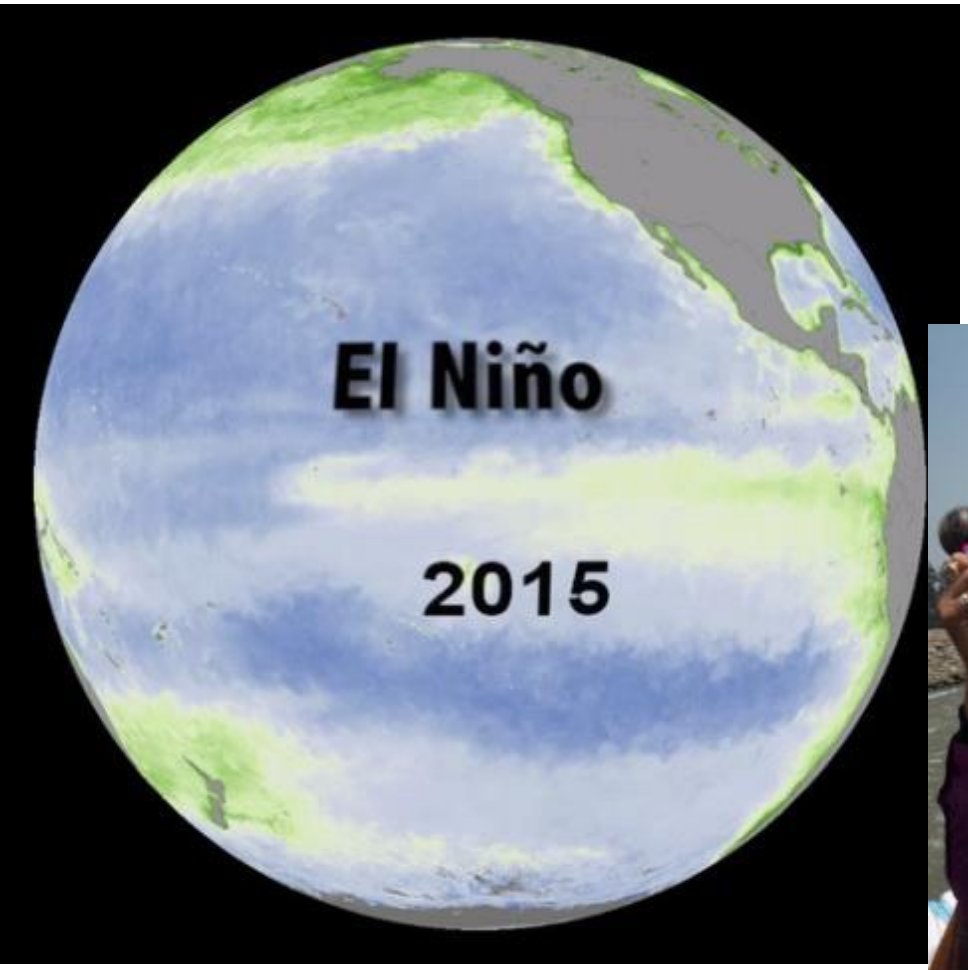
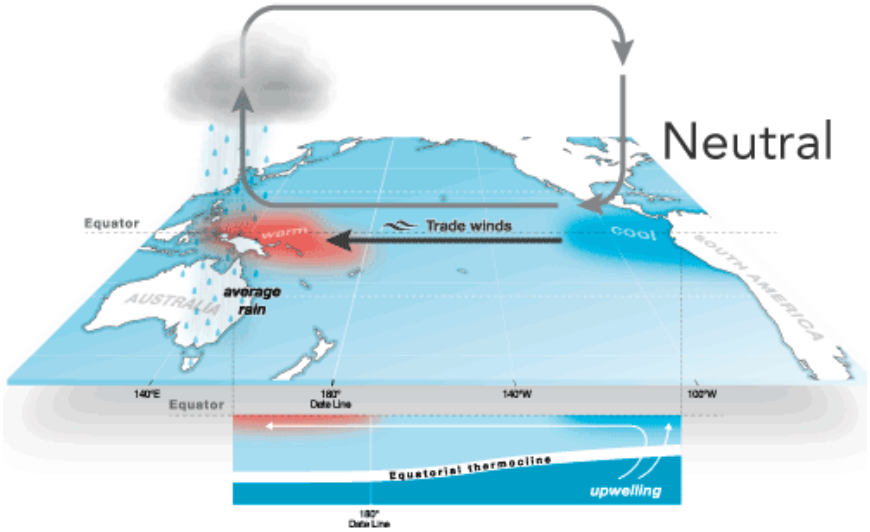
Impacts felt around the world



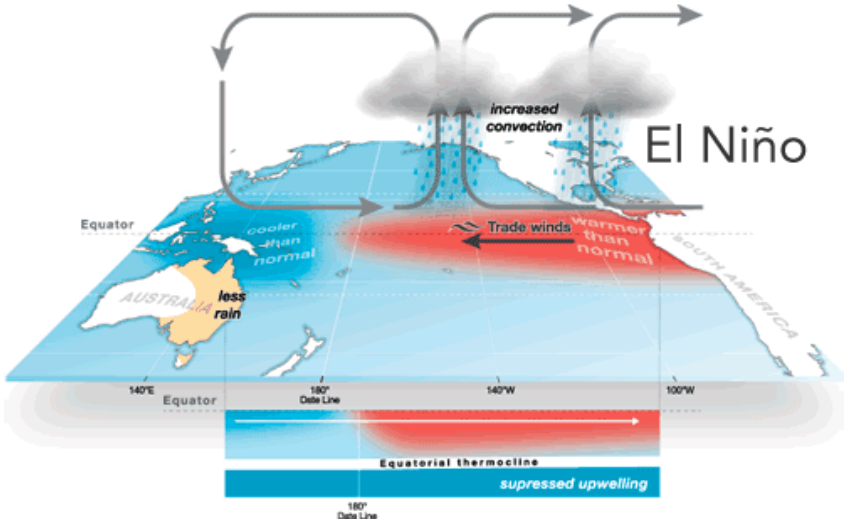
Stephanie Schollaert Uz, PhD
PACE Project, Earth Sciences Division
NASA GSFC (Global Science & Technology Inc.)

Equatorial Pacific: sea-surface temperatures, sea level, atmospheric circulation and precipitation patterns



Normally:

Trade winds blow east-to-west - push warm water westward cause warmer, fresher west Pacific warm pool. Upwelling in east.



El Niño:

Trade winds weaken, warm pool moves eastward, thermocline deepens in the east and upwelling is suppressed.

Images from the Australian Bureau of Meteorology

Every El Niño is different: strength

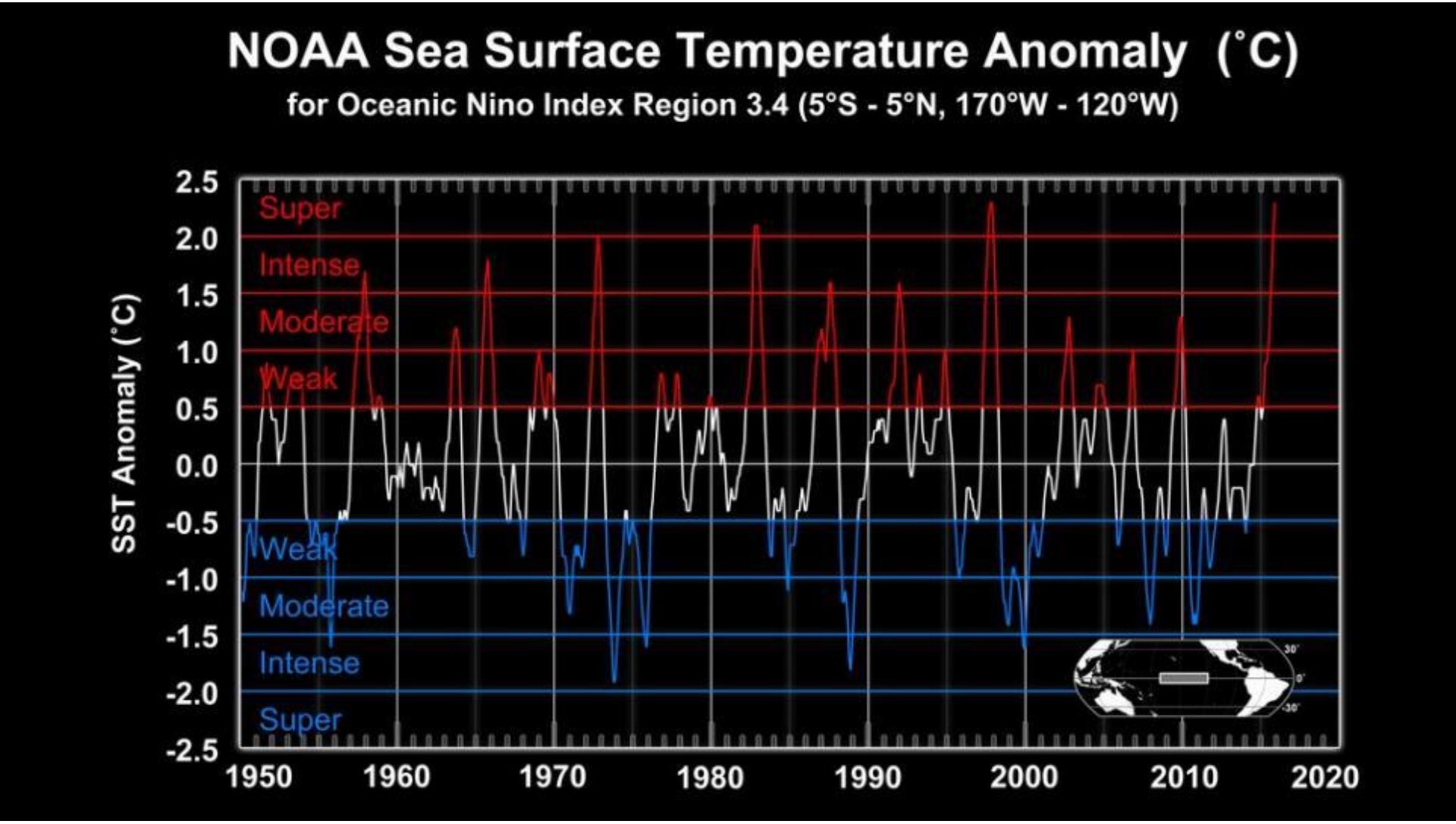


Image from NASA Scientific Visualization Studio using the NOAA Climate Prediction Center Ocean Niño Index

