

# Hawaii

# Climate Indicators Summary

## May 2020

PMNM Climate Change Working Group

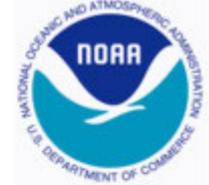
Dan A. Polhemus

U. S. Fish & Wildlife Service

Honolulu, HI

# 2020 is on track to be the hottest year on record

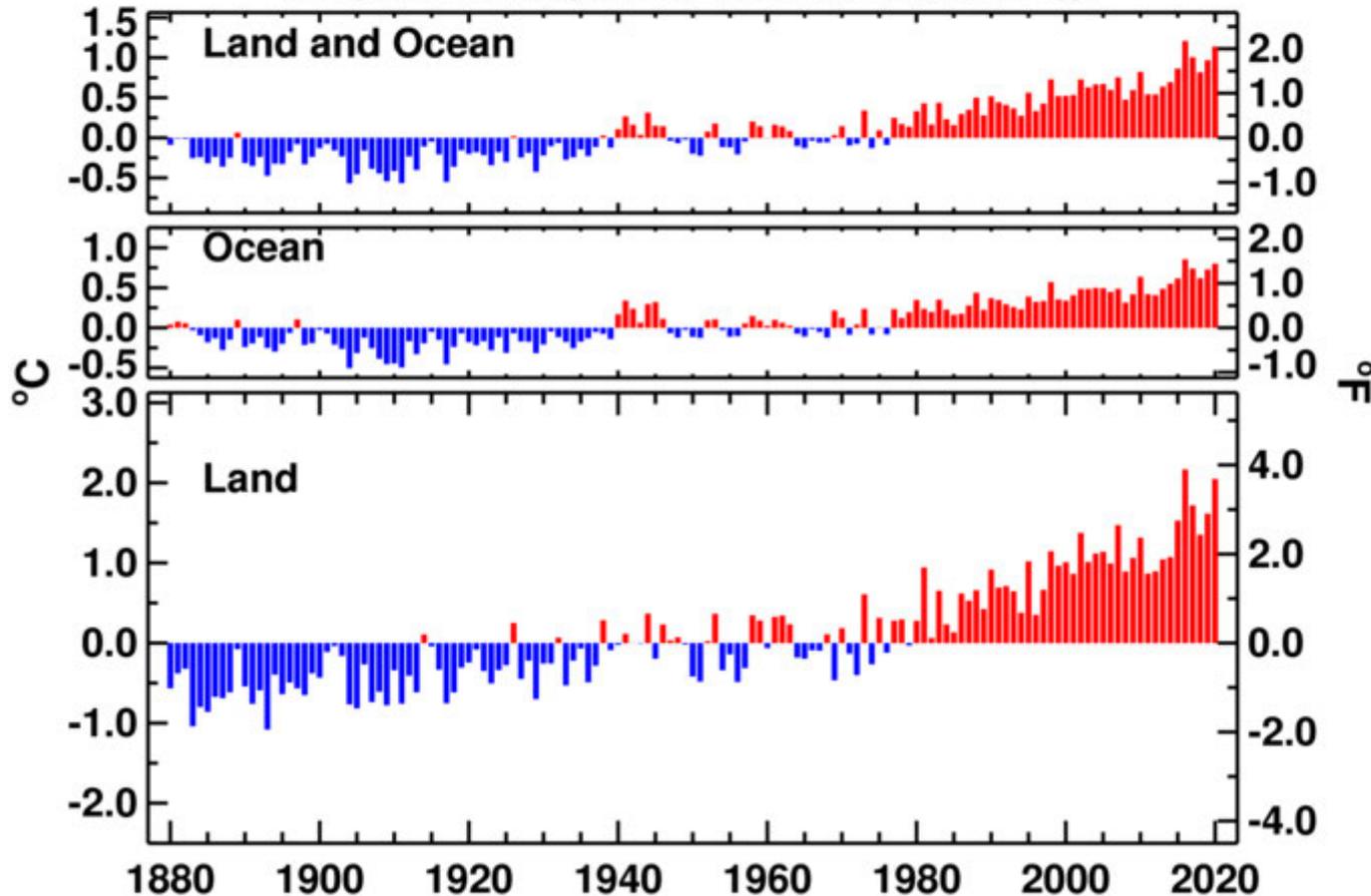
After an exceptionally warm winter in the Northern Hemisphere



## Jan-Apr Global Surface Mean Temp Anomalies

NCEI/NESDIS/NOAA

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



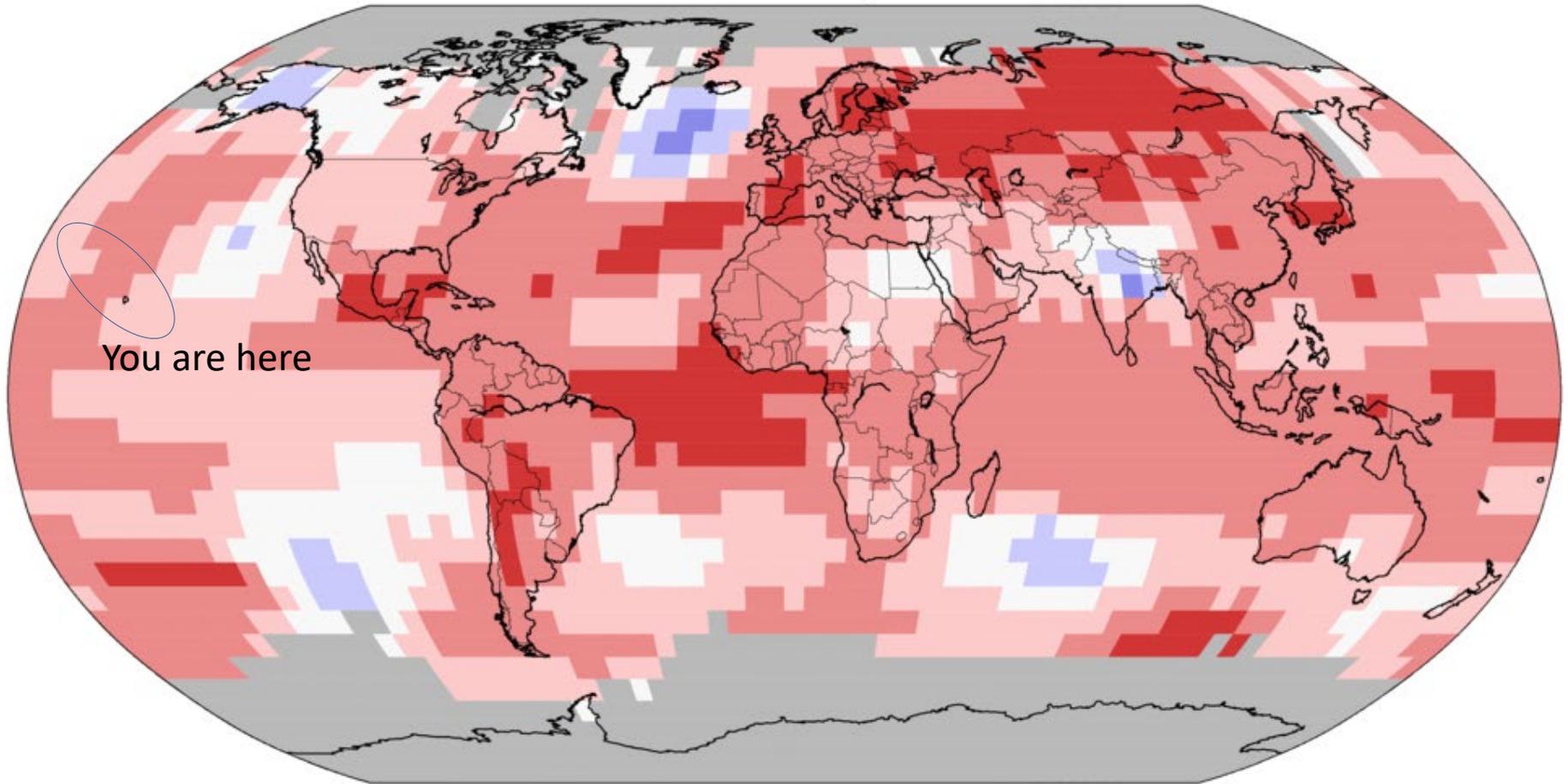
This was the second-hottest April ever recorded (the hottest was in 2016)

After 3 declining years, the heat is back

# Land & Ocean Temperature Percentiles Jan–Apr 2020

NOAA's National Centers for Environmental Information

Data Source: NOAA GlobalTemp v5.0.0–20200508



You are here

  
Record  
Coldest

  
Much  
Cooler than  
Average

  
Cooler than  
Average

  
Near  
Average

  
Warmer than  
Average

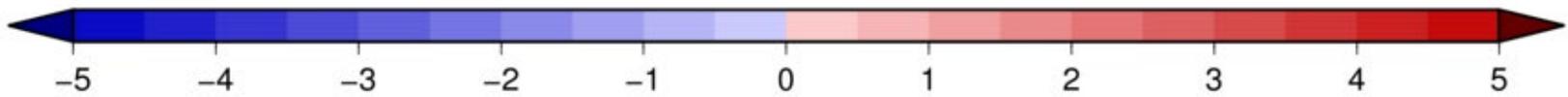
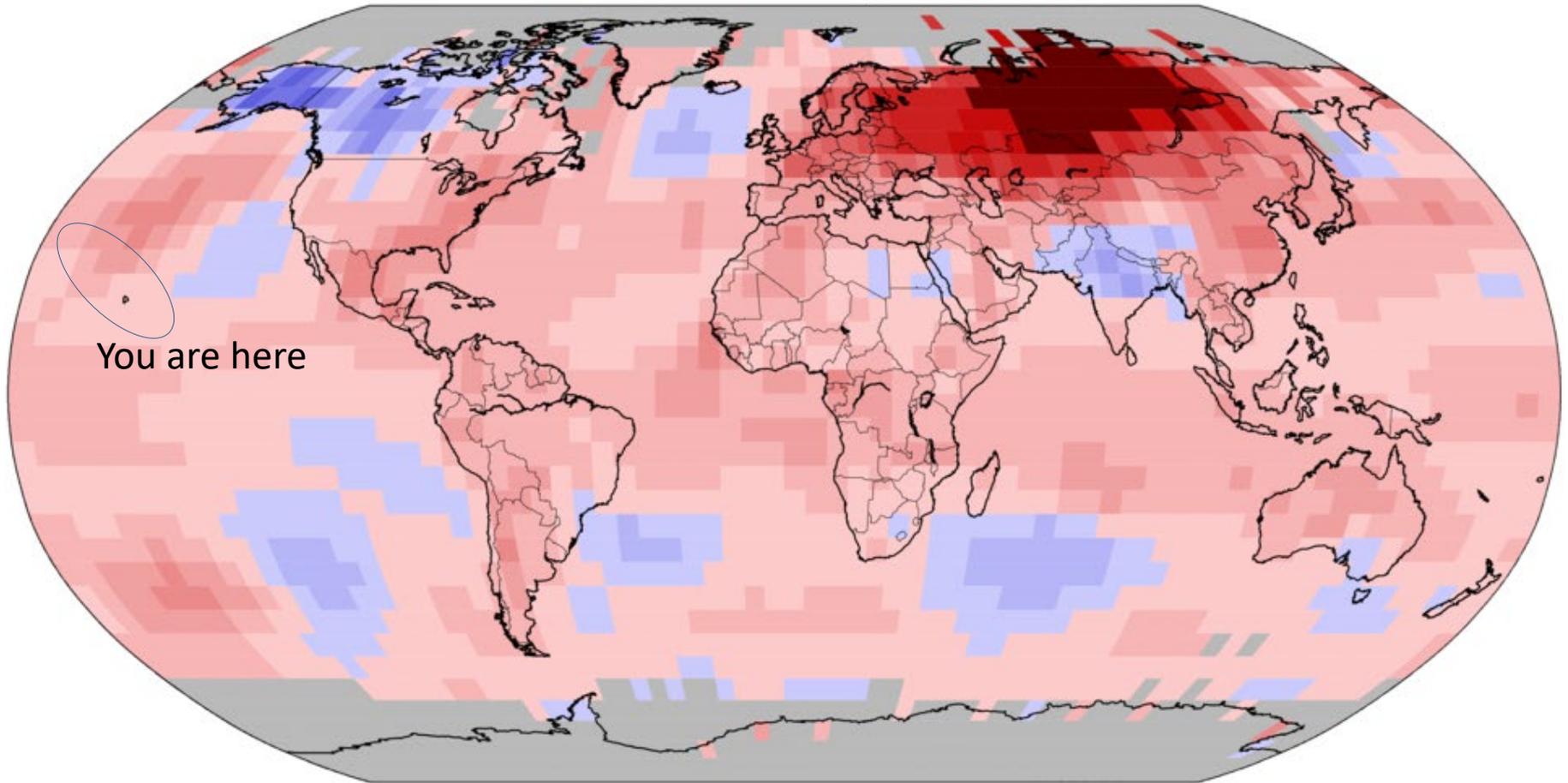
  
