Climate Indicators Summary November 2016

PMNM Climate Change Working Group

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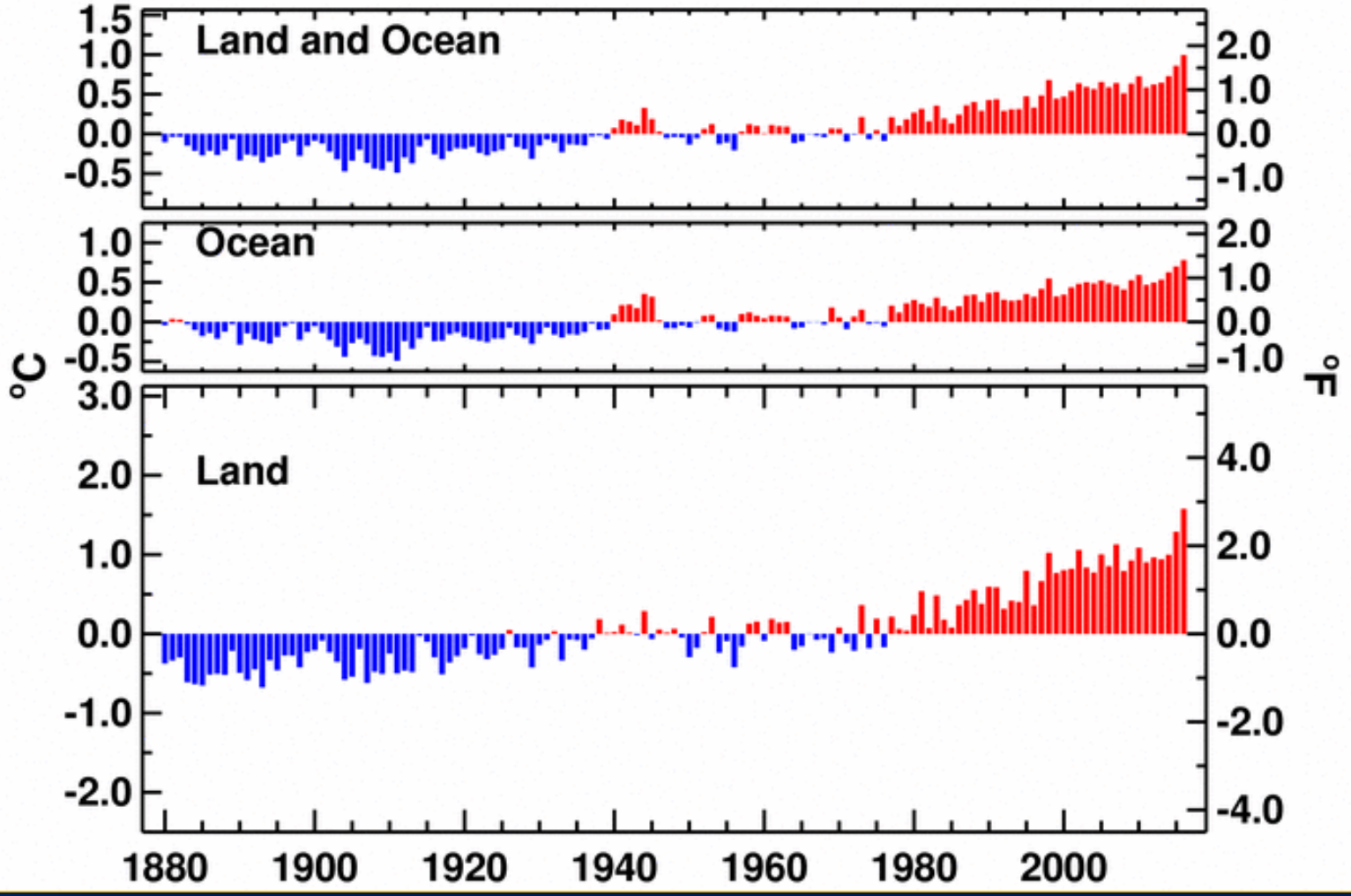
Honolulu, HI

Jan-Sep Global Surface Mean Temp Anomalies

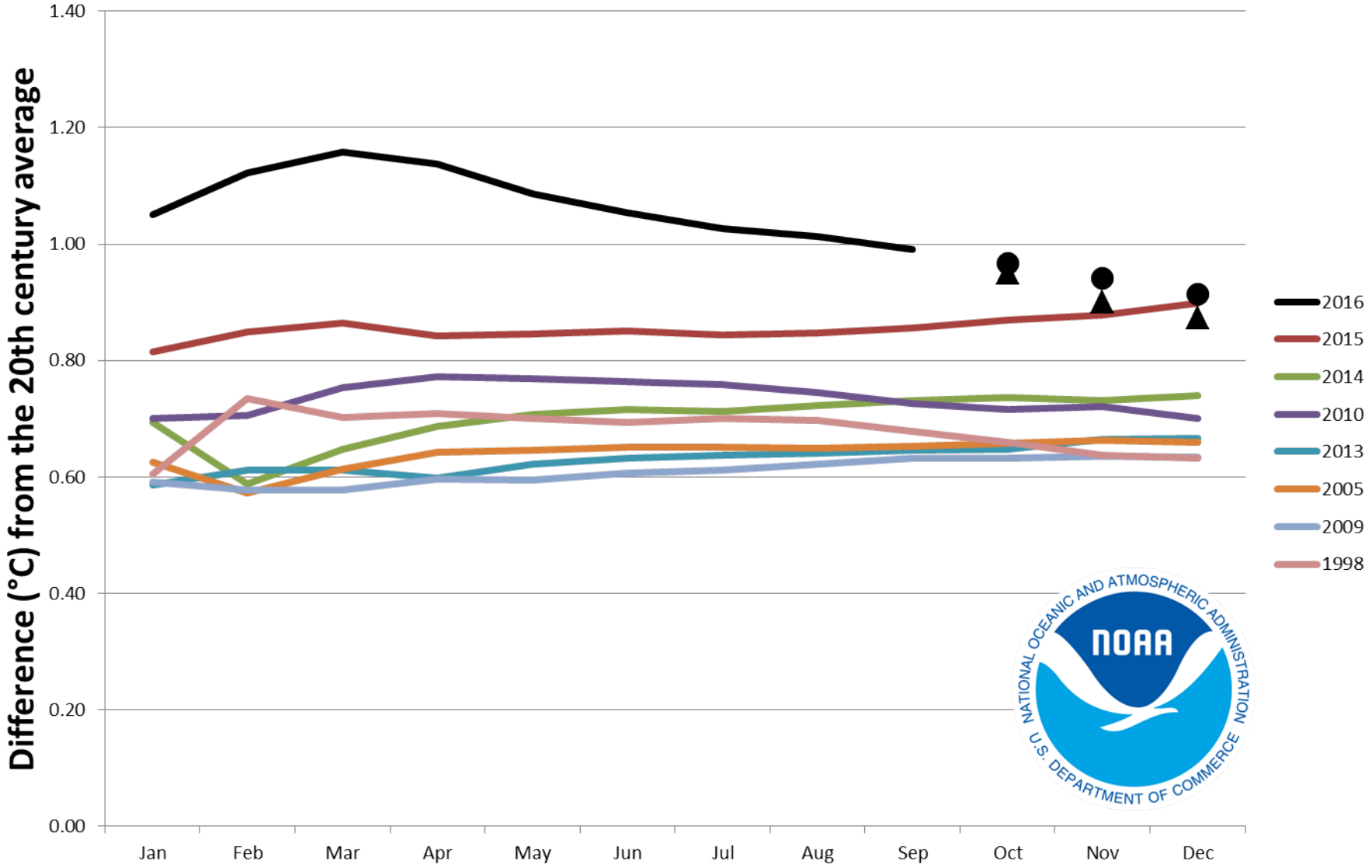
NCEI/NESDIS/NOAA

Analysis is based upon Smith et al. (2008) methodology.



Year-to-Date Global Temperatures

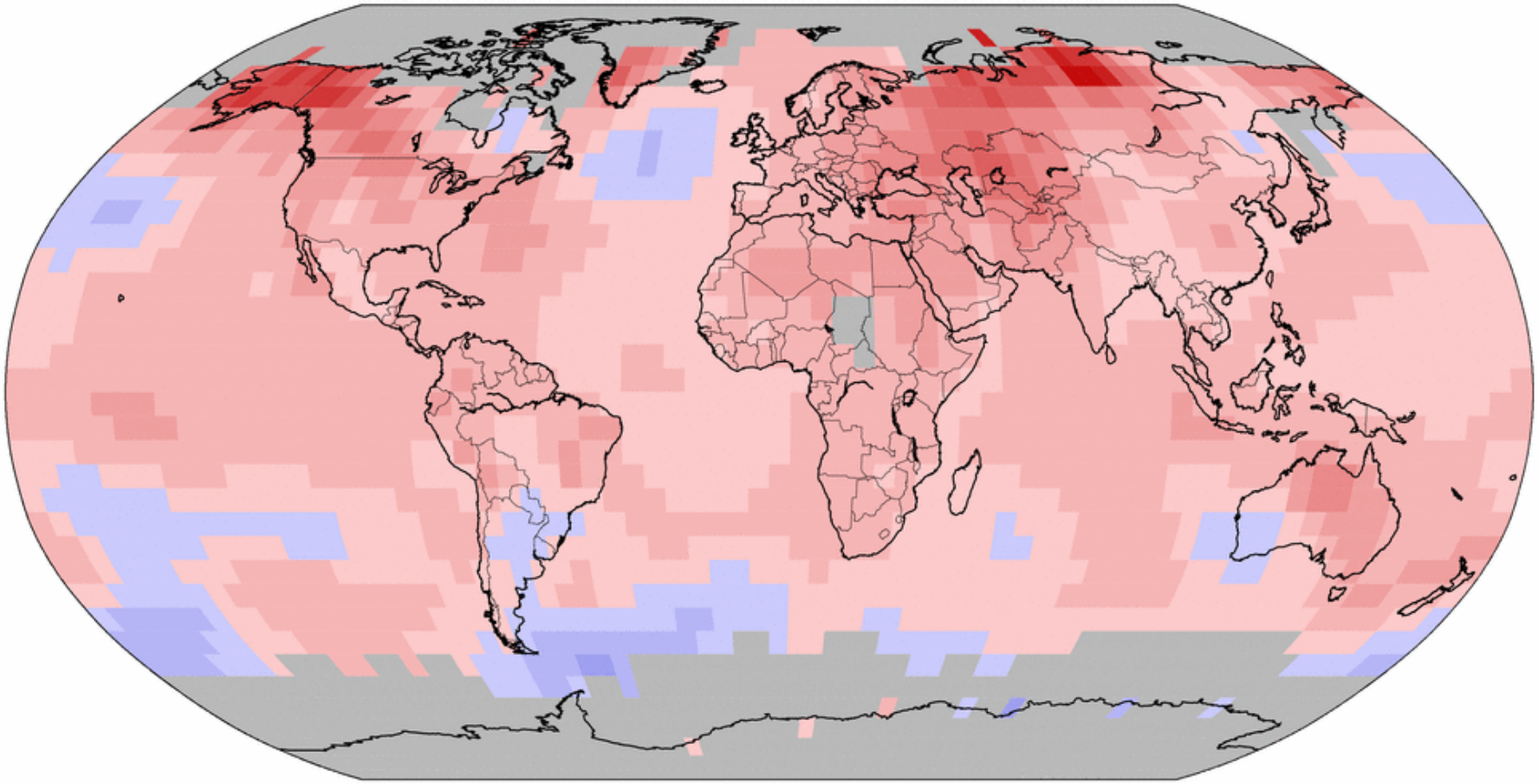
for 2016 and the other seven warmest years on record