For comparison: very strong La Niña

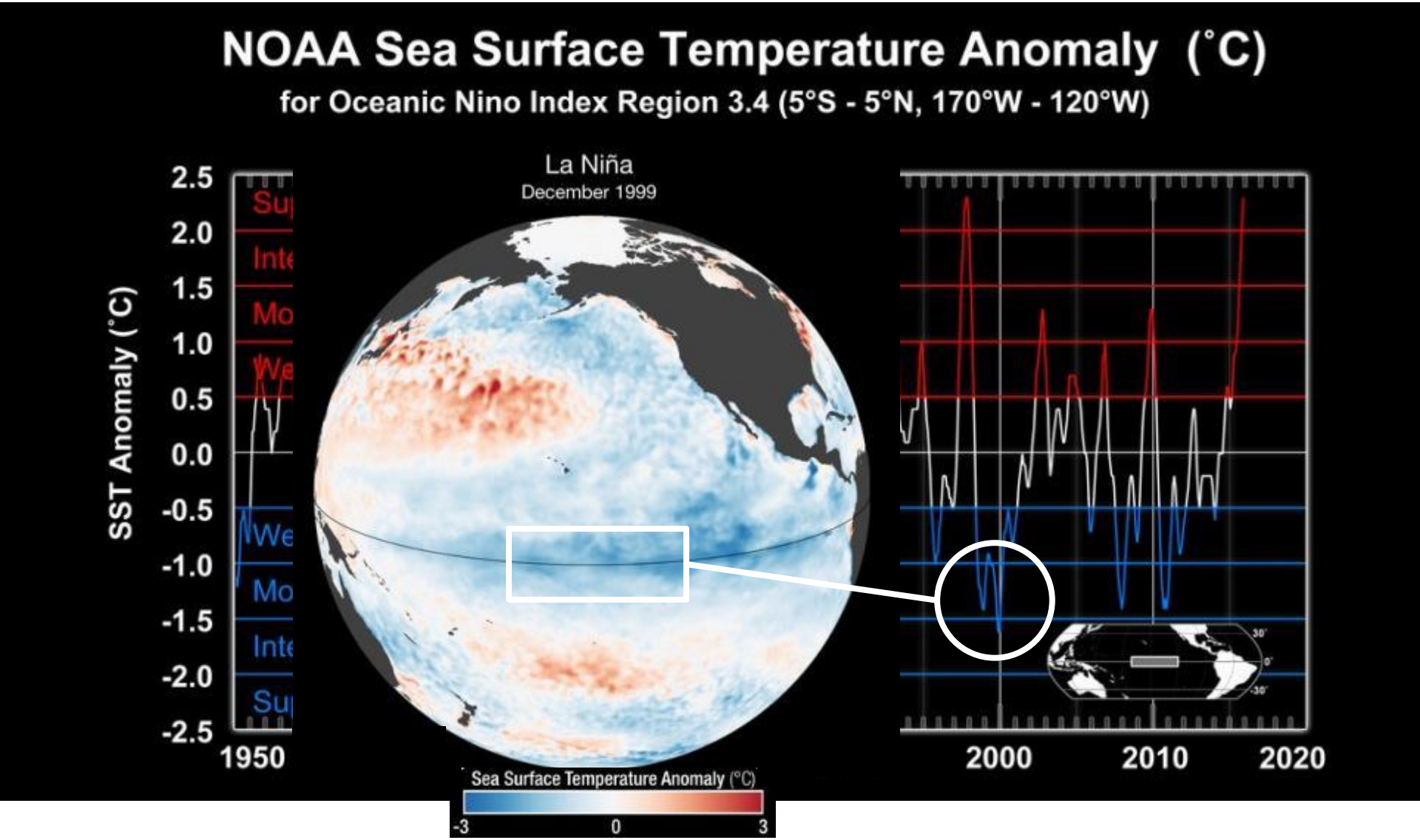


Image from NASA Scientific Visualization Studio using the NOAA Climate Prediction Center Ocean Niño Index

El Niño 2015: among 3 strongest on record

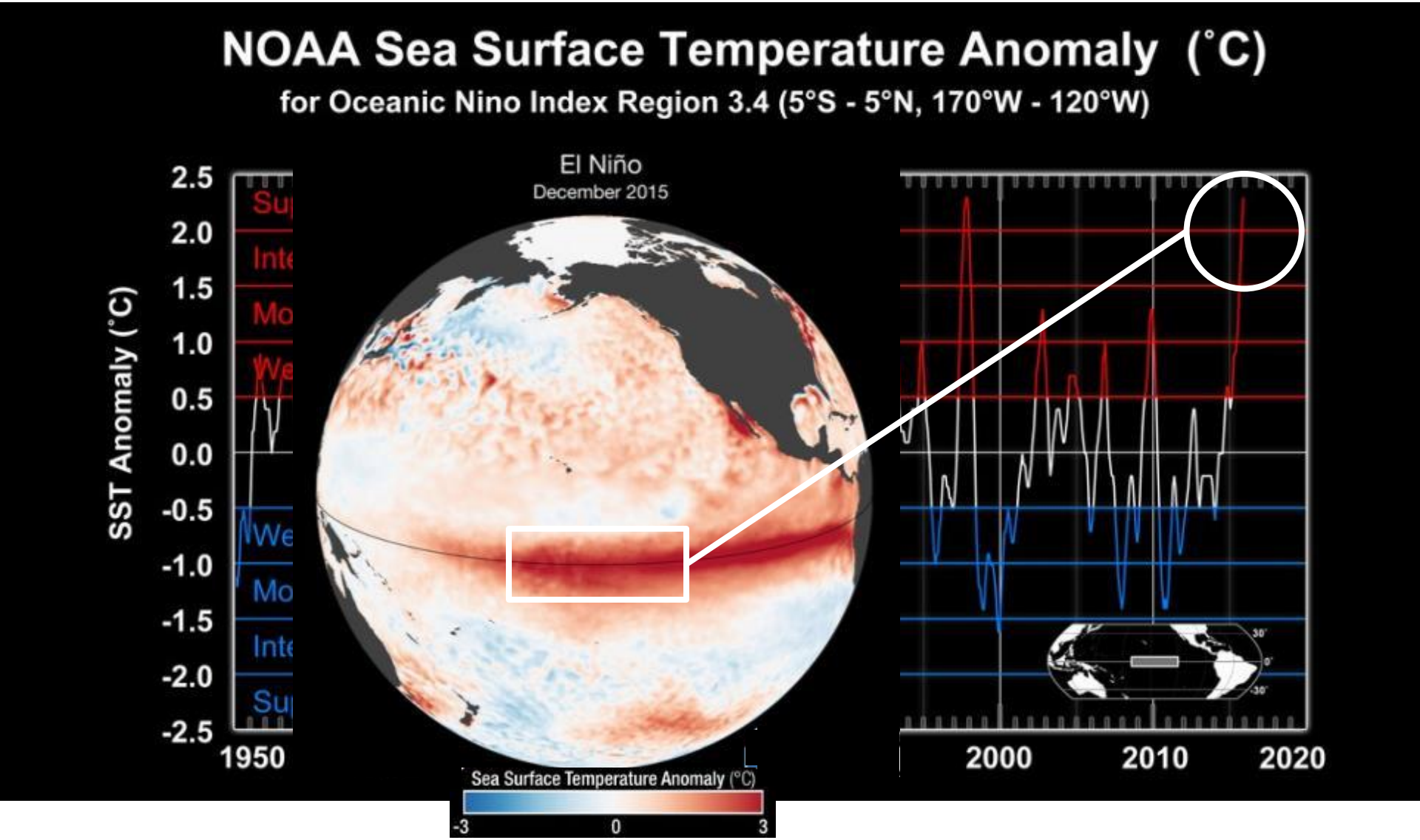
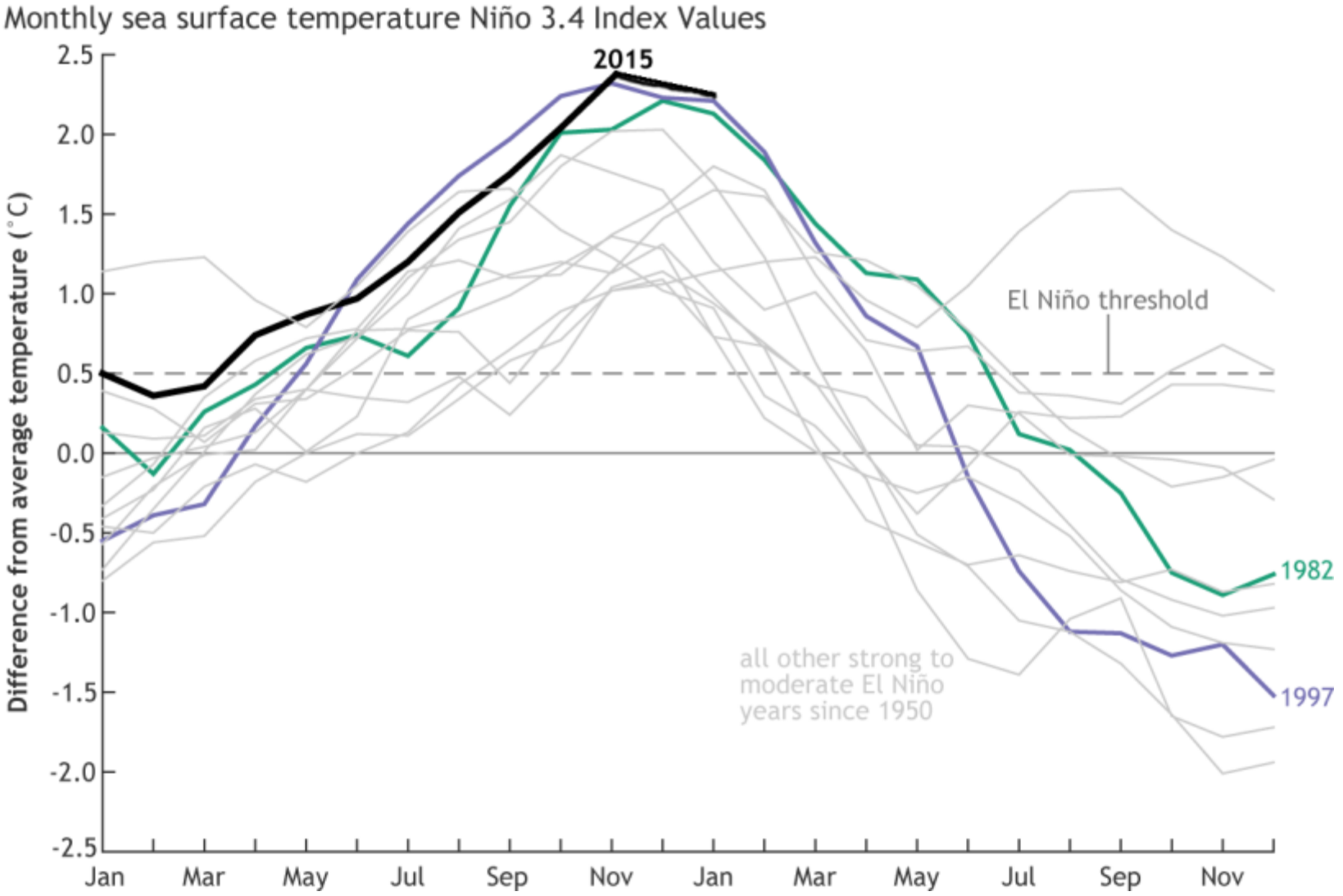


