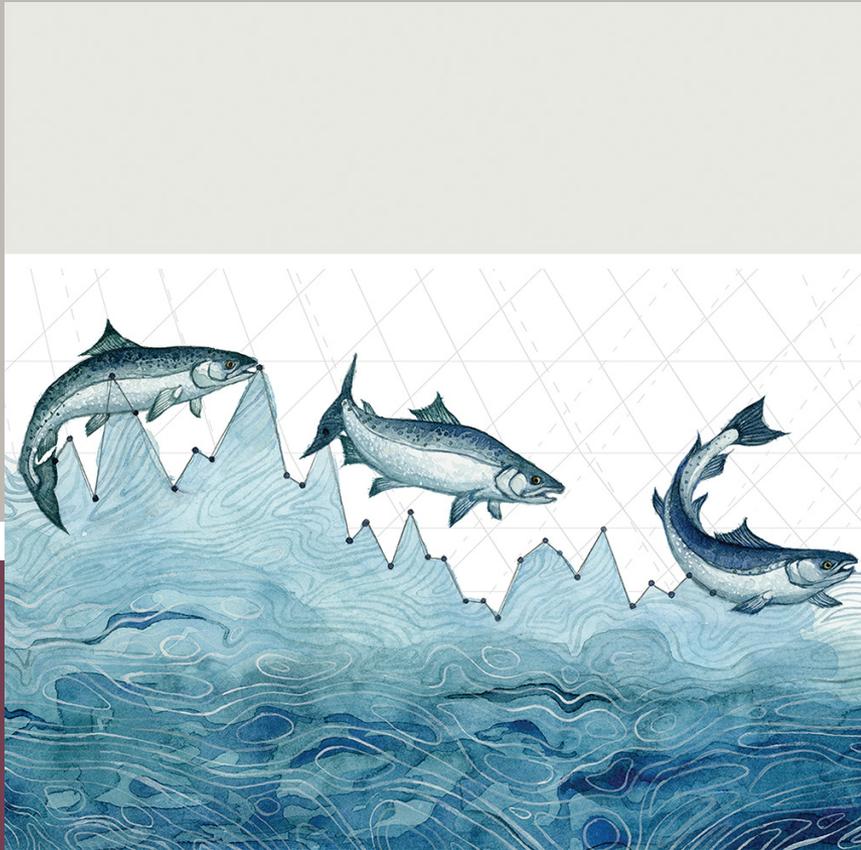
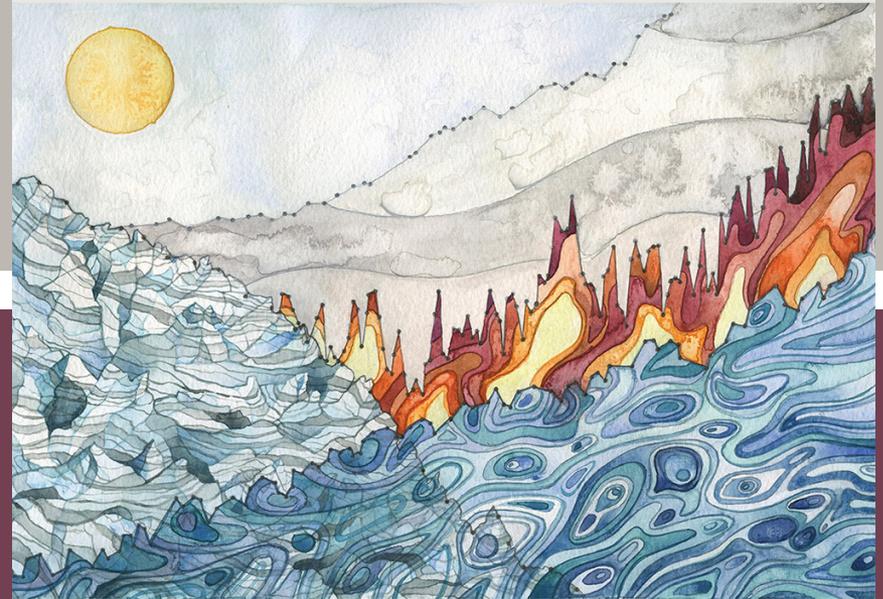


STATE OF THE CLIMATE IN 2015



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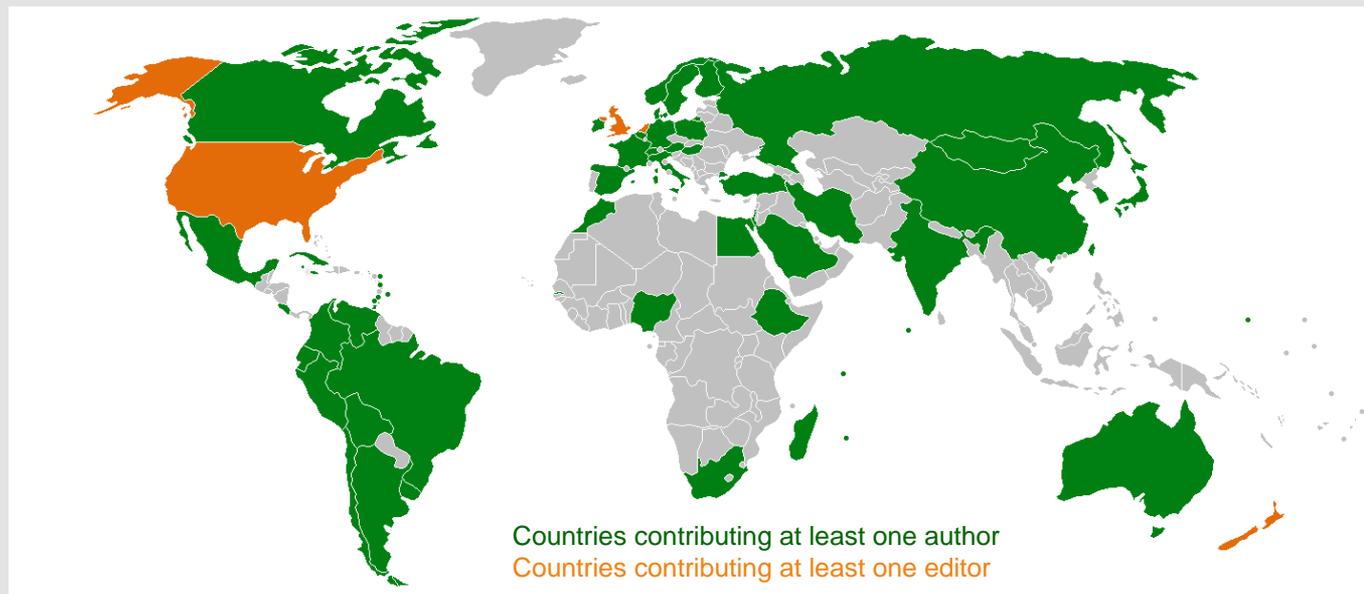
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Report is in its 26th Year of Publication

- Many scientists from many disciplines from around the world fit the pieces of Earth's climate system and its changes together to connect the dots
 - Dozens of essential climate indicators, extreme weather and climate events, historical context
- This report does not pursue “attribution” or contain forecasts, scenarios, or projections