Land & Ocean Temperature Departure from Average Jan–Aug 2016

(with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



−5 −4 −3 −2 −1 0 1 2 3 4 5

Degrees Celsius

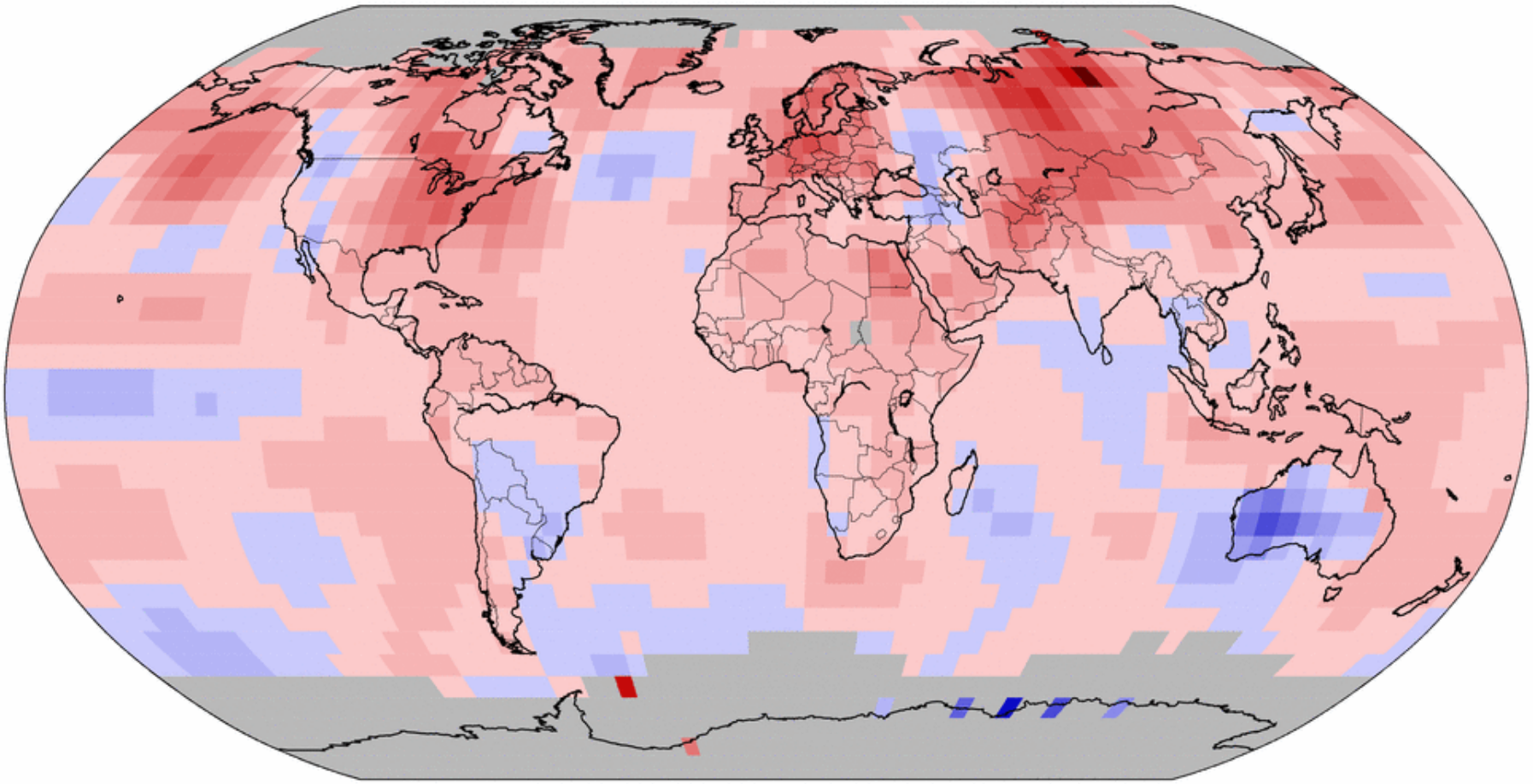
National Centers for Environmental Information
Fri Sep 16 10:01:08 EDT 2016

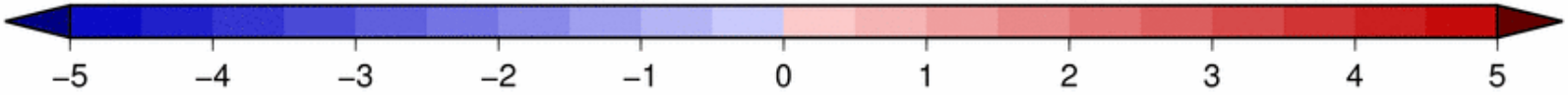
Please Note: Gray areas represent missing data
Map Projection: Robinson

Land & Ocean Temperature Departure from Average Sep 2016

(with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0





Degrees Celsius

National Centers for Environmental Information

Thu Oct 13 07:09:27 EDT 2016

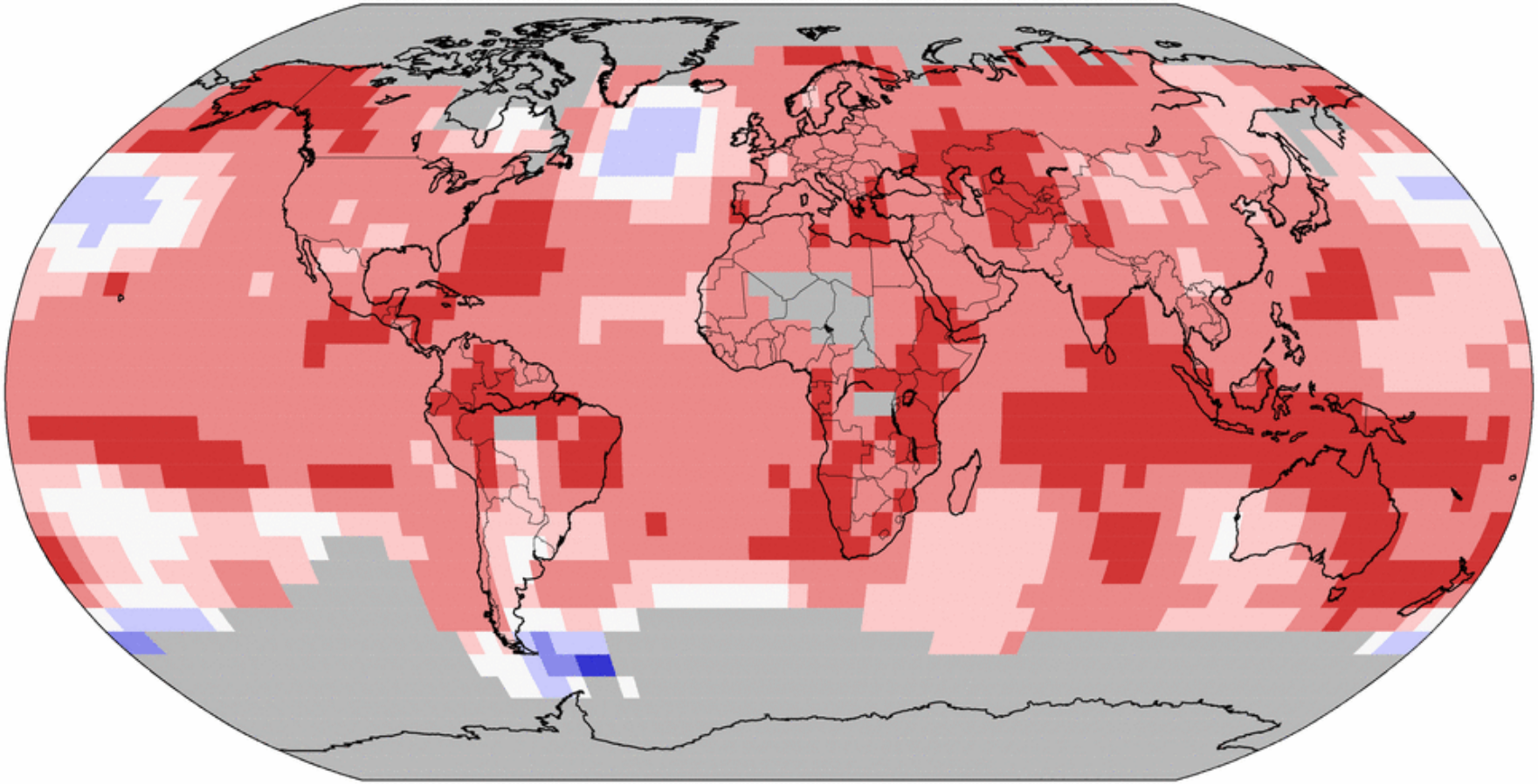
Please Note: Gray areas represent missing data

Map Projection: Robinson

Land & Ocean Temperature Percentiles Jan–Aug 2016

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



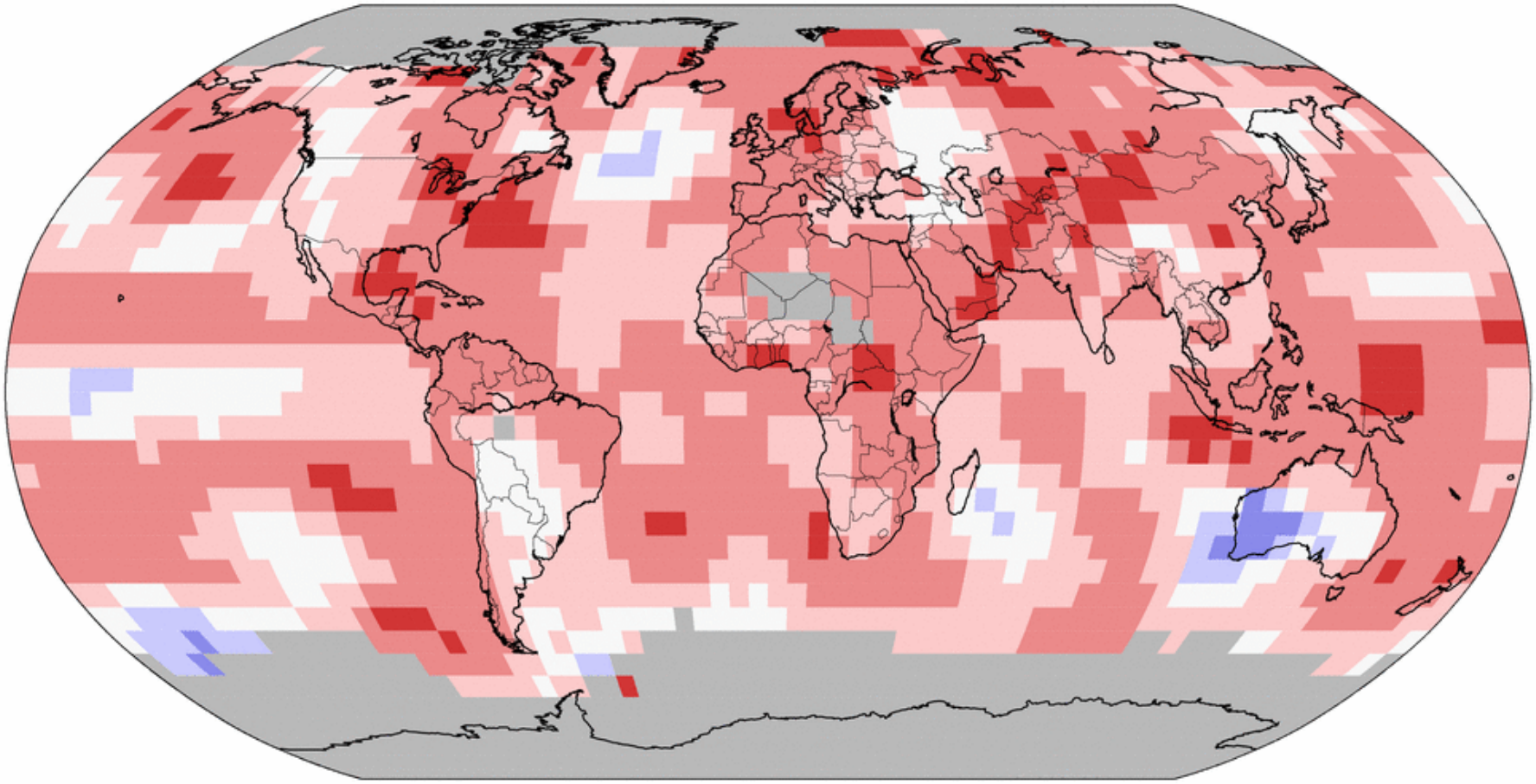
Record Coldest | Much Cooler than Average | Cooler than Average | Near Average | Warmer than Average | Much Warmer than Average | Record Warmest