Much  
Warmer than  
Average

  
Record  
Warmest



# Land & Ocean Temperature Departure from Average Jan–Apr 2020 (with respect to a 1981–2010 base period)

Data Source: NOAA GlobalTemp v5.0.0–20200508



National Centers for Environmental Information  
GHCNM v4.0.1.20200507.qfe

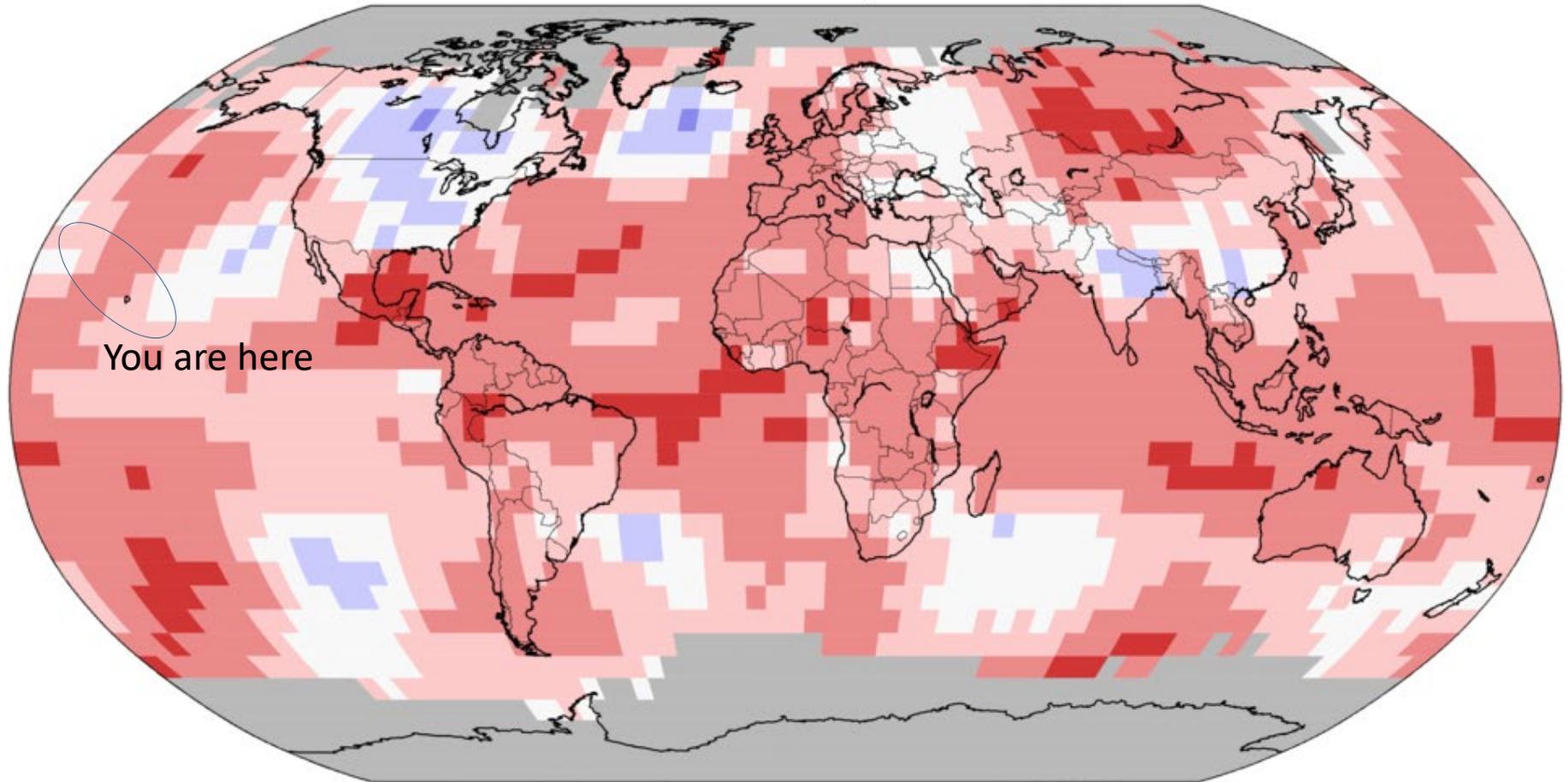
Degrees Celsius

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

# Land & Ocean Temperature Percentiles Apr 2020

NOAA's National Centers for Environmental Information

Data Source: NOAAGlobalTemp v5.0.0-20200508



You are here

  
Record  
Coldest

  
Much  
Cooler than  
Average

  
Cooler than  
Average

  
Near  
Average

  
Warmer than  
Average

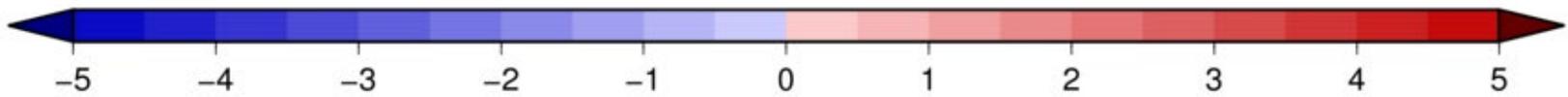
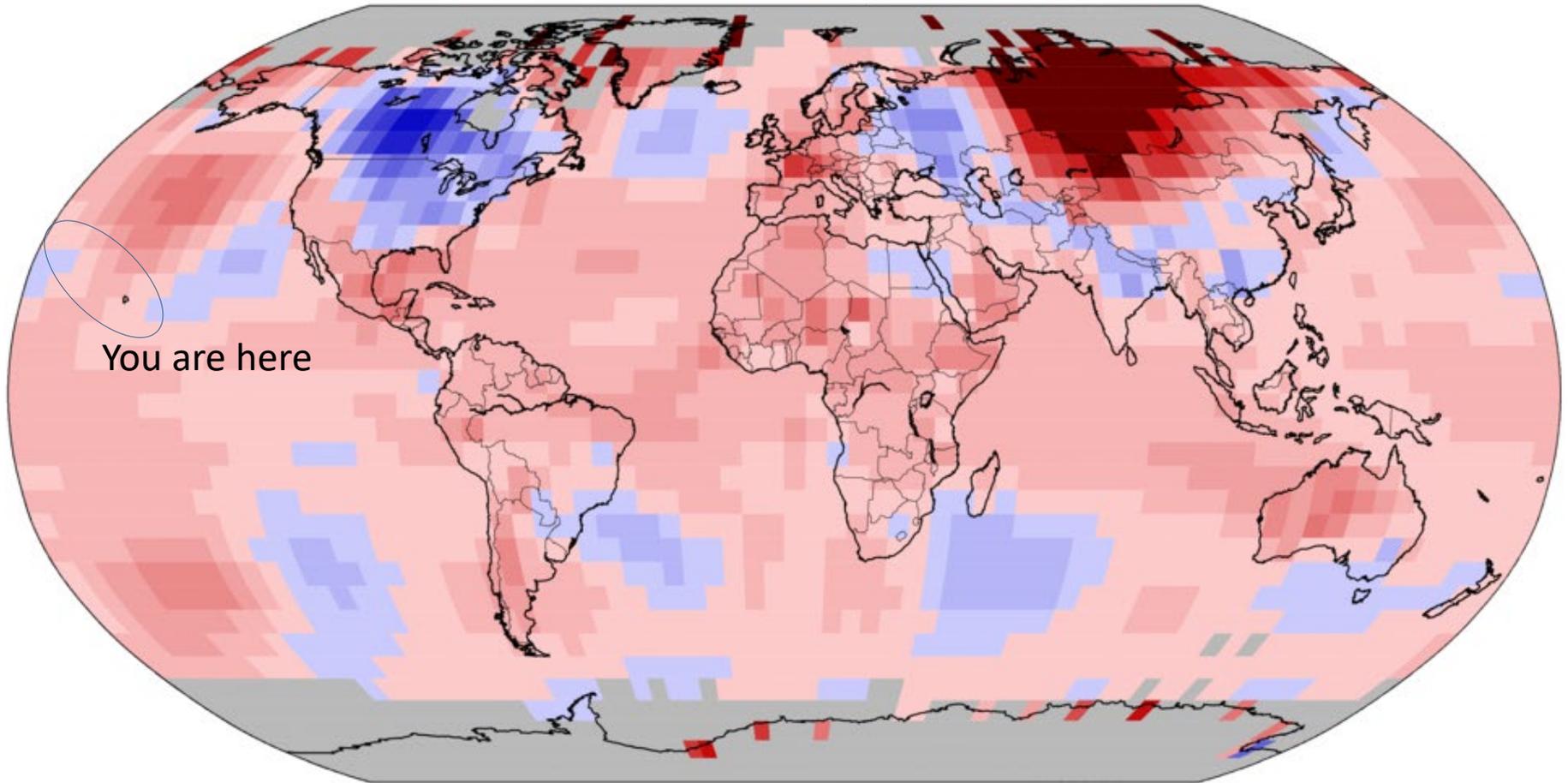
  
