



El Niño Básico

Verónica Nieves^{1,2}

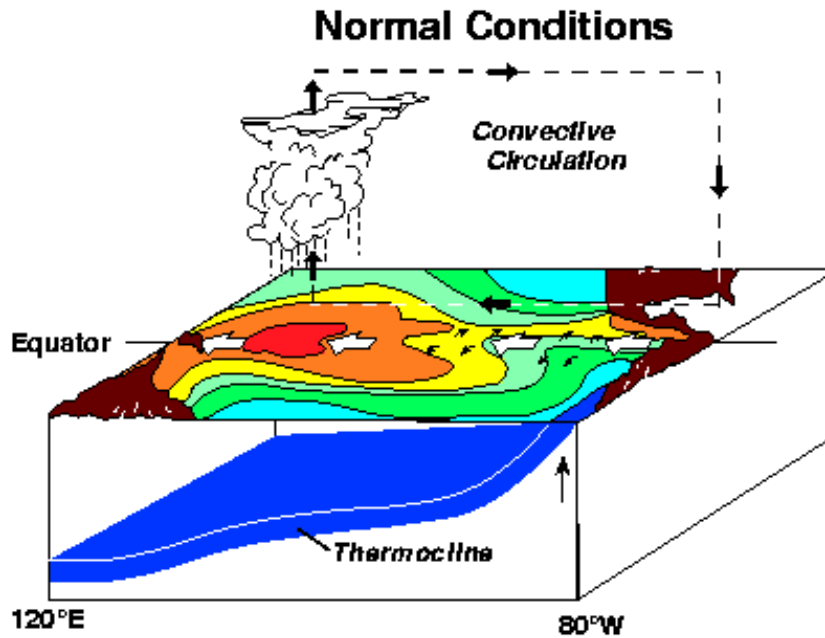
¹UCLA - JIFRESSE

²Jet Propulsion Laboratory / California Institute of Technology

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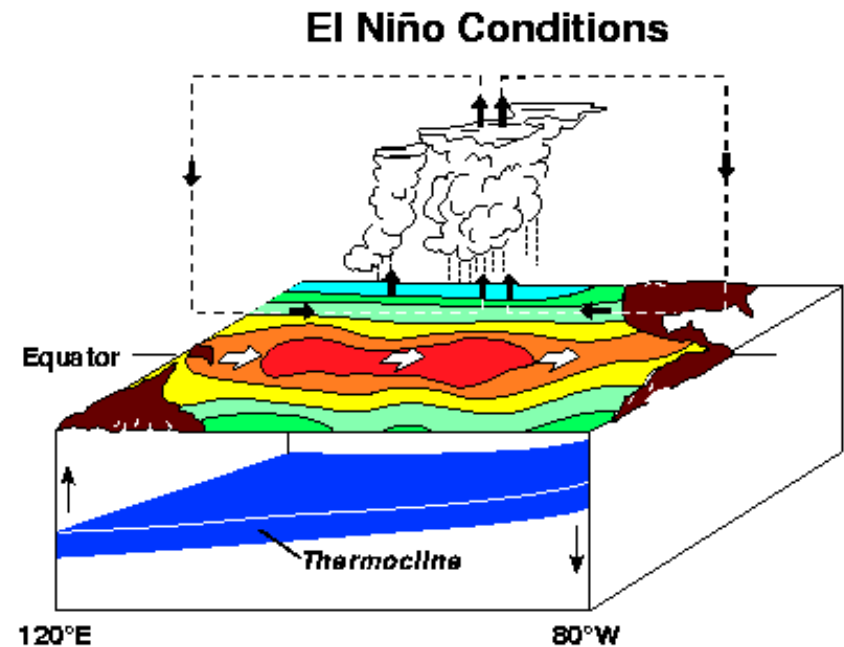


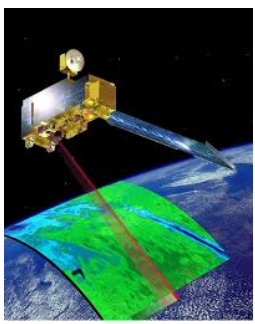
What is El Niño?



Strong Trade Winds
Warm water Piles Up off Asia
Cooler water off Americas

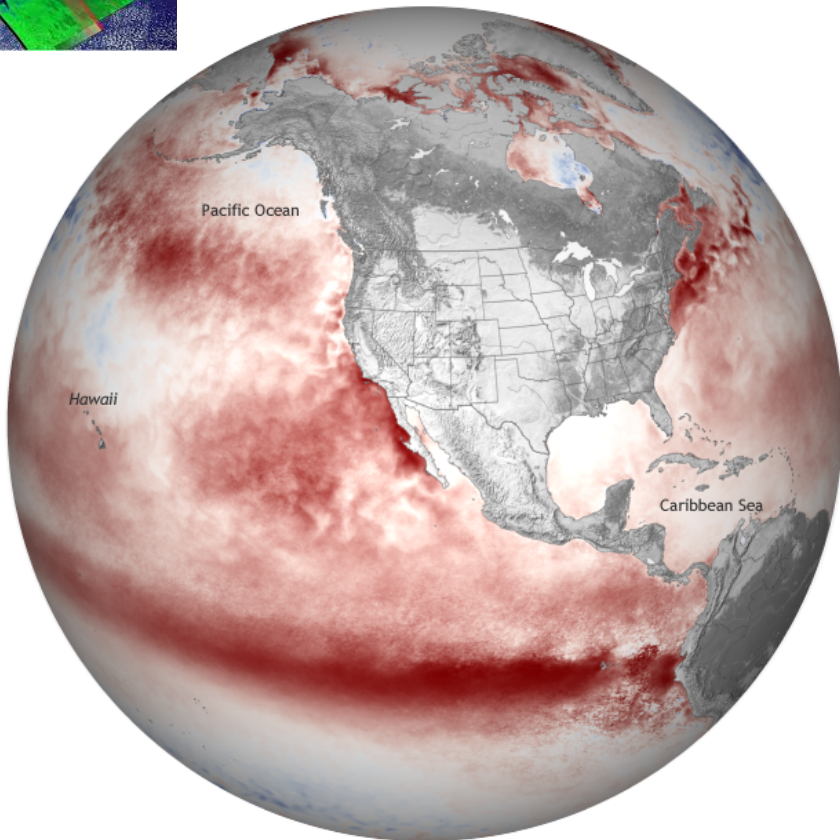
Weakening Trade Winds
Warm water off Asia
Moves toward Americas





How can we monitor El Niño?

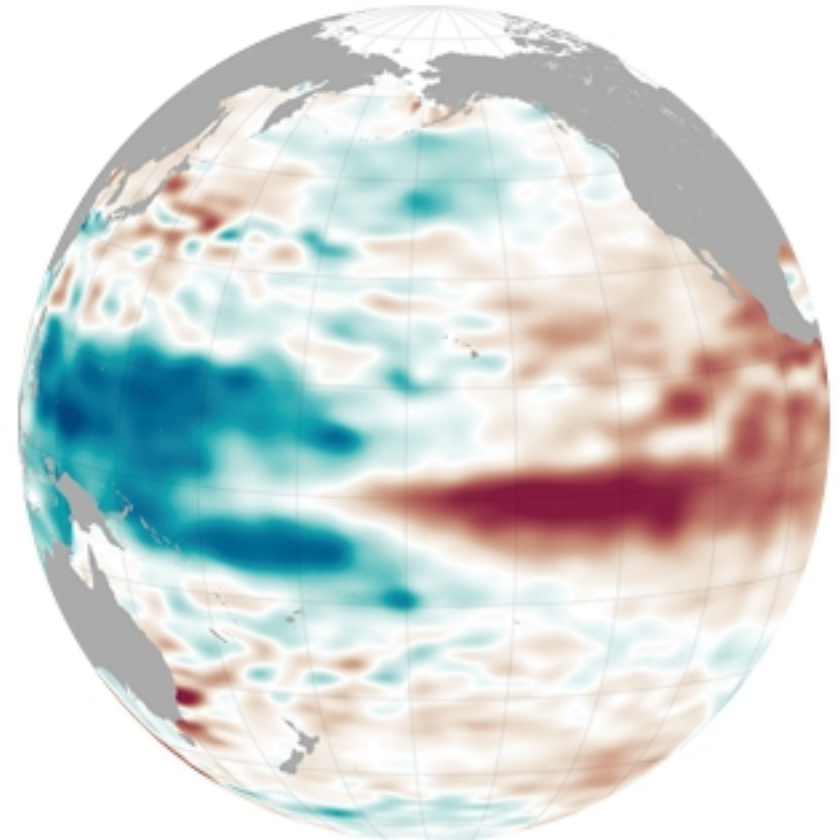
Satellite-derived SST or SSH



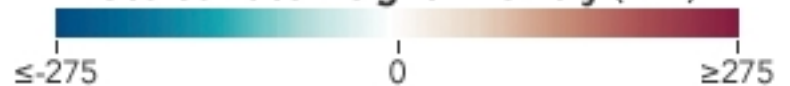
Difference from average (°F)



NOAA GOES; NASA MODIS Aqua.