Fri Sep 16 09:45:33 EDT 2016

Land & Ocean Temperature Percentiles Sep 2016

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



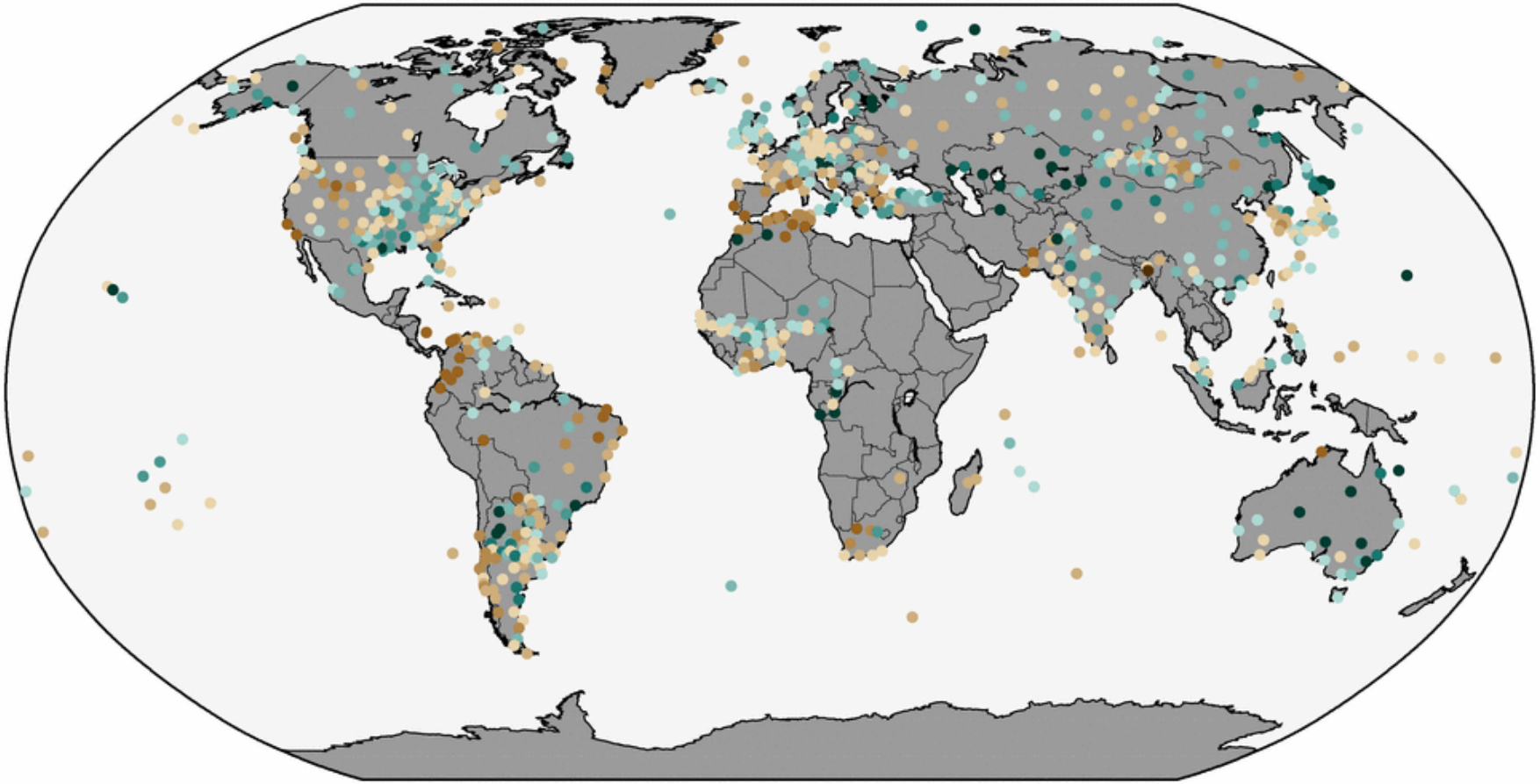
Record Coldest | Much Cooler than Average | Cooler than Average | Near Average | Warmer than Average | Much Warmer than Average | Record Warmest

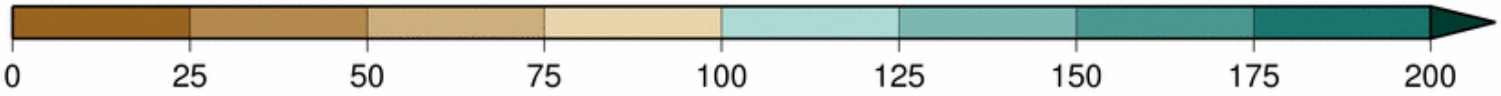
Thu Oct 13 07:09:39 EDT 2016

Land–Only Percent of Normal Precipitation Jun 2016–Aug 2016

(with respect to a 1961–1990 base period)

Data Source: GHCN–M version 2





Percent

National Centers for Environmental Information

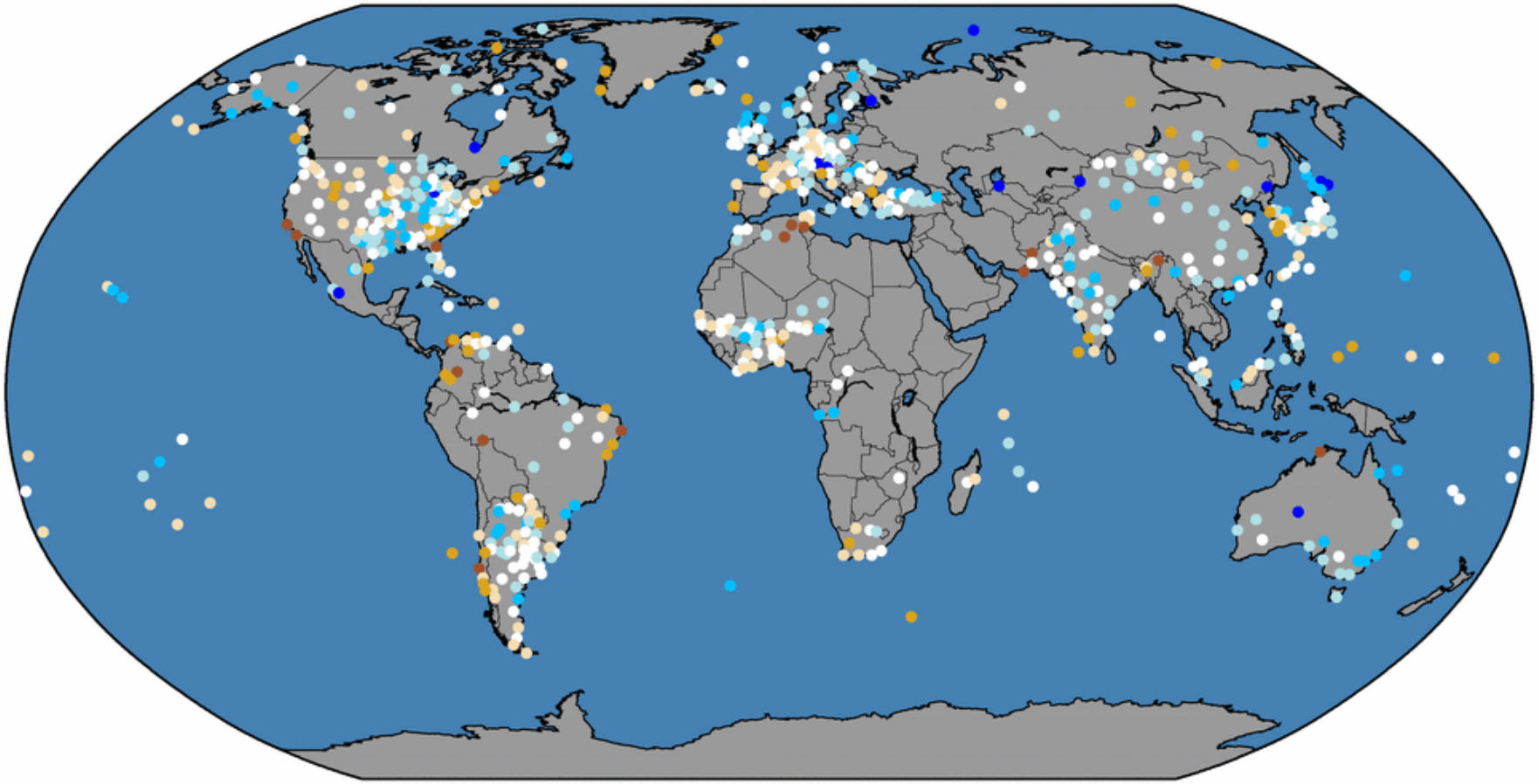
Please Note: Gray areas represent missing data