456 authors from 62 countries; 16 editors on 3 continents



Atmosphere



Land



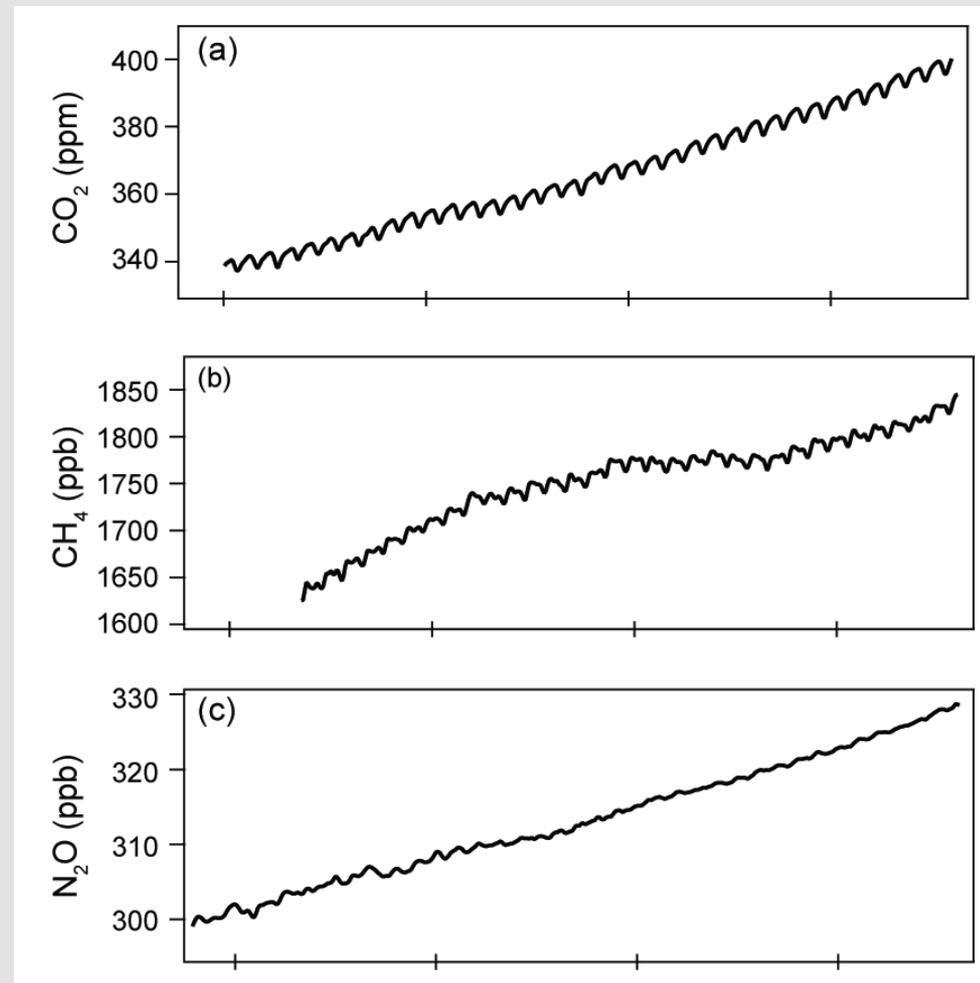
Oceans



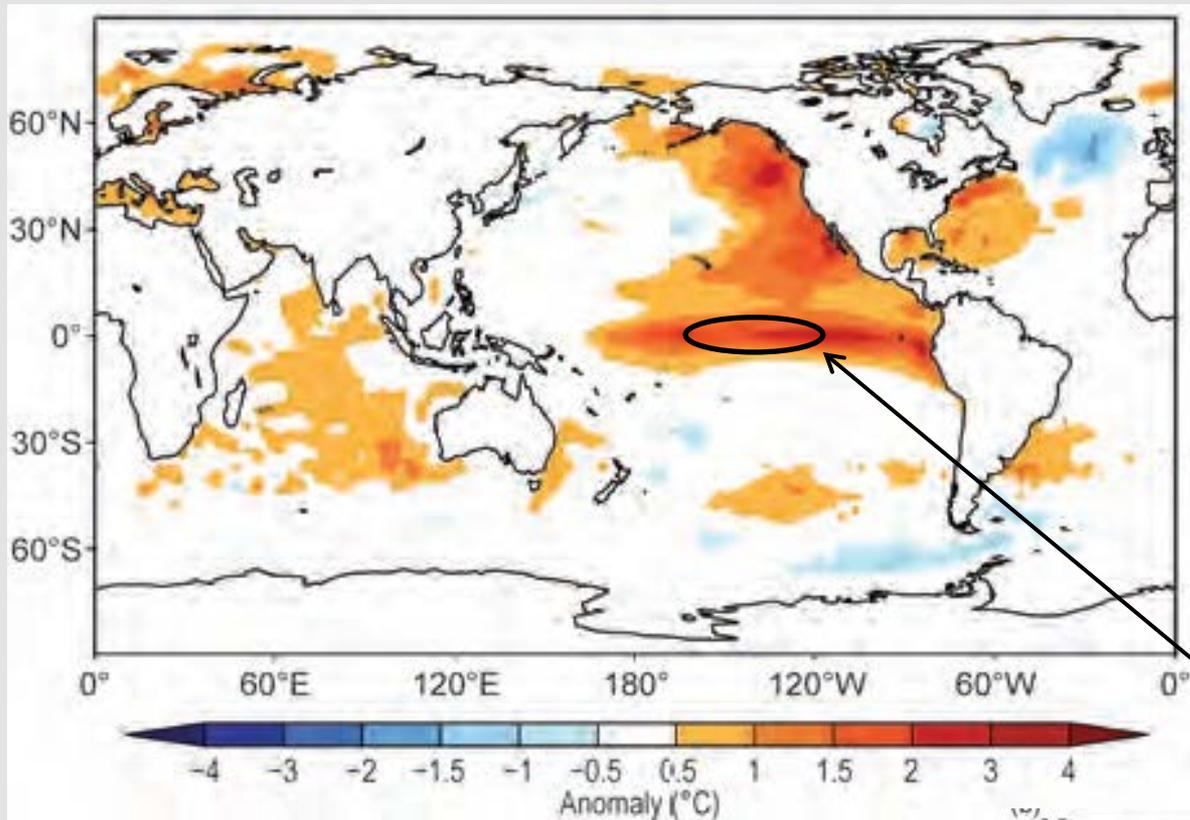
Snow and Ice

Greenhouse Gases Reach New Record Highs

- Global mean carbon dioxide (CO_2) reached 399.4 ppm, a 2.2 ppm increase from 2014
- Global mean methane (CH_4) reached 1834.0 ppb, a 11.5 ppb increase since 2013. Largest increase since 1997/98
- Global mean nitrous oxide (N_2O) reached 328.2 ppb, a 1.1 ppb increase since 2014



Strong El Niño Develops

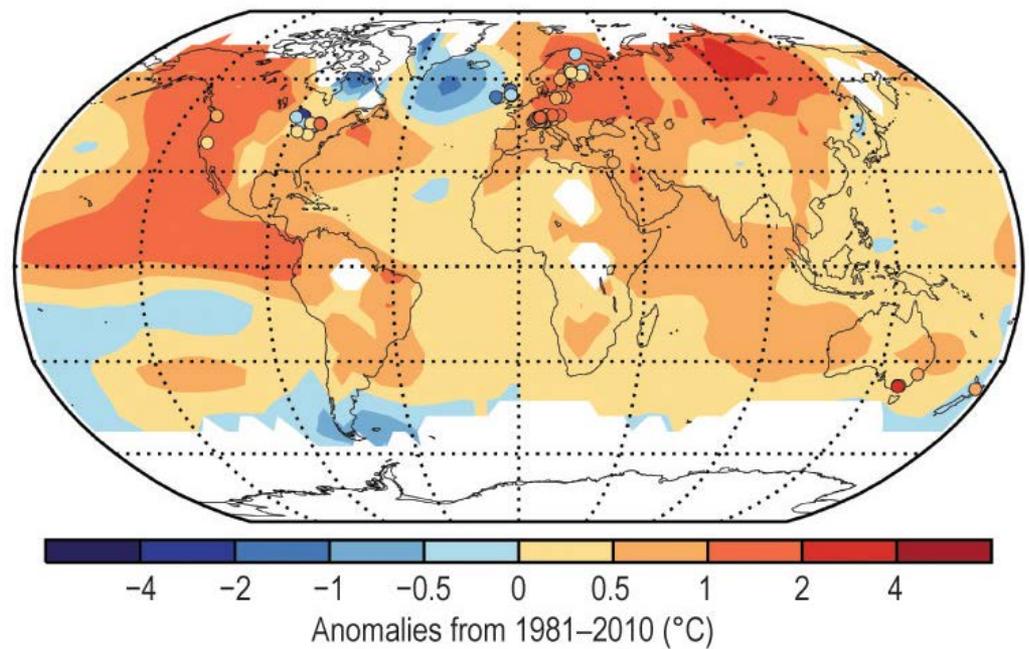
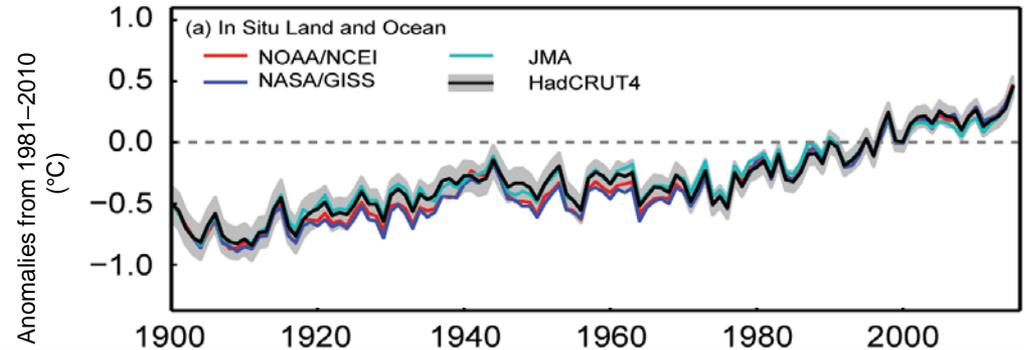