Sea Surface Height Anomaly (mm)



NASA Earth Observatory map, Jason-2.



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NASA's

Ocean Surface Topography Missions

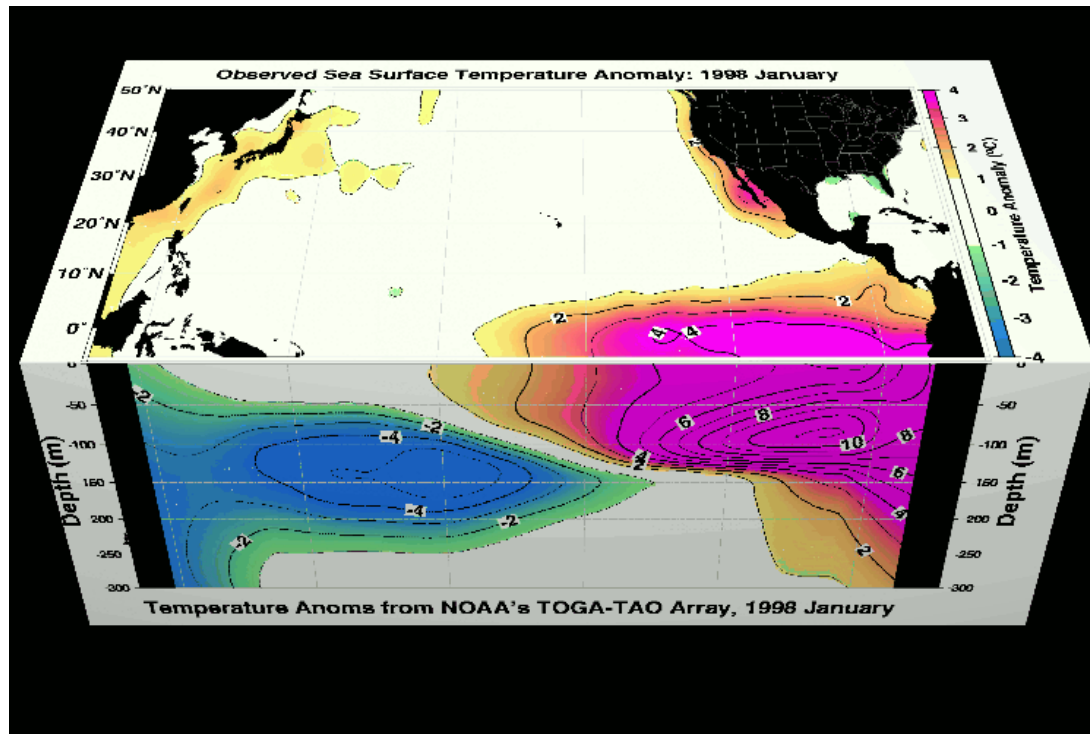


How tall the ocean is? A measure of how much heat is stored in the ocean.

<https://sealevel.nasa.gov/resources/33>

How can we monitor El Niño?

Direct Measurements



Temperature Anomalies from NOAA's TOGA-TAO array.

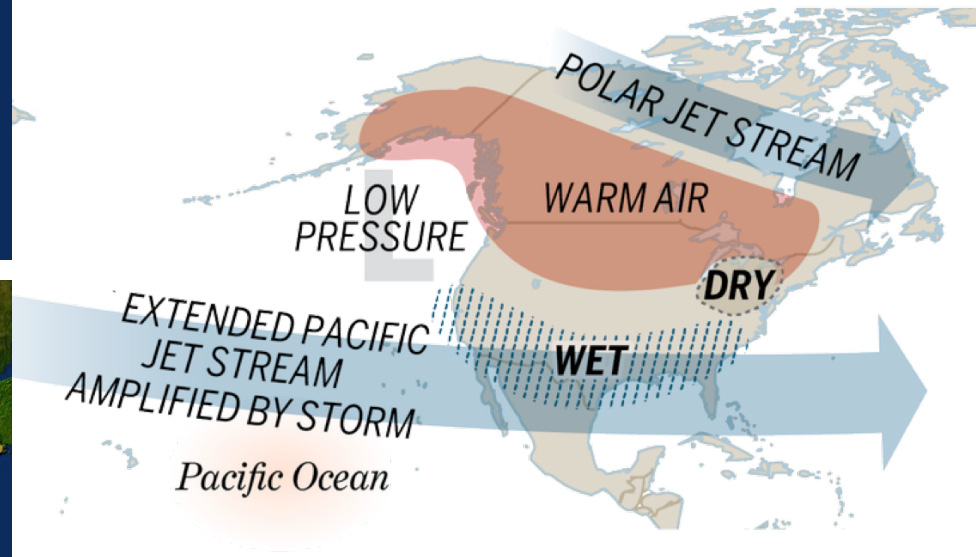
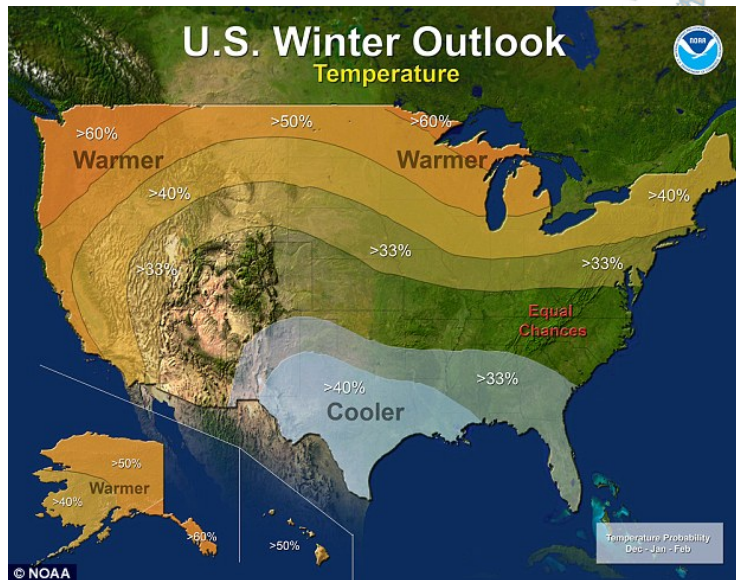
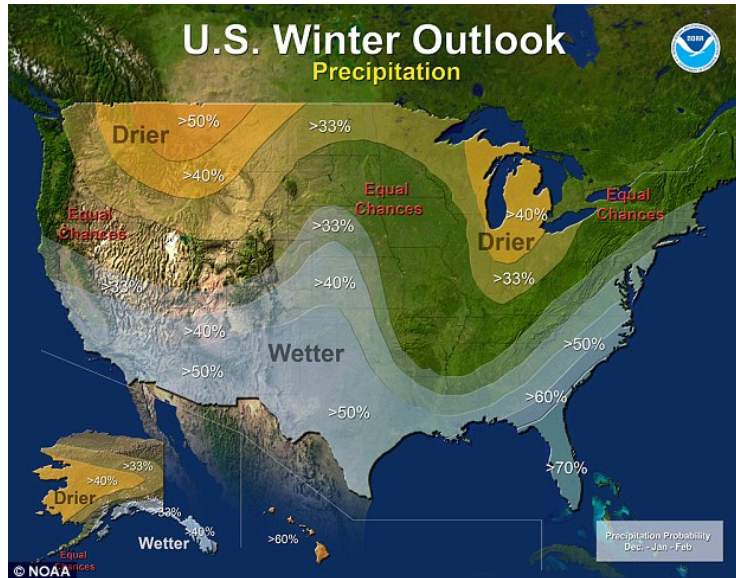


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**What kind of effects does
El Niño have on the U.S.
and around the world?**