Much  
Warmer than  
Average

  
Record  
Warmest



# Land & Ocean Temperature Departure from Average Apr 2020 (with respect to a 1981–2010 base period)

Data Source: NOAA GlobalTemp v5.0.0–20200508



National Centers for Environmental Information  
GHCNM v4.0.1.20200507.qfe

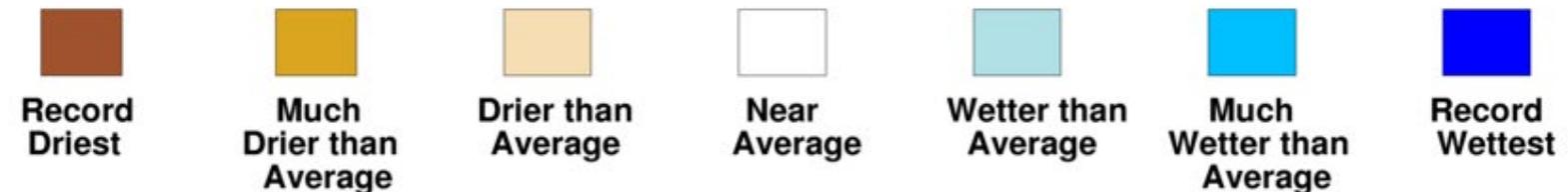
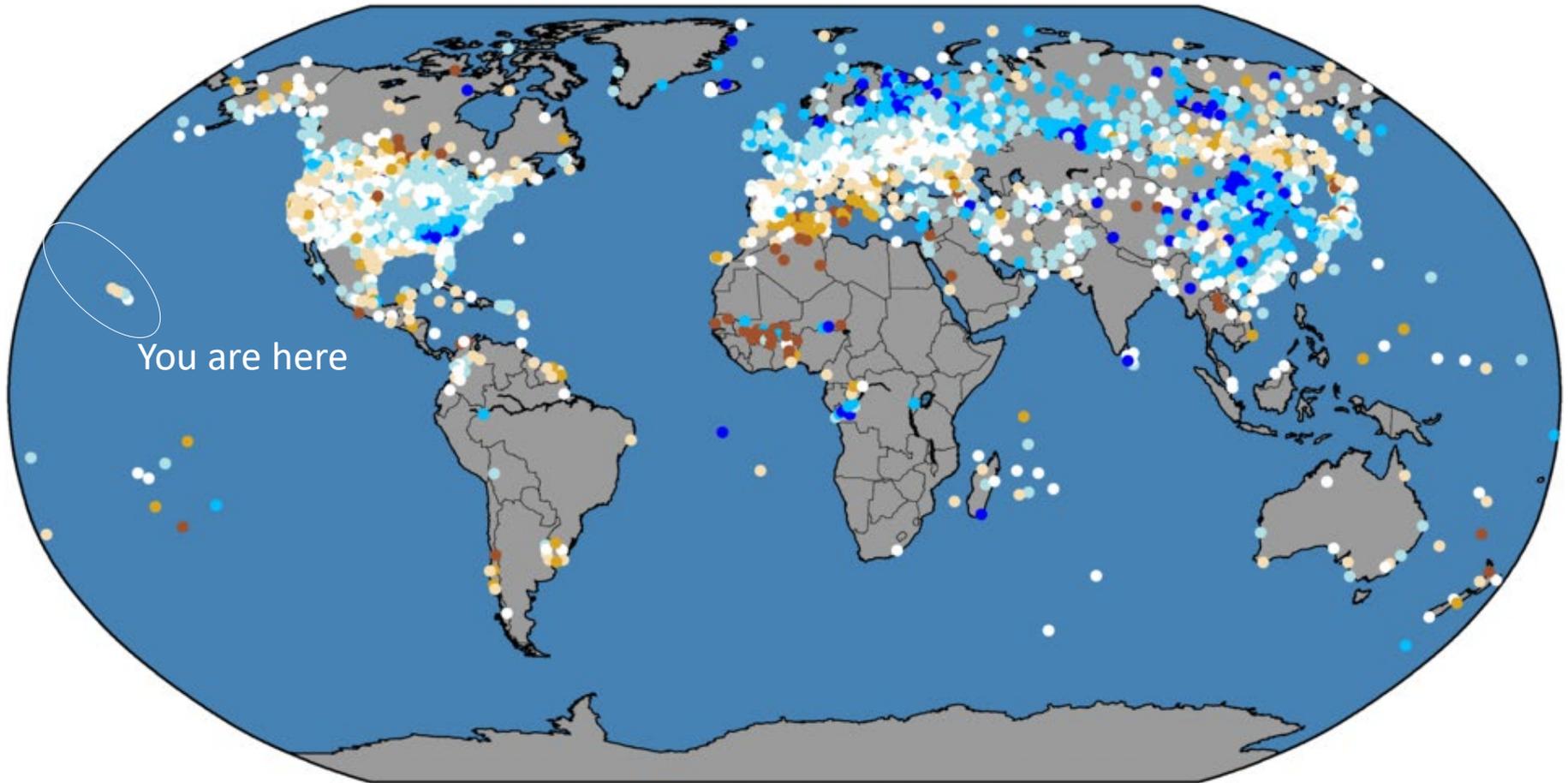
Degrees Celsius

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

# Land-Only Precipitation Percentiles Dec 2019–Feb 2020

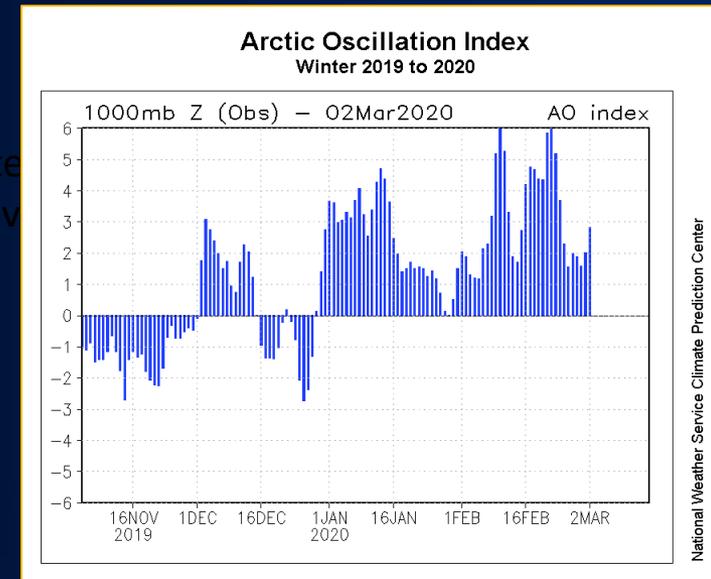
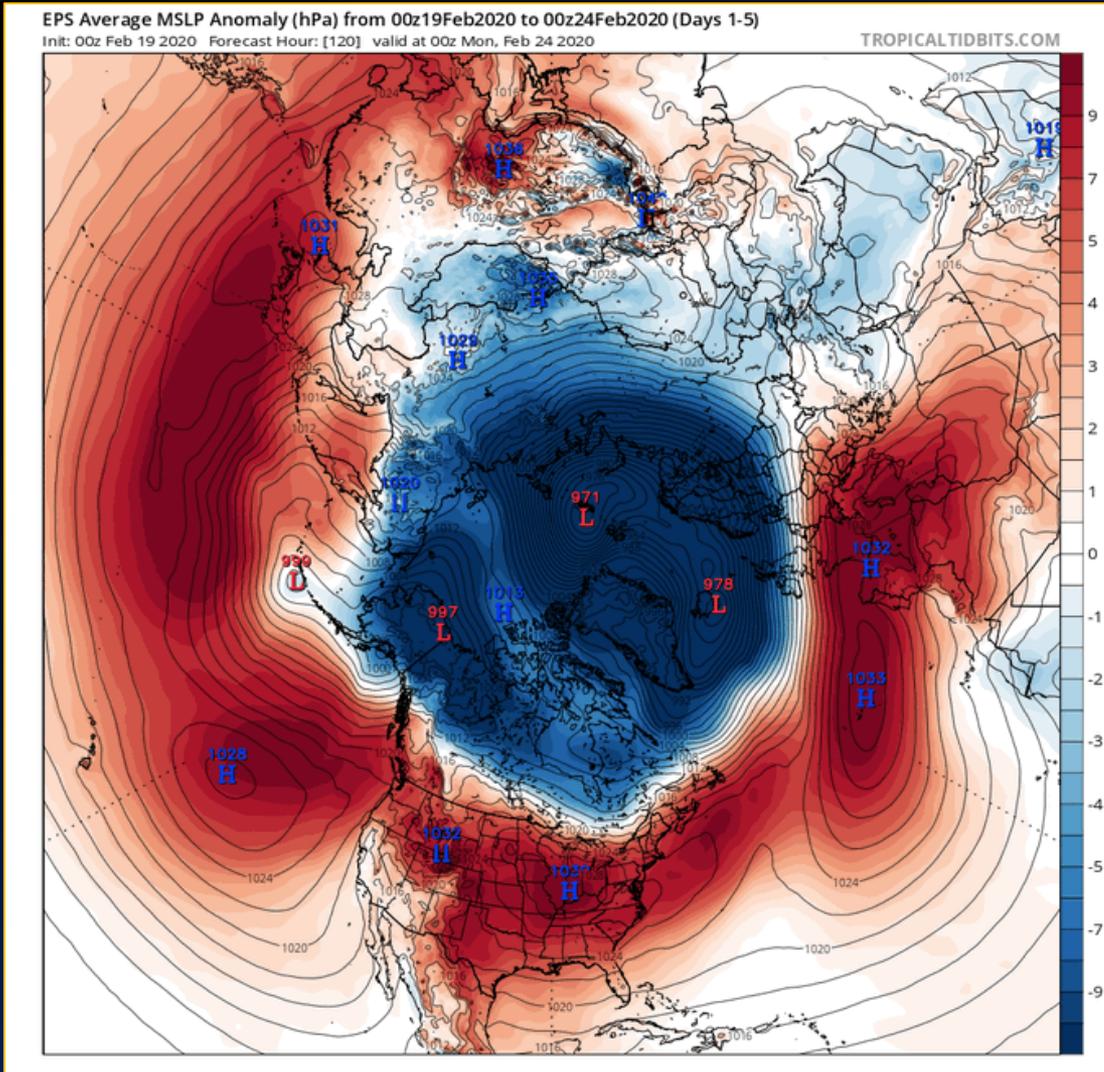
NOAA's National Centers for Environmental Information

Data Source: GHCN-M version 4beta



# Digression #1

A strong polar vortex = a warm winter in the Northern Hemisphere



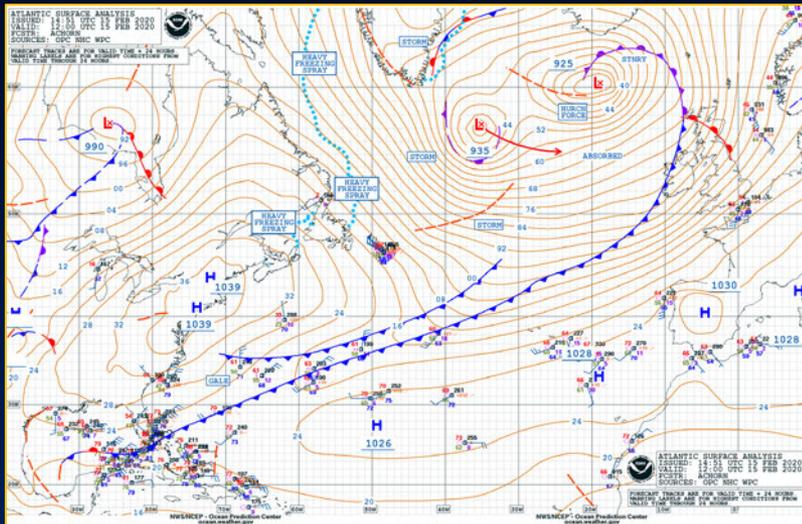
Cold air stayed bottled up in the Arctic due to strong circumpolar circulation  
As a result, North America and Eurasia stayed warm

# Digression #1

A strong polar vortex spawns very intense storms



920 mb central pressure - same as a Cat 4 Hurricane



...very wetter,  
dr...



