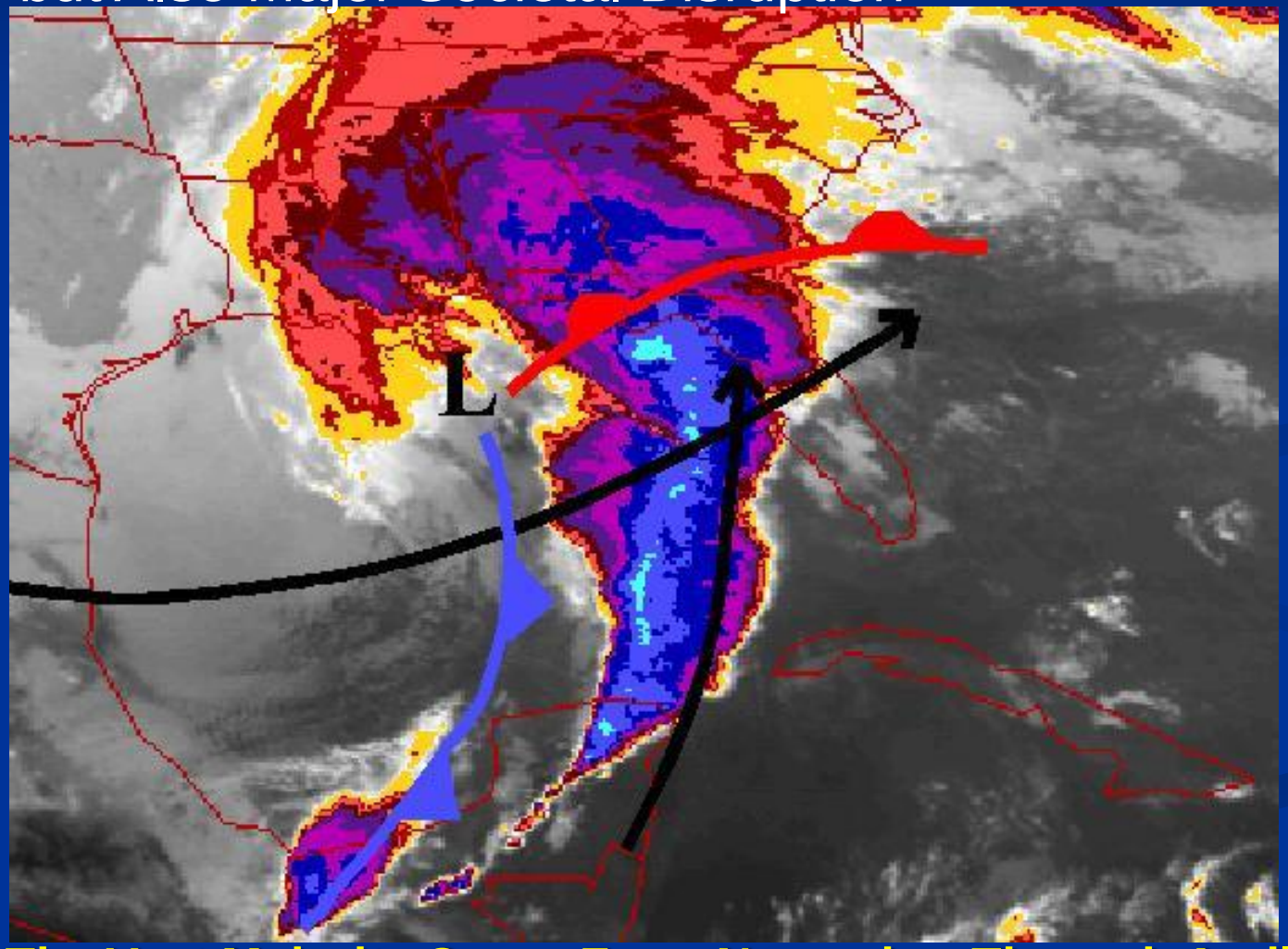


Strong La Nina Storm Track

Strong EL Nino Storm Track



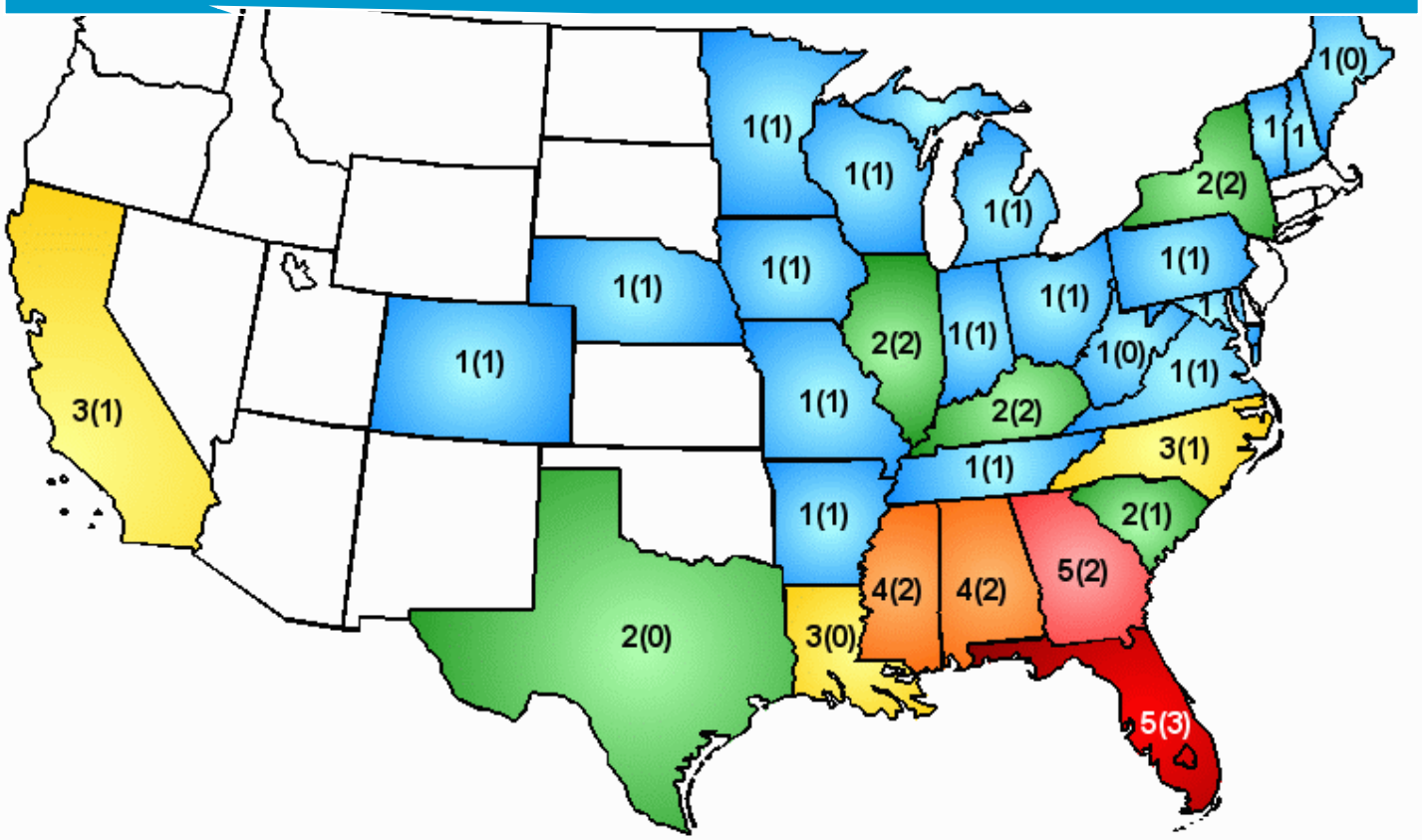
Extra Tropical Storms : Tornado Outbreaks, Hail, Damaging Thunderstorm Winds, Flooding Rainfall, Coastal Flooding, Marine Hazards, Strong Gradient Winds. Can Bring Beneficial Rain, but Also Major Societal Disruption