Map Projection: Robinson

Land–Only Precipitation Percentiles Jun 2016–Aug 2016

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 2



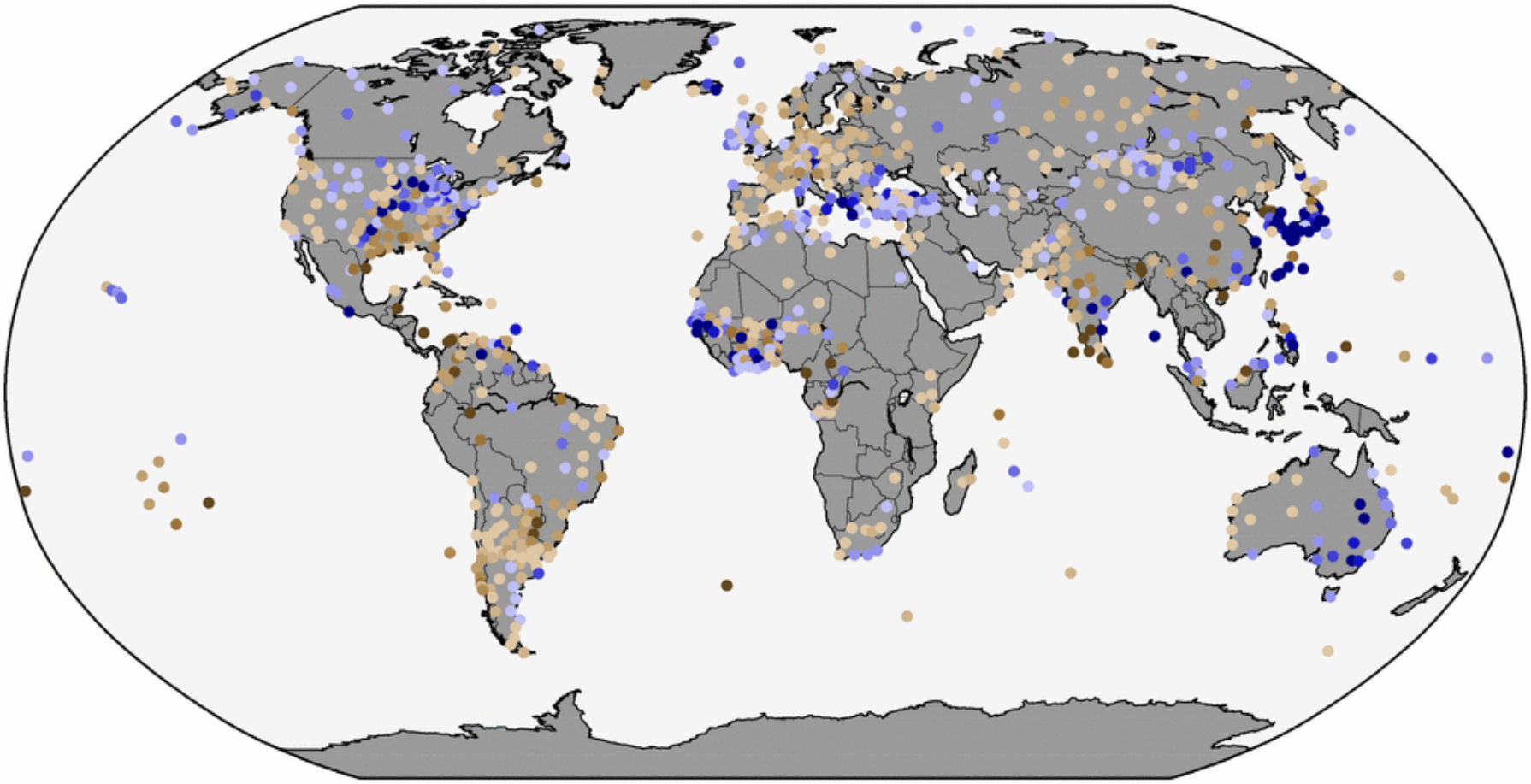
Record Driest | Much Drier than Average | Drier than Average | Near Average | Wetter than Average | Much Wetter than Average | Record Wettest

Fri Sep 16 09:35:27 EDT 2016

Land–Only Precipitation Anomalies Sep 2016

(with respect to a 1961–1990 base period)

Data Source: GHCN–M version 2



−100 −80 −60 −40 −20 0 20 40 60 80 100

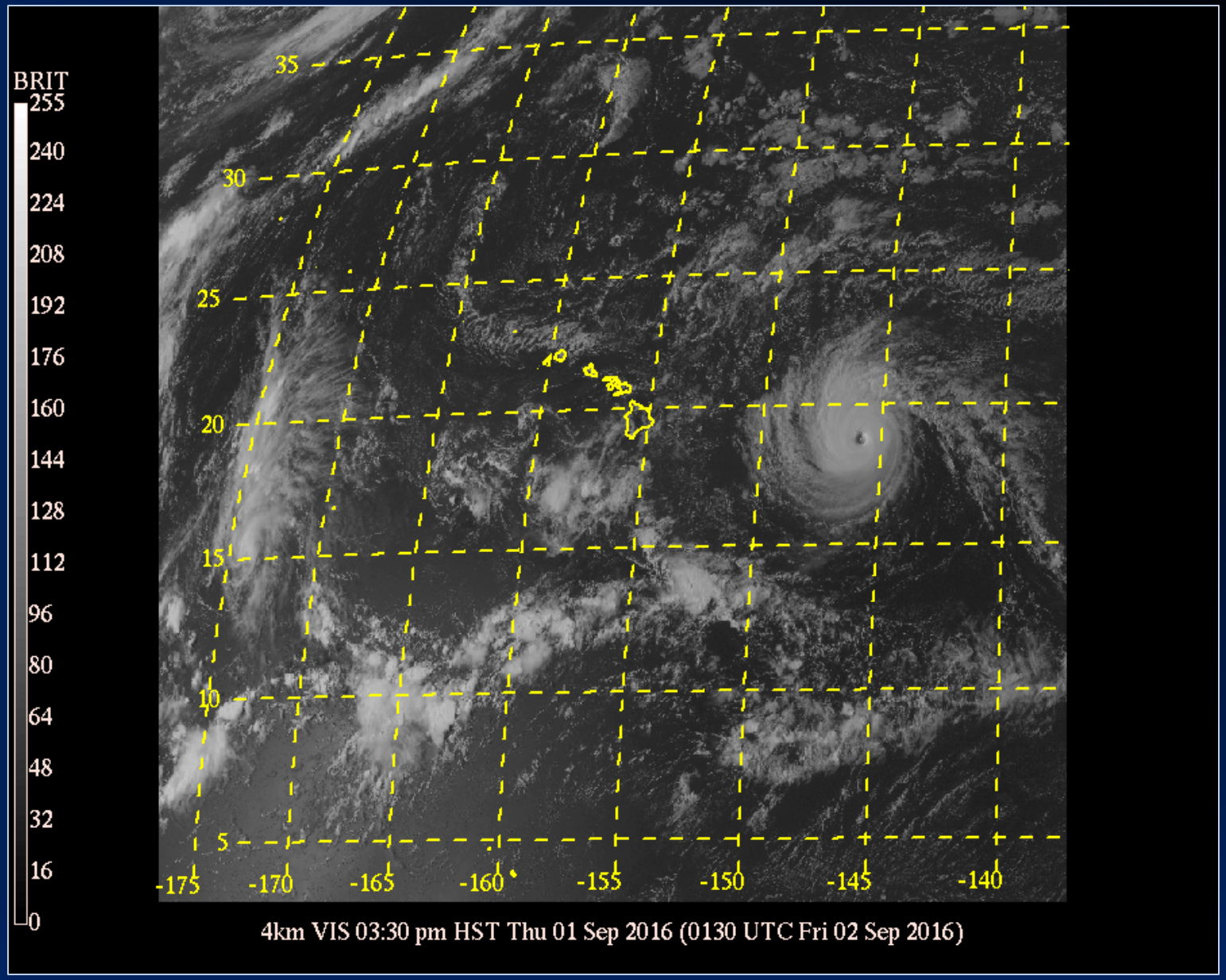
Millimeters

National Centers for Environmental Information

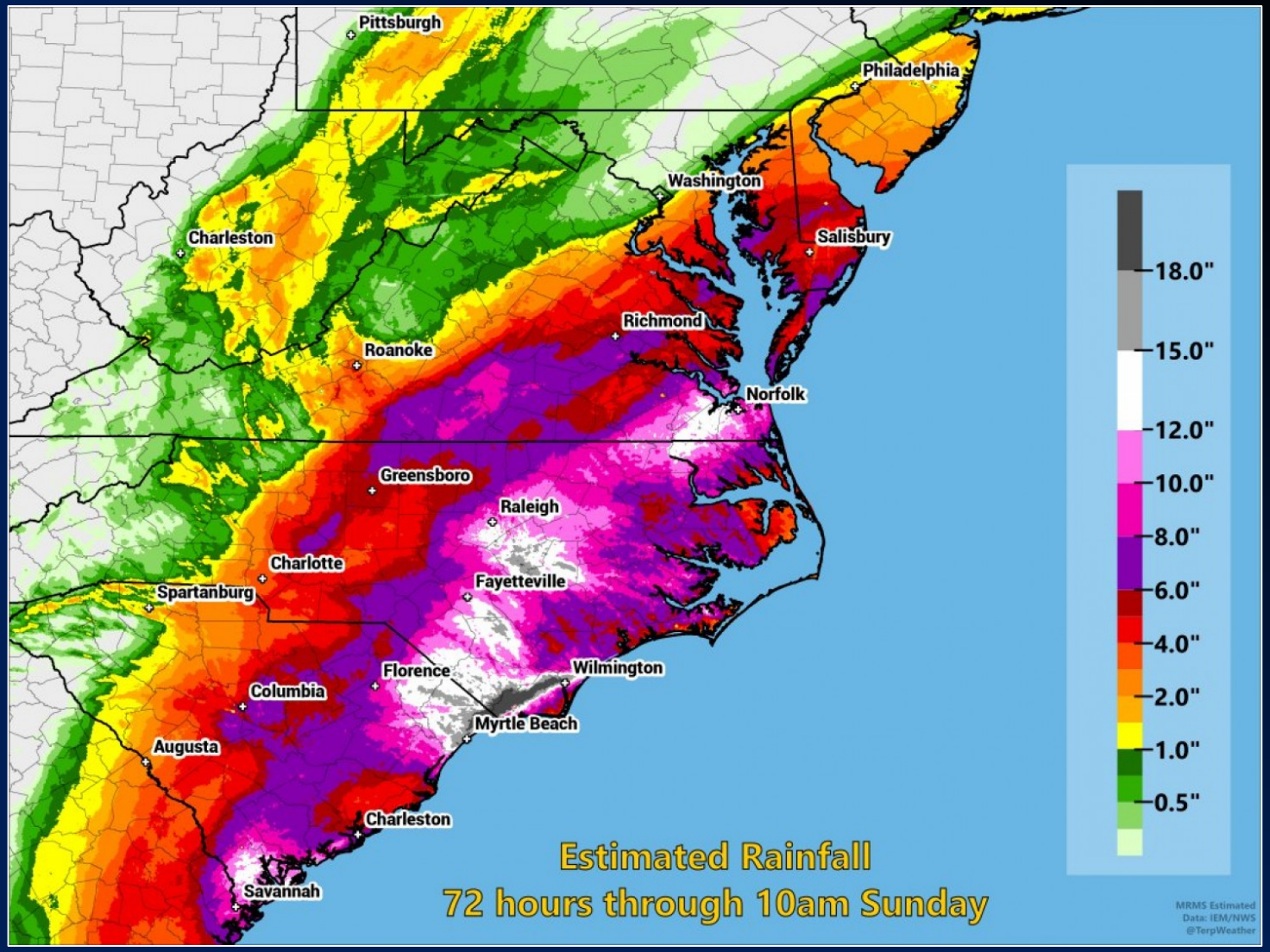
Please Note: Gray areas represent missing data