Image from NASA Scientific Visualization Studio using the NOAA Climate Prediction Center Ocean Niño Index

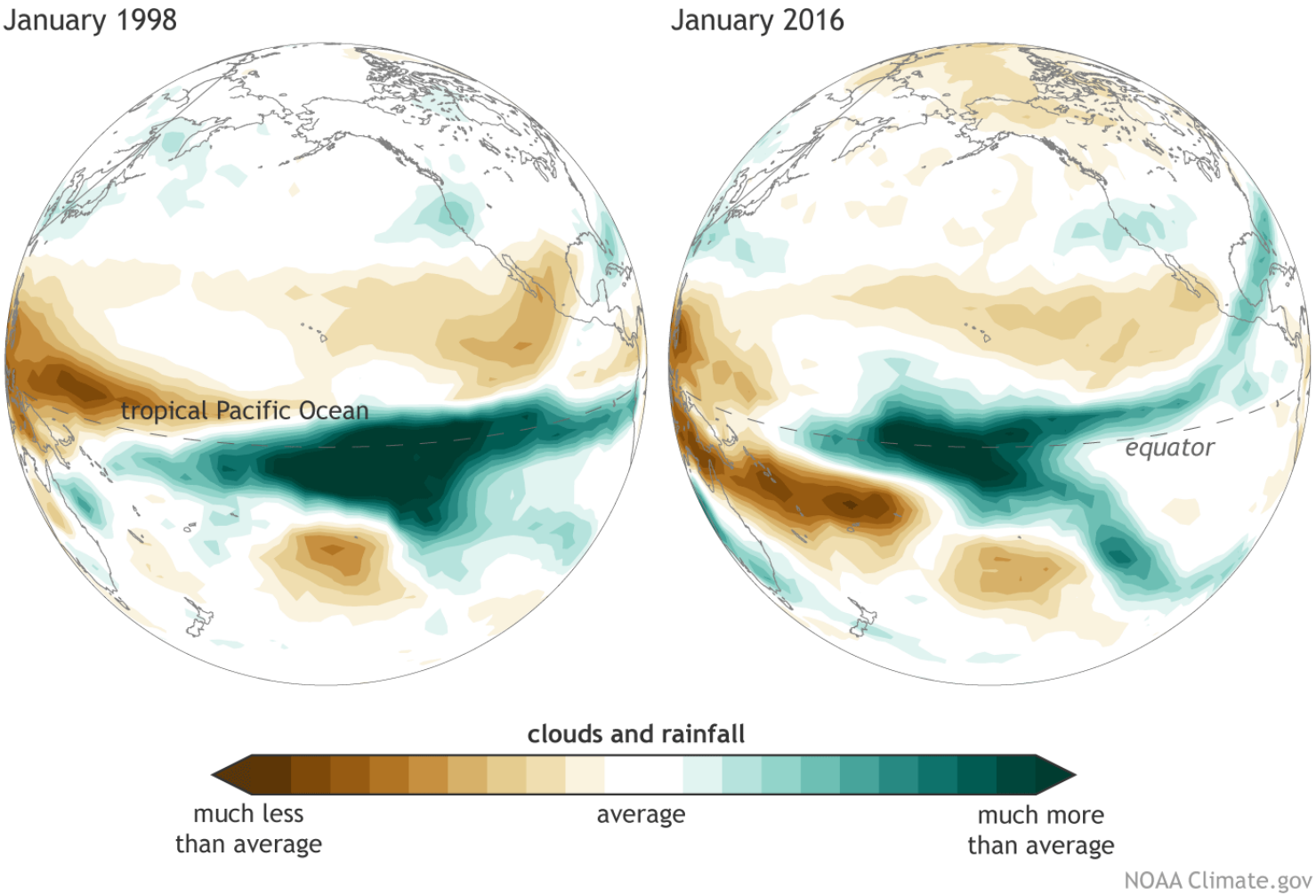
Every El Niño is different: timing



Physical oceanography: sea-surface temperatures, subsurface temperature, salinity,

Images from [NOAA Climate Prediction Center]

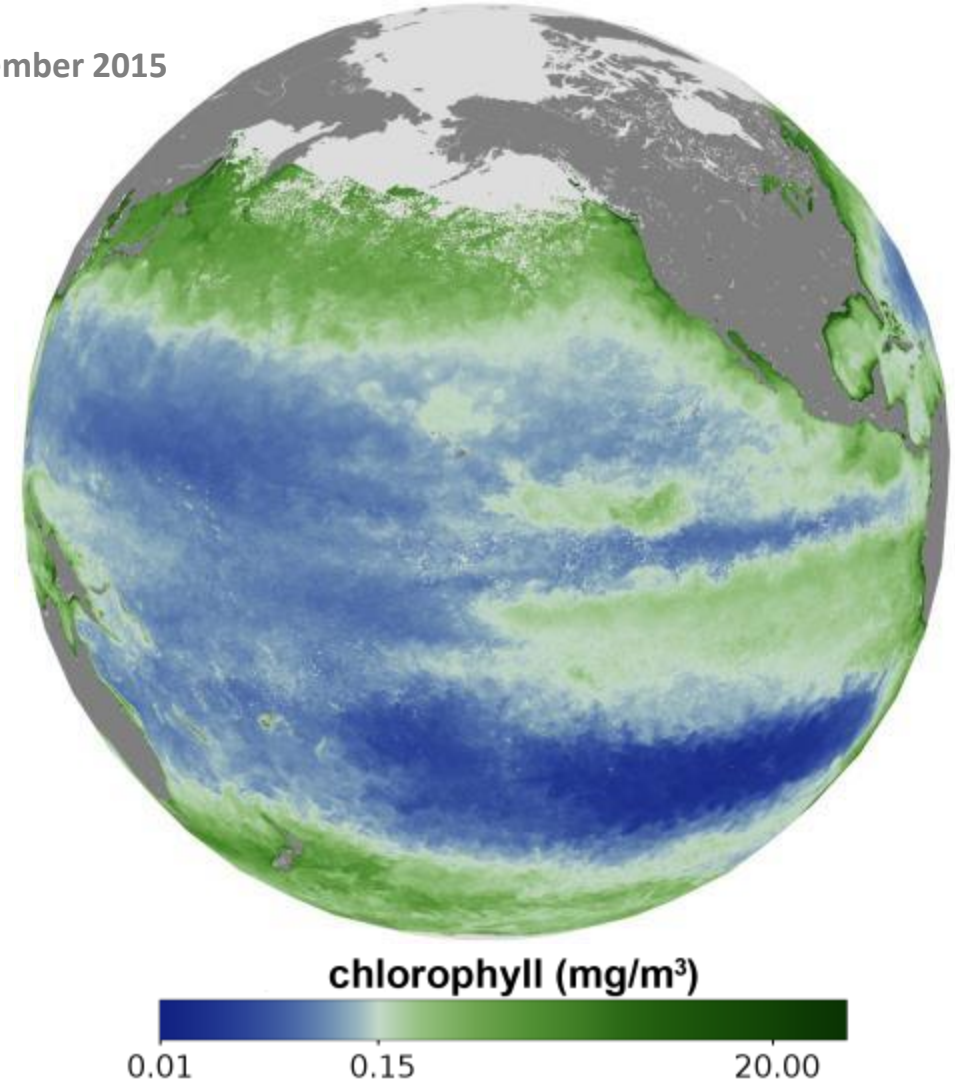
Every El Niño is different: eastward extent