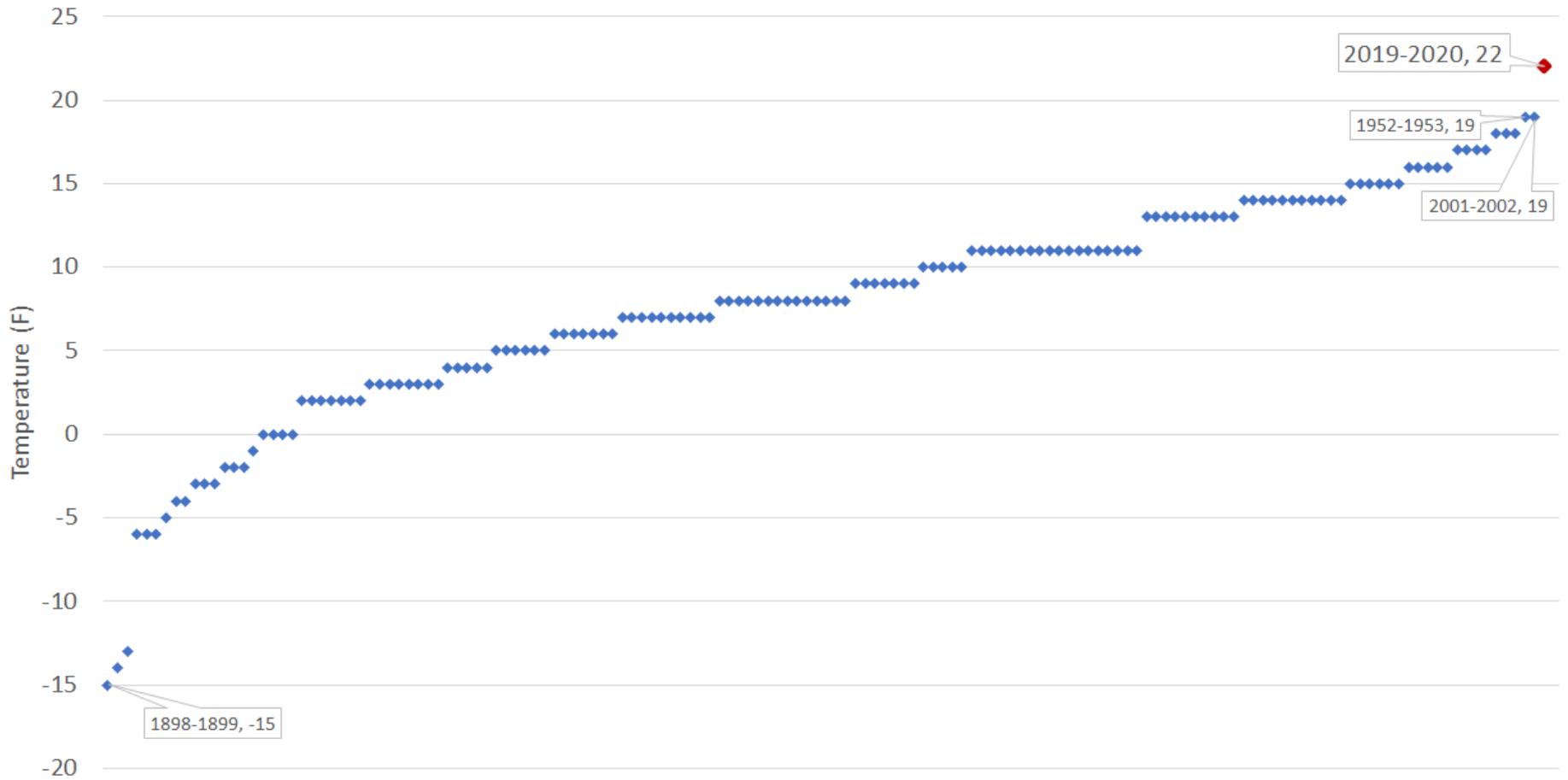
Tewkesbury, England underwater

Storm Dennis in mid-February 2020 – one of the lowest central pressures ever seen in the North Atlantic Attached to a 5000 mile long cold front running from Iceland to Florida – created severe flooding in Britain

# Digression #1

## Unusual winter warmth in North America

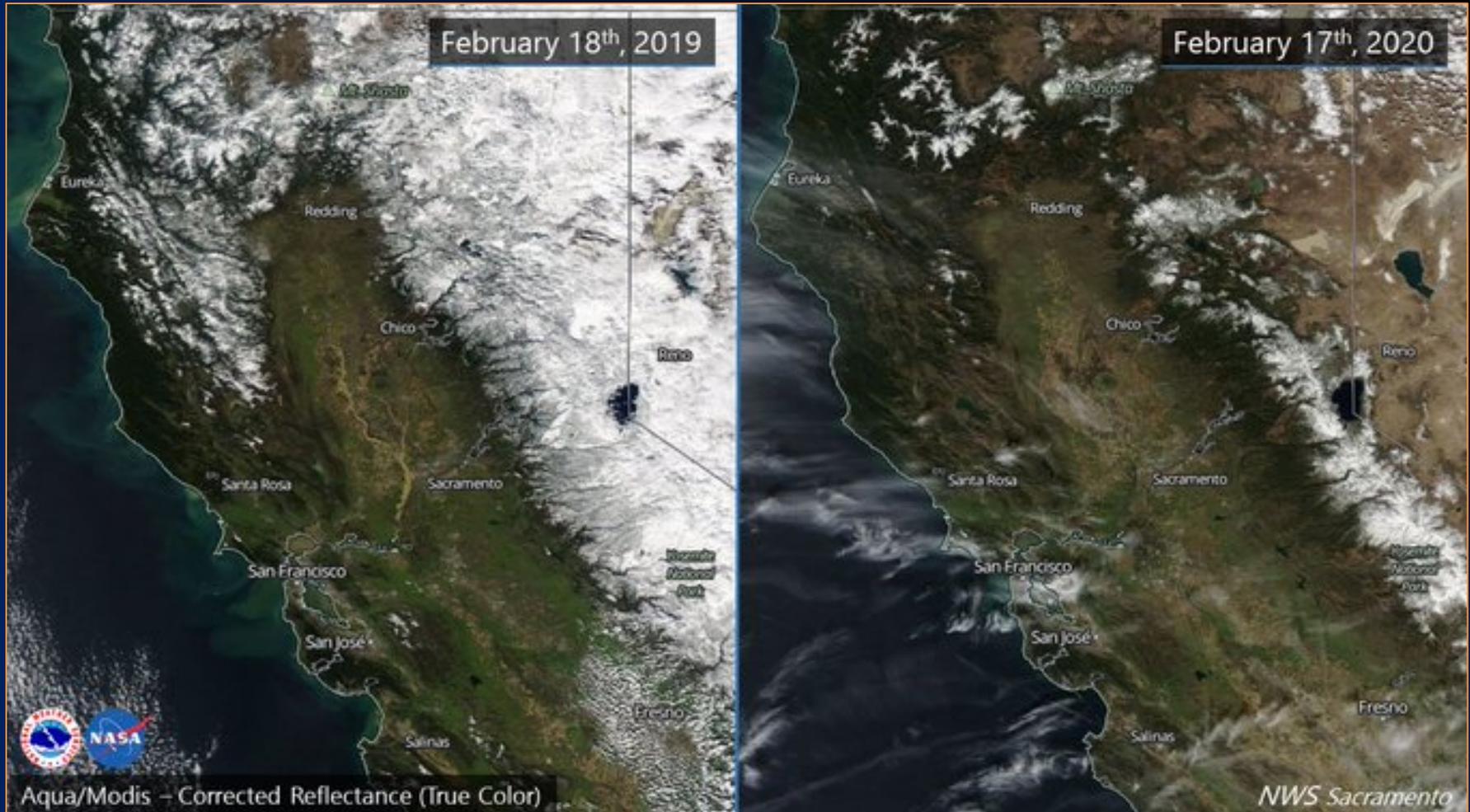
### Coldest temperature of all winters in Washington since 1871-72



Washington, DC had its warmest winter ever – no snow, and the lowest temperature was 22° F.

# Digression #1

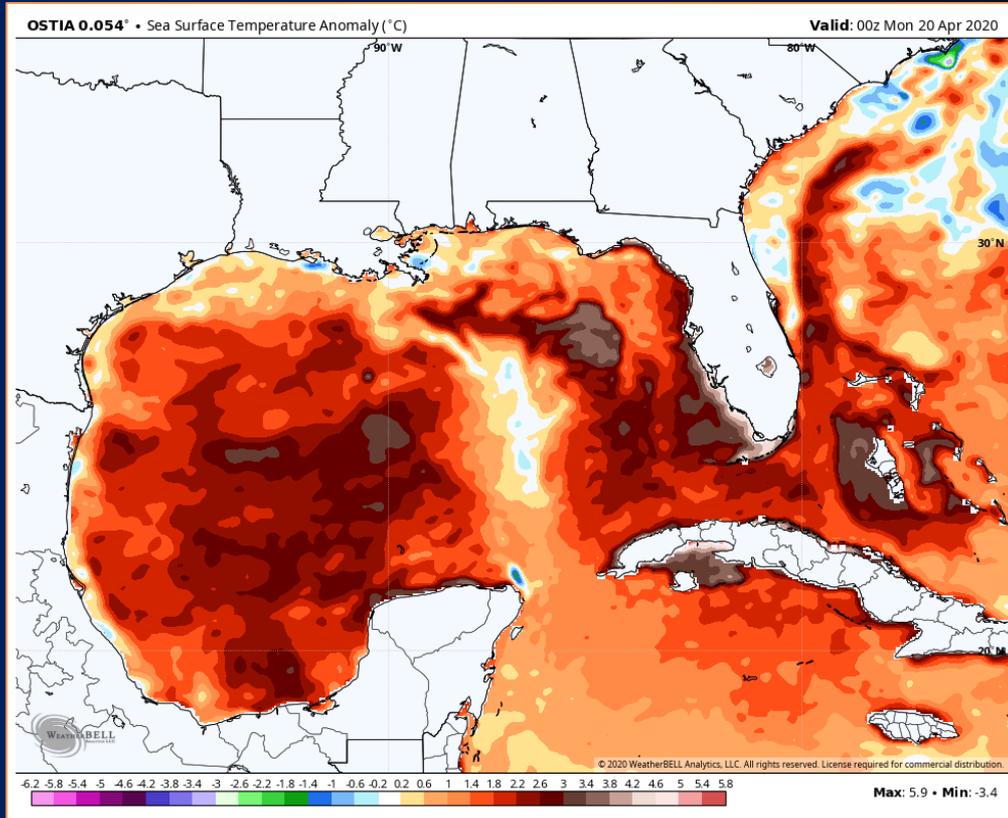
## Unusual winter warmth in North America



California snowpack was far below average  
Striking contrast to 2019 – the drought is back