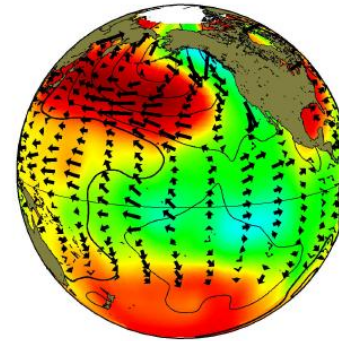
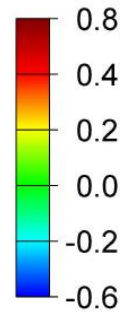
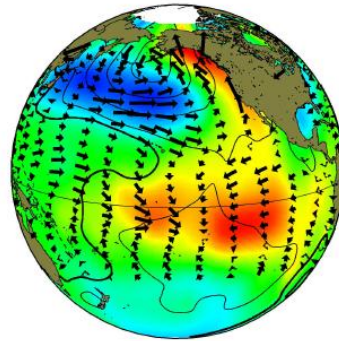
U.S. Weather Patterns Dec-Feb





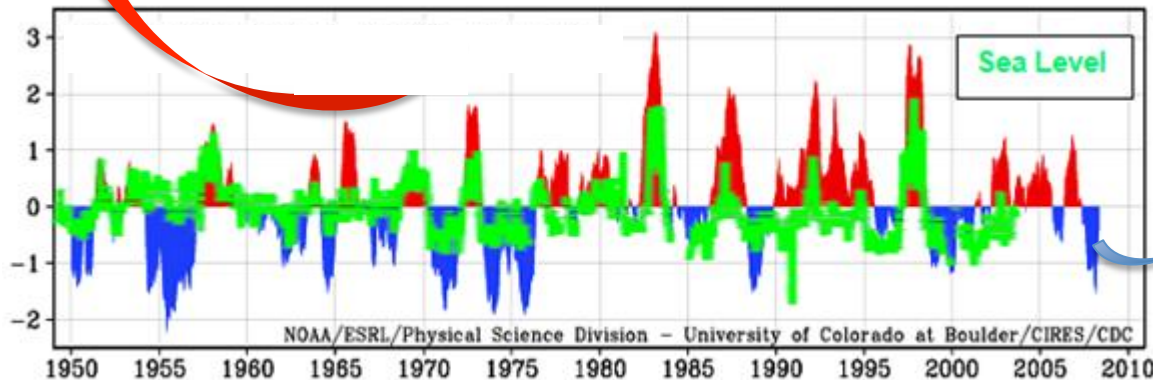
Sea Level Changes: SL Raises in the Eastern Pacific