Meteorology: atmospheric pressure, winds, **cloudiness, precipitation,**

Images from [NOAA Climate Prediction Center]

El Niño impacts



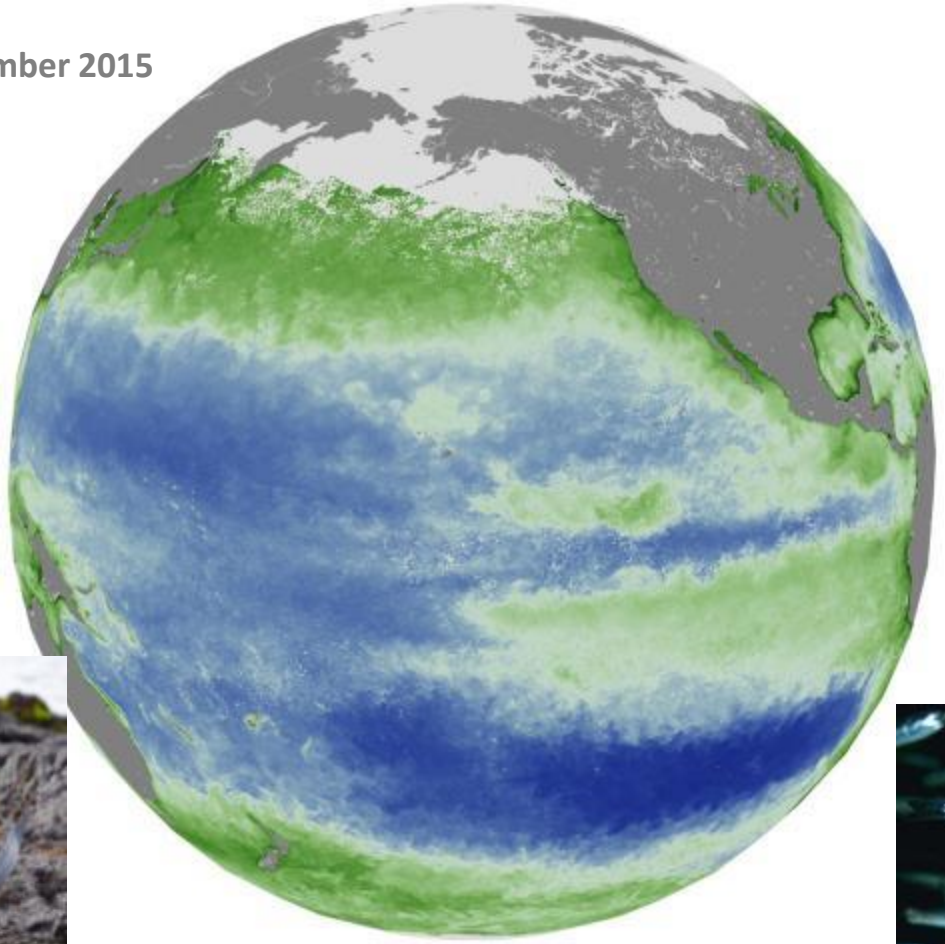
Chemistry & **Biology**: nutrients, **phytoplankton** (concentration, species)

Images from NASA GSFC Ocean Ecology Lab

El Niño impacts

December 2015

Skipjack tuna



Galapagos penguin

Marine iguana

Anchovy fish

Chemistry & **Biology**: nutrients, **phytoplankton** (concentration, species)

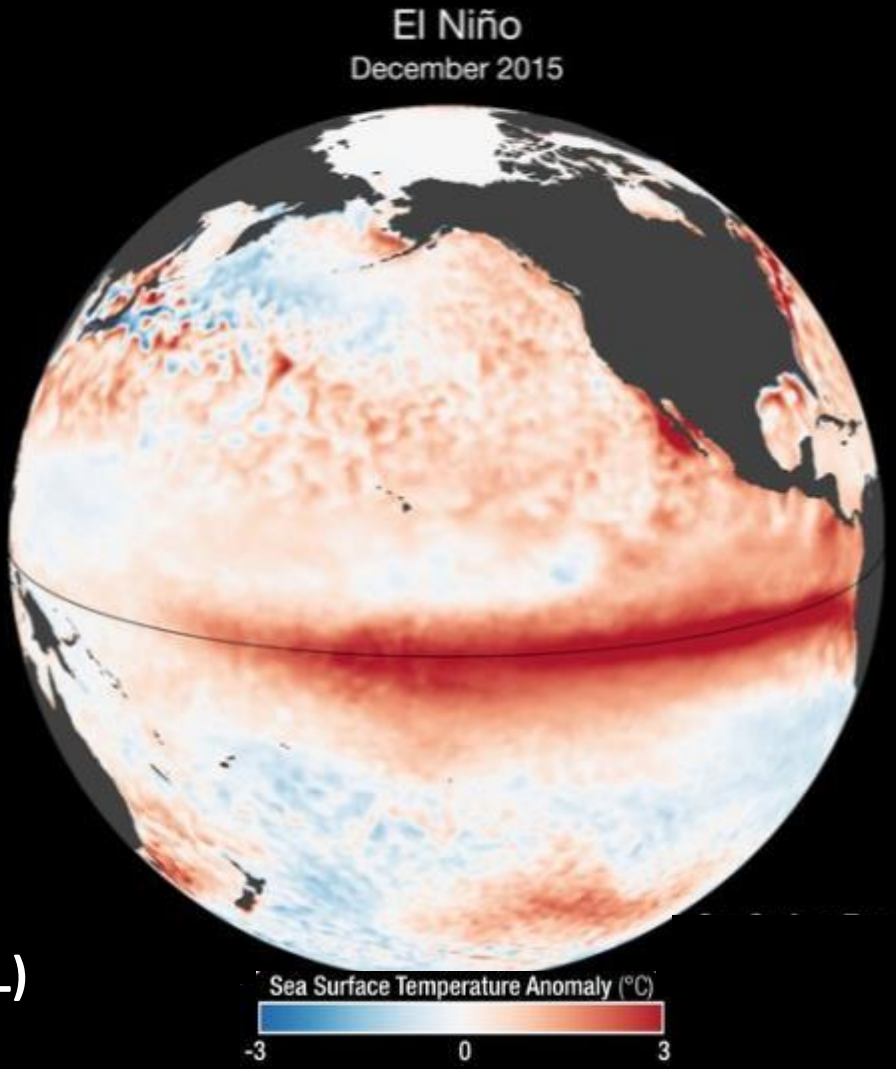
Images from NASA GSFC Ocean Ecology Lab, NOAA, USGS

El Niño 2015: longest coral bleaching event

http://www.noaa.gov/el-niño-prolongs-longest-global-coral-bleaching-event

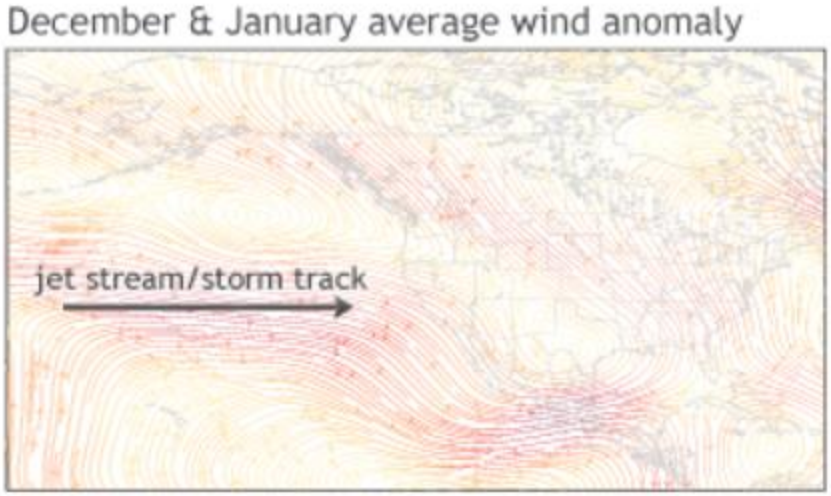
http://airbornescience.jpl.nasa.gov/campaign/coral