The Vast Majority Occur From November Through April

Verification: Losses From 1997-98 El Nino

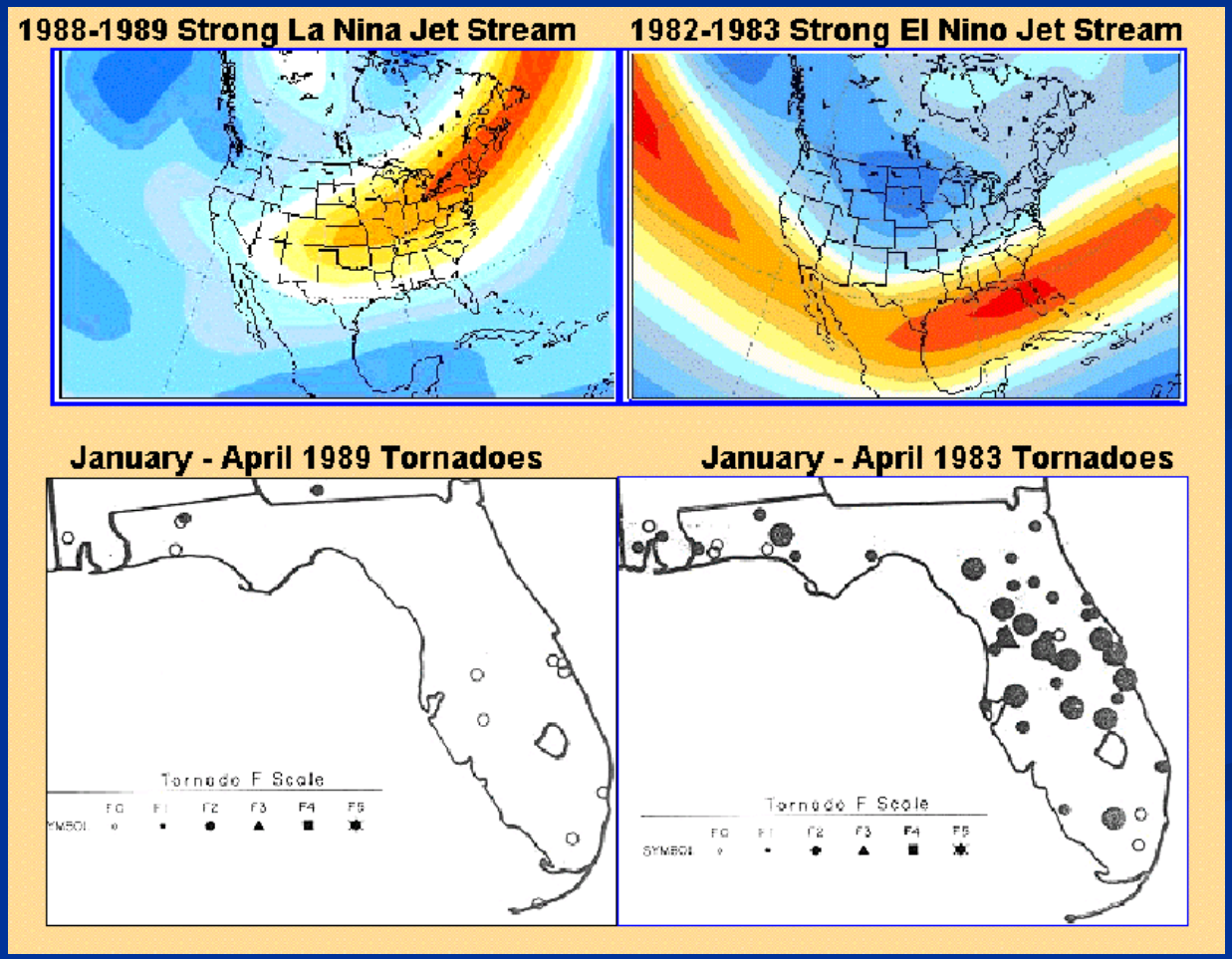
- Deadliest Tornado Outbreak in Florida History
- Most Damaging Tornado Outbreak in South Florida History
- Most Strong and Violent Tornadoes in Florida Since 1983