- Strongest event since 1997/98
- Impacts felt across the globe



Global Surface Temperature Reaches Record High for 2nd Straight Year

- Four major independent datasets show 2015 was the warmest year since records began in mid-to-late 19th century

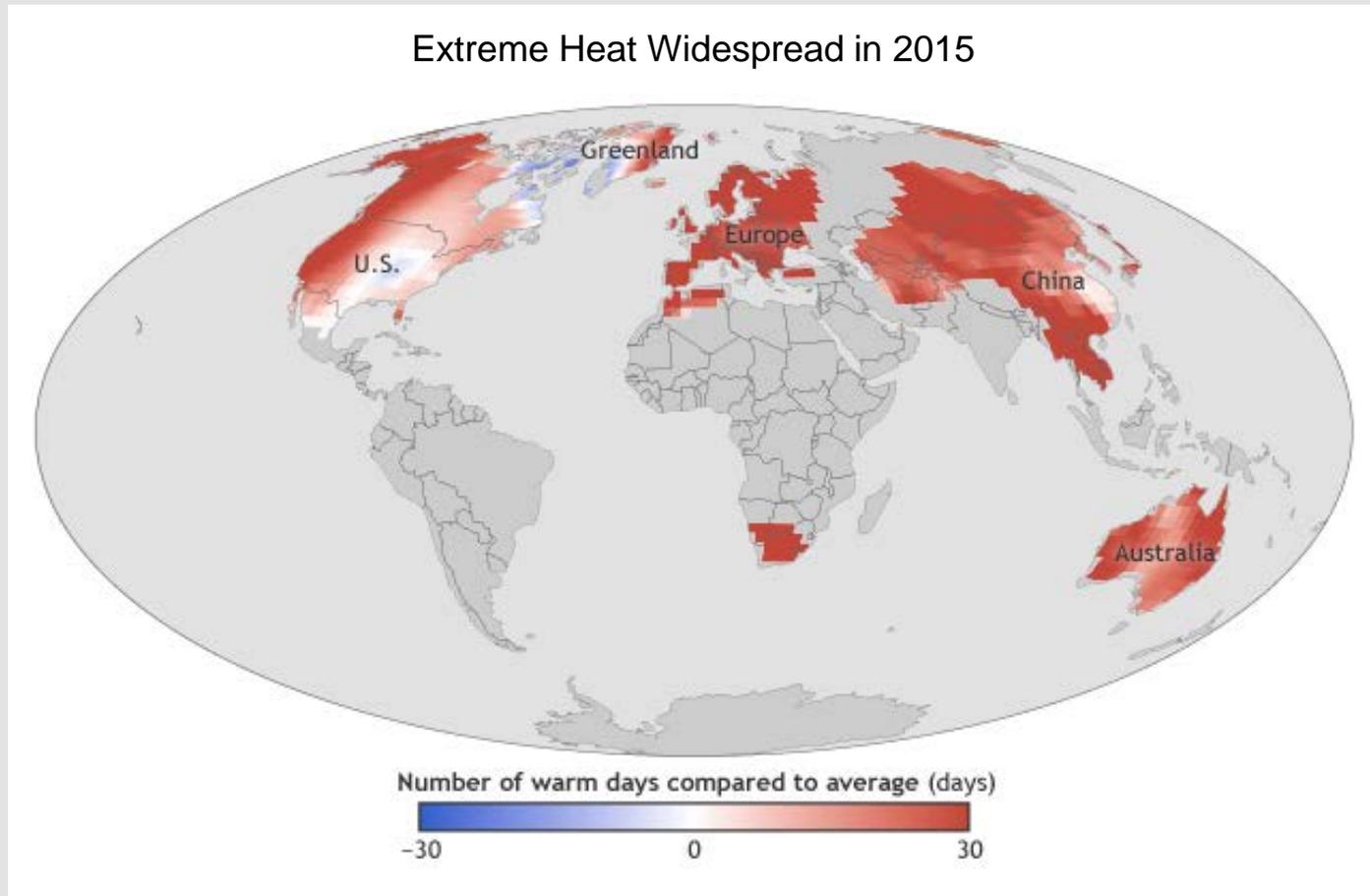


NOAA: Annual Average



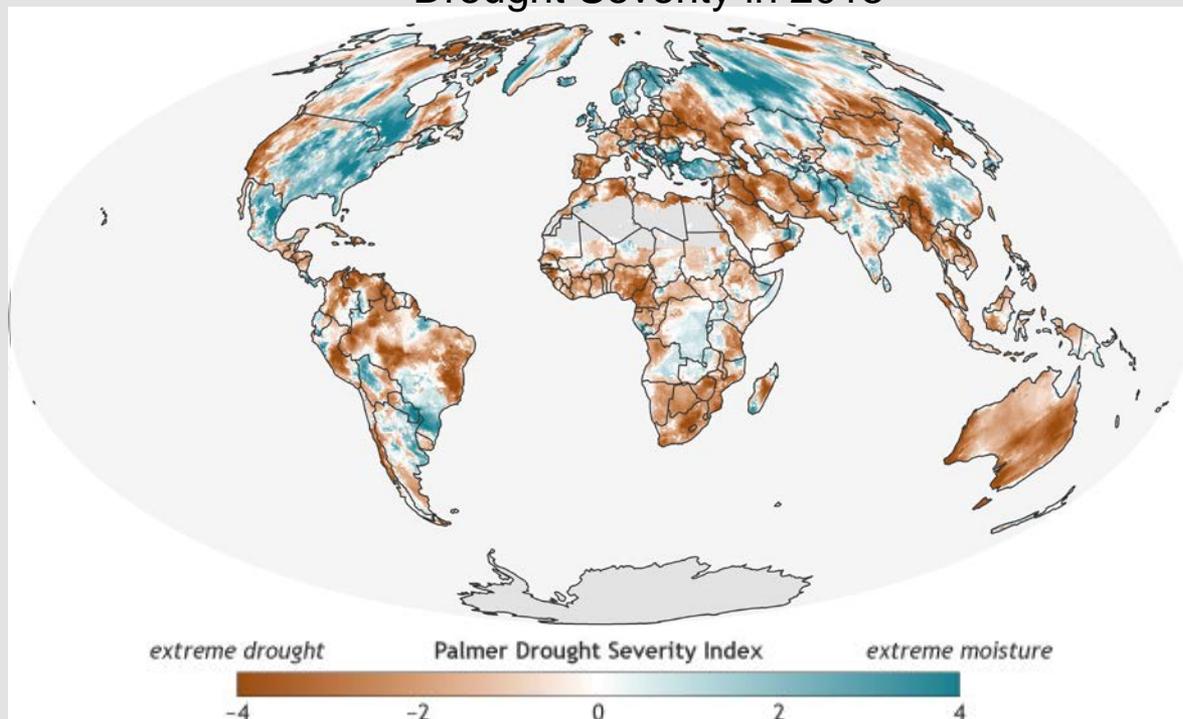
Extreme Warm Temperature Events Record High

- Western North America, Europe, and large parts of Asia and Australia experienced strong warm anomalies throughout much of the year.
- European summer heat waves
- Warm spring and autumn in Australia, Alaska, and western Russia