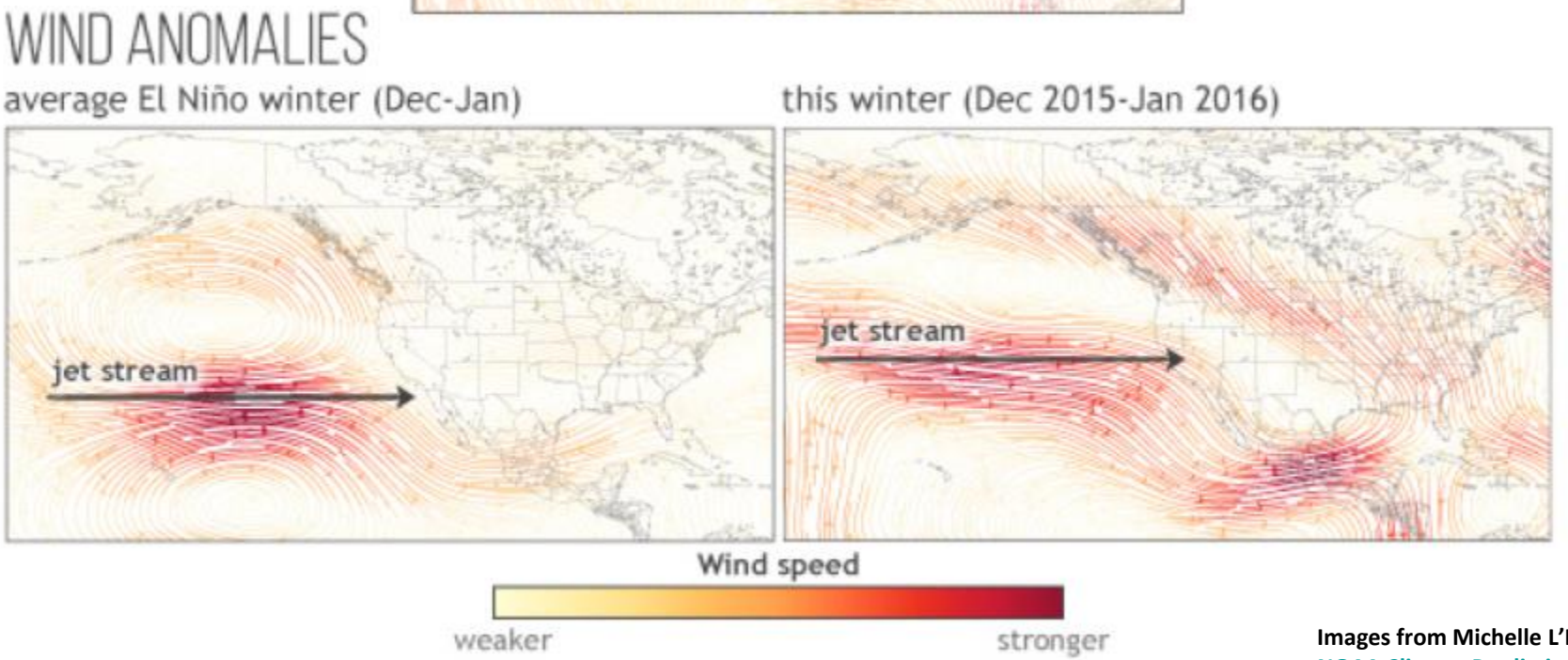
COral Reef Airborne Laboratory (CORAL)
NASA field campaign



Images from NASA

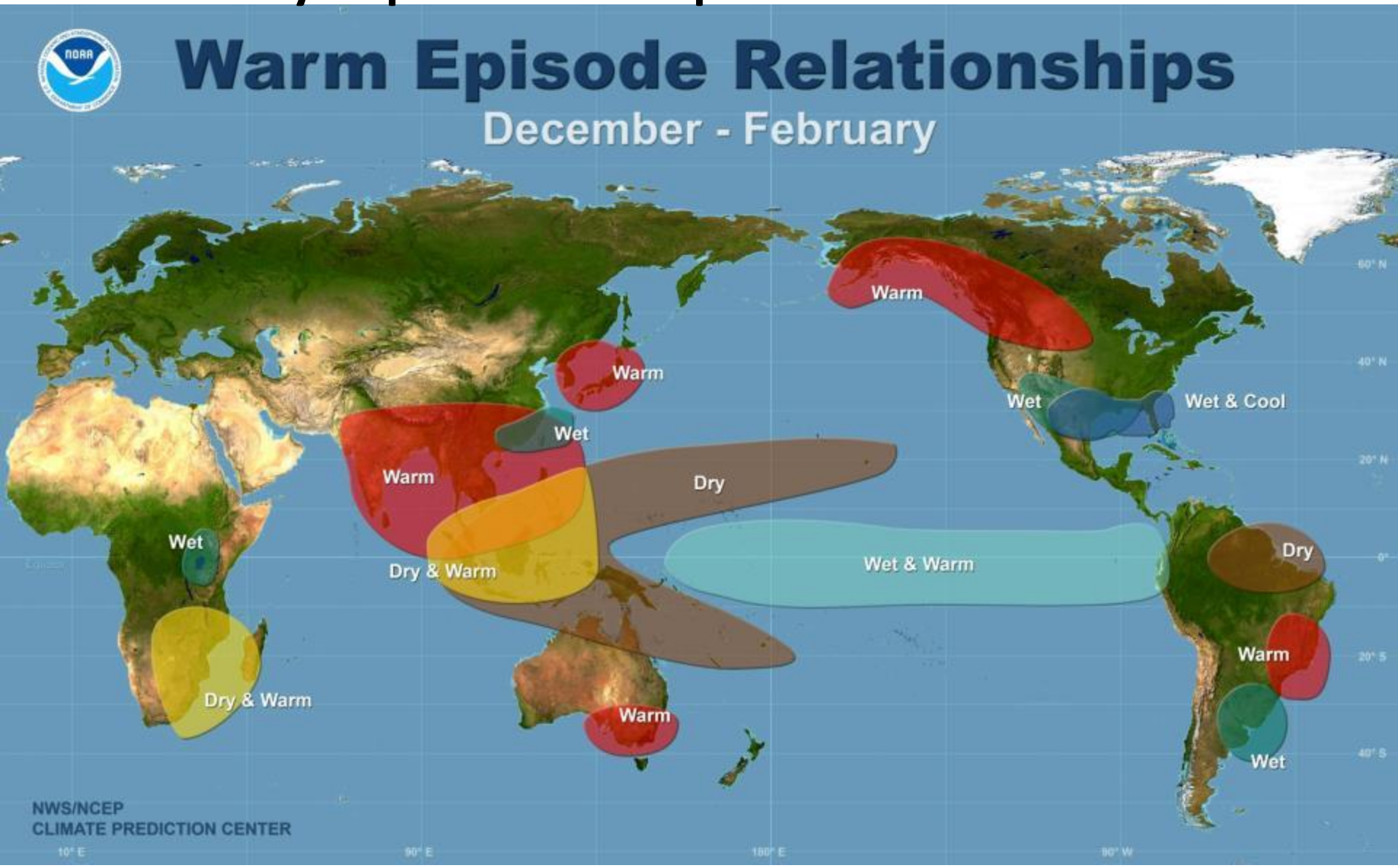
El Niño perturbs jet stream, atmospheric pressure patterns





Images from Michelle L'Heureux
NOAA Climate Prediction Center

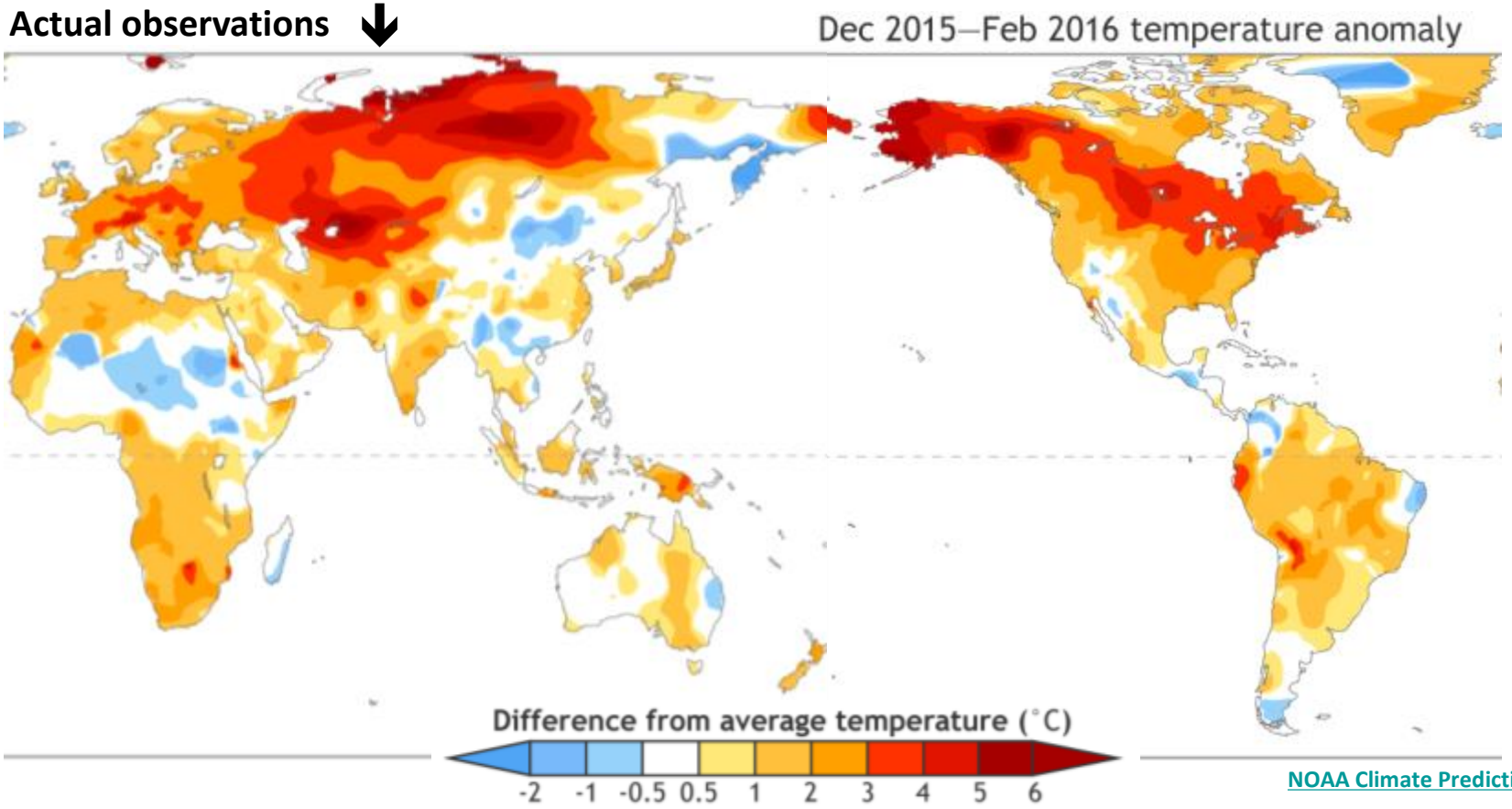
El Niño likely impacts based upon historical event statistics



