El Niño Basics

Verónica Nieves$^{1,2}$

$^1$UCLA - JIFRESSE
$^2$Jet 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

http://www.pmel.noaa.gov/tao/elnino/nino_normal.html
How can we monitor El Niño?
Satellite-derived SST or SSH

NOAA GOES; NASA MODIS Aqua.

NASA Earth Observatory map, Jason-2.
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.
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

Credit: NOAA & NASA
The Global Impact of El Niño

- Europe is less affected by El Niño, but weather patterns are abnormal.
- The Southwest and California are affected by storms, flooding and mudslides.
- Gulf states become cool and wet. Flooding occurs.
- In the Pacific Ocean stronger hurricanes occur.
- Northern States and the Pacific Northwest become warmer and drier than usual. Fisheries are disrupted.
- In the Atlantic Ocean fewer hurricanes occur.
- South Africa is affected by drought.
- Australia is affected by drought, forest fires and crop failures.
- Flooding in Equador and Northern Peru.
- Southern Brazil, Argentina and Paraguay experience heavy rains.
- Indonesia and New Guinea are affected by drought and severe forest fires.
- In Chile, fisheries are disrupted.

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
Historical El/La Niñ@ Data
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 Nino, La Nina, & Neutral Seasonal Breakdowns:
http://www.wrcc.noaa.gov/10x/climate/Los%20Angeles%20Yearly%20Rainfall%20-%20jo_8822-image001.gif
Has El Niño 2015-16 reached its potential?

https://www.climatestations.com/san-francisco/
Has El Niño 2015-16 reached its potential?

https://www.climatestations.com/san-francisco/
1997-98 vs. 2015-16

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

Will El Niño bring relief to the drought in California?
CA drought began 15 years ago
Last 4 years: 25% of this drought!

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

- 2011-2015: 29.14 inches
- 1947-1951: 34.02 inches
- 1986-1990: 35.57 inches
- 1897-1901: 36.85 inches
- 1958-1962: 37.40 inches

Source: National Weather Service
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

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

Top 10 monthly temperature departure from average (NOAA).

<table>
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<th>RANK</th>
<th>MONTH + YEAR</th>
<th>ANOMALY °C</th>
<th>ANOMALY °F</th>
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<td>January 2007</td>
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<td>March 2015</td>
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<td>May 2015</td>
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<td>December 2014</td>
<td>0.84</td>
<td>1.51</td>
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To what extent will El Niño increase warming this year?
Niño events and Global Temperature

2016: 0.72-0.95 °C

Two Effects:
Natural Cycles & Human-Caused Warming

Global mean surface temperature
12-month running mean

El Niño
La Niña
events

°C


-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
Final Remarks

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.
Thank you for your attention!

Tune in to NASA’s El Nino Watch at:

http://sealevel.jpl.nasa.gov/

Veronica.Nieves@jpl.nasa.gov