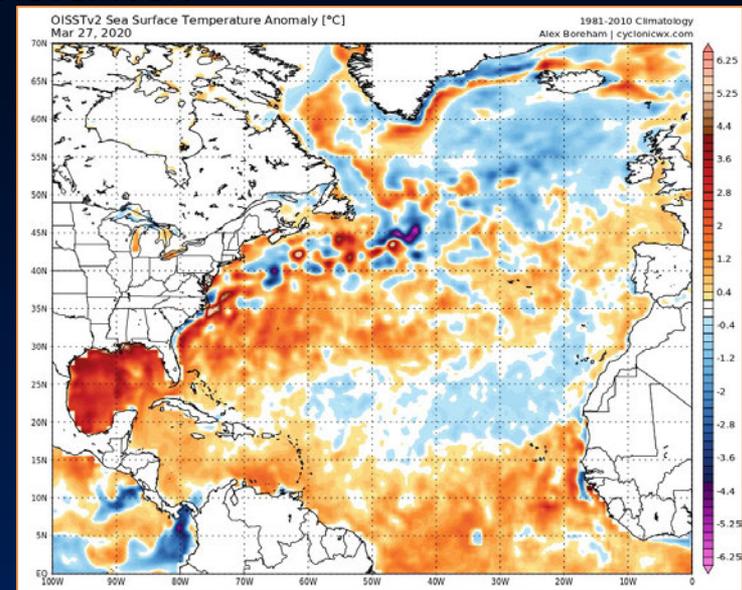
# Digression #1

## Unusual winter warmth in North America



Gulf of Mexico with record SST heat anomaly in late April

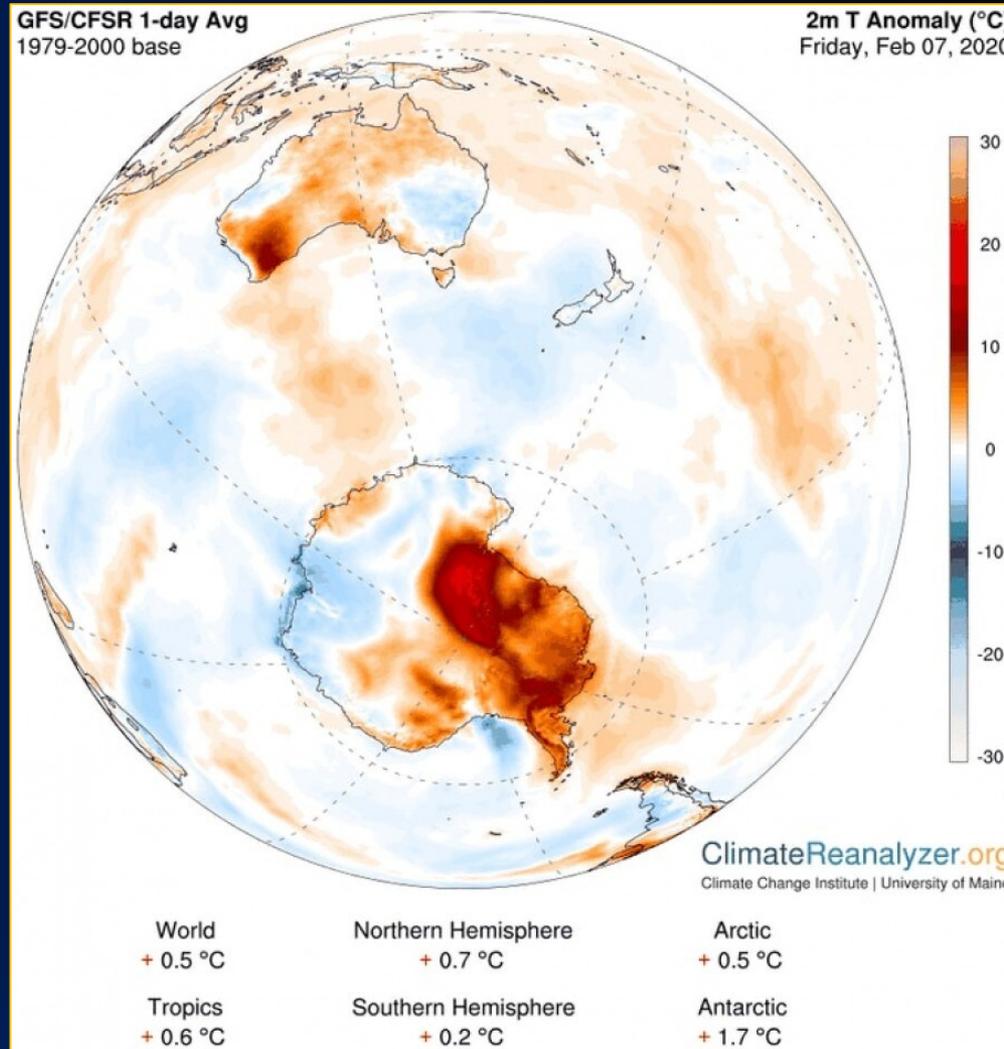
mer temperatures  
In November!



Gulf of Mexico is staring the summer with very high heat content, as is the Atlantic  
Current predictions call for a very active Atlantic hurricane season

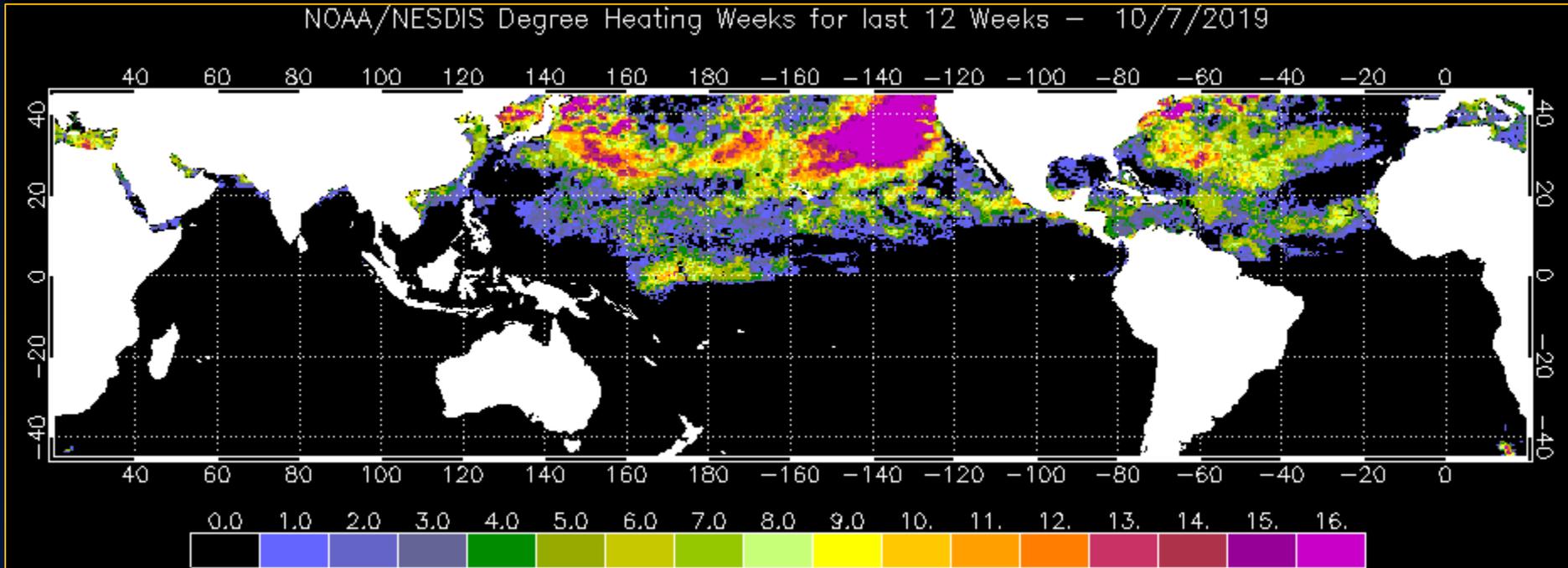
# Digression #2

Meanwhile, it was a nice summer in Antarctica



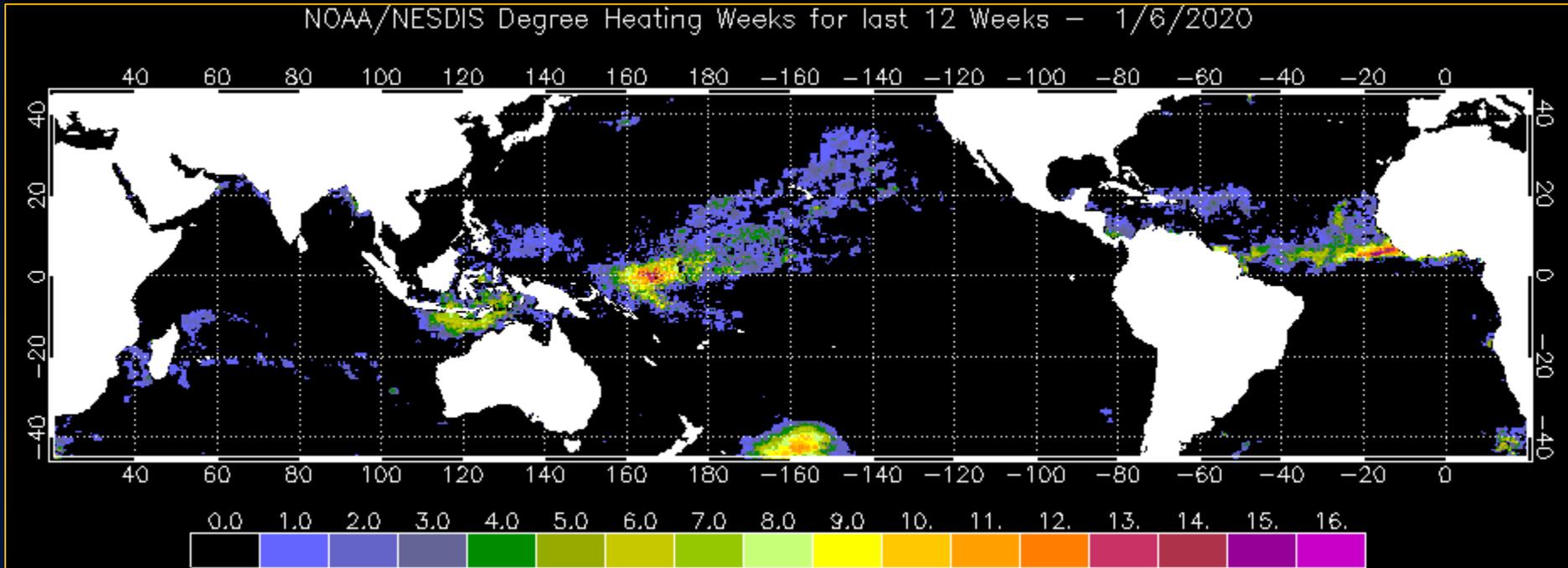
On 7 February 2020, some spots in the Antarctic Peninsula were warmer than Los Angeles

# Degree Heating Weeks – 7 October 2019



Last fall, a North Pacific Modal Pattern (aka “The Blob”) was very evident

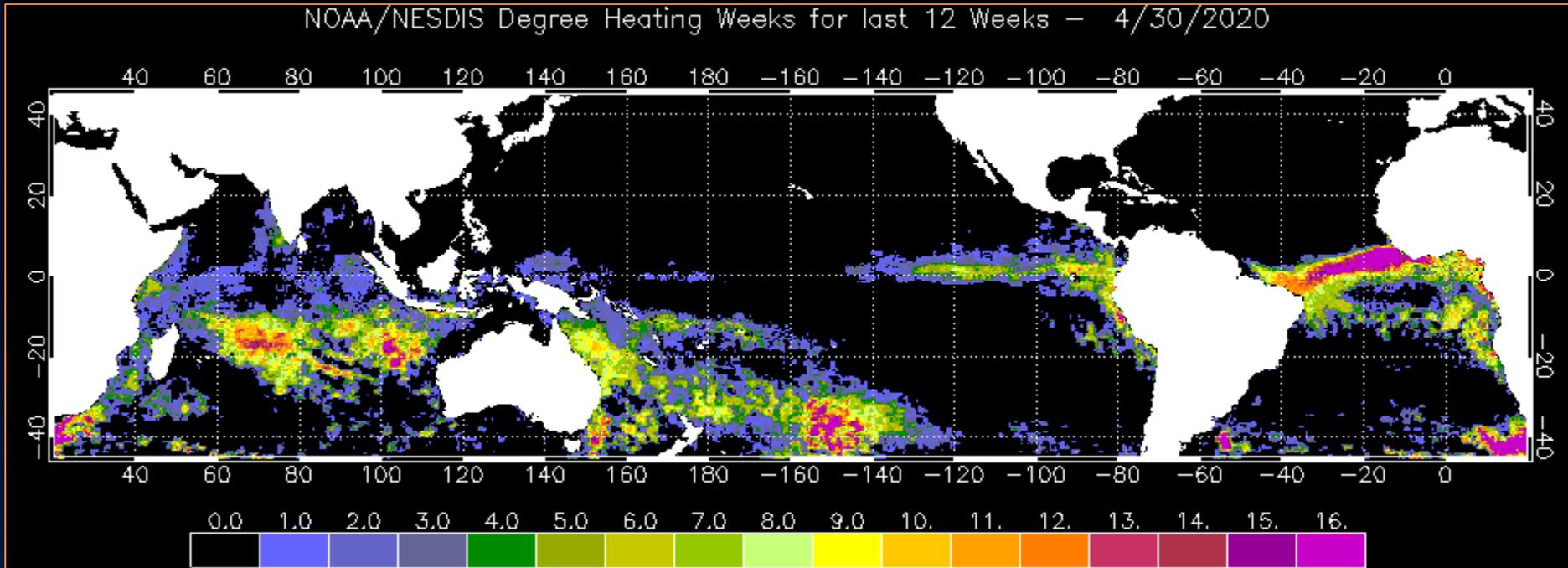
# Degree Heating Weeks – 6 January 2020



By January, heat ocean heat content abated near Hawaii, but was more acute near the Marshall Islands