Impacts – global temperature departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔

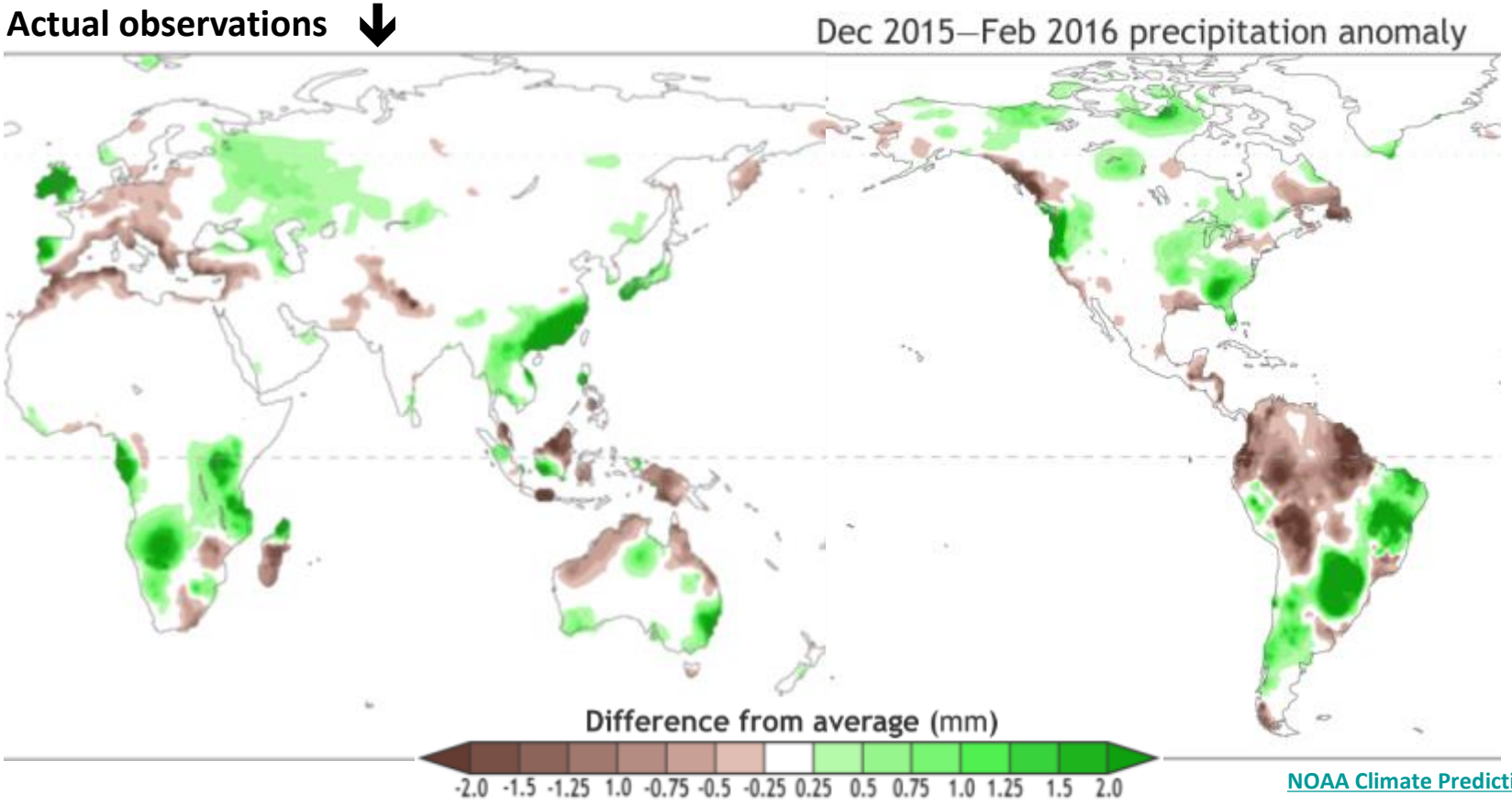


NOAA Climate Prediction Center

Impacts – global precipitation departures from 30 yr average

Statistical likelihood map →

Actual observations ↓

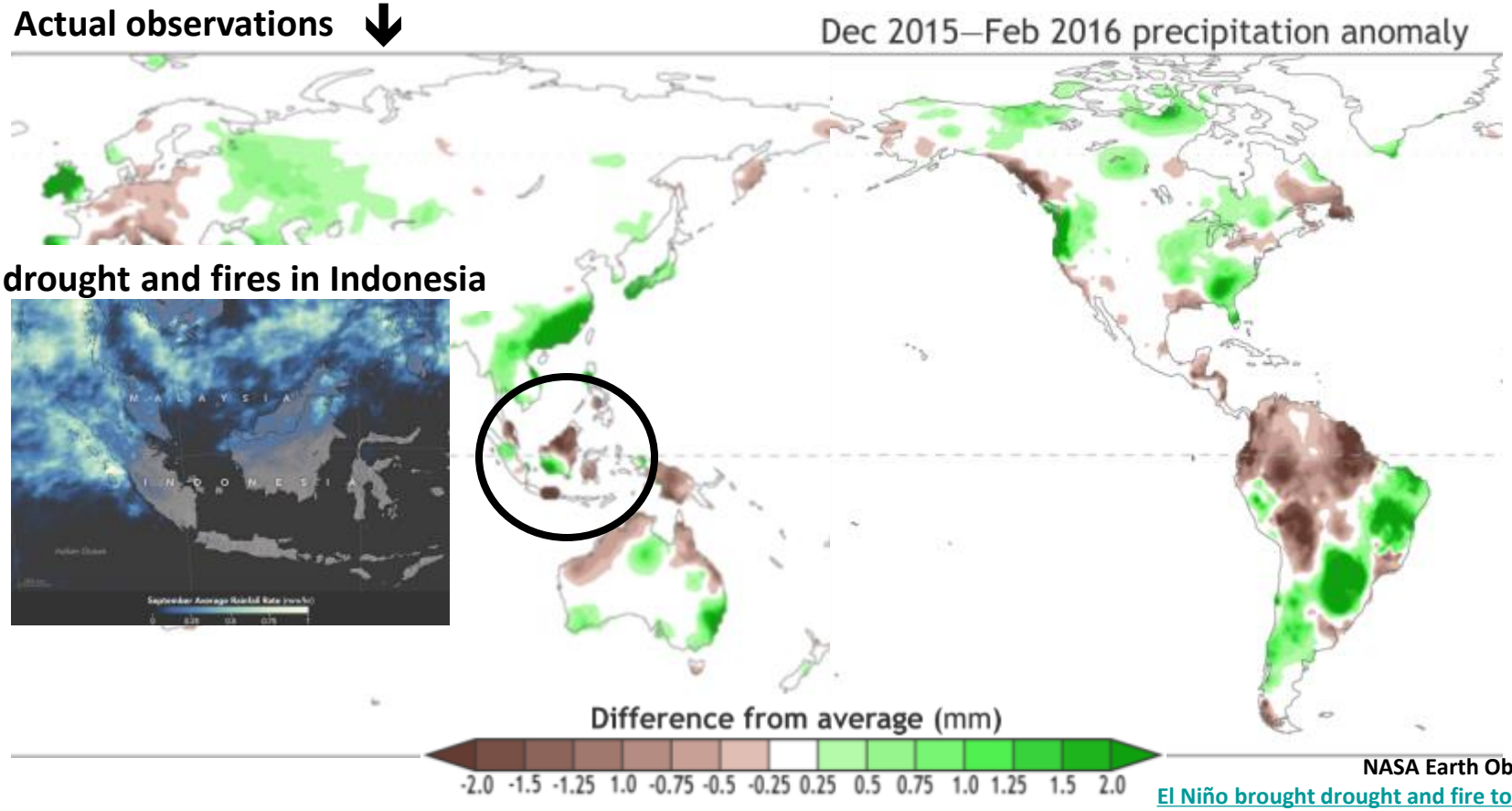


NOAA Climate Prediction Center

Impacts – global precipitation departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔



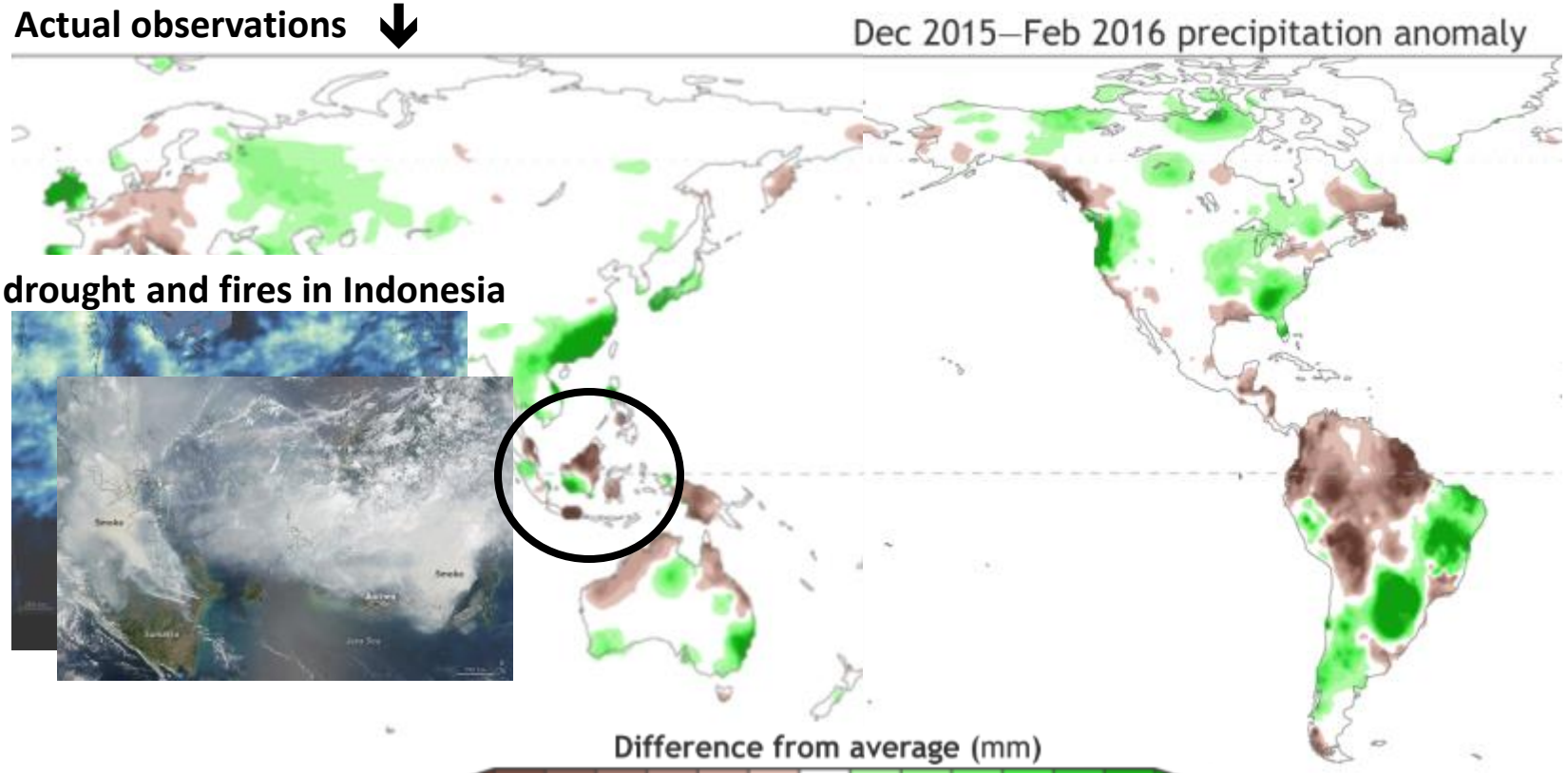
drought and fires in Indonesia

NASA Earth Observatory:
El Niño brought drought and fire to Indonesia

Impacts – global precipitation departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔



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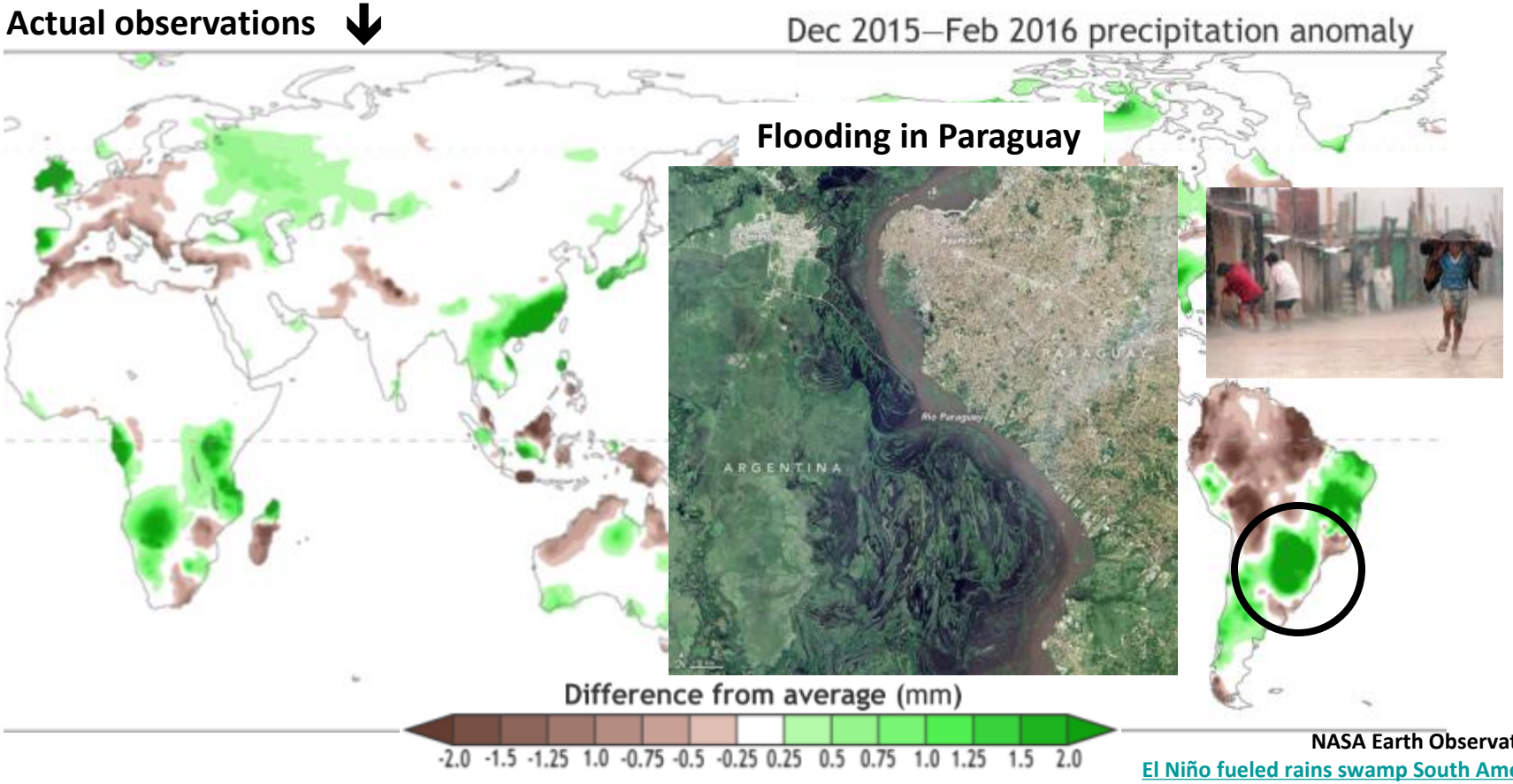


NASA Earth Observatory:
El Niño fueled rains swamp South America

Impacts – global precipitation departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔

Dec 2015–Feb 2016 precipitation anomaly

landslides in Pacific northwest

flash floods, mudslides in California

Difference from average (mm)

-2.0 -1.5 -1.25 1.0 -0.75 -0.5 -0.25 0.25 0.5 0.75 1.0 1.25 1.5 2.0

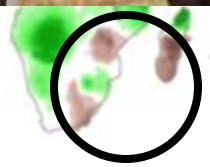
NASA maps shift on U.S. precipitation

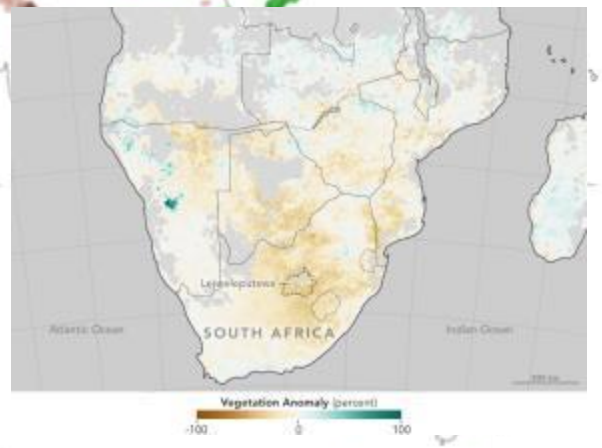
Impacts – global precipitation departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔

drought, reduced rainy season in sub Saharan Africa





NASA Earth Observatory:
Drought in Southern Africa

Impacts – global precipitation departures from 30 yr average

Statistical likelihood map ➔

Actual observations ➔

Dec 2015–Feb 2016 precipitation anomaly

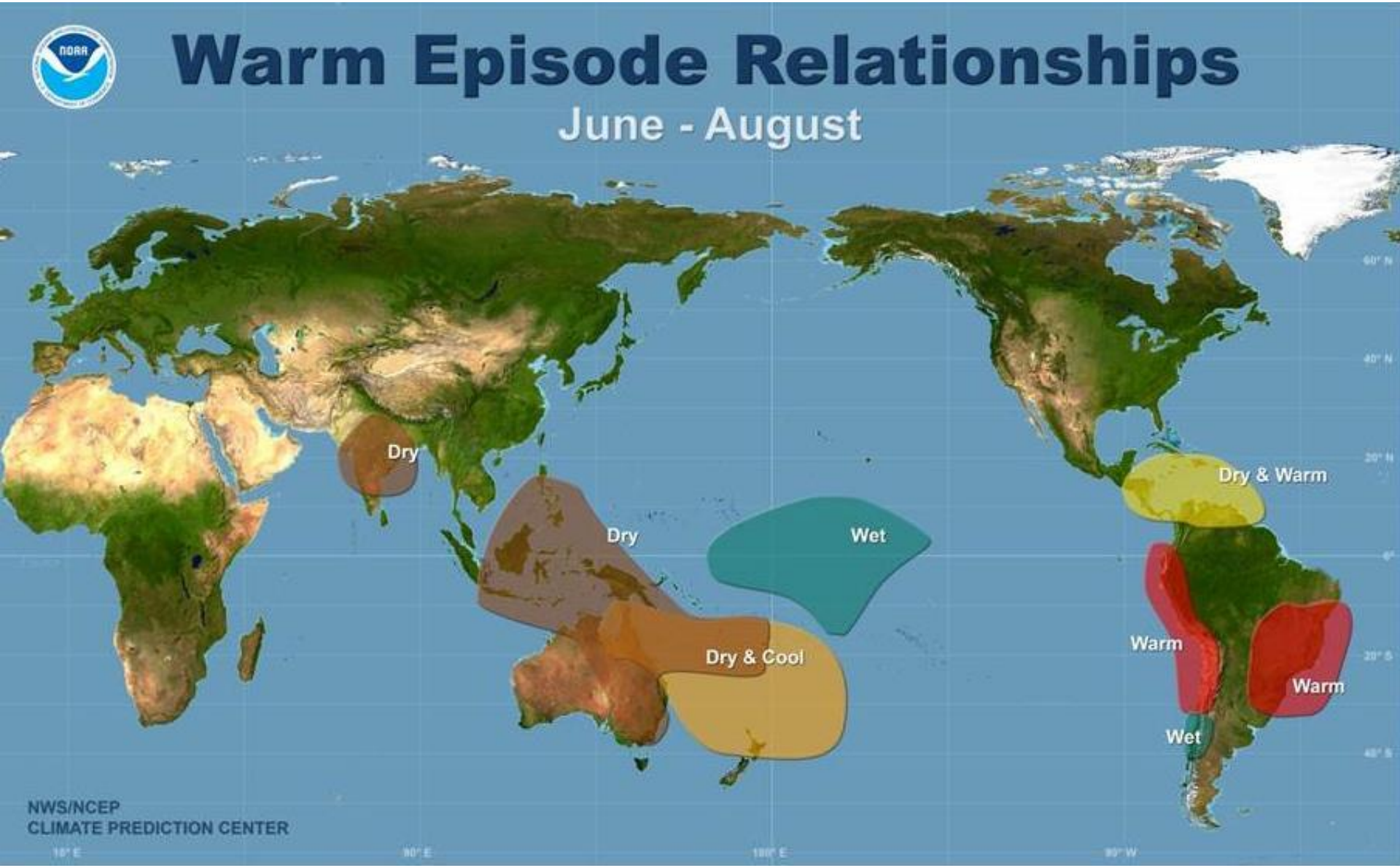
Panama Canal limits ship size due to drought