Losses From the 1997-1998 El Nino

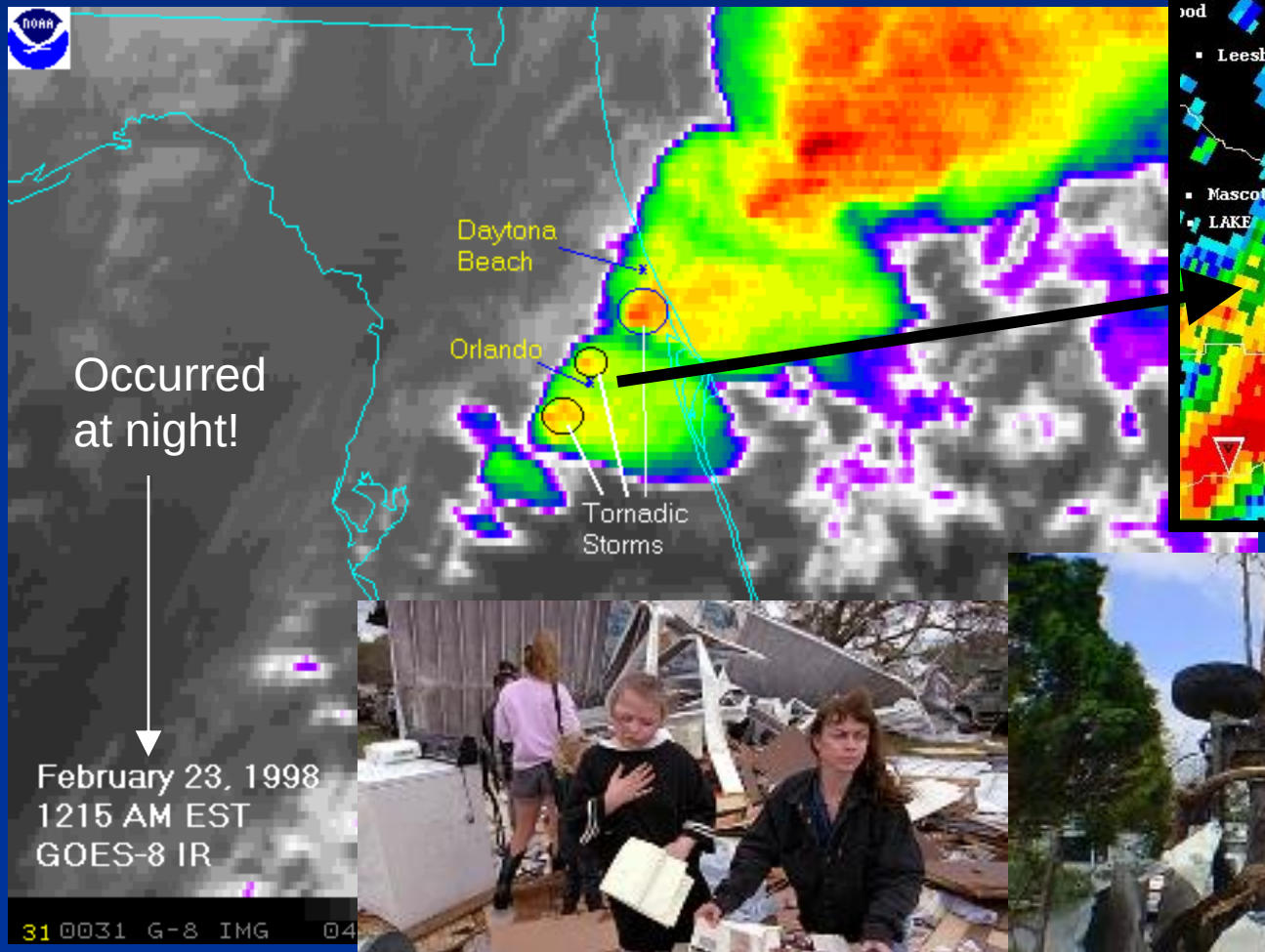
The number of catastrophes, defined as events causing $25 million or more in insured losses nationally, that caused property losses in each state during September 1997 -May 1998. The areal distribution reveals where most of the El Nino-induced weather losses occurred. The values in parenthesis are the number of times each state experienced losses due to catastrophes causing greater than $100 million nationally. (From Changnon, BAMS, 1999)

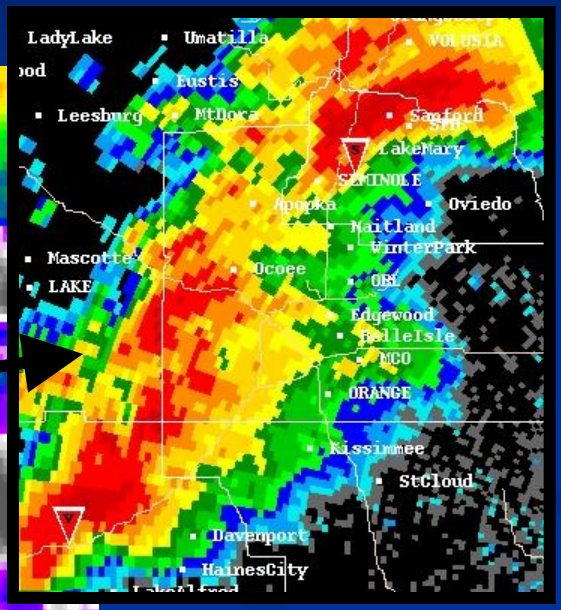
The 1982-83 Strong El Nino and the 1988-89 Strong La Nina had profound effects on Florida – Primarily because of the influence of the jet stream and associated storminess.