Map Projection: Robinson

Hurricane Lestor, 1 September 2016



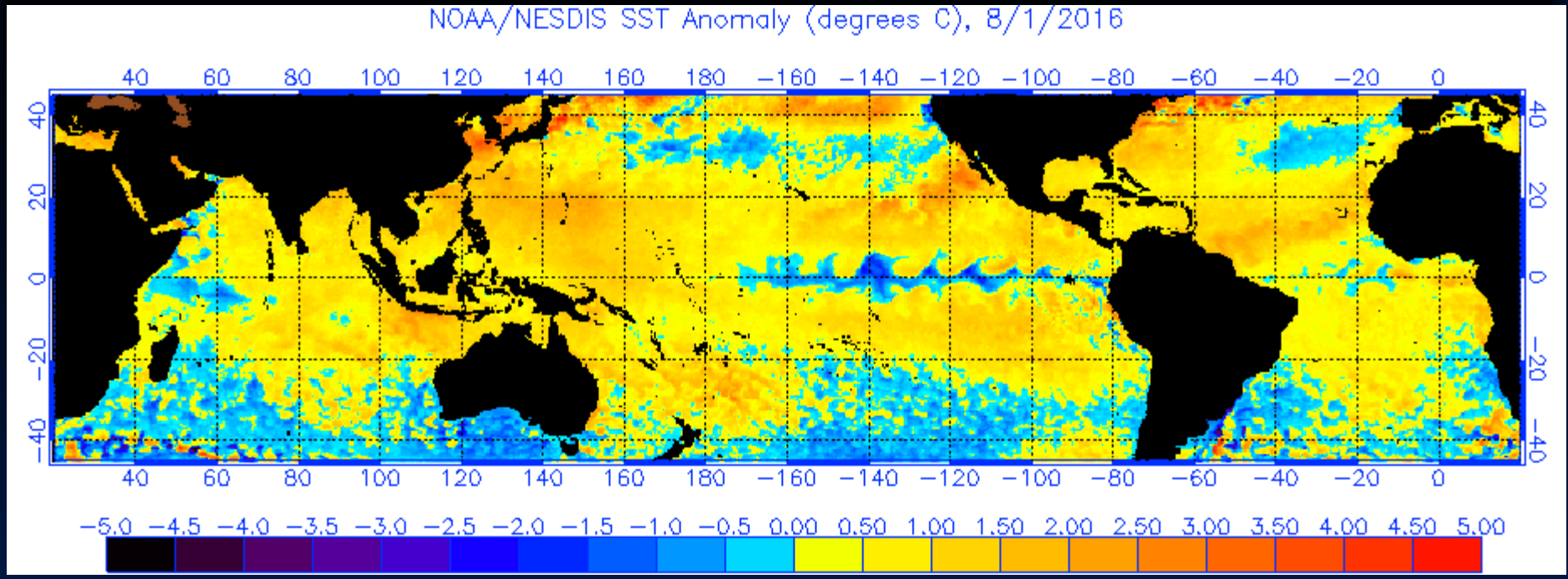
Digression #1 – A Warmer Atmosphere Holds More Water



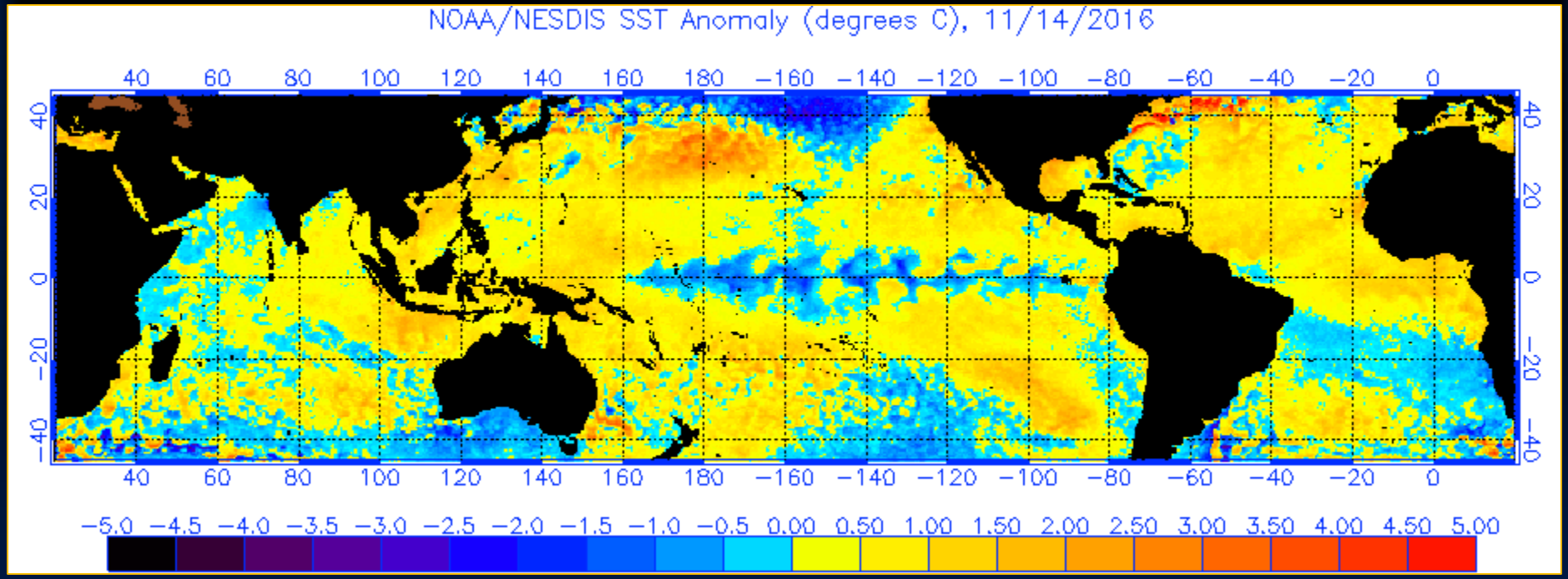
Rainfall totals from Hurricane Matthew, 10 October 2016

Precipitation was equivalent to 75% of the volume of Chesapeake Bay

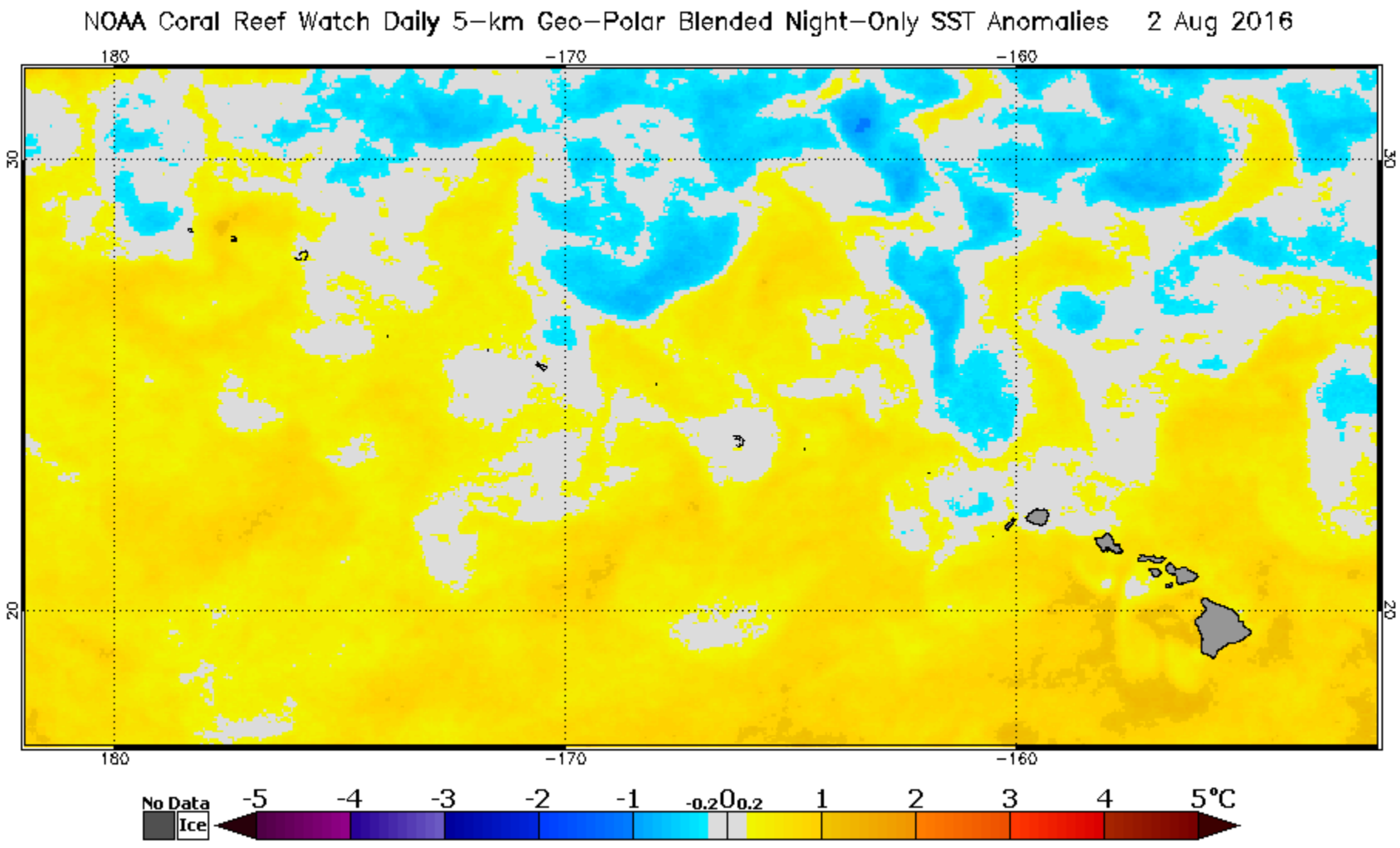
Global Sea Surface Temperature Anomaly 1 August 2016



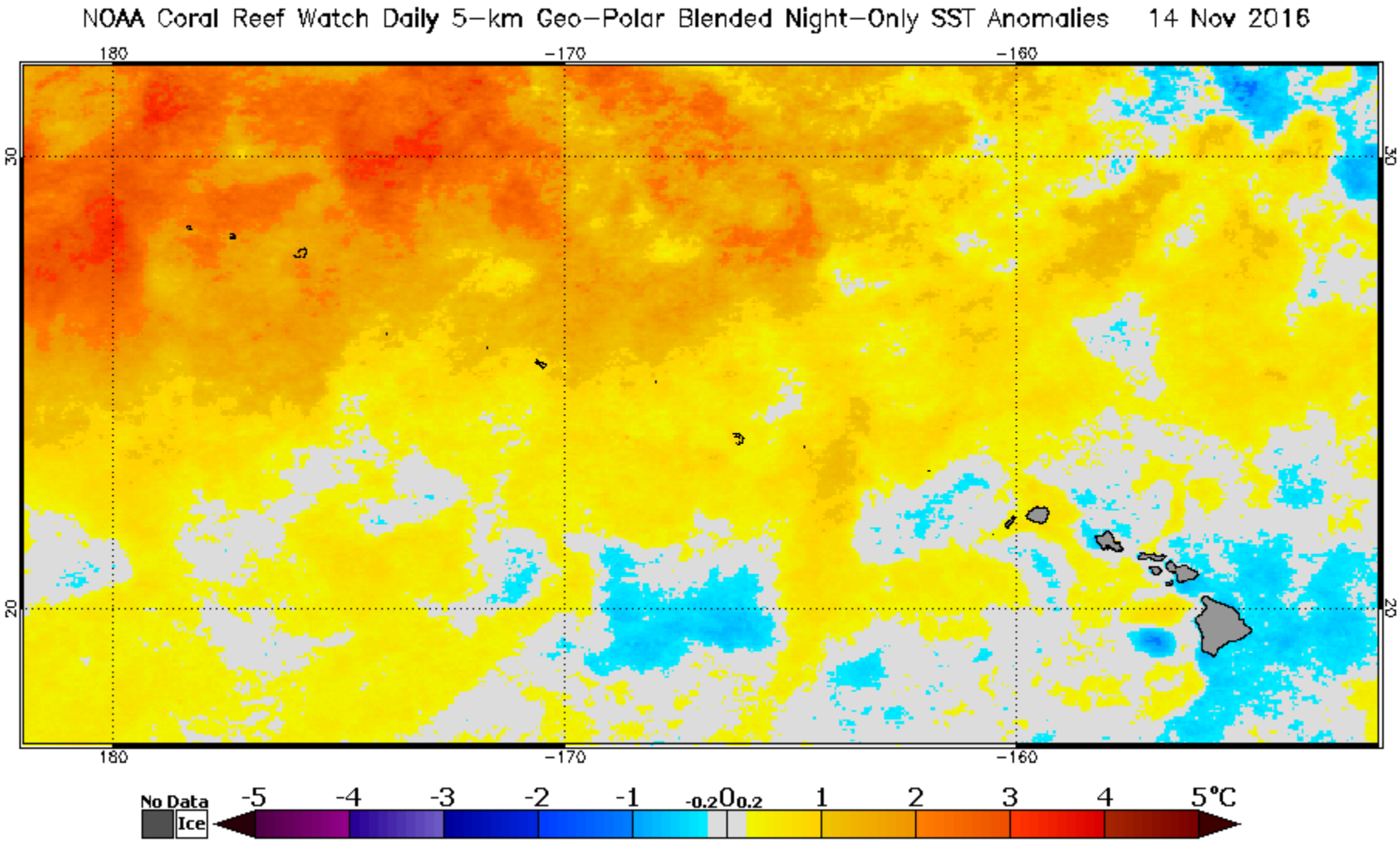
Global Sea Surface Temperature Anomaly 14 November 2016