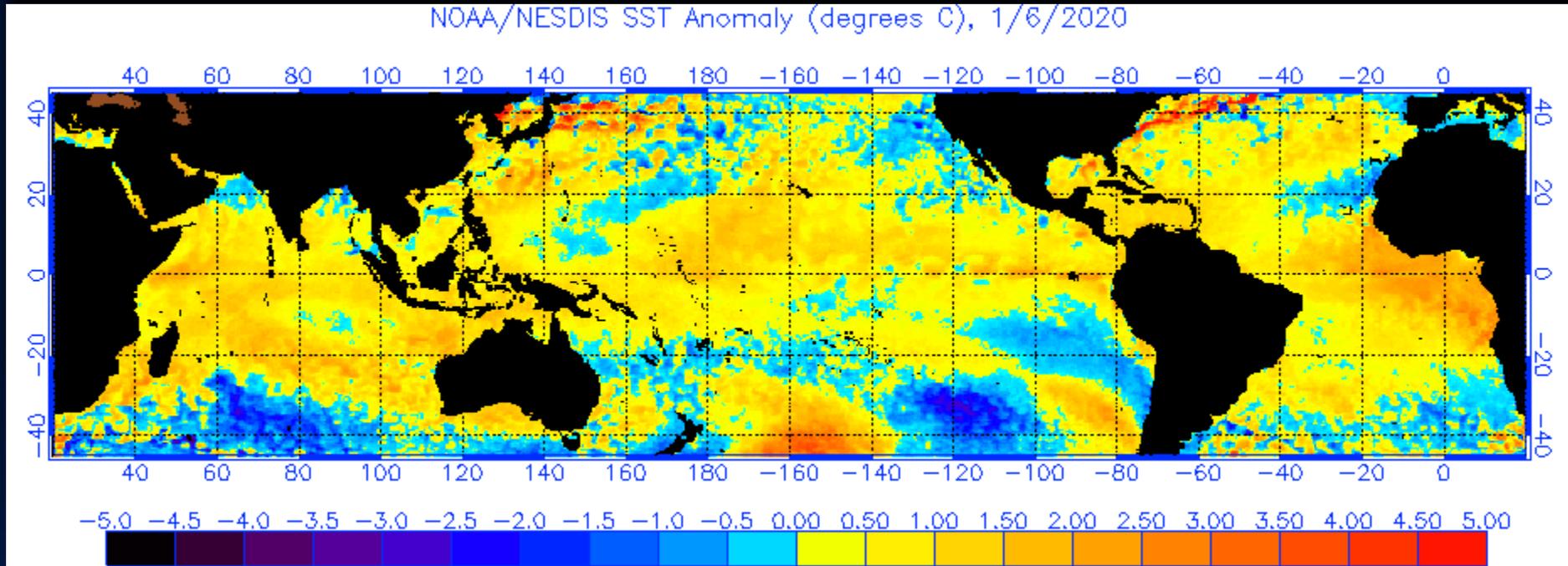
# Degree Heating Weeks – 30 April 2020

NOAA/NESDIS Degree Heating Weeks for last 12 Weeks – 4/30/2020



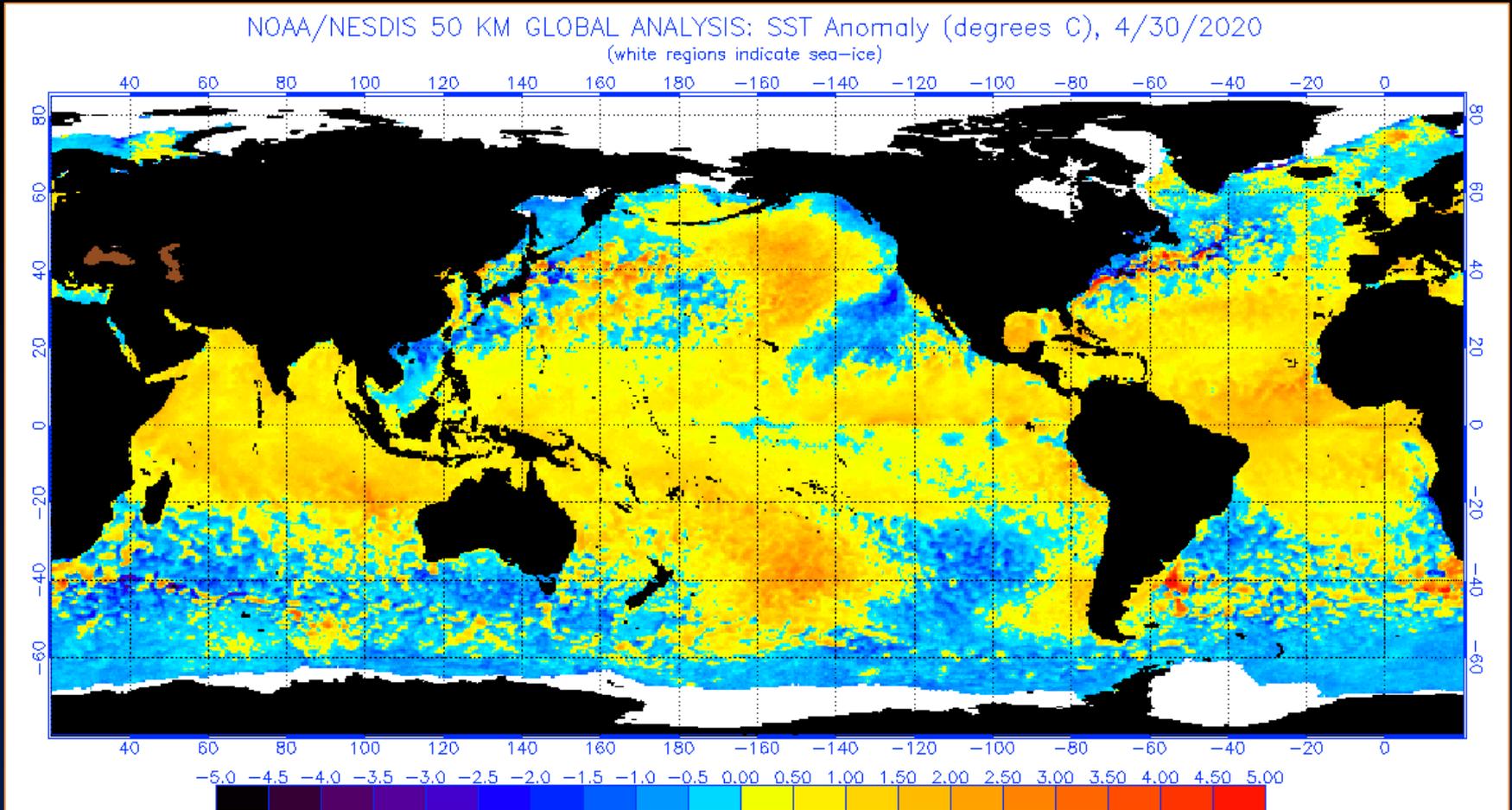
In spring 2020 the Northern Hemisphere has cooled, but the South Pacific and Indian Ocean, as well as the equatorial Atlantic, are rapidly accumulating heat

# Global Sea Surface Temperature Anomaly – 6 January 2020



At the ocean surface, patterns have not changed as much

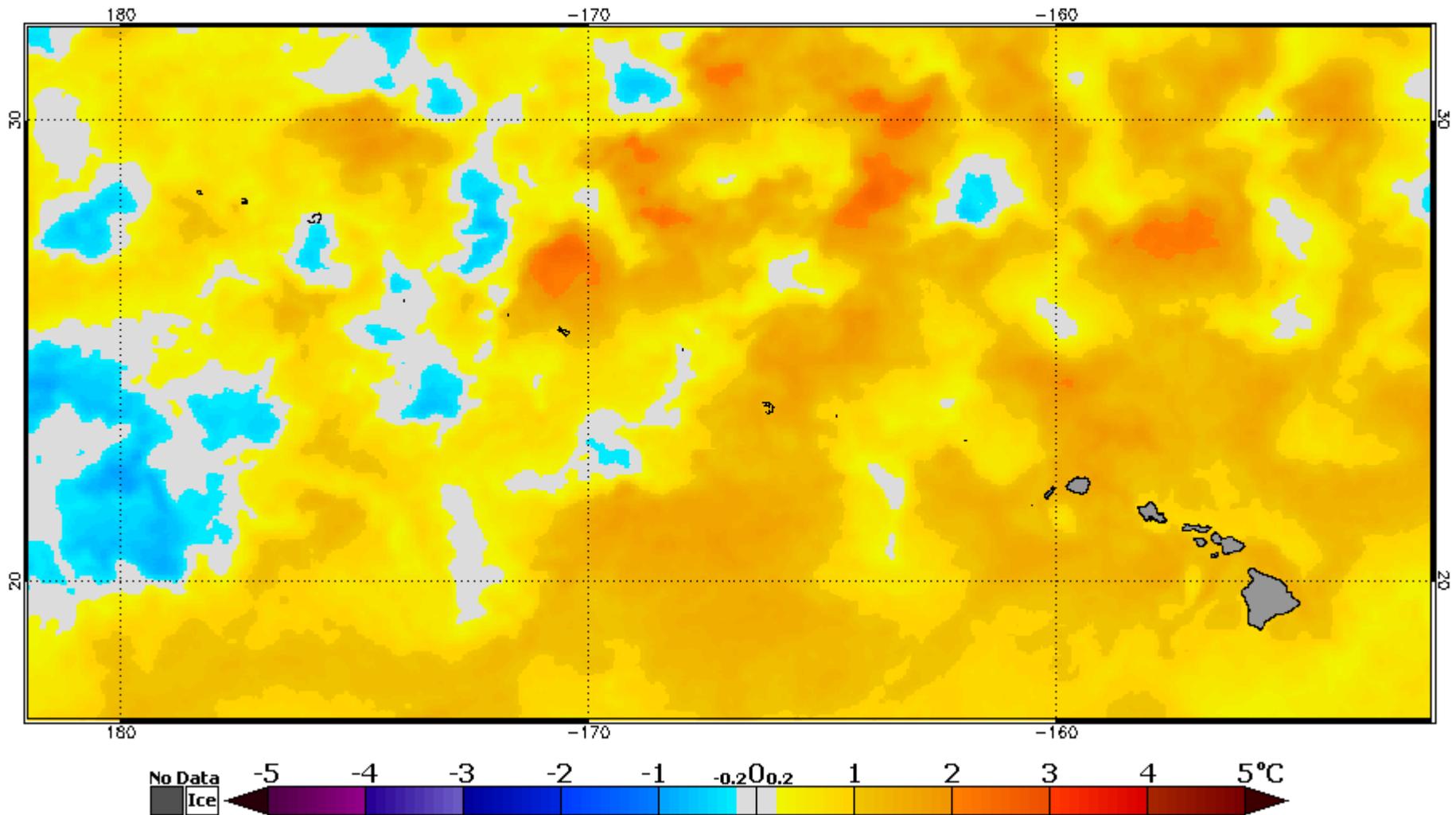
# Global Sea Surface Temperature Anomaly – 30 April 2020



Sea surface temperatures in the Monument are currently a mosaic of slightly below to slightly above long-term average, with the Midway sector the warmest. Above normal heat content is also concentrated between the Main Hawaiian Islands and Alaska.