Drought Affects Nearly 1/3 of Global Land Surfaces

Drought Severity in 2015

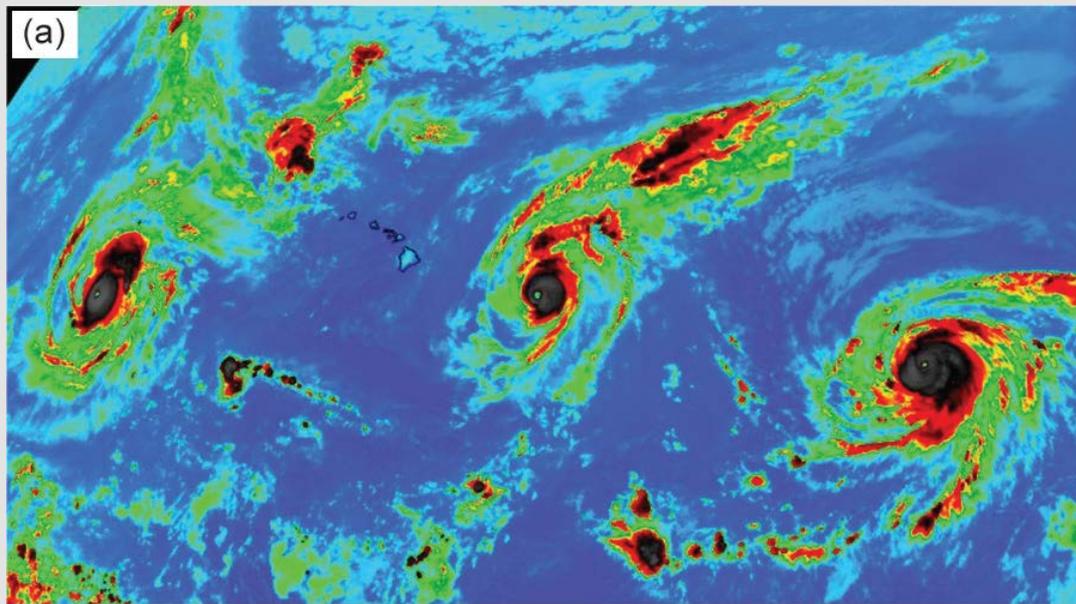


Areas in severe or extreme drought:
8% in 2014
14% in 2015

- Extreme drought occurred on every continent
- The Caribbean, the Amazon in South America, southern and eastern and southern Africa, and Southeast Asia all tend to experience dry conditions during El Niño

Active Year for Tropical Cyclones

Globally: 101 tropical cyclones in 2015
(1981-2010 average is 82)

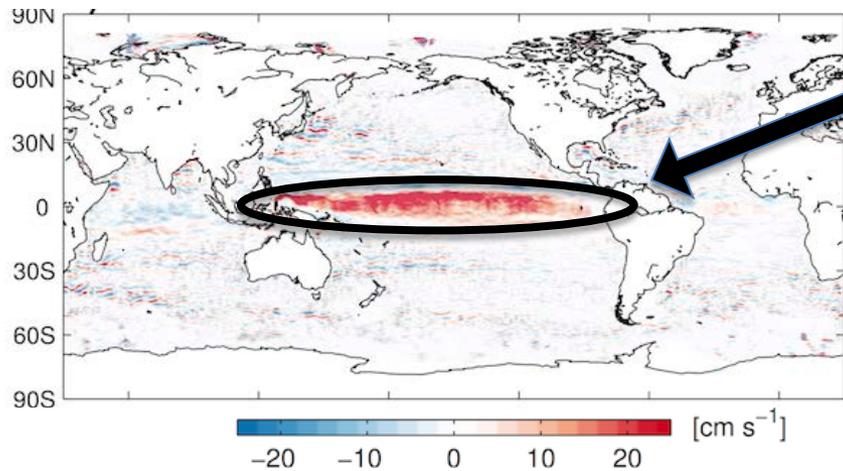


- Three Category 4 storms lined up in the eastern Pacific on August 30, 2015
- First time this has happened in any basin

- 36 storms reached major hurricane status (average is 21)
- The eastern/central Pacific basin had 26 named storms, the most since 1992. 11 were major hurricanes.

2015's Strong El Niño

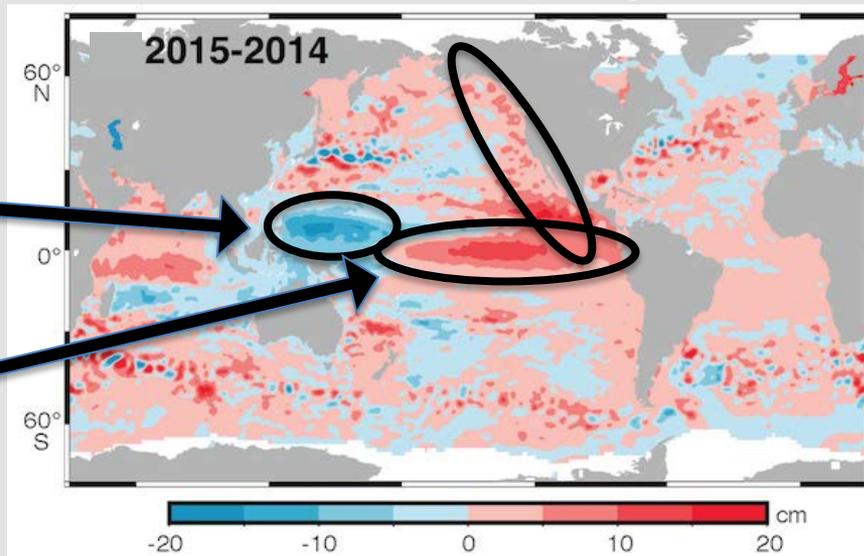
2015 East-West Surface Current Anomalies



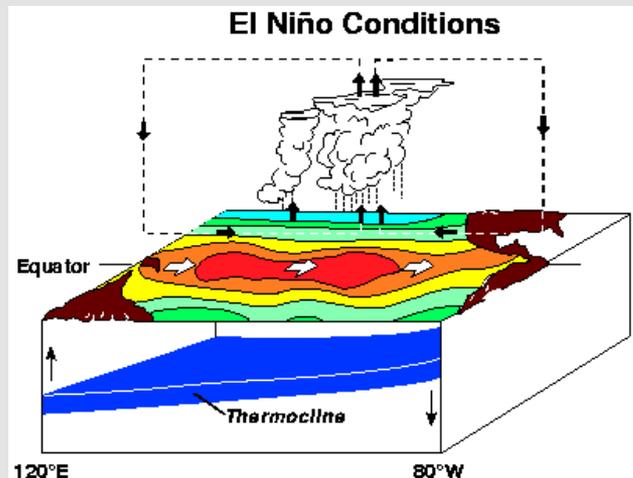
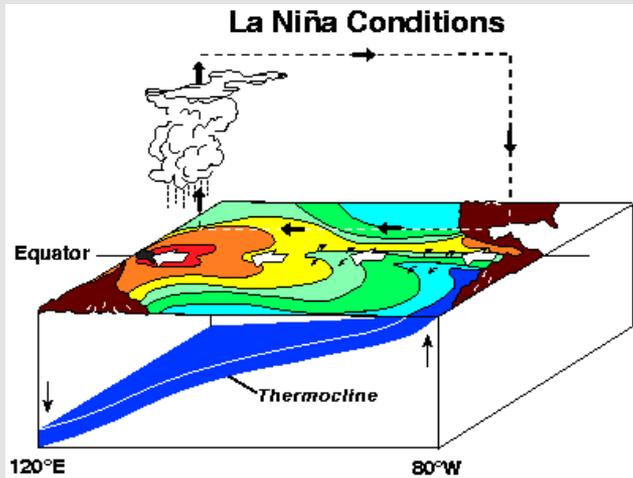
- Very strong eastward equatorial Pacific surface currents in 2015
- 2nd year in a row like this (2014 looked like an El Niño in the ocean)

- Sea level falls east of the Philippines from 2014 to 2015 (again for the 2nd year in a row)
- Sea level rises in the central and eastern equatorial Pacific, and off the west coast of North America.

2015 - 2014 Sea Surface Height



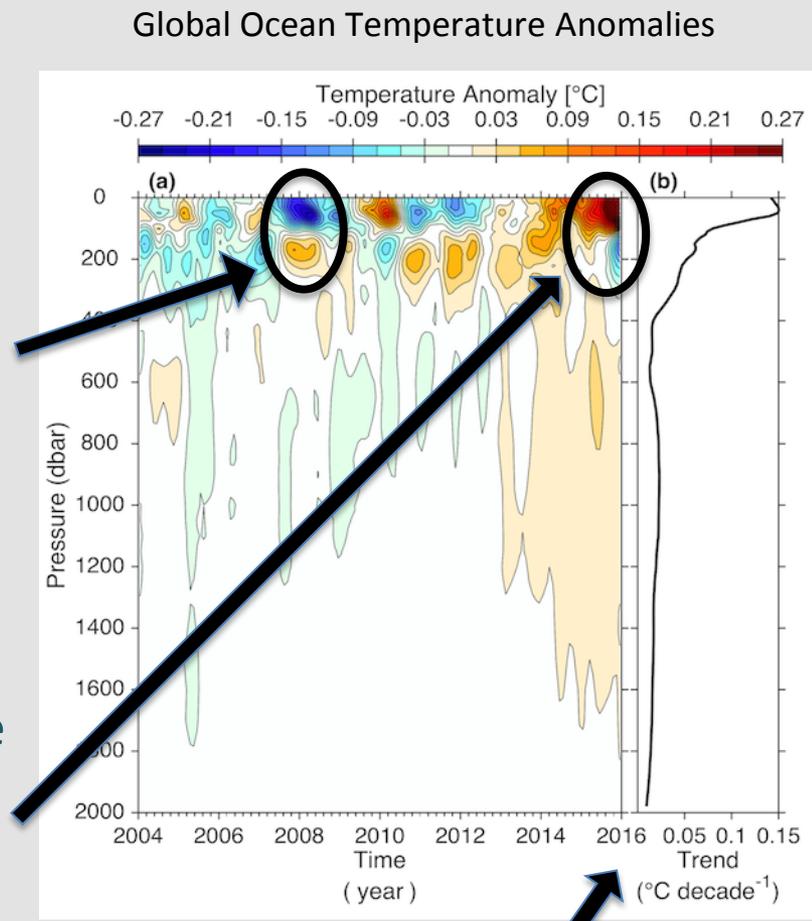
El Niño & La Niña Rearrange Ocean Heat



- La Niña conditions bring cold water to the surface (2008)