Warm Pacific:
Sea Level Rises



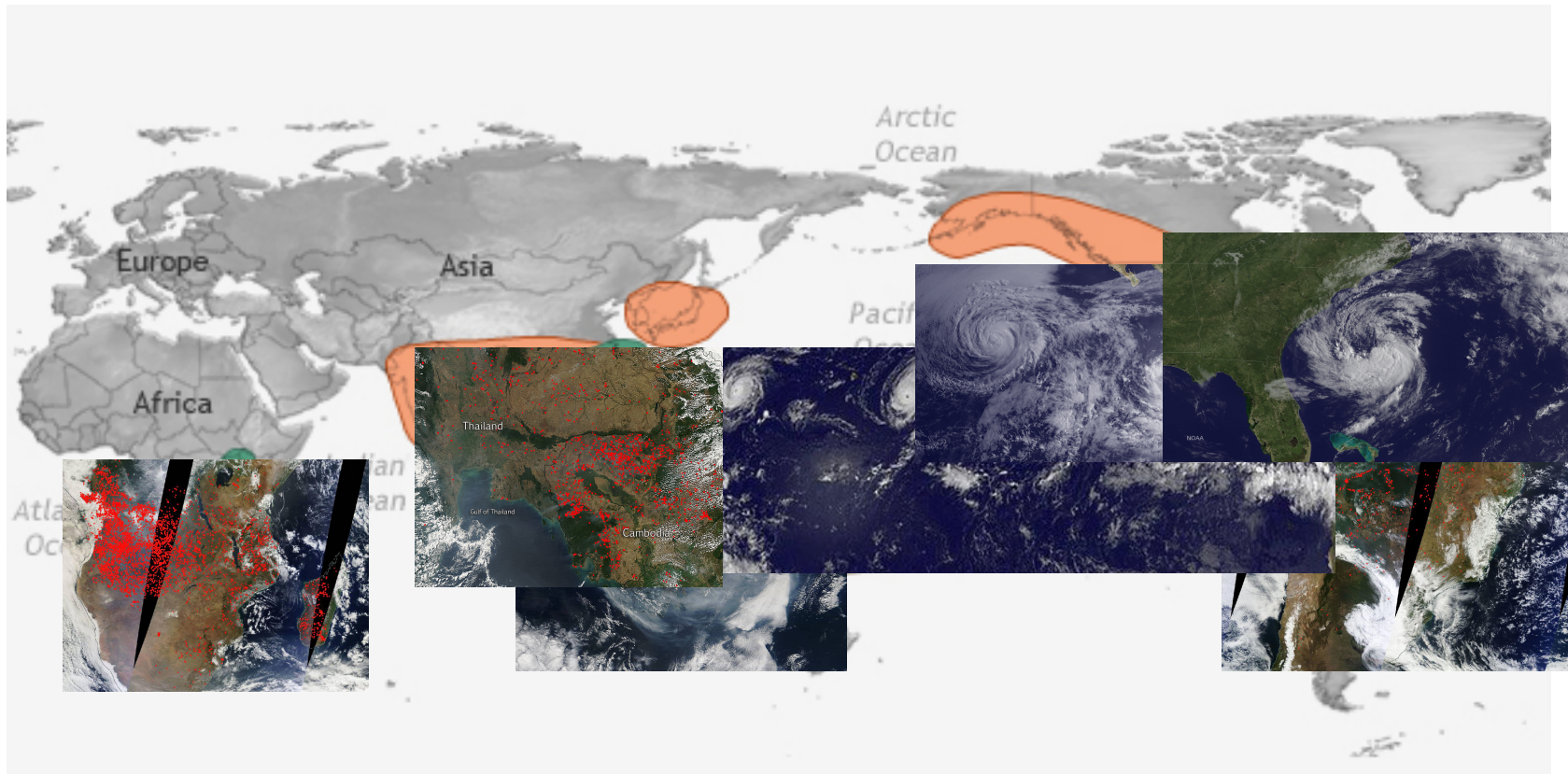
Cool Pacific:
Sea Level Drops

From: <http://jisao.washington.edu/pdo/>

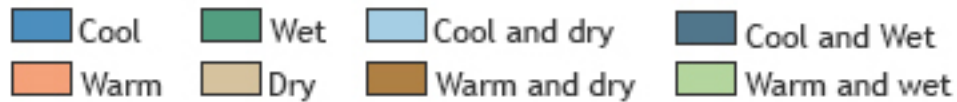




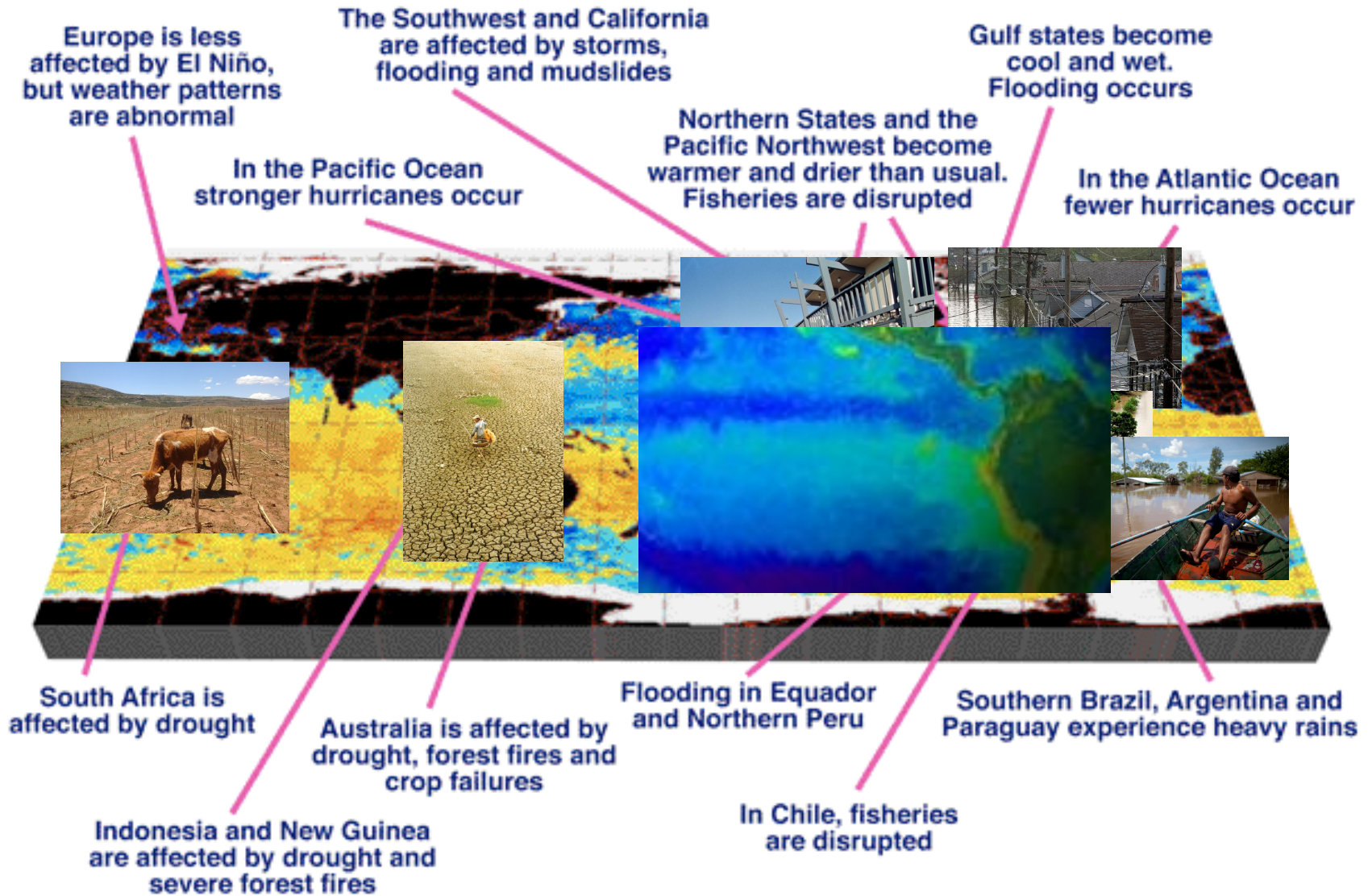
Global Patterns Dec-Feb



El Niño patterns
December-February



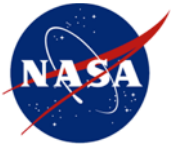
The Global Impact of El Niño



El Niño graphic courtesy of: Visit to an Ocean Planet CD ROM produced by TOPEX/Poseidon Project NASA.

<http://www.nasa.gov/feature/goddard/how-nasa-sees-el-ni-o-effects-from-space>

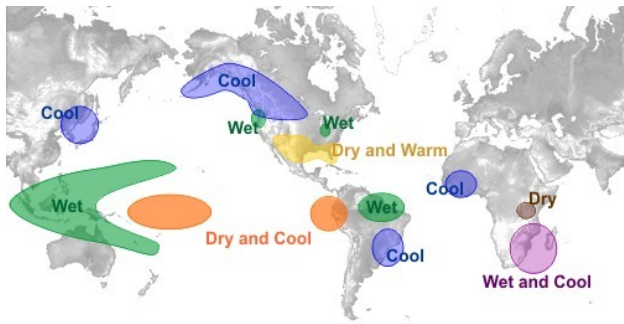
Climate.gov; UNEP.org; dailymail.co.uk



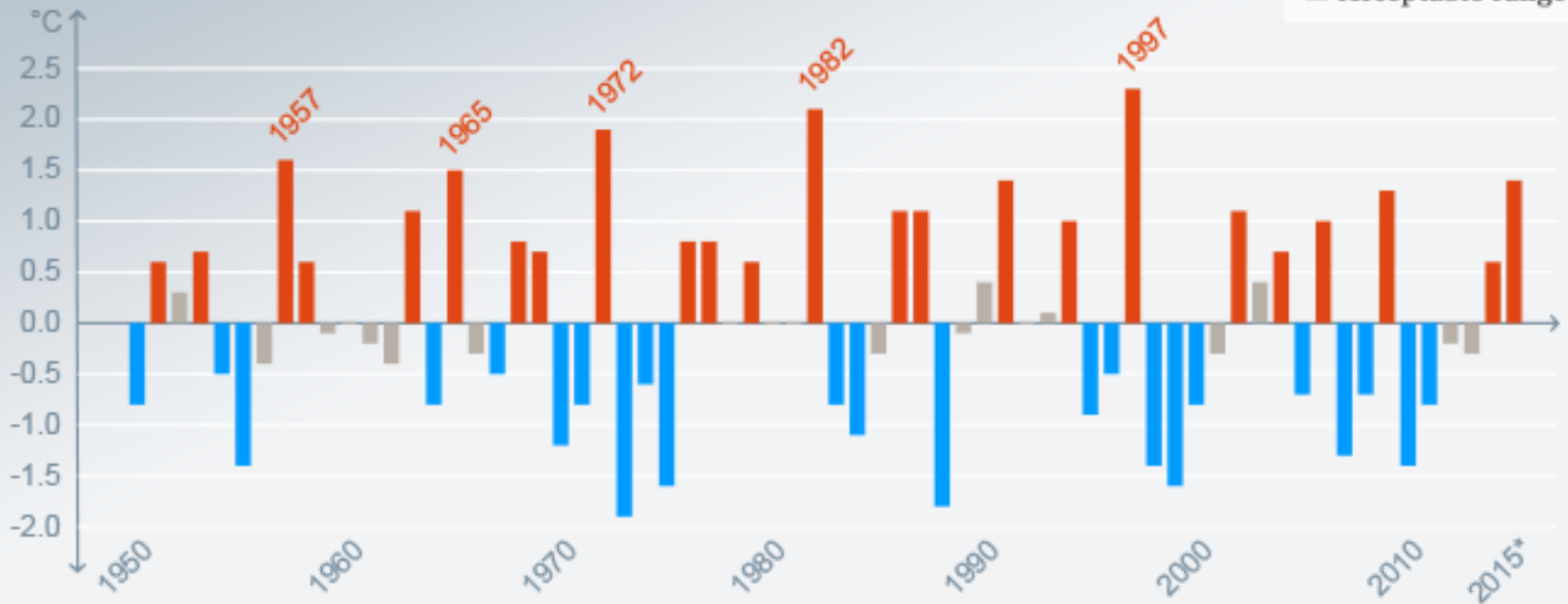
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Historical El/La Niñ@ Data

Historical Record



The diagram shows anomalies in the sea surface temperature in the Central Pacific during the three-month period of November, December, January - when the events peak - except for 2015, for which the latest data is from June, July, August.



Source: National Oceanic and Atmospheric Administration (NOAA)