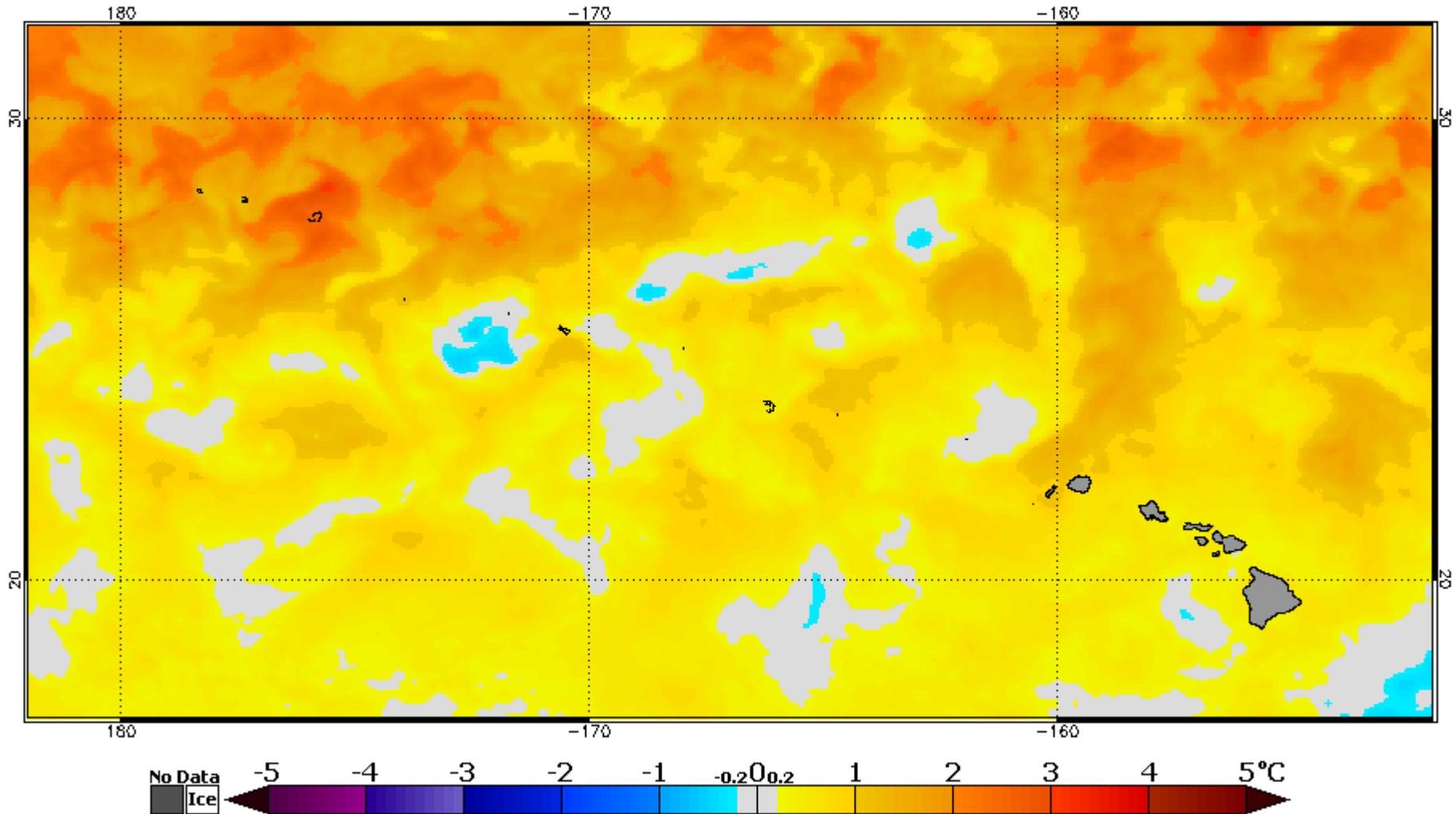
# Sea Surface Temperature Anomaly, Hawaii Sector – 5 January 2020

NOAA Coral Reef Watch Daily 5km SST Anomalies (Version 3.1) 5 Jan 2020



# Sea Surface Temperature Anomaly, Hawaii Sector – 13 May 2020

NOAA Coral Reef Watch Daily 5km SST Anomalies (Version 3.1) 13 May 2020

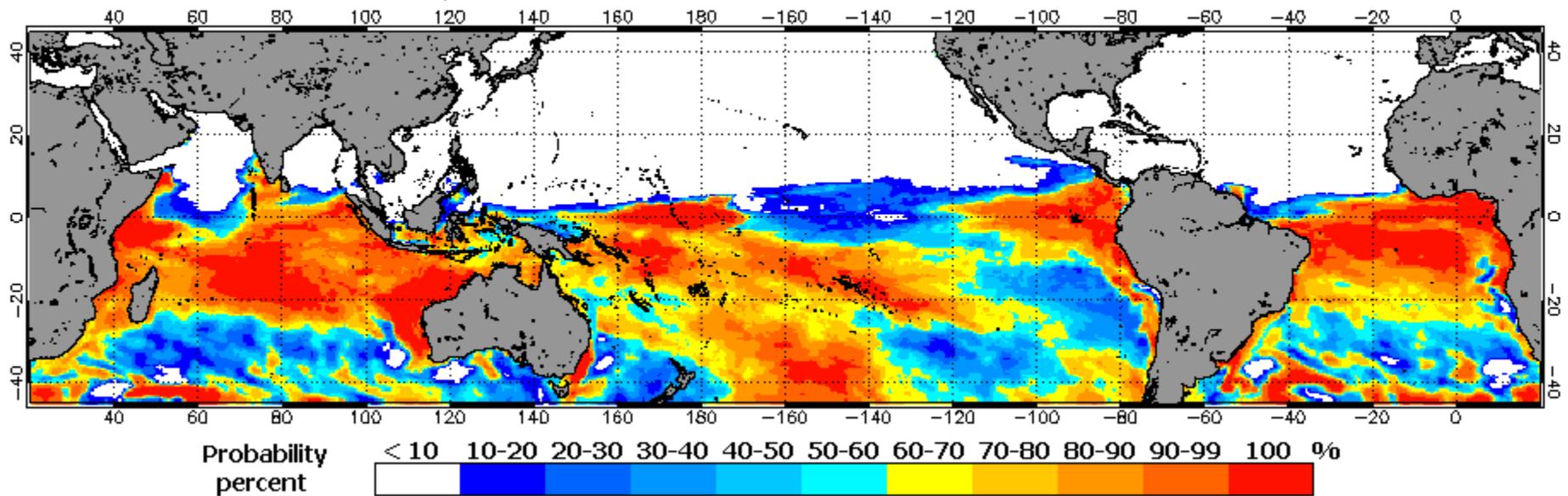


Zone of excess heat to the north, possibly linked to this winter's strong polar vortex pattern

# Bleaching Stress Probability – January-April 2020

Prediction as of 31 December 2019

2019 Dec 31 NOAA Coral Reef Watch Bleaching Heat Stress Probabilities (Warning & Higher) for Jan–Apr 2020  
Experimental, v5.0, CFSv2-based, 28 to 112 Ensemble Members

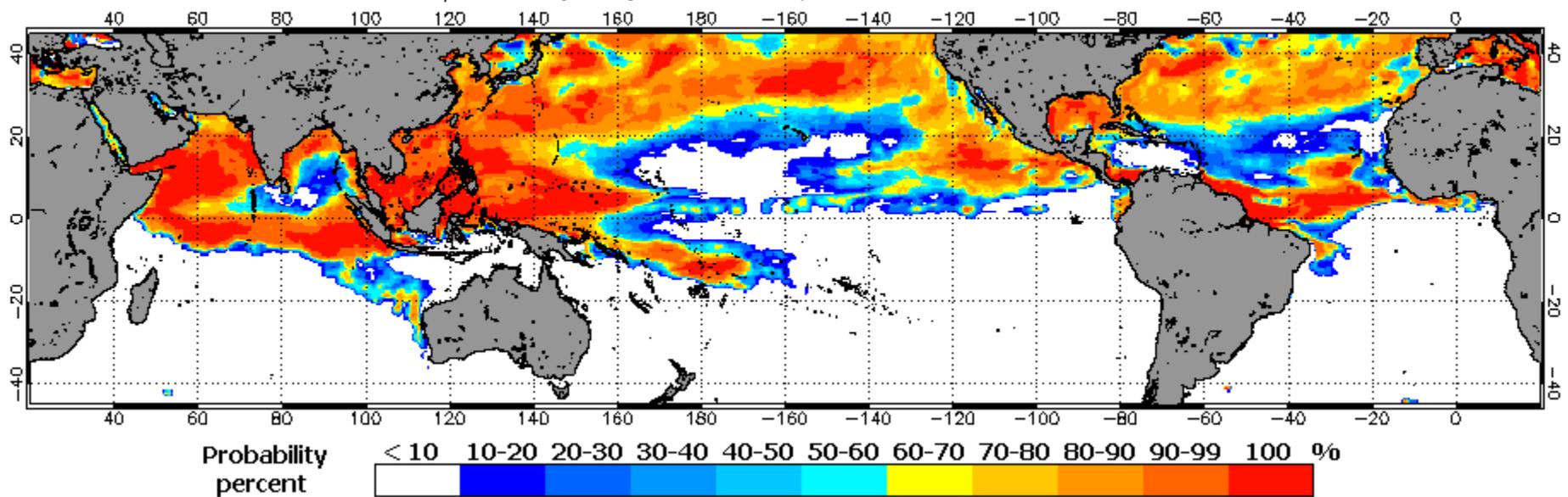


During the winter, heat stress was not an issue

# Bleaching Stress Probability – May-Aug. 2020

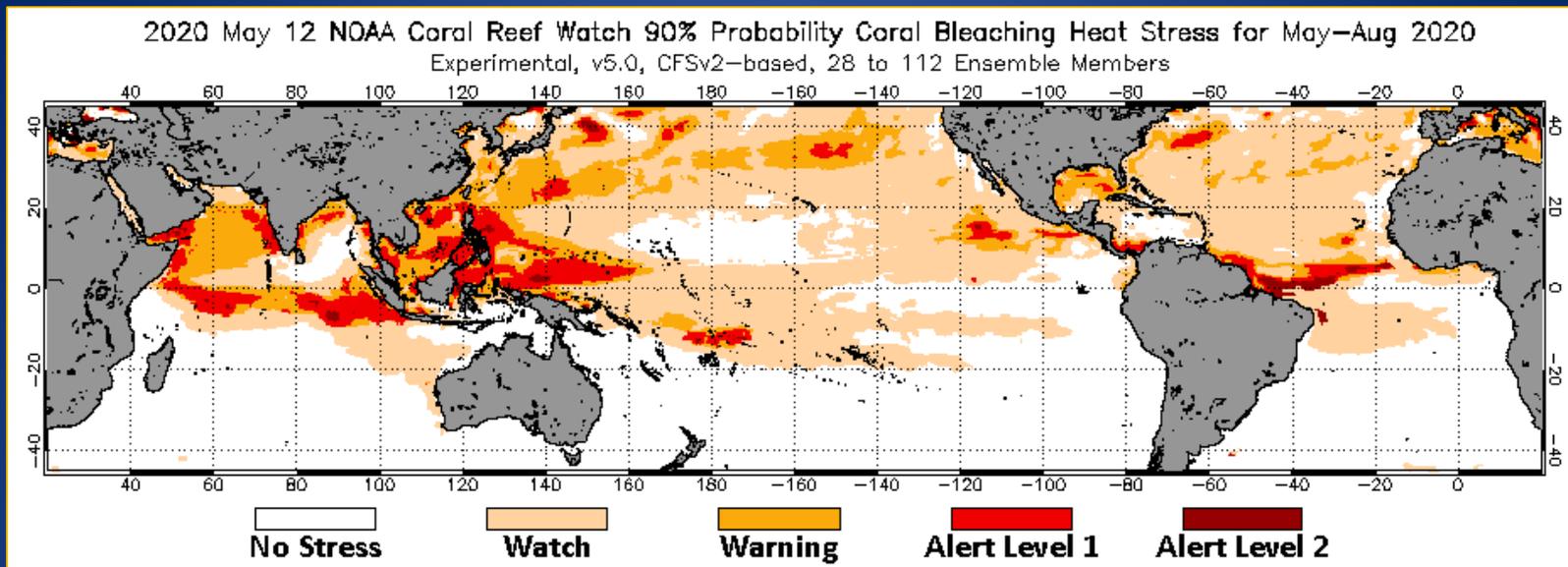
## Prediction as of 12 May 2020

2020 May 12 NOAA Coral Reef Watch Bleaching Heat Stress Probabilities (Warning & Higher) for May–Aug 2020  
Experimental, v5.0, CFSv2–based, 28 to 112 Ensemble Members