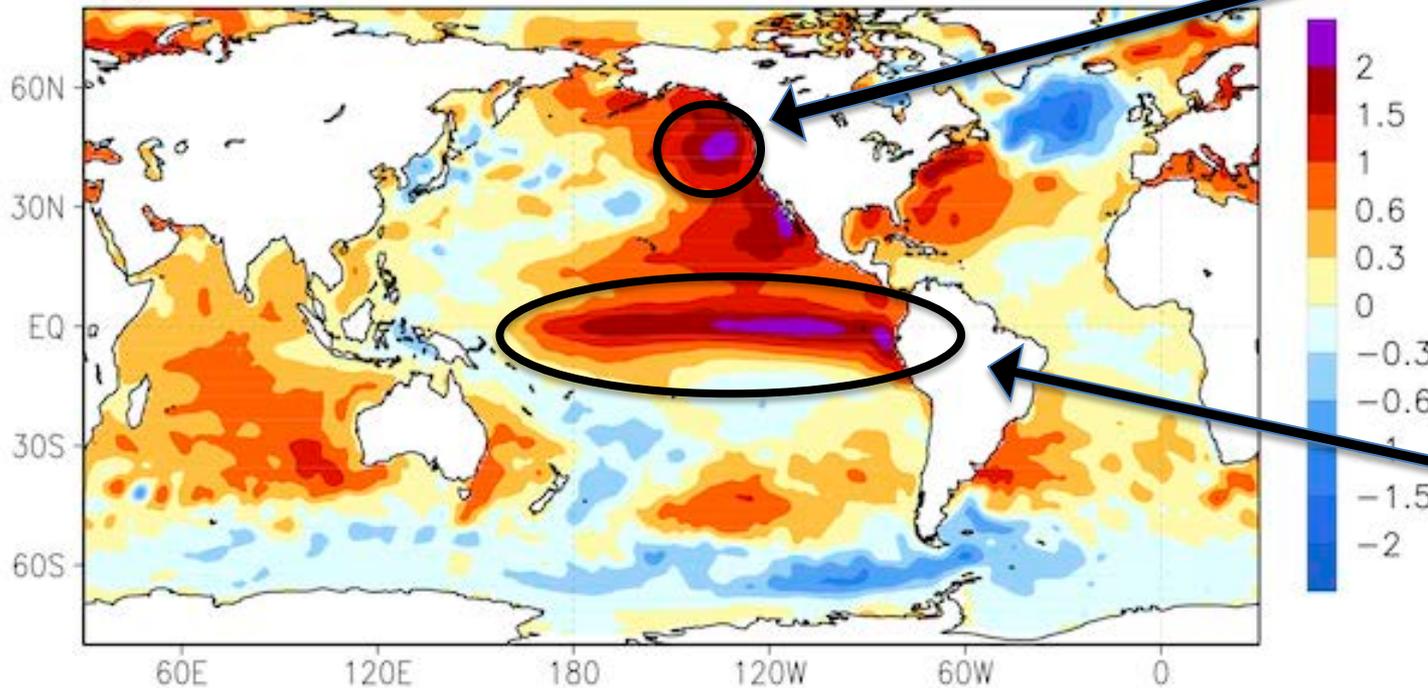
- El Niño conditions spread warm water over the surface (2015)

- Decadal warming trend to 2000 dbar



El Niño & "The Blob": Warm SSTs

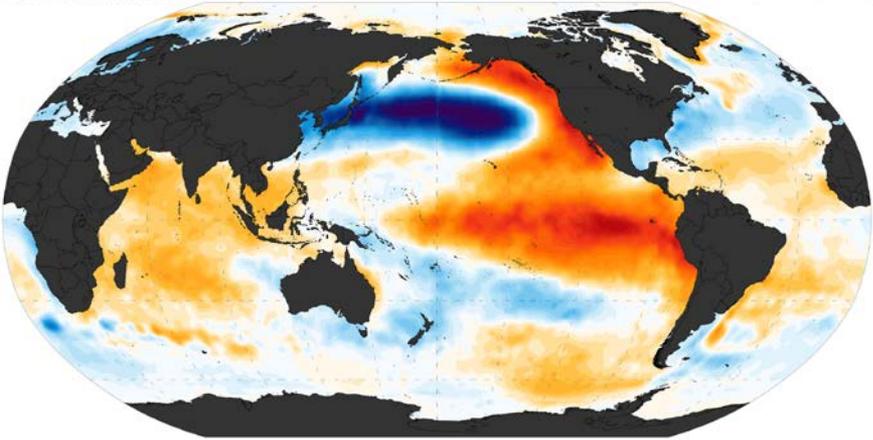
2015 SST Anomaly (°C)



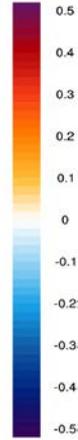
- Very warm SST off the Pacific Northwest ("The Blob") persists through much of 2015
- Very warm SST develops in the eastern equatorial Pacific (El Niño) during 2015

Pacific Decadal Oscillation in a Positive Phase

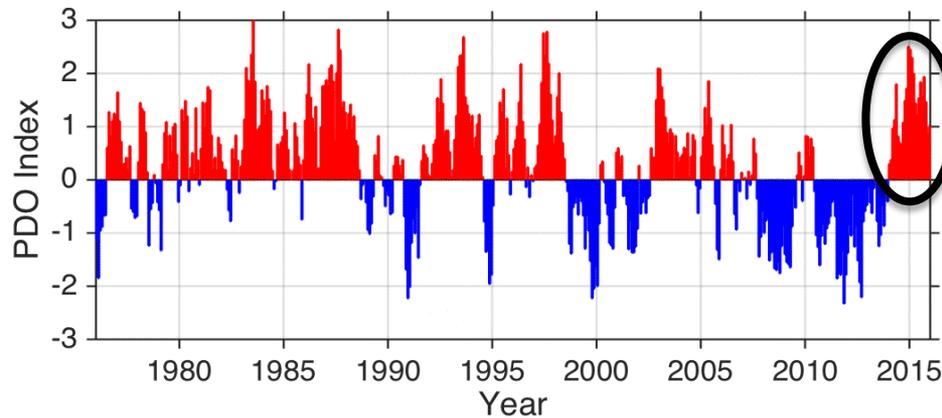
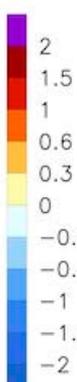
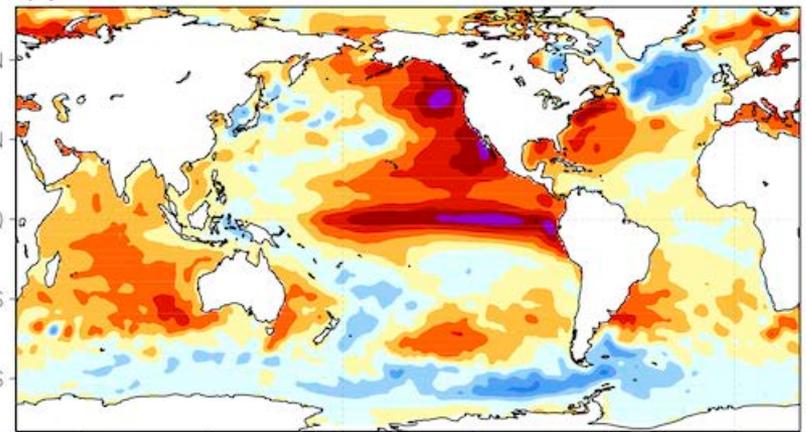
Pacific Decadal Oscillation



Temperature (°C sd⁻¹)