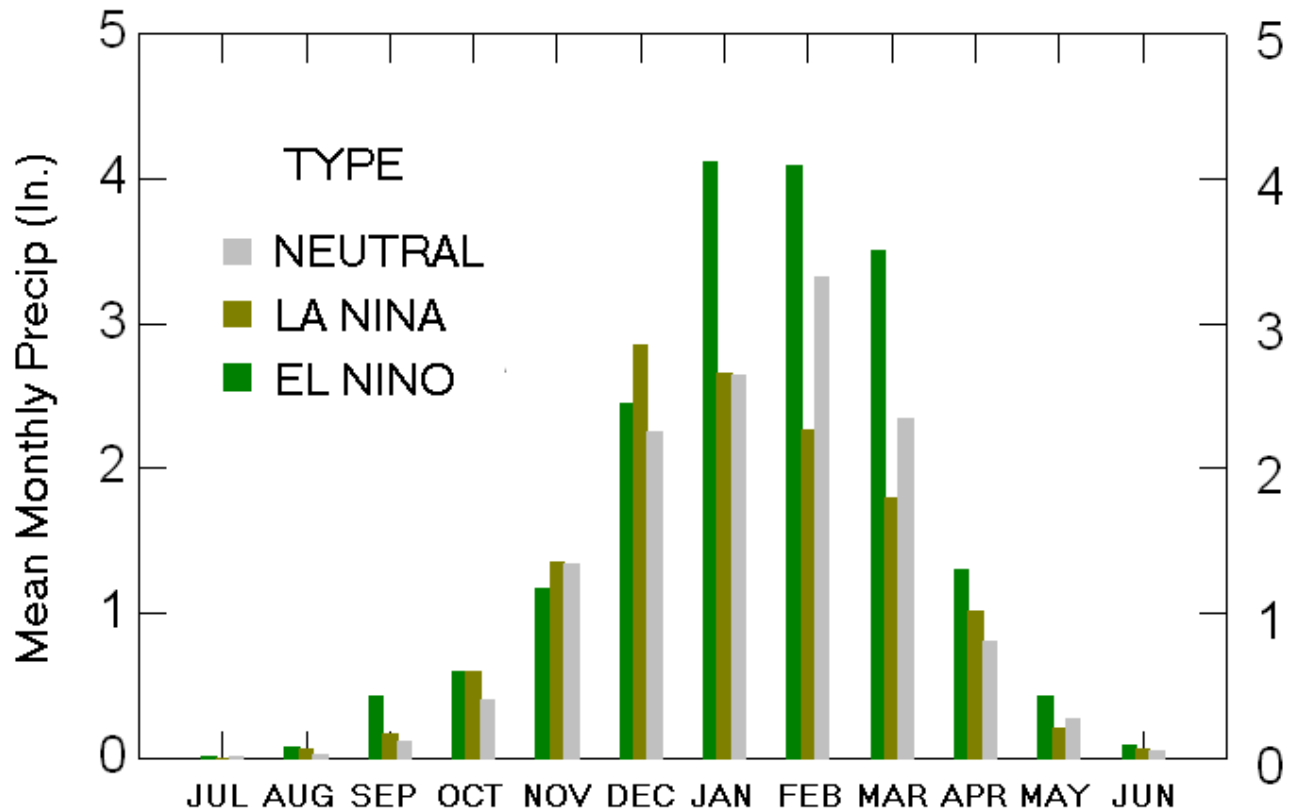
© DW

There is over 60% probability that El Niño will morph into La Niña!



Has El Niño 2015-16 reached its potential?

**MEAN MONTHLY PRECIPITATION FOR NEUTRAL,
LA NINA, & EL NINO EPISODES - DOWNTOWN LOS ANGELES
- 1877-78 THRU 2008-09 SEASONS -**



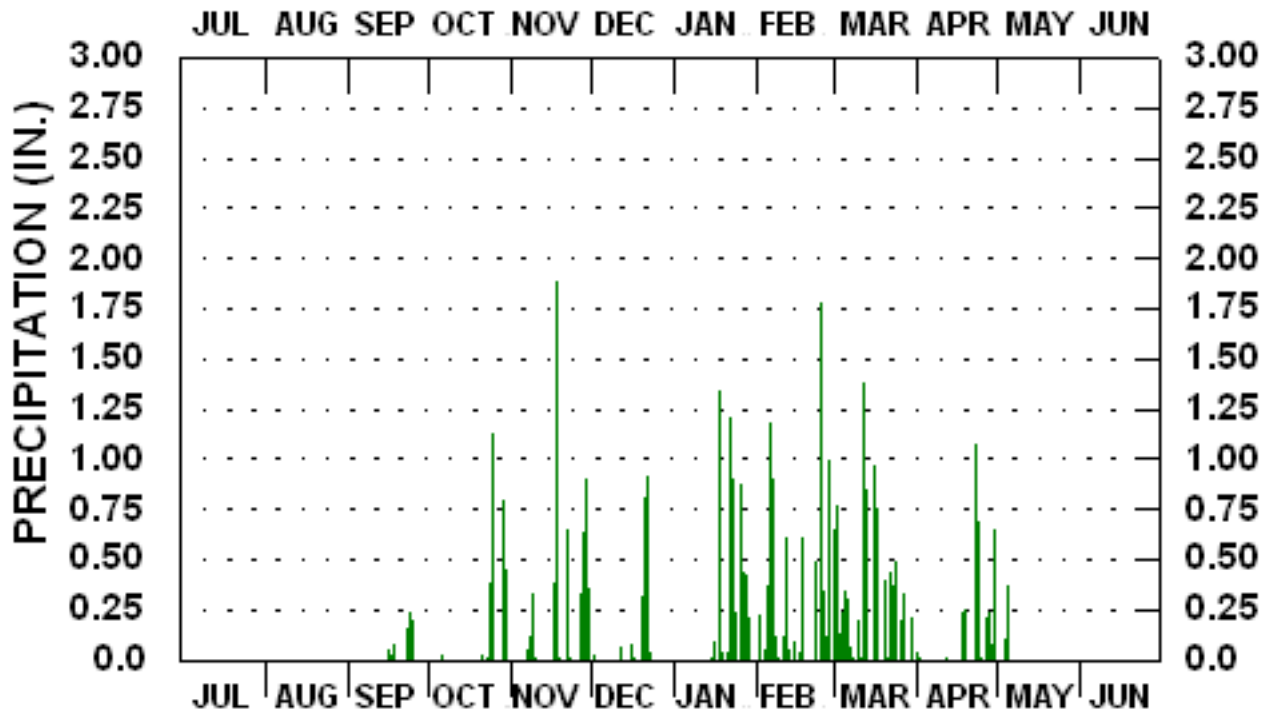
Source of El Niño, La Niña, & Neutral Seasonal Breakdowns:

http://www.wrh.noaa.gov/10x/climate/Los%20Angeles%20Yearly%20Rainfall%20-%20jo_8822-image001.gif



Has El Niño 2015-16 reached its potential?