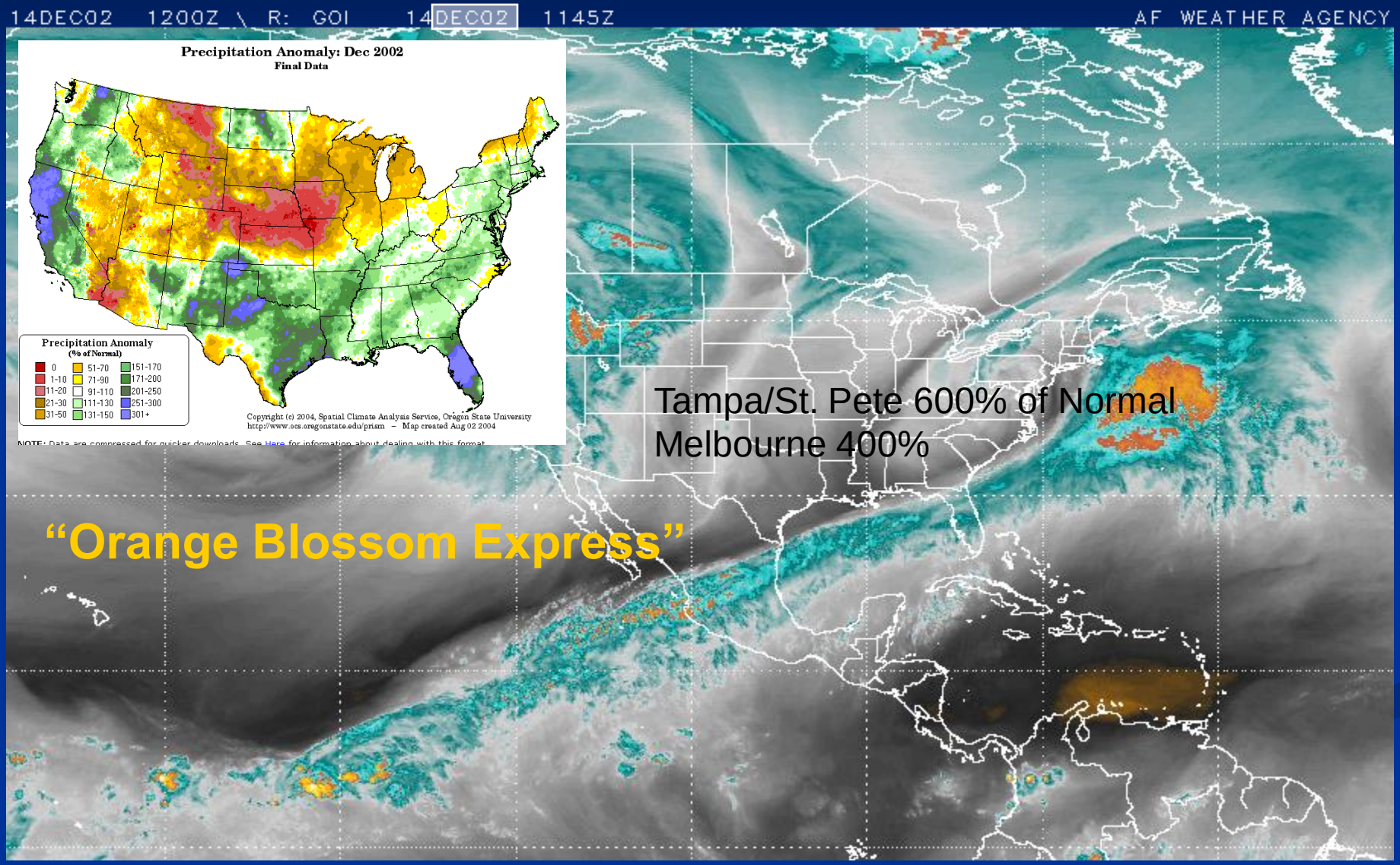
Worst Tornado Outbreak in FL History

- 42 killed
- Strongest El Niño on record





December 2002 El Nino + MJO



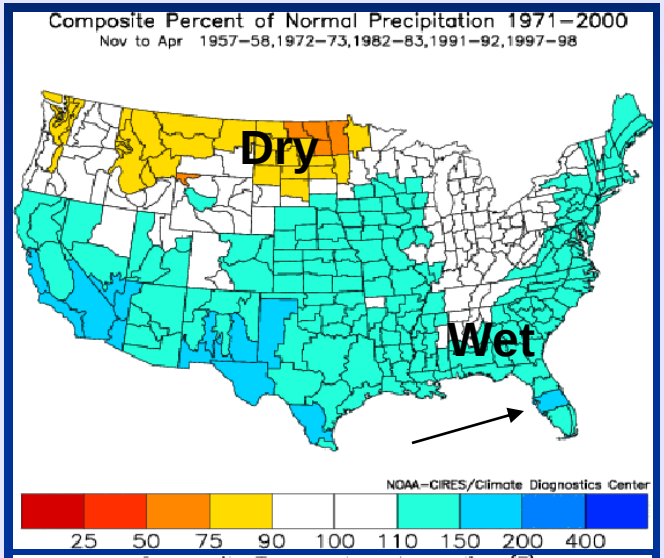
Analogs - Five Strongest Events

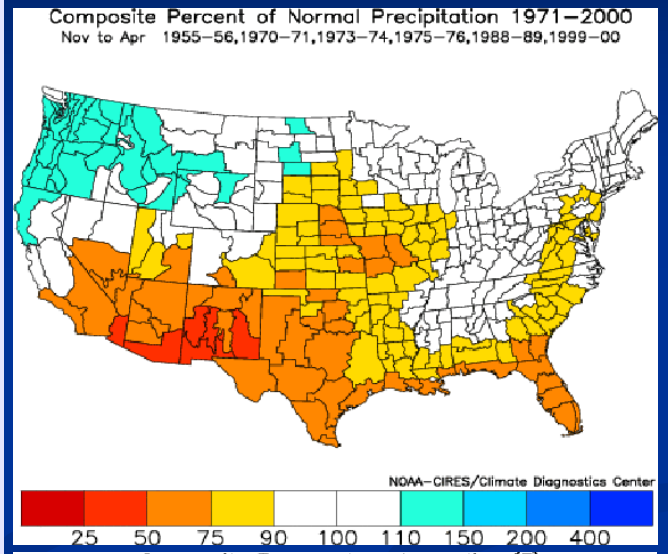
El Niño

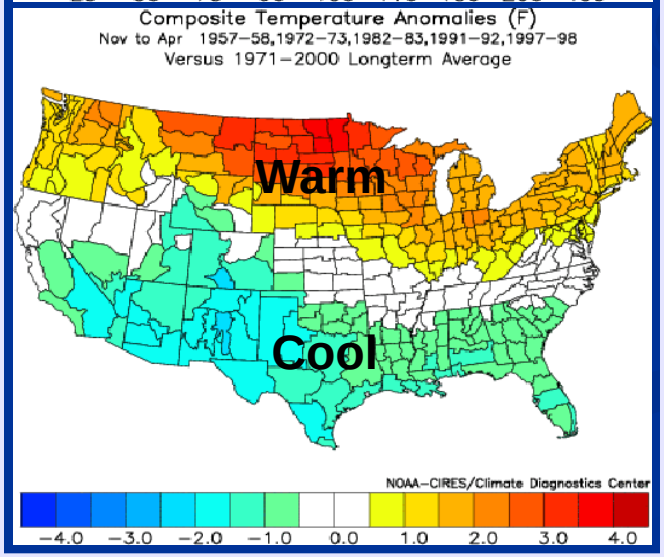