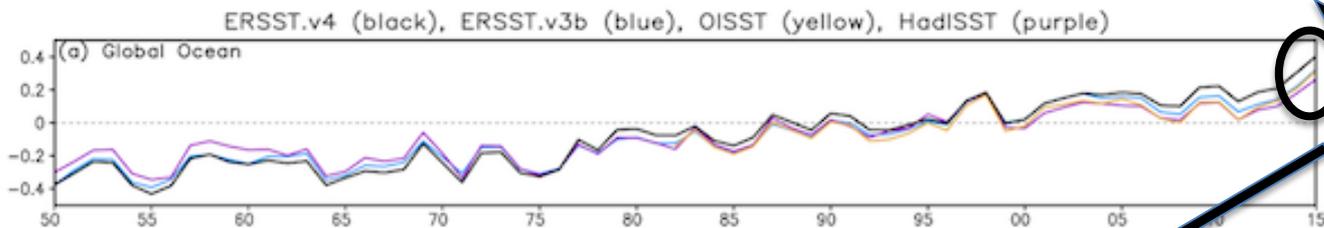
2015 SST Anomaly (°C)



- Warm phase of the Pacific Decadal Oscillation (PDO) started in 2014, continues through 2015.
- Warm in the tropics, along the west coast, and in Gulf of Alaska
- Cool east of Japan.
- Global and regional impacts...

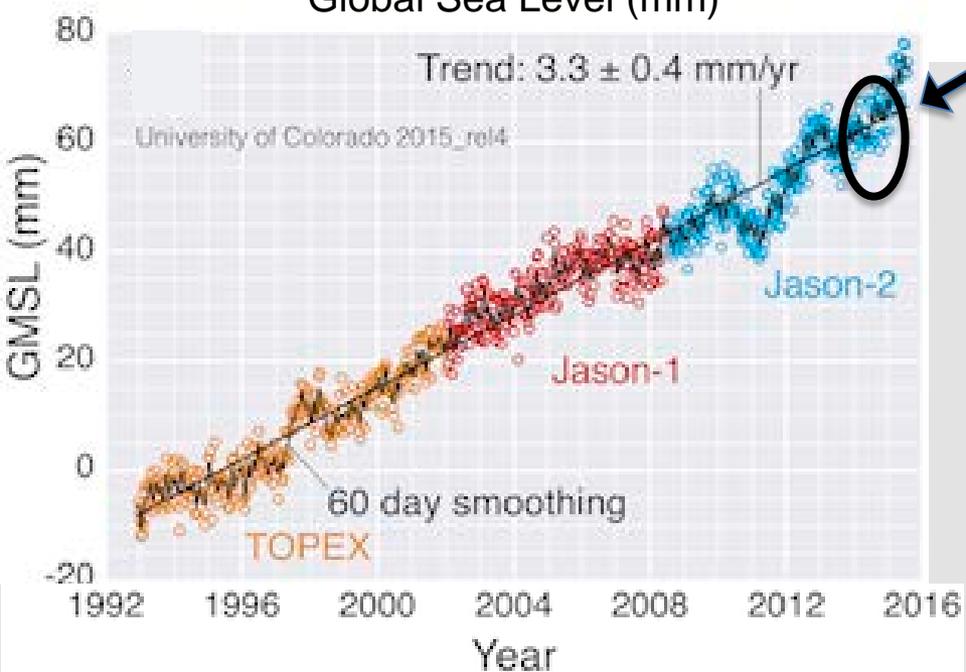
Record High SST, Sea Level, & Ocean Heat

Global SST Anomaly (°C)

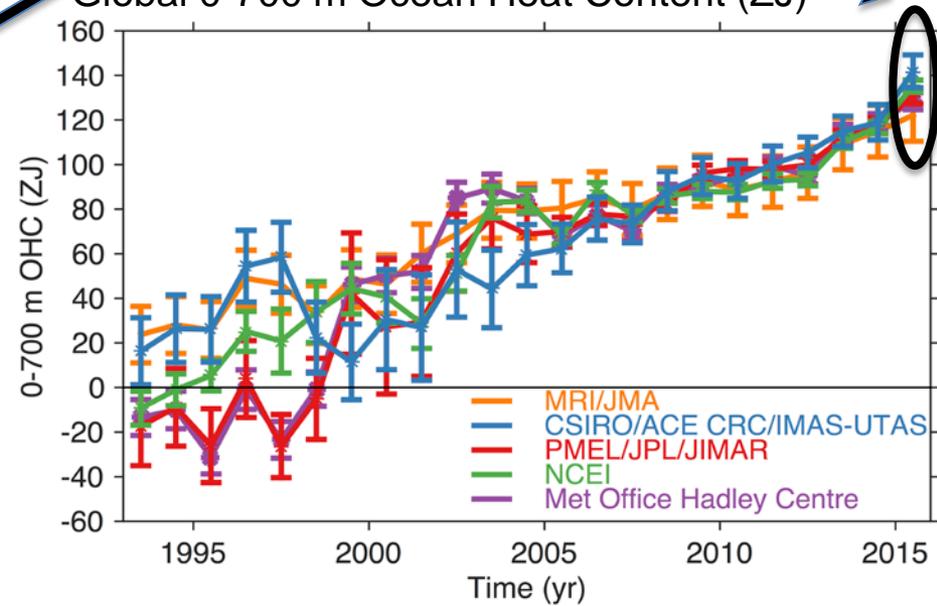


- 2015 Sea-Surface Temperature record high in all analyses
- 2015 Sea Level record high
- 2015 Upper (0-700 m) Ocean Heat Content Anomaly record high in all analyses

Global Sea Level (mm)

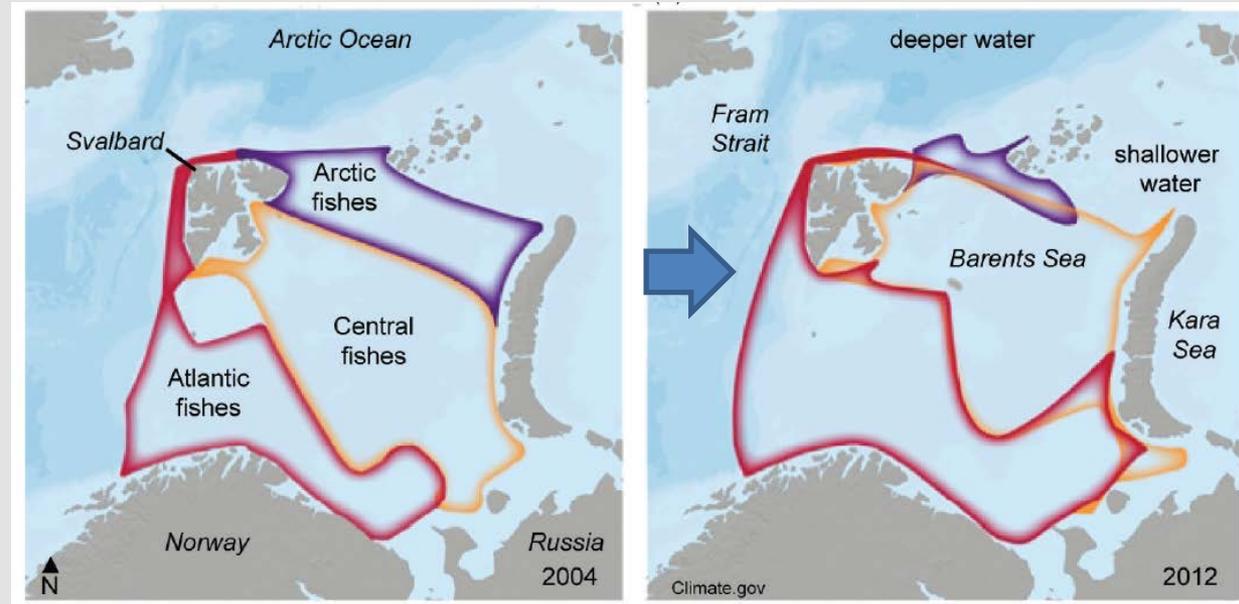


Global 0-700 m Ocean Heat Content (ZJ)



Rapid Change Affects Living Systems

- Plants and animal life on the move
- More southern species and more “generalist” species adapting; more northern and more specialized species under stress