DOWNTOWN SAN FRANCISCO DAILY PRECIPITATION FOR 1982-83

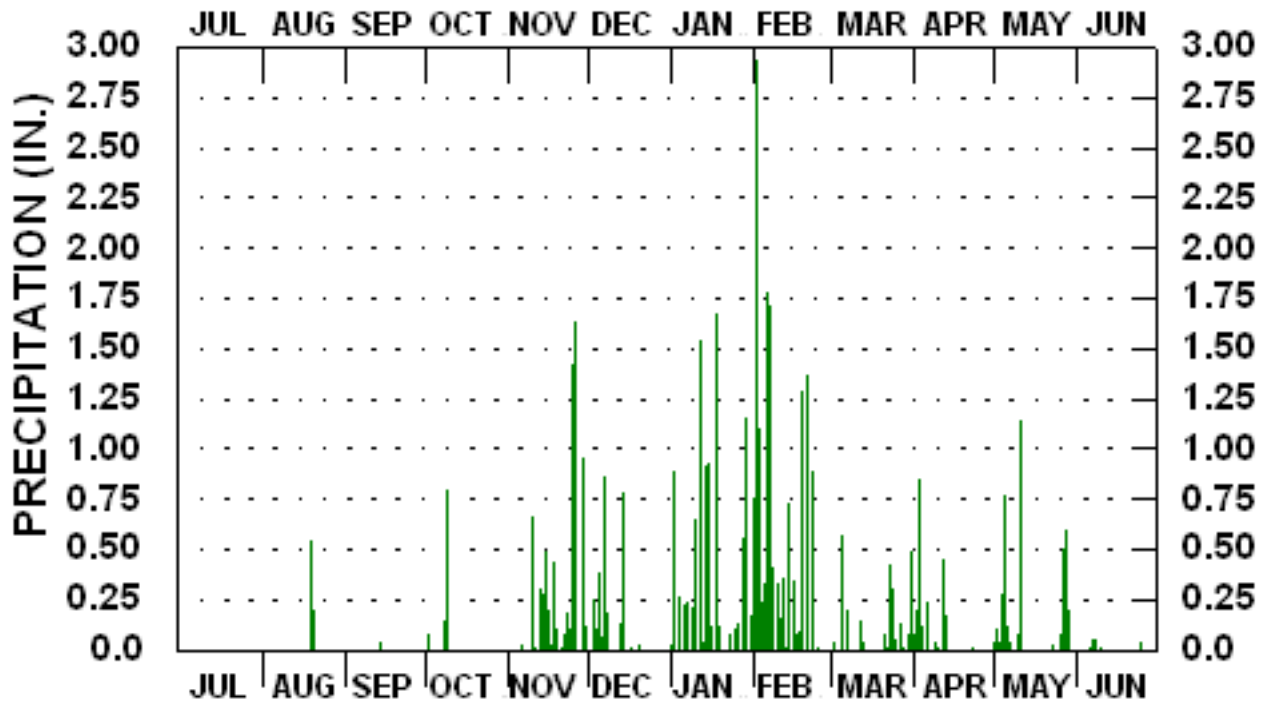


<https://www.climatestations.com/san-francisco/>



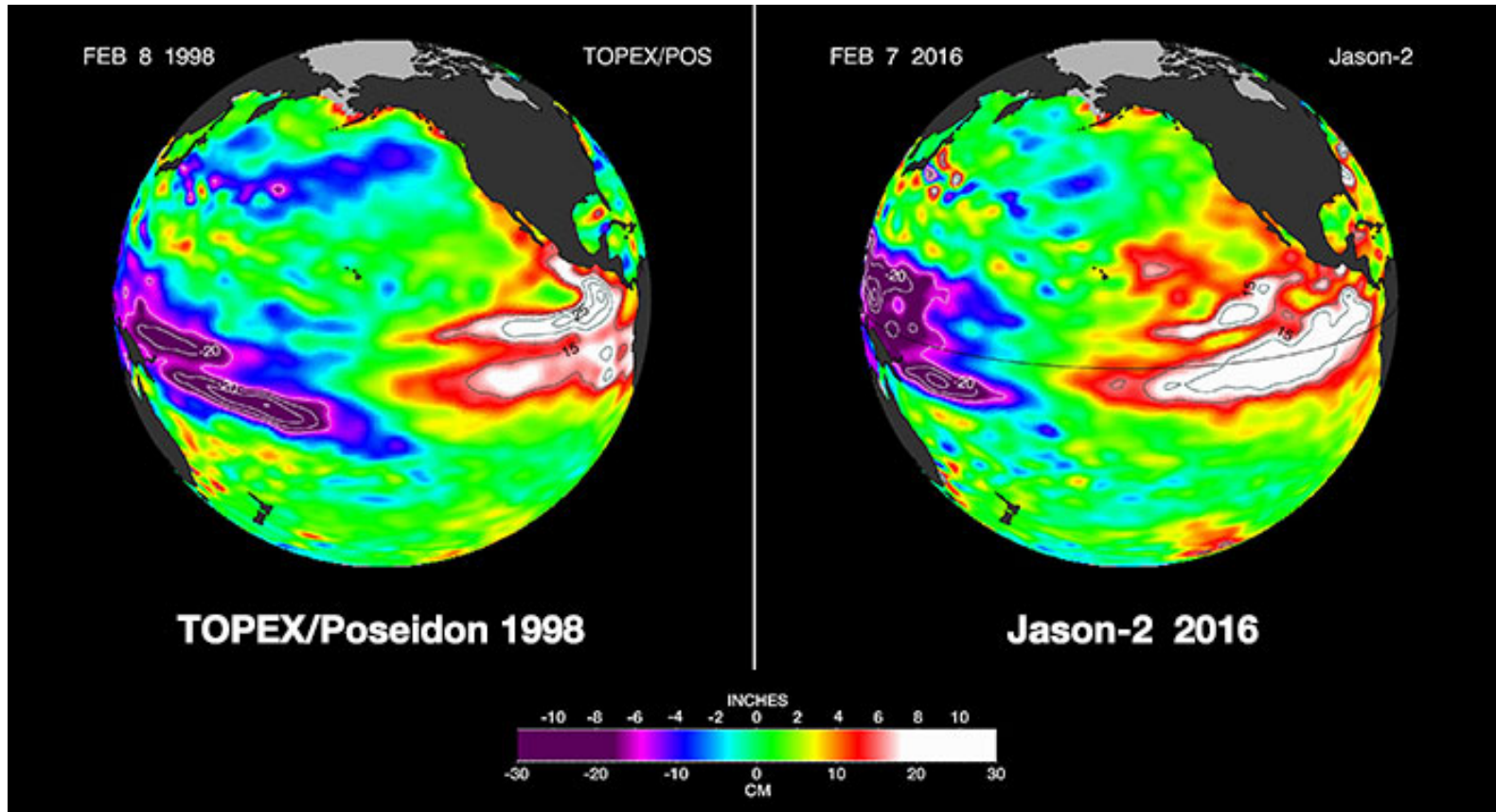
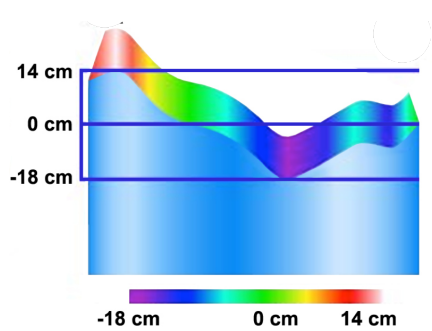
Has El Niño 2015-16 reached its potential?

DOWNTOWN SAN FRANCISCO DAILY PRECIPITATION FOR 1997-98



<https://www.climatestations.com/san-francisco/>

1997-98 vs. 2015-16



El Niño 2015-16: one of the strongest on record!

<https://sealevel.jpl.nasa.gov/elnino2015/index.html>



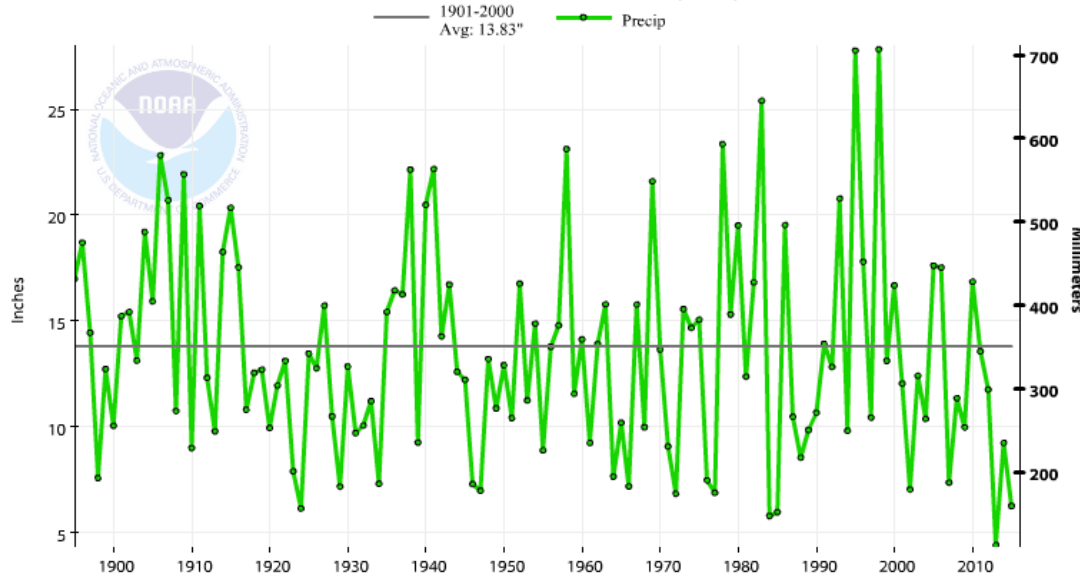
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**Will El Niño bring relief
to the drought in California?**

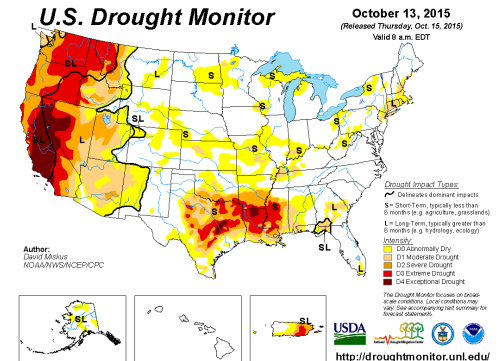
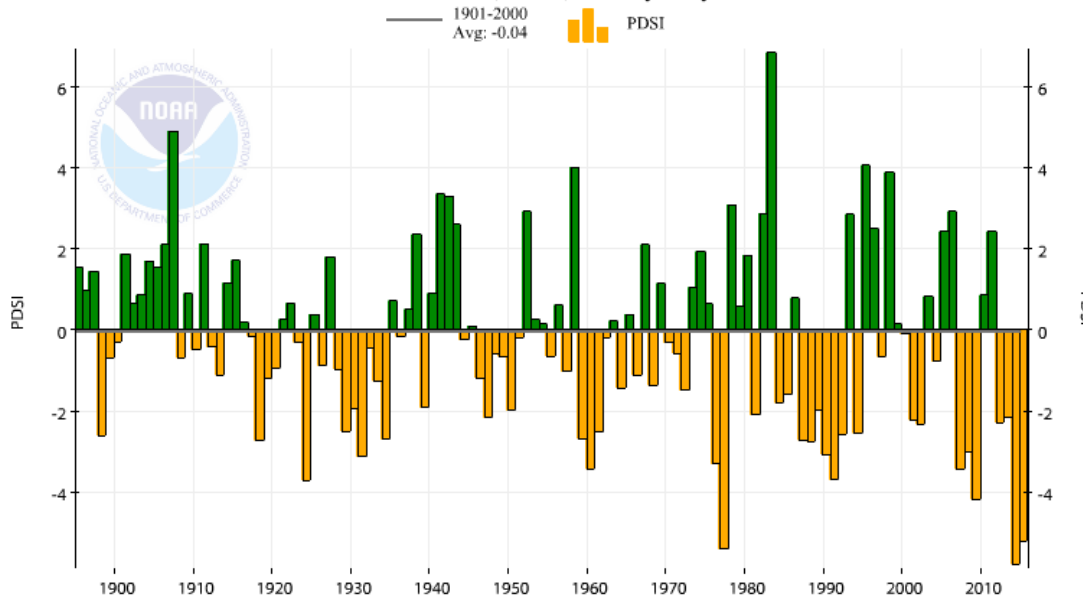


CA drought began 15 years ago

California, Precipitation, January-May



California, PDSI, January-May





Last 4 years: 25% of this drought!