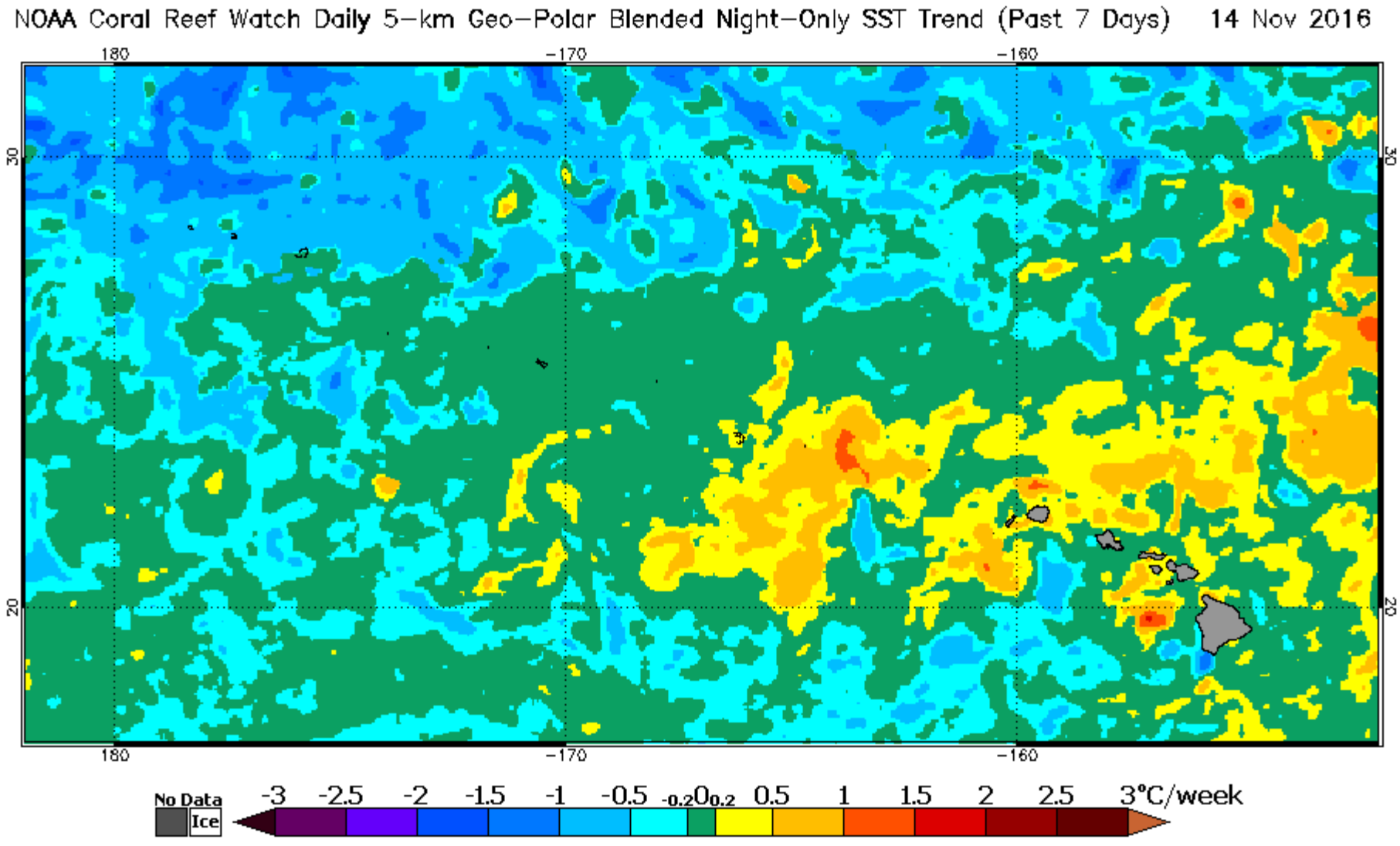
Sea Surface Temperature Anomaly, Hawaii Sector, 2 August 2016



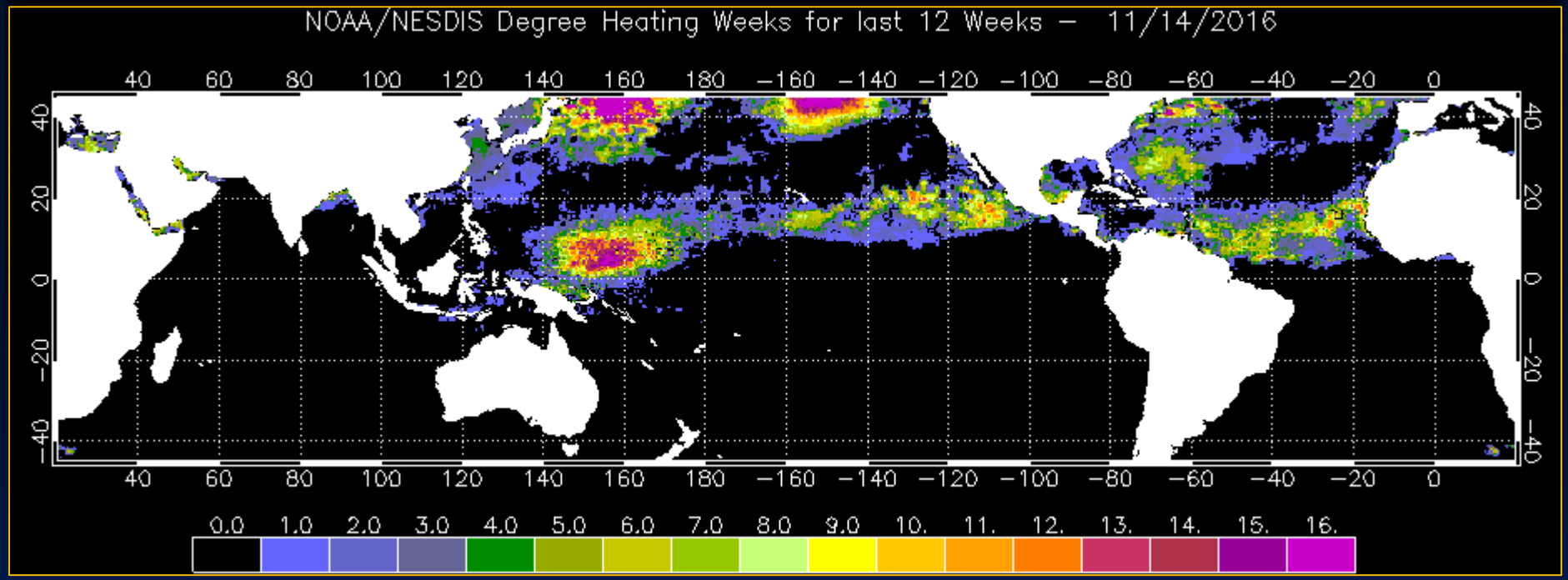
Sea Surface Temperature Anomaly, Hawaii Sector, 14 Nov. 2016