La Niña

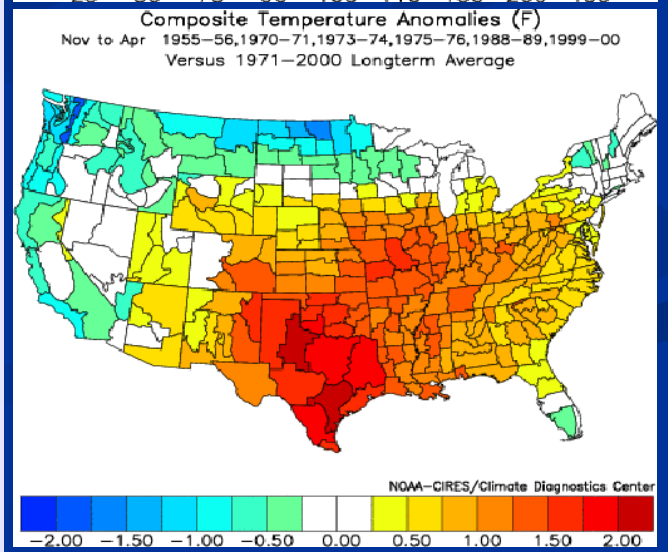
Precipitation

Temperature

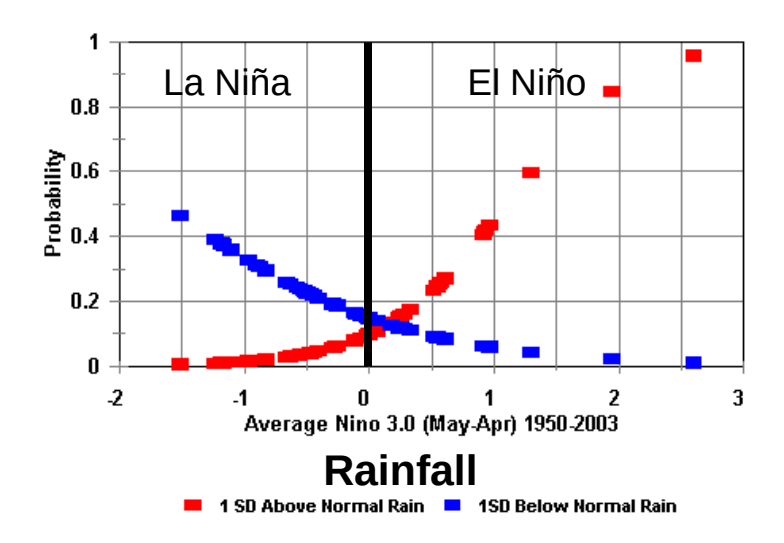


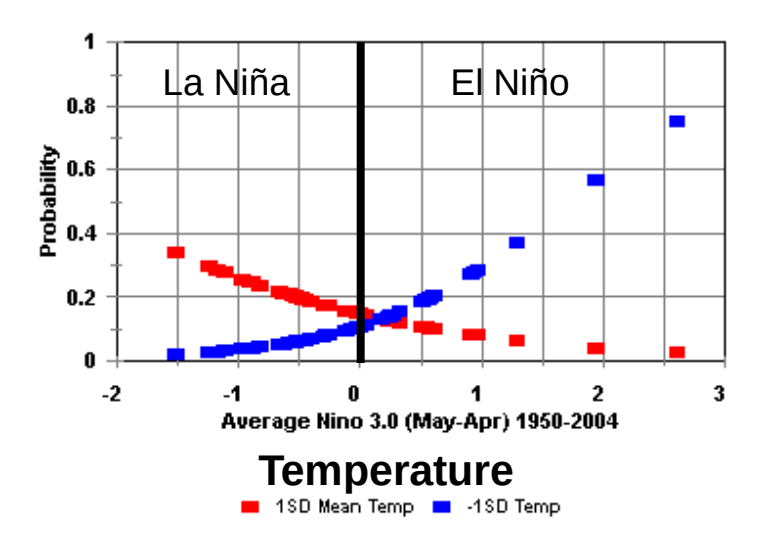


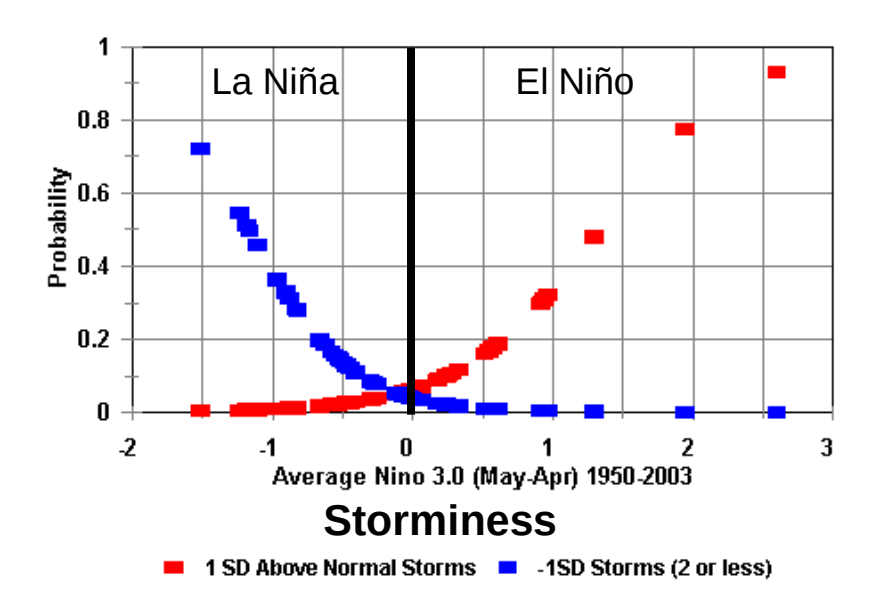




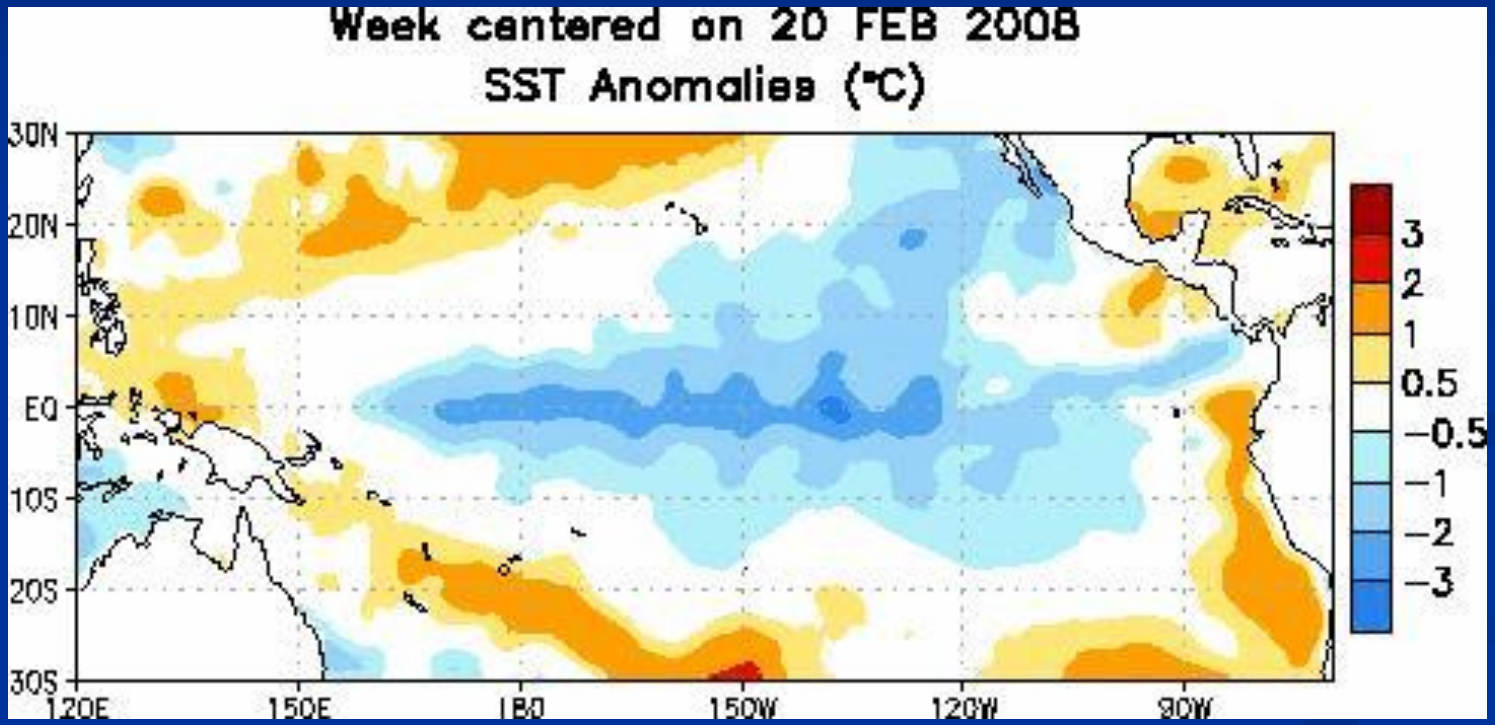
Predictability of ENSO Impacts!