2011-2015 marked the driest four consecutive rainy seasons on record in downtown L.A.

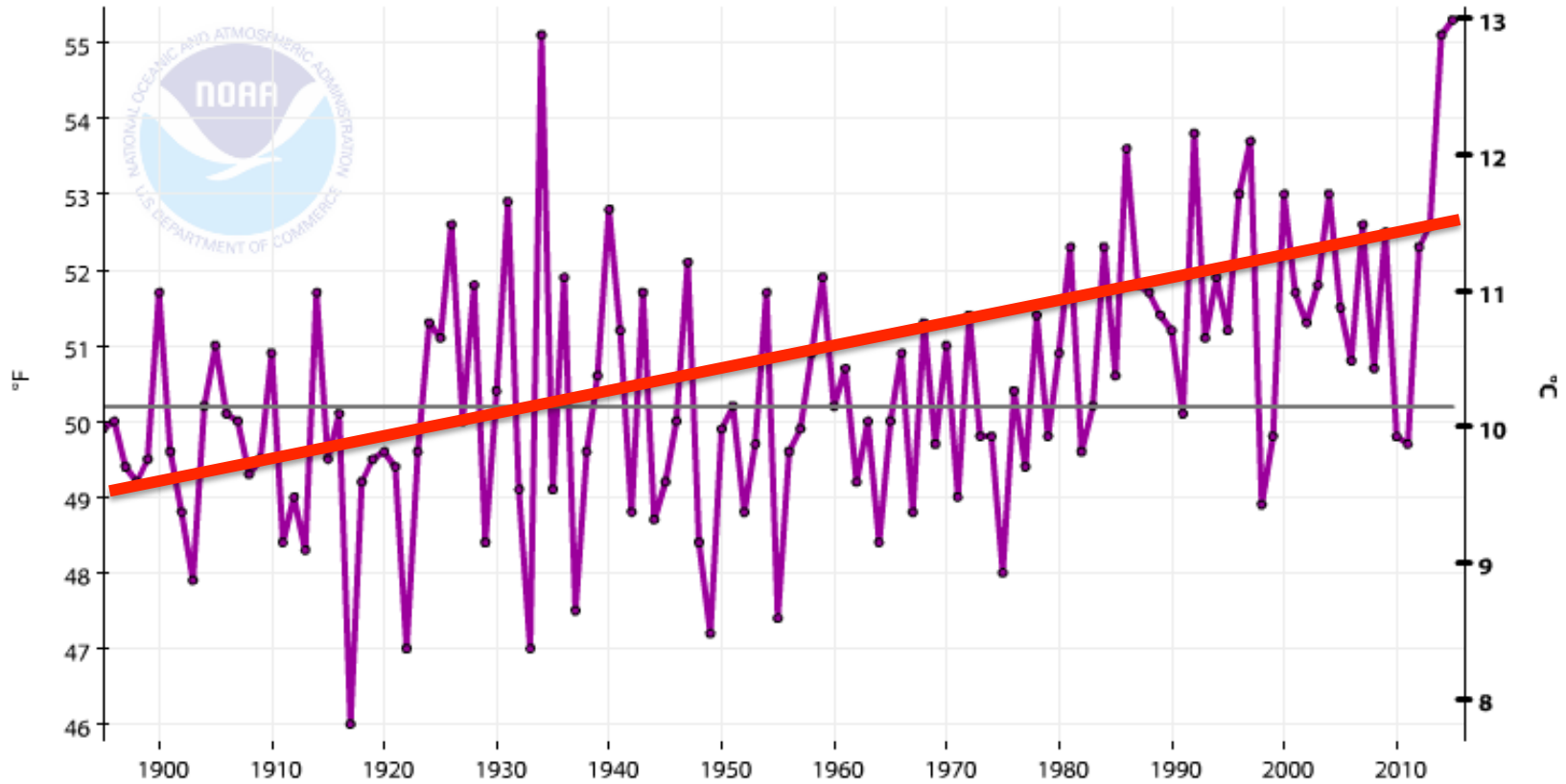




Global Warming Trend: 2.5 °F in 115 years

California, Average Temperature, January-May

— 1901-2000 Avg: 50.2°F —●— Avg Temperature





2015 Hottest Year on Record

Year-to-Date Global Temperature
for 2015 and the six warmest years on record

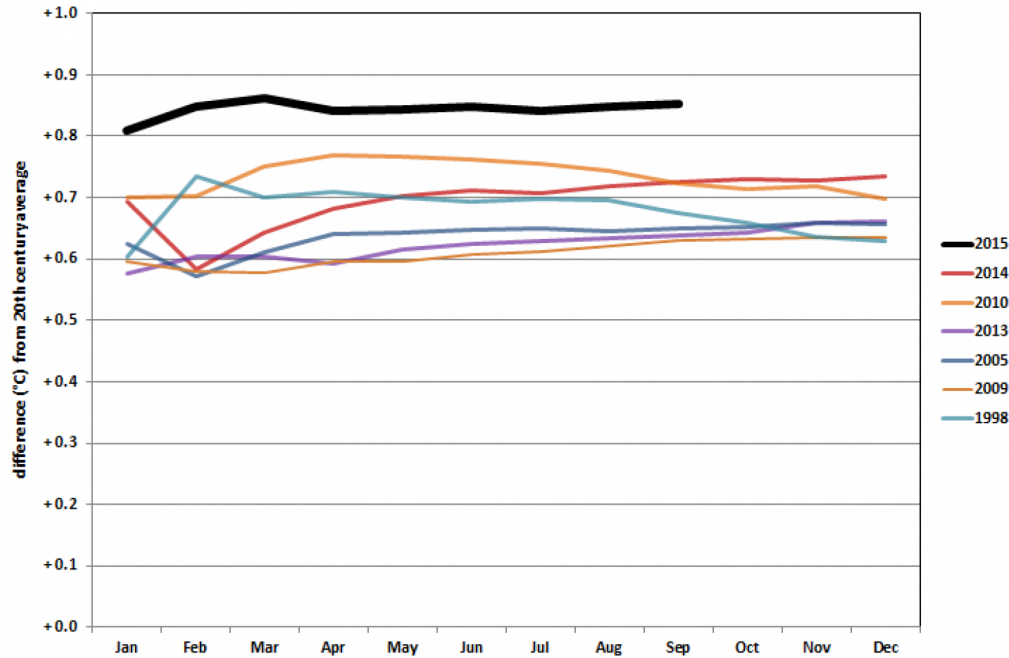


Chart shows global warmth of 2015 is on another level compared to previous warmest years (NOAA).

RANK 1 = WARMEST PERIOD OF RECORD: 1880–2015	MONTH + YEAR	ANOMALY °C	ANOMALY °F
1	September 2015	0.90	1.62
2 (tie)	January 2007	0.89	1.60
2 (tie)	February 2015	0.89	1.60
2 (tie)	March 2015	0.89	1.60
2 (tie)	August 2015	0.89	1.60
6	June 2015	0.87	1.57
7	February 1998	0.86	1.55
8 (tie)	March 2010	0.85	1.53
8 (tie)	May 2015	0.85	1.53
10	December 2014	0.84	1.51