Projected SST Trend, Hawaii Sector, 14 Nov. 2016

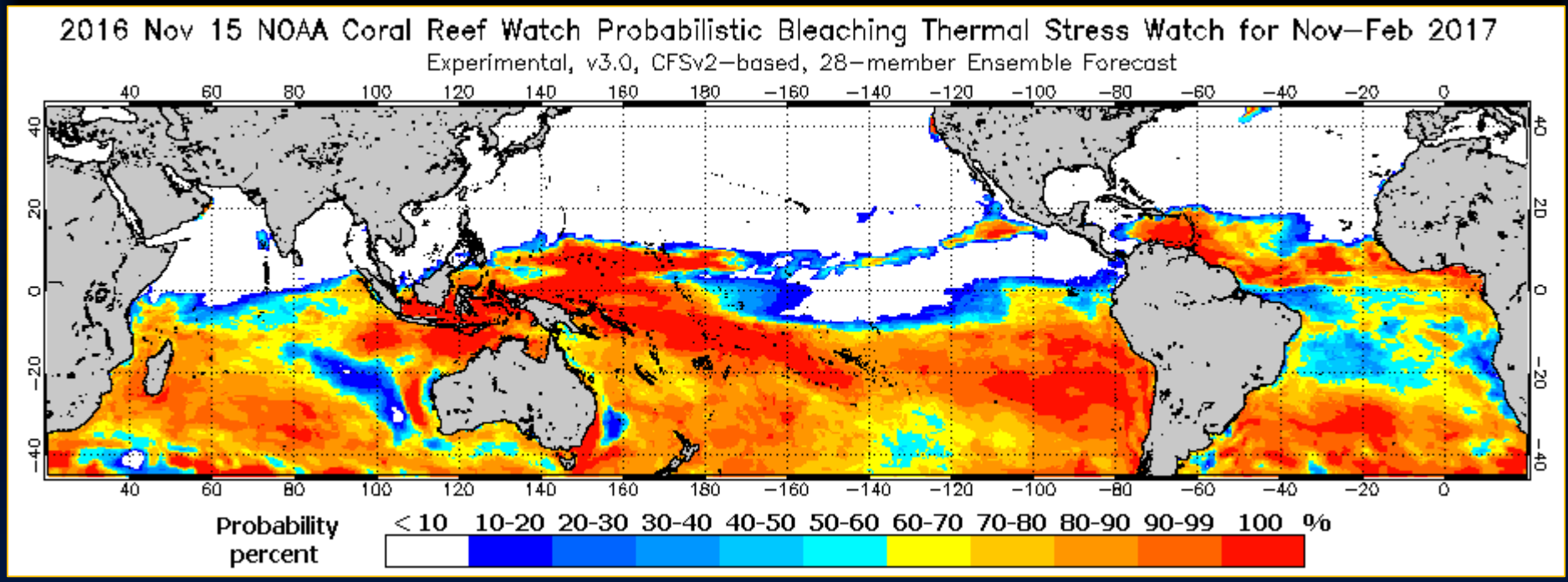


Degree Heating Weeks, 14 November 2016

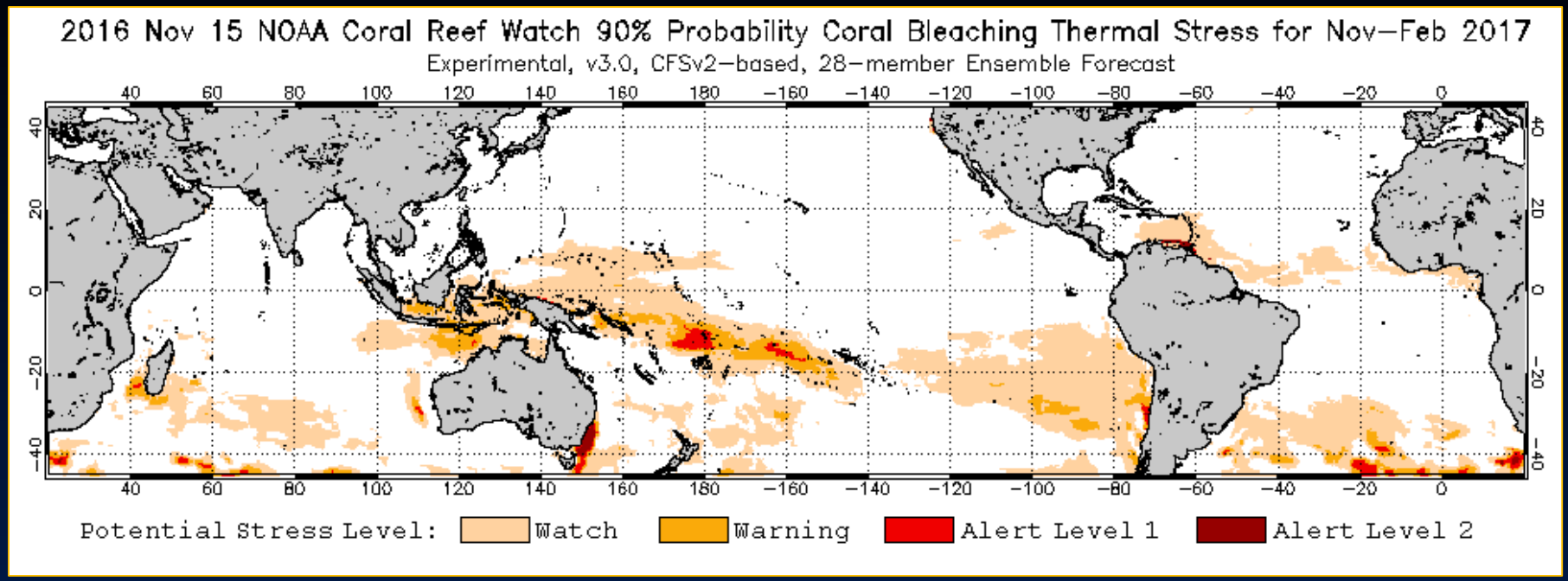


Bleaching Stress Probability, November 2016-February 2017

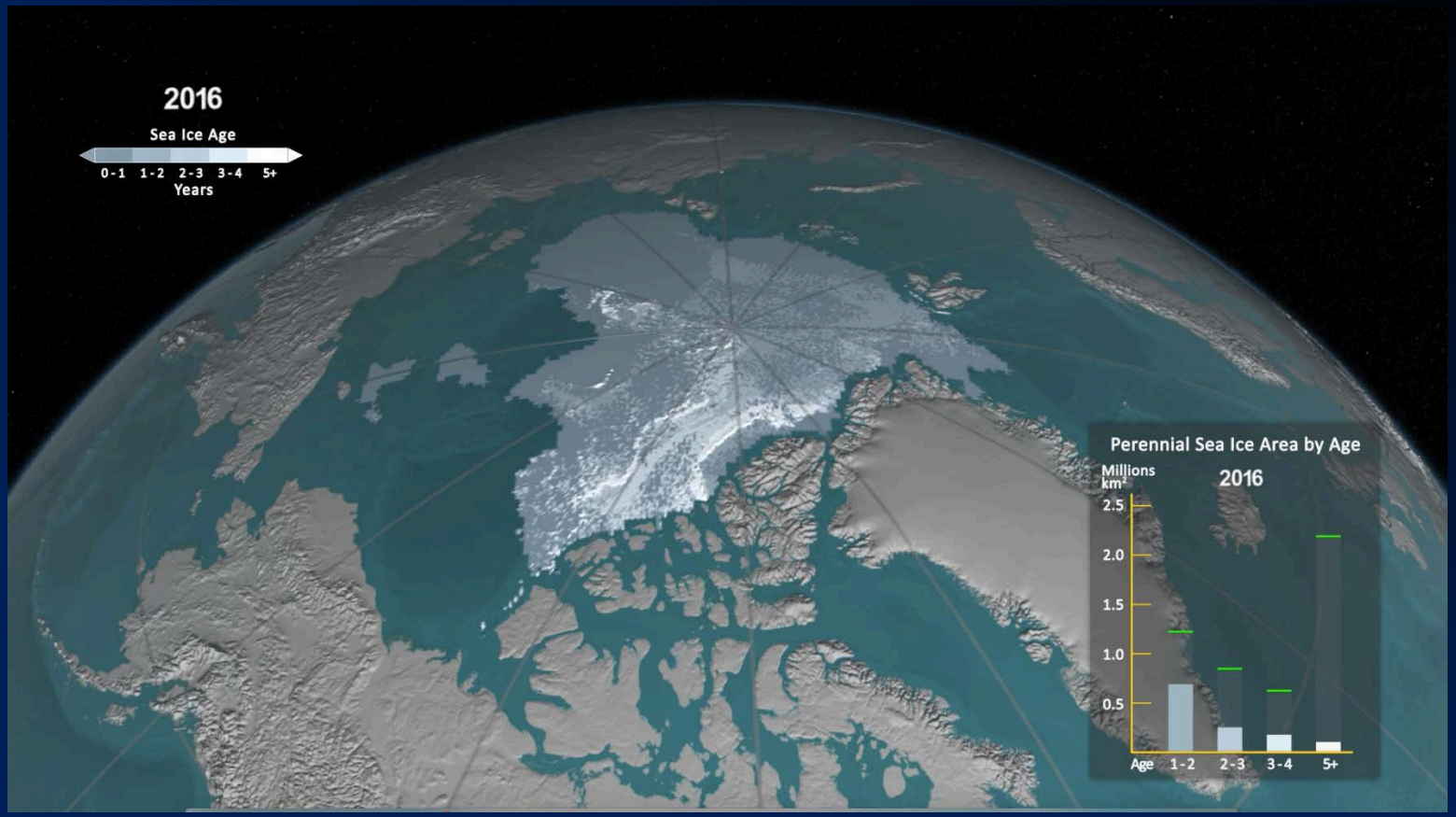
Prediction as of 15 November 2016

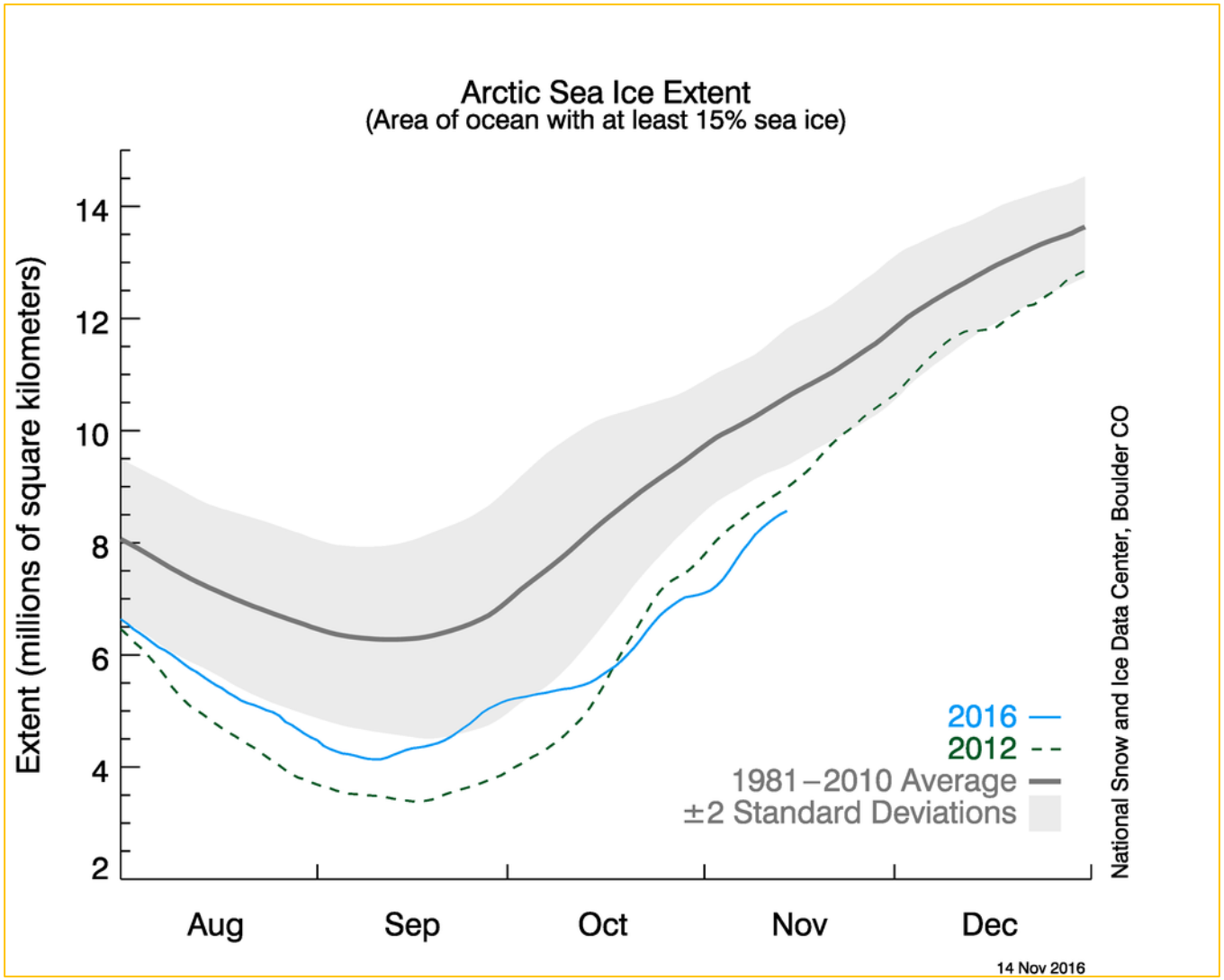


60% Bleaching Probability, 15 November 2016



Digression #2 – A Warmer Ocean Means a Melting Arctic





Lowest sea ice extent ever for this date in the modern record

A Melting Arctic Means Drastically Increased Shoreline Erosion

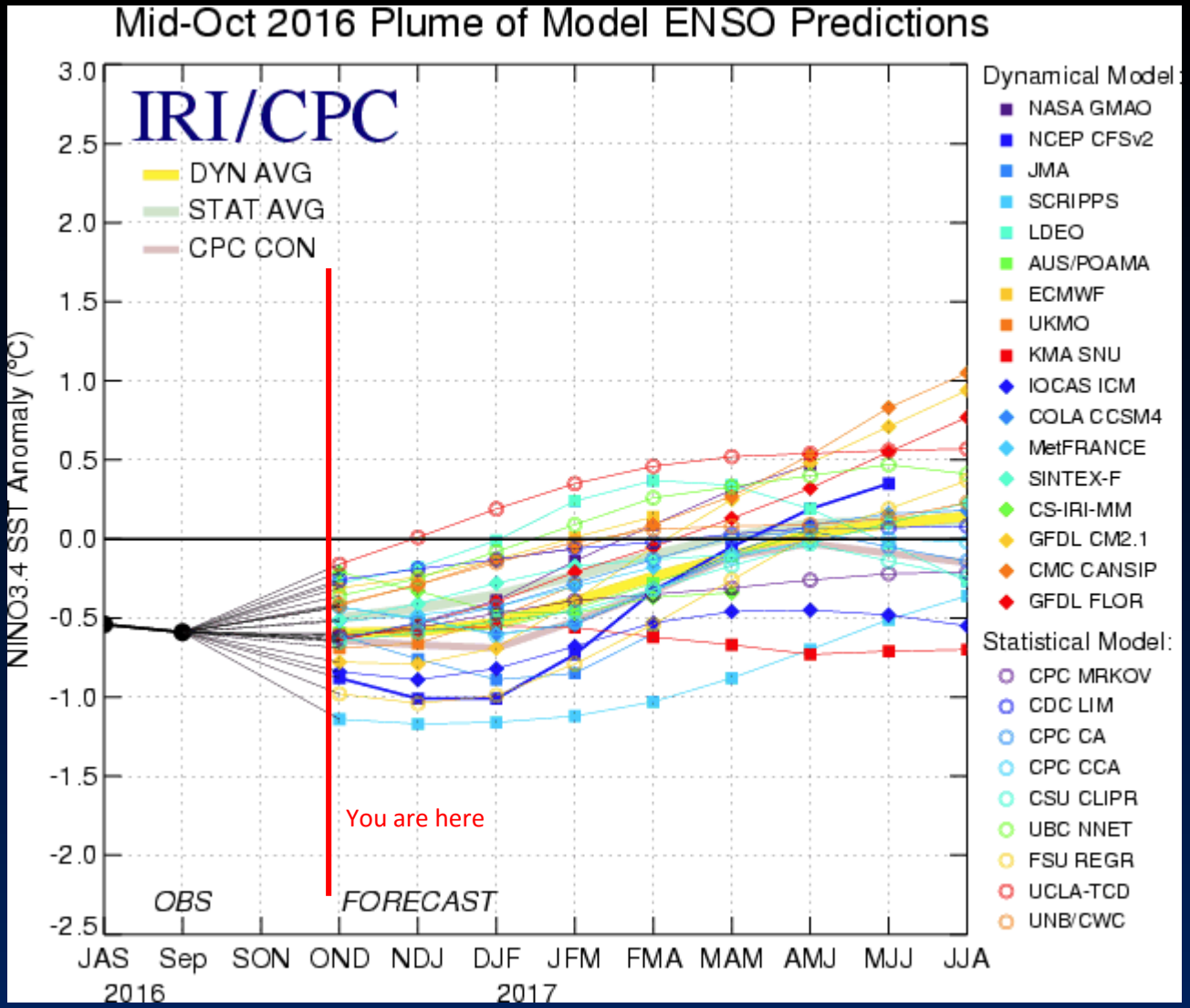
from both wave attack and permafrost melting

Shoreline collapse in the New Siberian Islands, September 2016

Melting permafrost shores release methane – a potent greenhouse gas

Looking Forward

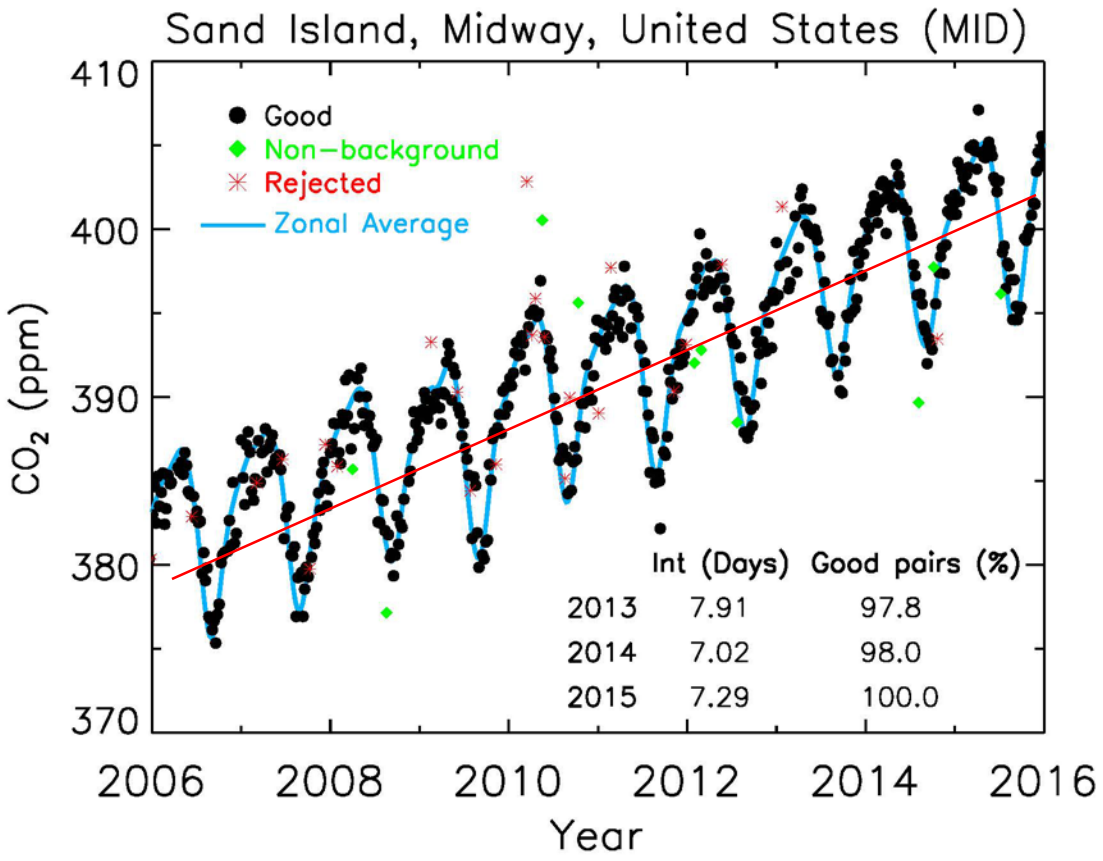
An ensemble of 25 climate models
predicts mild La Nina or ENSO neutral conditions by late 2016