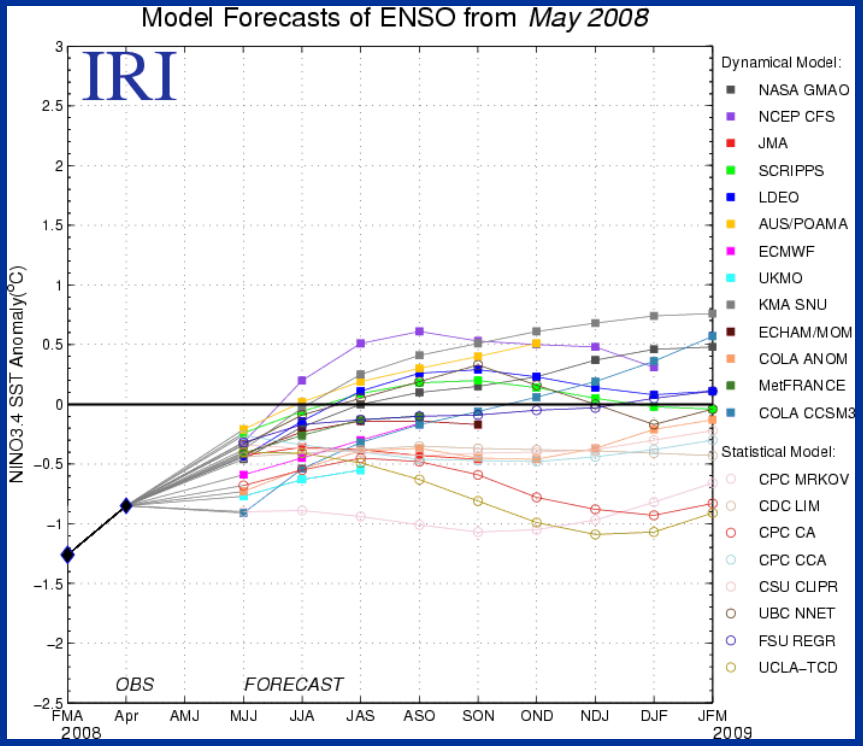


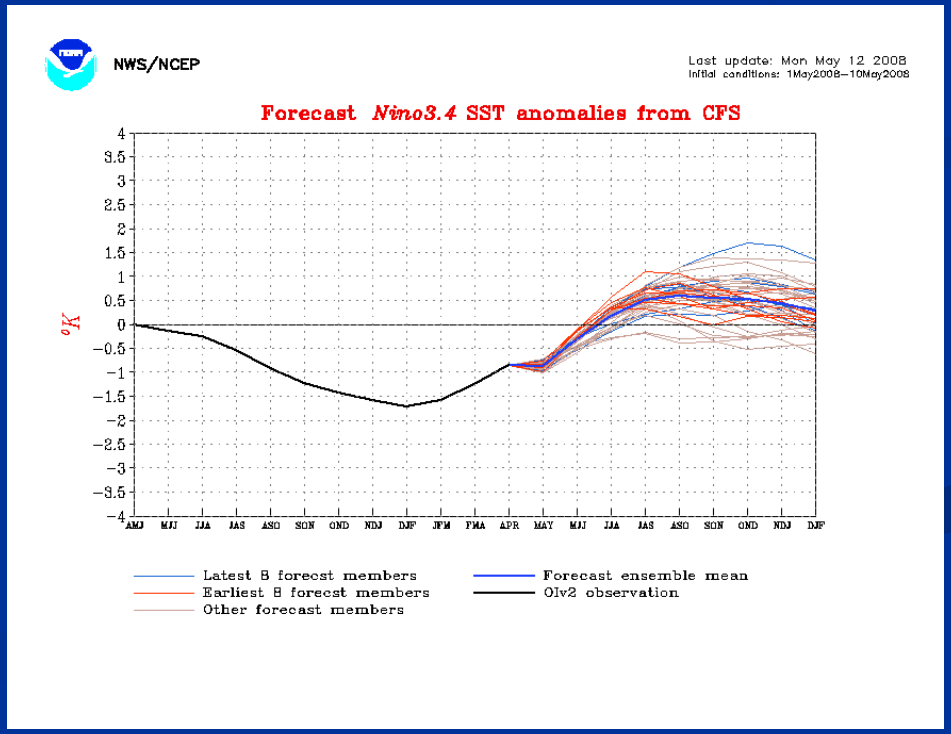
Latest Observations



How do we forecast El Niño?

Skill is not that great, especially timing of onset, but watch for overall trends