Difference from average (mm)

-2.0 -1.5 -1.25 1.0 -0.75 -0.5 -0.25 0.25 0.5 0.75 1.0 1.25 1.5 2.0

http://www.bbc.com/news/world-latin-america-33833129

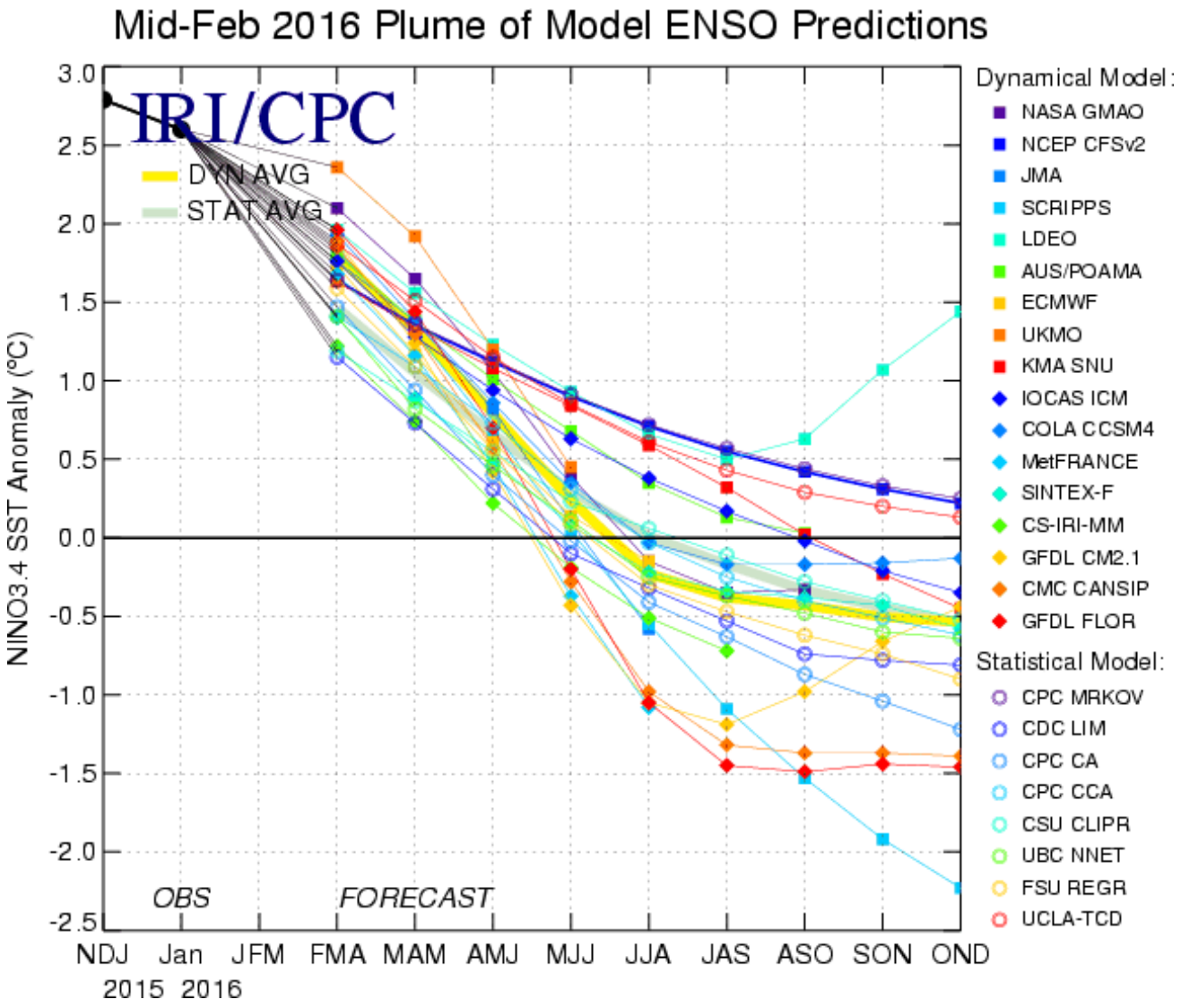
El Niño likely impacts based upon historical event statistics



Summary

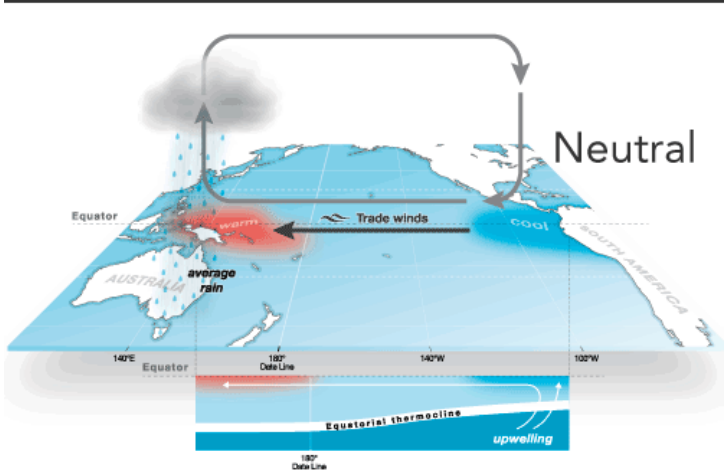
- El Niño massively redistributes heat
- Impacts weather, biology and chemistry locally
- Impacts weather around the world
- Impacts fishing & farming industries, economy, society
- We still can’t predict it more than a few months ahead

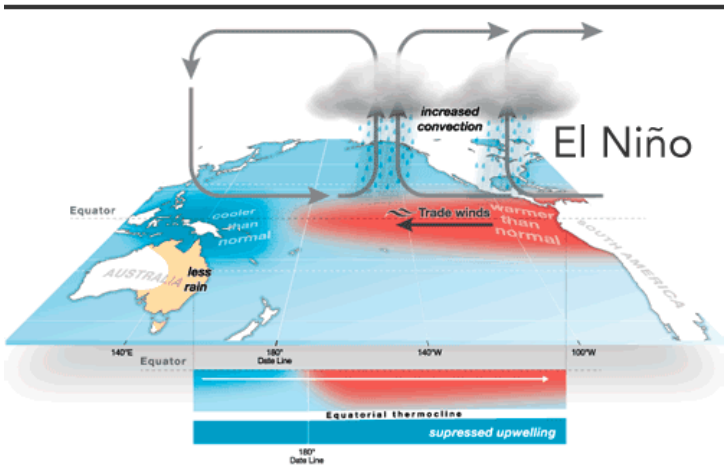
El Niño is weakening, no consensus on what's next (La Niña, neutral, El Niño)
Spring predictability barrier **(autumn in SH) means forecasts after April have higher confidence**

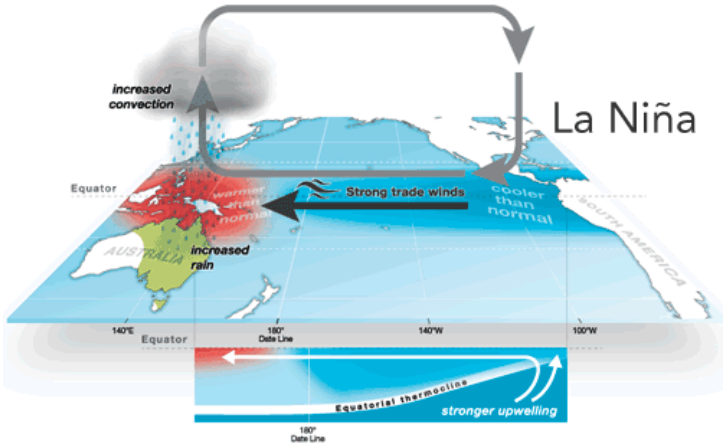


International Research Institute (IRI) for Climate and Society:
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

La Niña







Images from the Australian Bureau of Meteorology

La Niña

Images from the NOAA Climate Predication Center