Fun New Time Series

CO_2 Data from Midway

(with thanks to the NOAA Carbon Cycle Greenhouse Gases Group)



Conclusions

2016 is the warmest year on record globally, both on land and in the ocean

The Monument was spared the worst of this heat

El Nino has dissipated, and ENSO neutral to mild La Nina conditions are developing

This generally means cooler ocean temperatures and fewer hurricanes

So far there are no reports of additional bleaching in the NWHI in 2016

With the change to fall weather patterns, the threat for this year is over

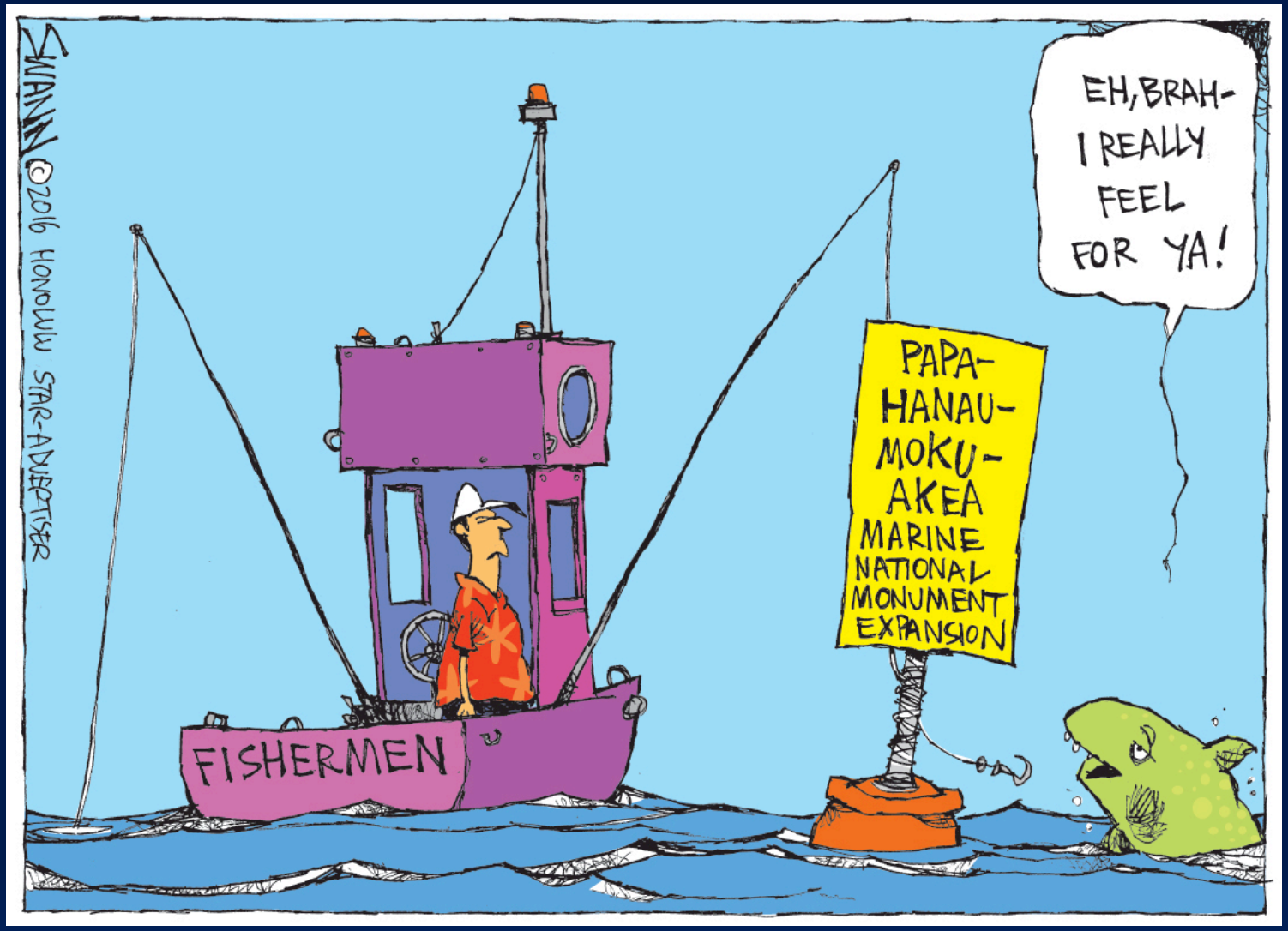
Cyclogenesis was anomalously high in the Eastern Pacific again this year

A worrisome trend, since this was not an El Nino year; is this the new normal?

Sea level continues to rise at 3-5 mm per year

Inundation is a long-term problem that will not go away

Questions?



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