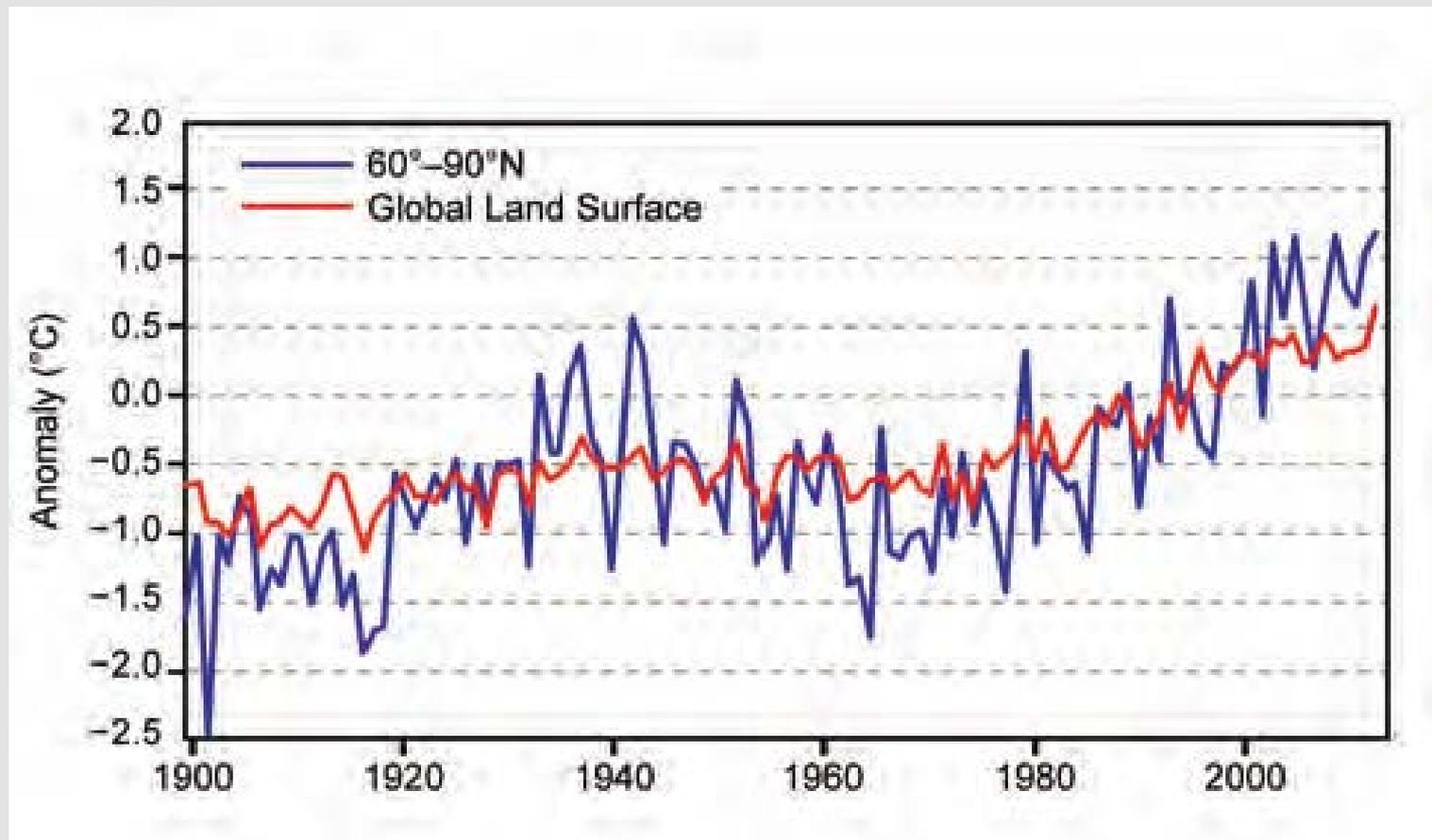


Fisheries in the Barents Sea: 2004 vs. 2012

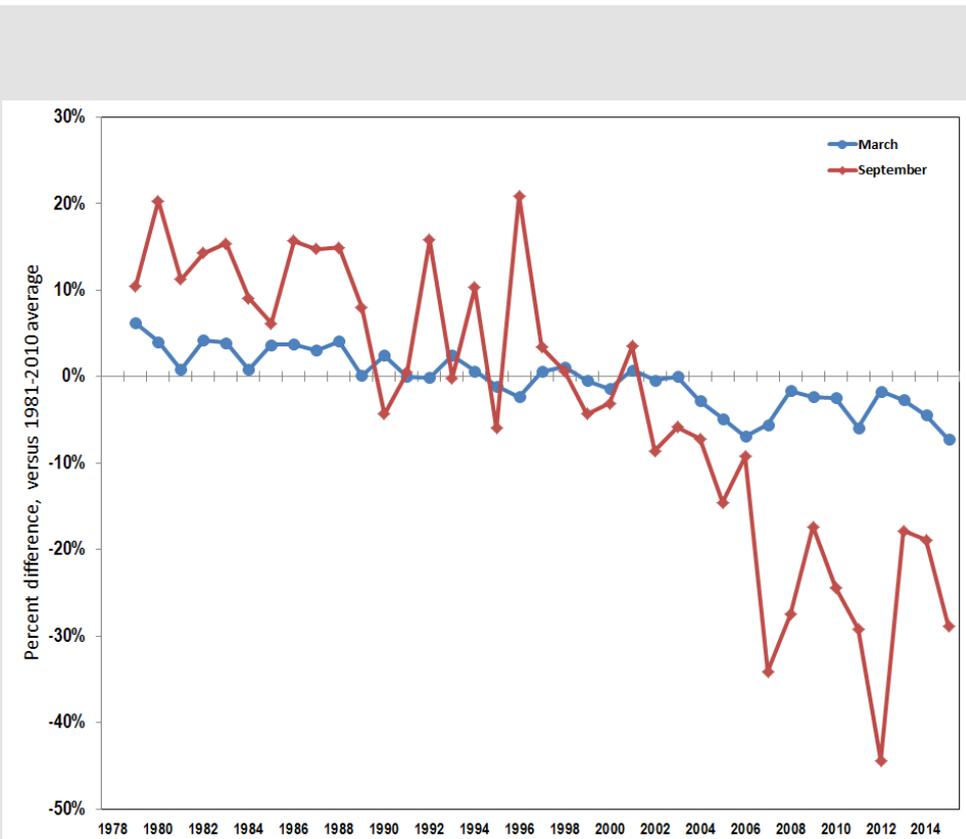
- Late summer temperature at the seafloor of the Barents Sea has increased by almost 1°C during the last decade
- Average surface temperatures in ice-free regions in August 2015 were up to 8°C above average in the Chukchi, Barents, and Kara Seas

Arctic Temperature "Amplification"

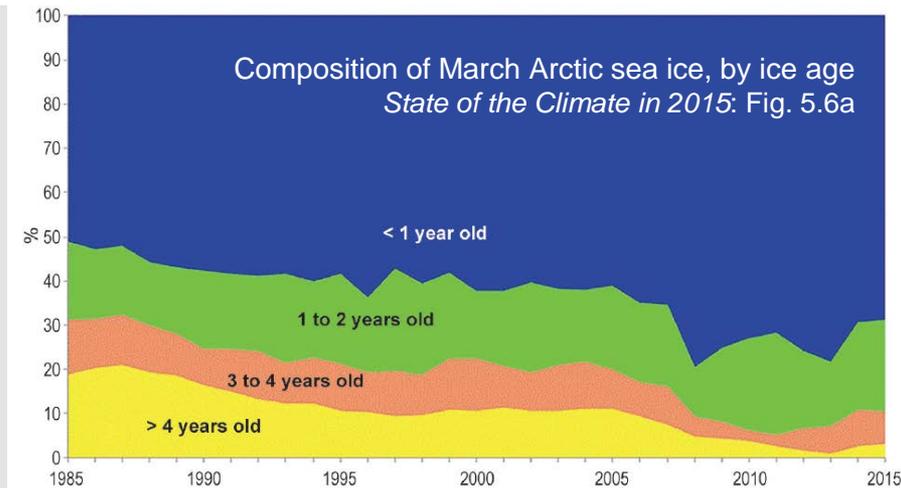
Currently, the Arctic is warming at twice the rate of lower latitudes.