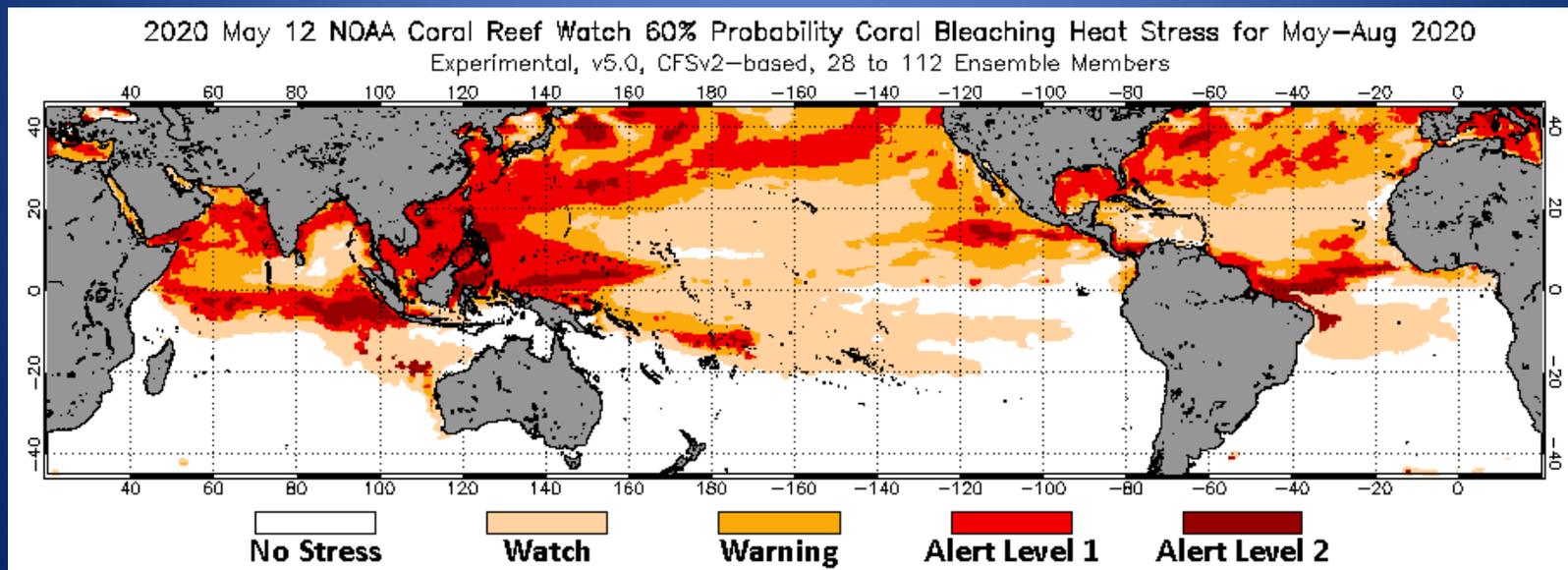


With spring nearly over, an experimental product indicates that thermal stress is likely into late summer for the Pearl & Hermes – Midway – Kure sector of the Monument (but there is a low likelihood of bleaching elsewhere)

# 90% Stress Level Probability – May-August 2020



# 60% Stress Level Probability – May-August 2020



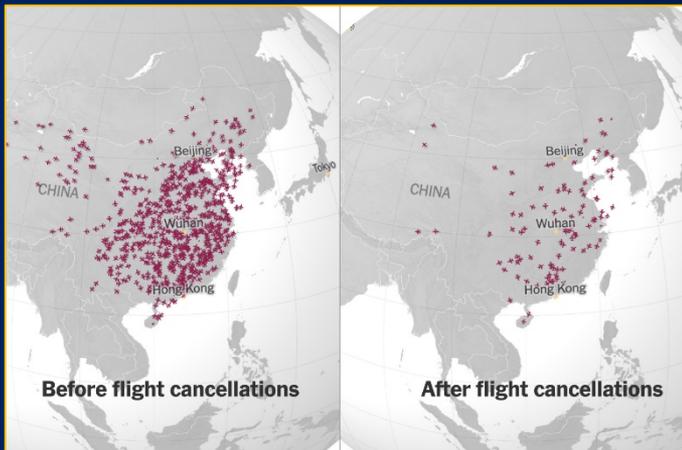
There is a 60 percent probability of bleaching in the Midway sector later this summer

# Digression #2

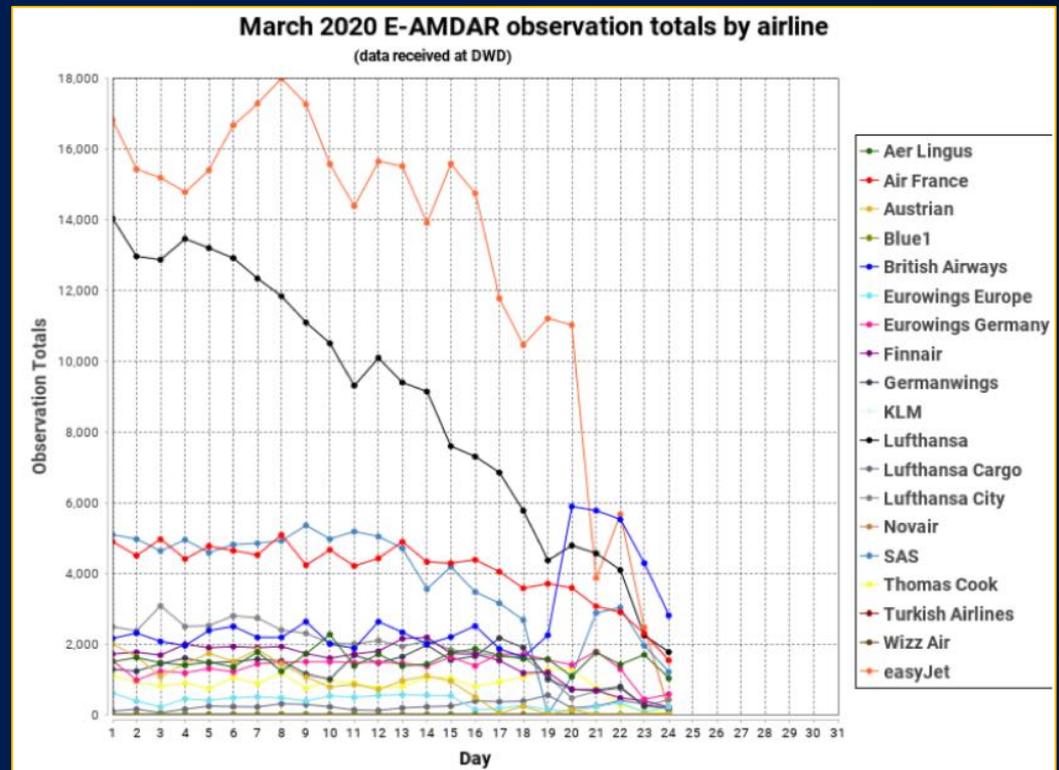
## Coronavirus impacts commercial air travel – and atmospheric data collection



Lots of parked planes currently going nowhere...



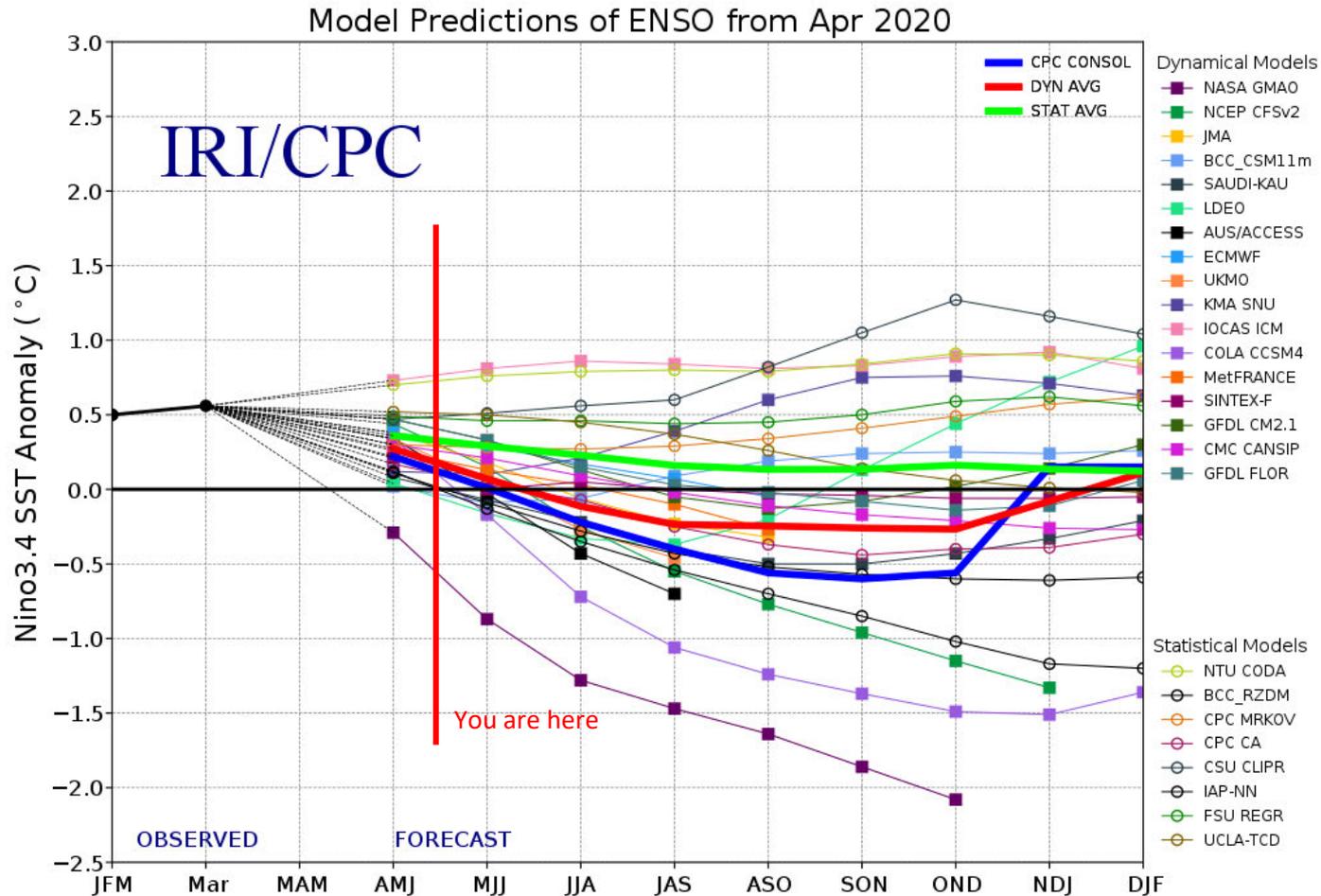
Dramatic reduction of flights over China



Leading to a sharp decline in airborne meteorological observations...which means less resolution in forecast and climate models during the immediate future

# Looking Forward

An ensemble of 27 climate models predicts ENSO-neutral conditions through summer 2020



# Conclusions

**2020 has started with the second hottest April on record**, after one of the warmest winters on record in the Northern Hemisphere, due to a strong Polar Vortex pattern

As a result, the ocean in the far northwestern sector of the Monument is carrying excess heat content – although the vortex has now broken down, so air temperatures may moderate in the north

**ENSO-neutral conditions are present**, and expected to persist through summer 2020

Neither an El Niño nor a La Niña are predicted to develop this year

**There is a moderate chance of thermal stress to Monument coral reefs this summer**, primarily in the sector containing Pearl & Hermes, Midway and Kure

Elsewhere in the Monument and main Hawaiian Islands, the risk of late summer bleaching currently appears low

**Local tropical cyclone formation is not favored**, due to the presence of an ENSO-neutral pattern

By contrast, the heat content of the Atlantic carries risks for a severe season there

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

Inundation is a long-term problem that will not go away, and may increase over time depending on future melting trends in Greenland and Antarctica

# Questions?