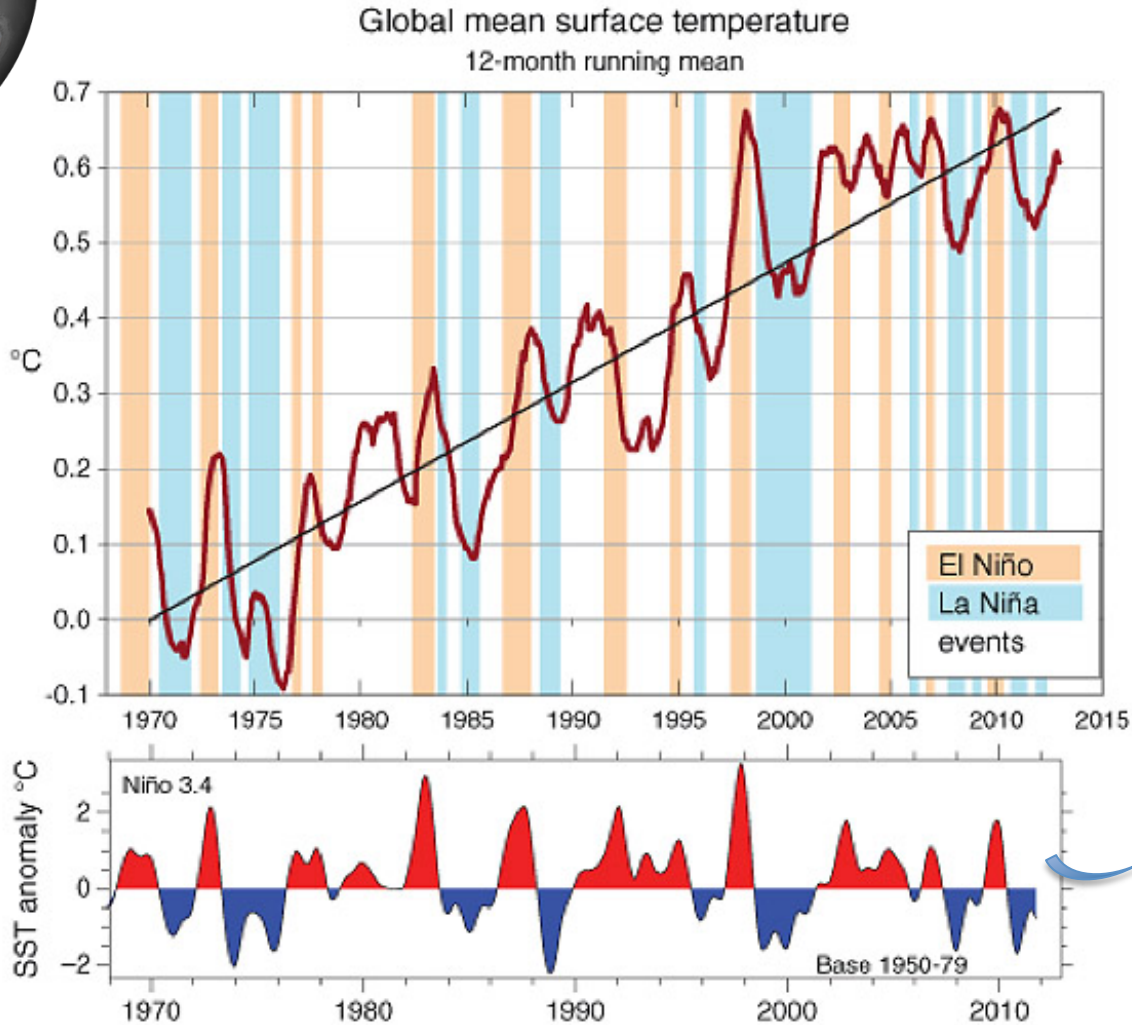
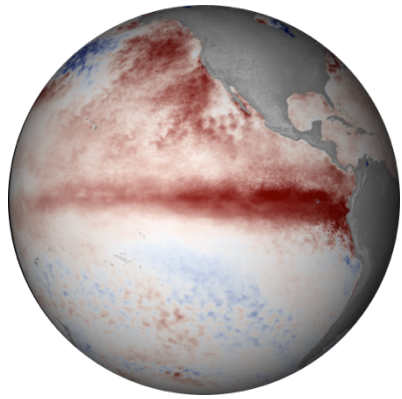
Top 10 monthly temperature departure from average (NOAA).



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**To what extent will El Niño
increase warming this year?**

Niños and Global Temperature

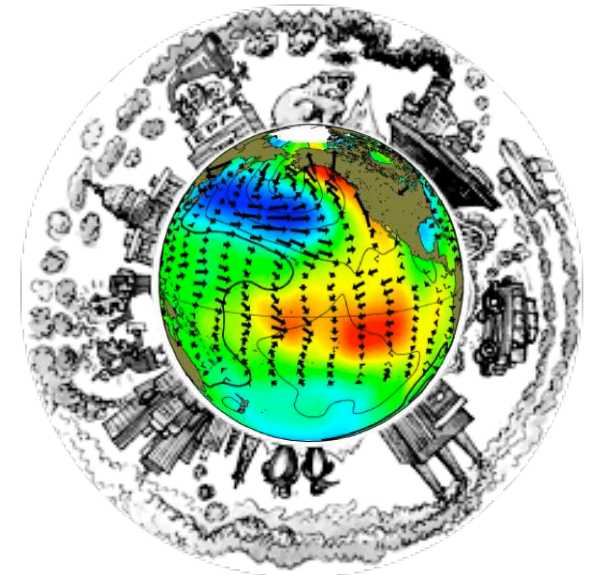
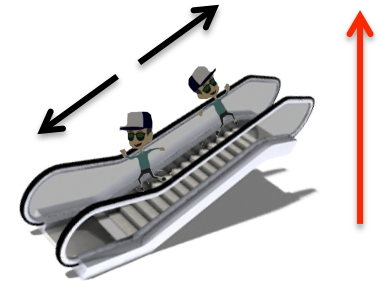
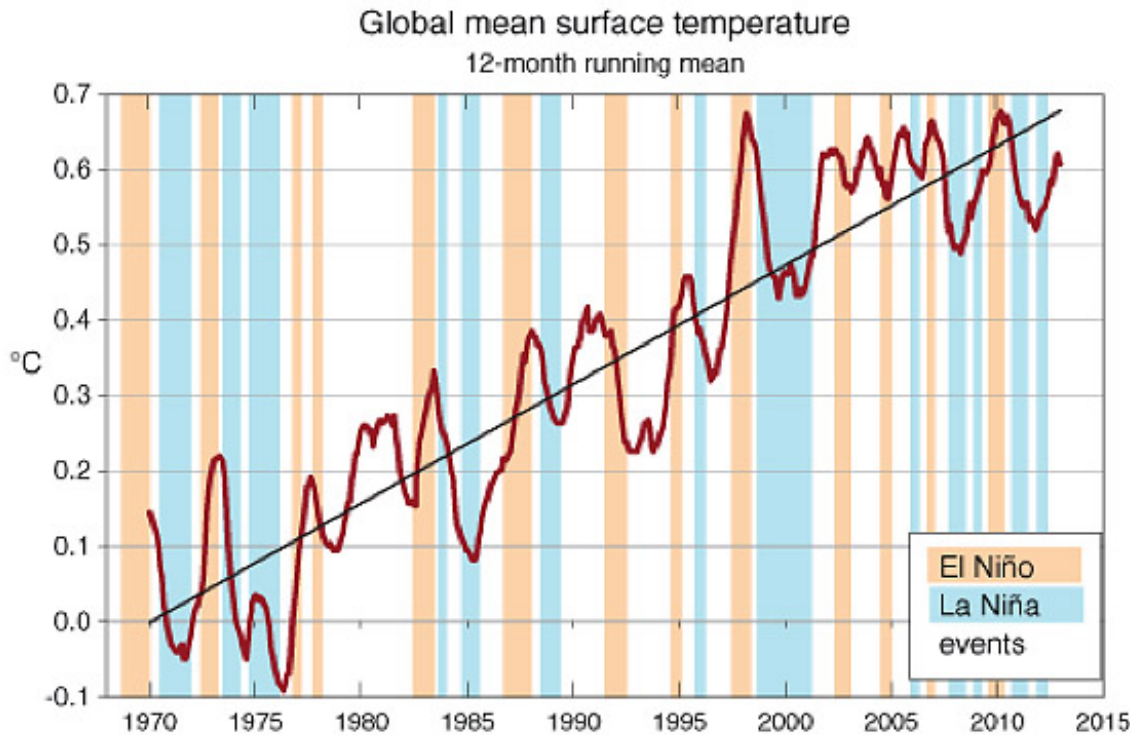


K. E. Trenberth and J. T. Fasullo, *Earth's Future*, 2013.



Two Effects:

Natural Cycles & Human-Caused Warming





EL NIÑO

- Has a large impact on society: weather patterns & sea level changes.
- Plays an important role regulating the Earth's surface temperature .
- Is not a real drought buster: but a decade or more of above normal precipitation.



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Thank you for your attention!

Tune in to NASA's El Nino Watch at:
<http://sealevel.jpl.nasa.gov/>

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