Arctic Sea Ice

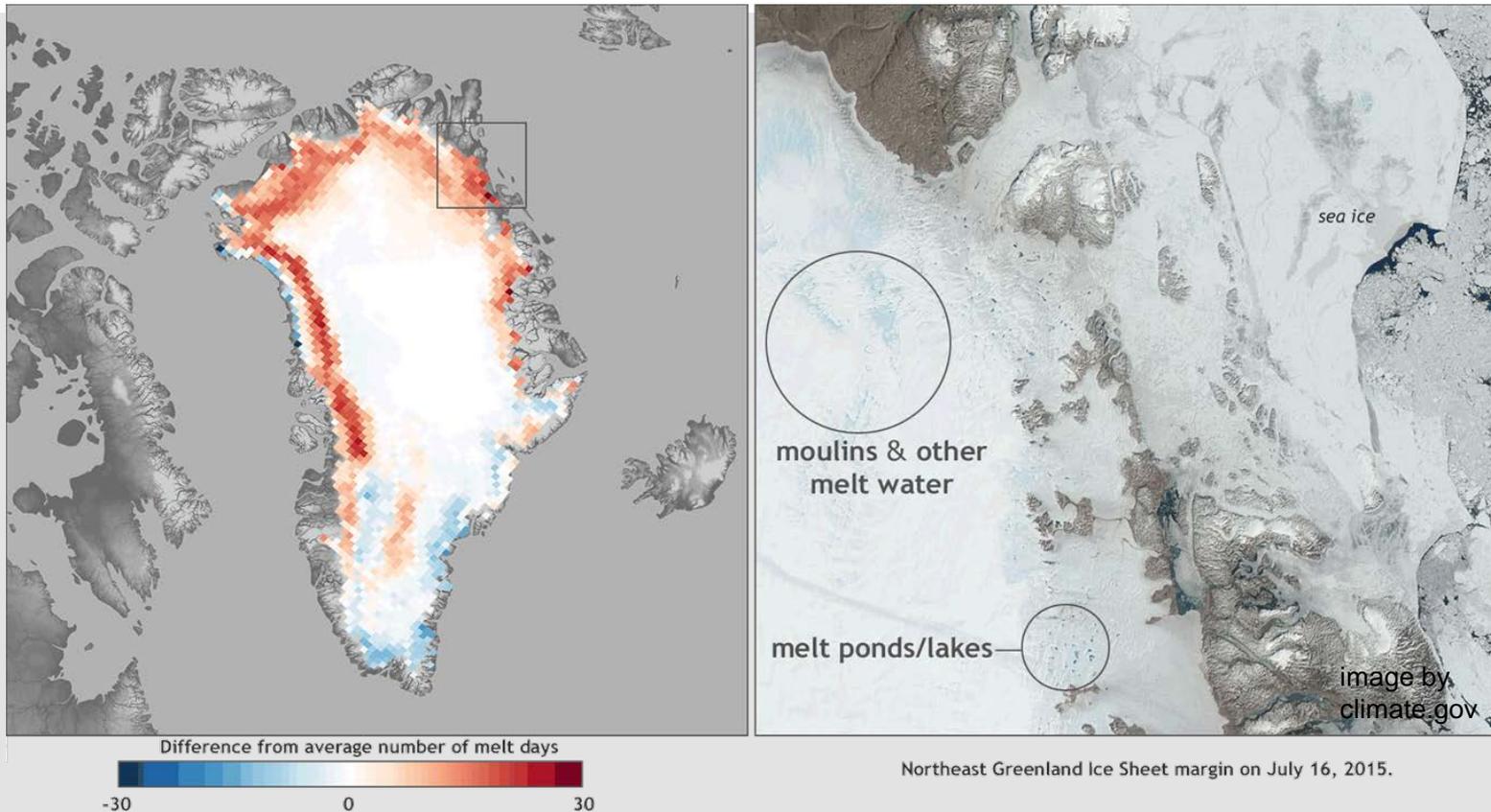


Change in Arctic sea ice extent during March and September
Adapted from *State of the Climate in 2015*: Fig. 5.5



- 25 Feb 2015: Lowest maximum extent in 37-year satellite record
- 9 lowest minimum extents have occurred in past 9 years.
- February-March 2015:
 - ✓ 4+ year ice made up 3% of pack (vs 20% in 1985)
 - ✓ First year ice made up 70% of pack (vs. 35% in 1985)

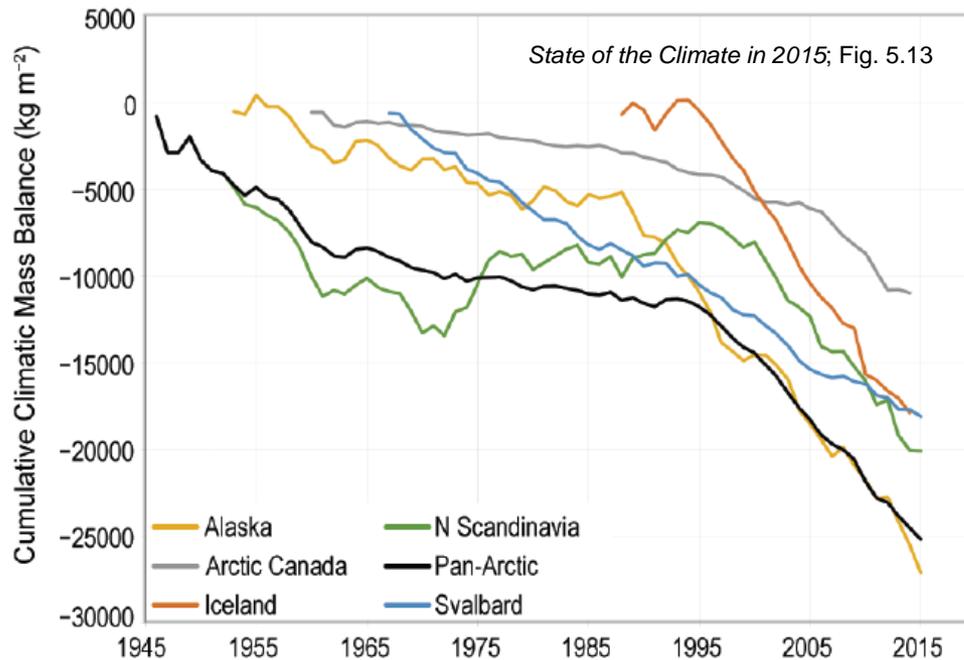
Greenland Ice Sheet



- The number of melt days during 2015 was much higher than normal for much of Greenland
- 52% of the ice sheet in melt on July 4th, 2015

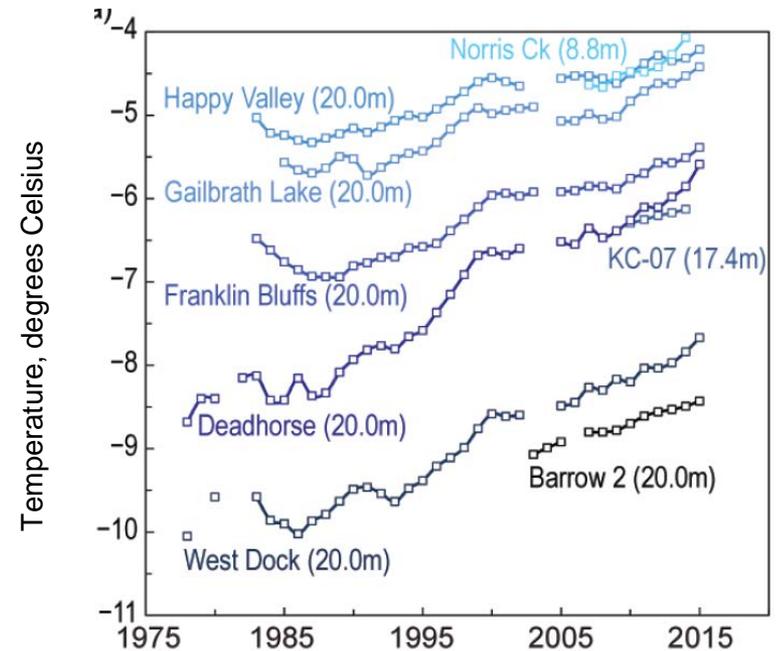
Glaciers and Permafrost Changes

Cumulative glacier mass for several Arctic regions



- Globally: preliminary data indicates 2015 will be the 36th consecutive year of glacier ice loss

Permafrost temperature at several North American locations



- Permafrost changes: warming at continuously frozen locations (as above), more thawing at locations with annual freeze / thaw cycle, and novel thawing at some locations

For More Information



Link to Full Report and Today's Presentation:

<http://www.ncdc.noaa.gov/bams>

Report Highlights:

<https://www.climate.gov/news-features/features/2015-state-climate-highlights>

NOAA's National Centers for Environmental Information:

www.ncdc.noaa.gov

NOAA's Pacific Marine Environmental Laboratory:

www.pmel.noaa.gov

U.S. Army Corps of Engineers Cold Regions Research and Engineering
Laboratory:

<http://www.erdc.usace.army.mil/Locations/CRREL.aspx>

Climate Portal:

www.climate.gov

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