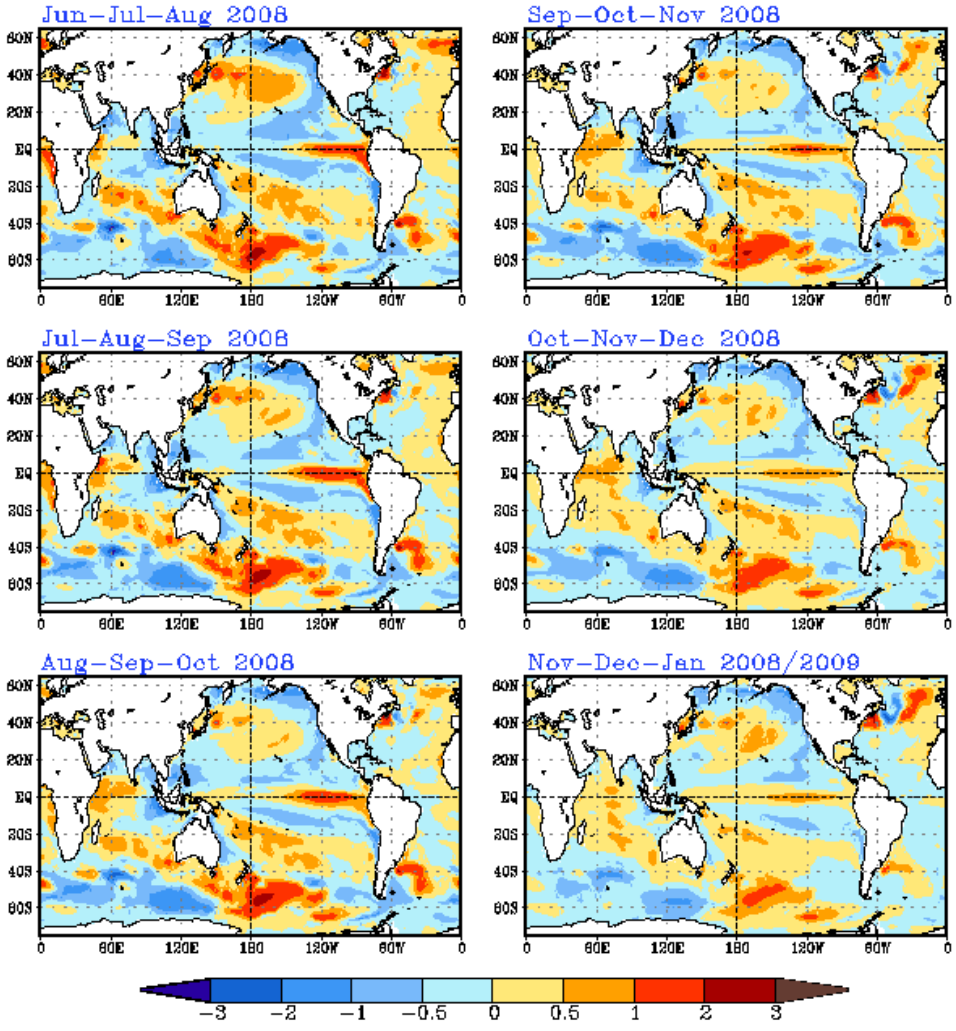




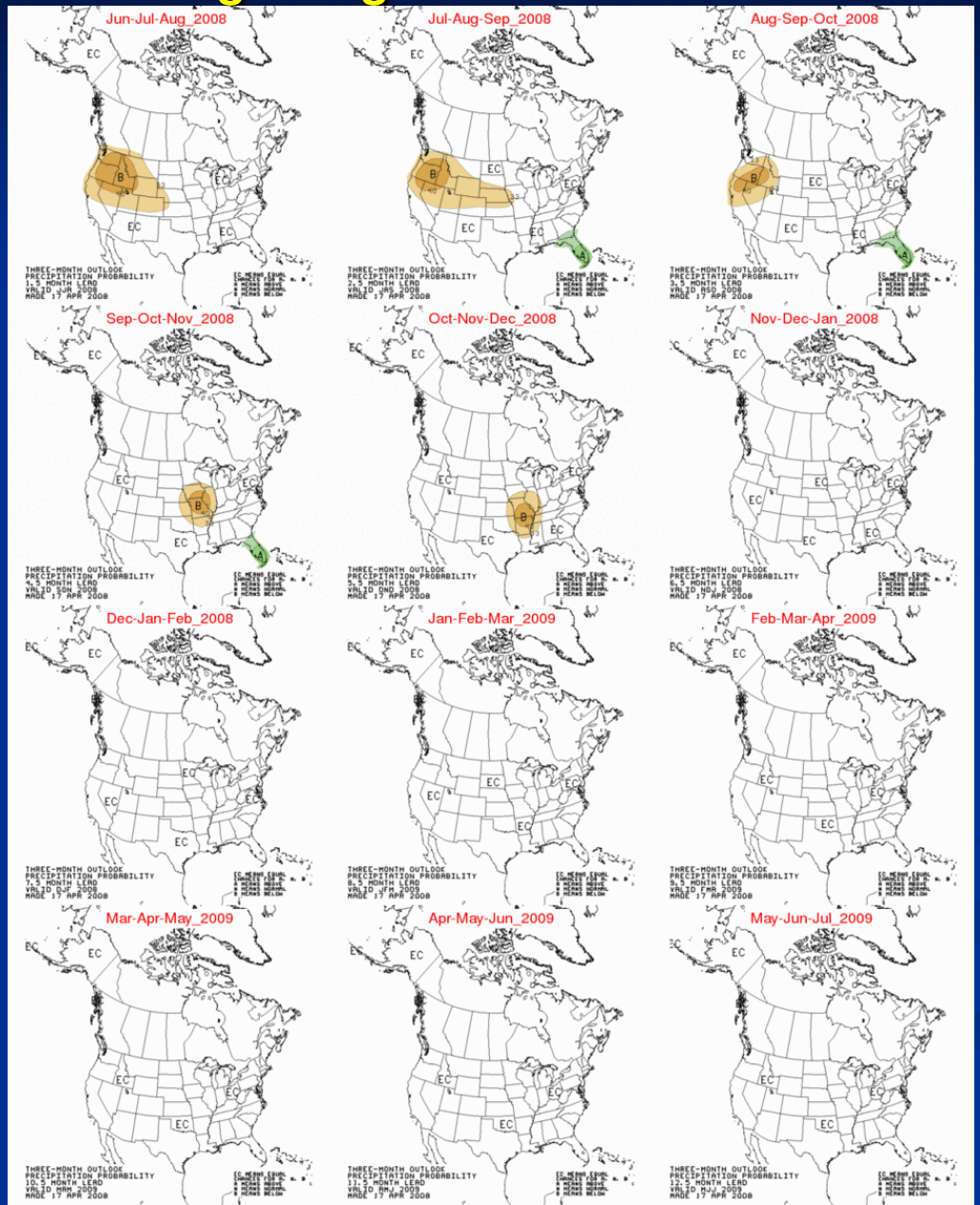
NWS/NCEP

Last update: Mon May 12 2008
Initial conditions: 1May2008–10May2008

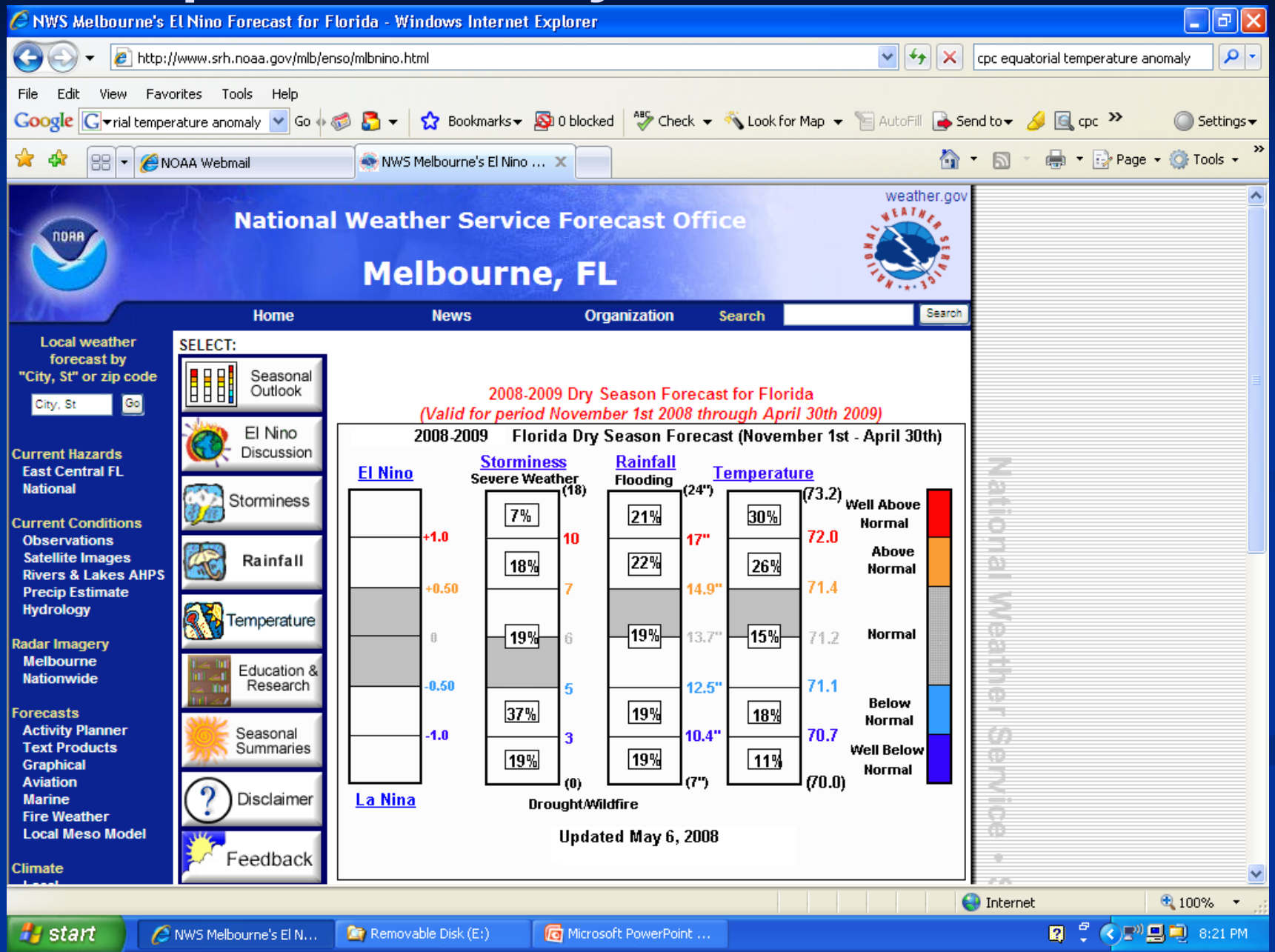
CFS seasonal SST forecast (K)

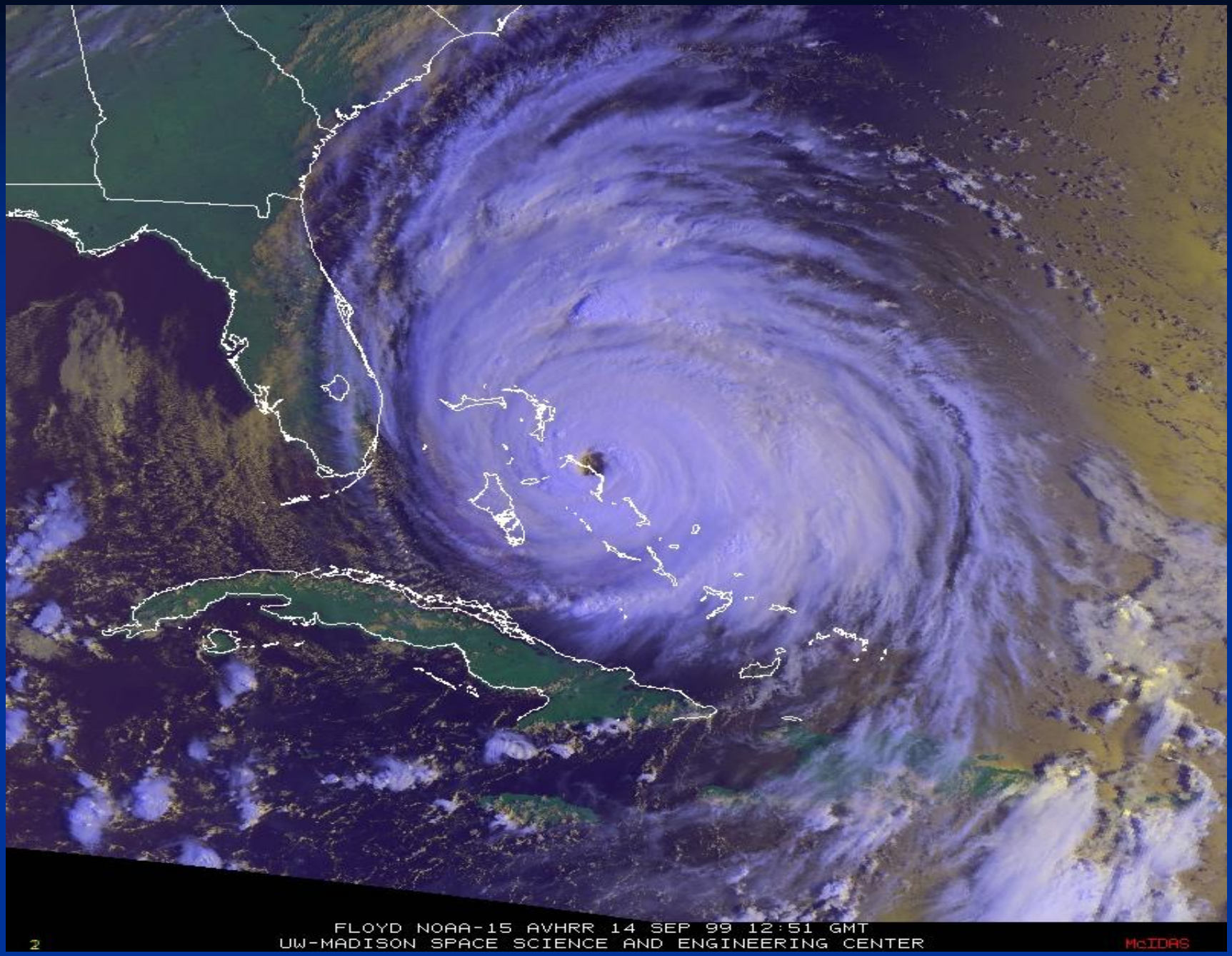


Long-Range Rainfall Predictions



Experimental Dry Season Forecast

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Thank You

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Questions?

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