

January 2024

PMNM Climate Change Working Group

Dan A. Polhemus

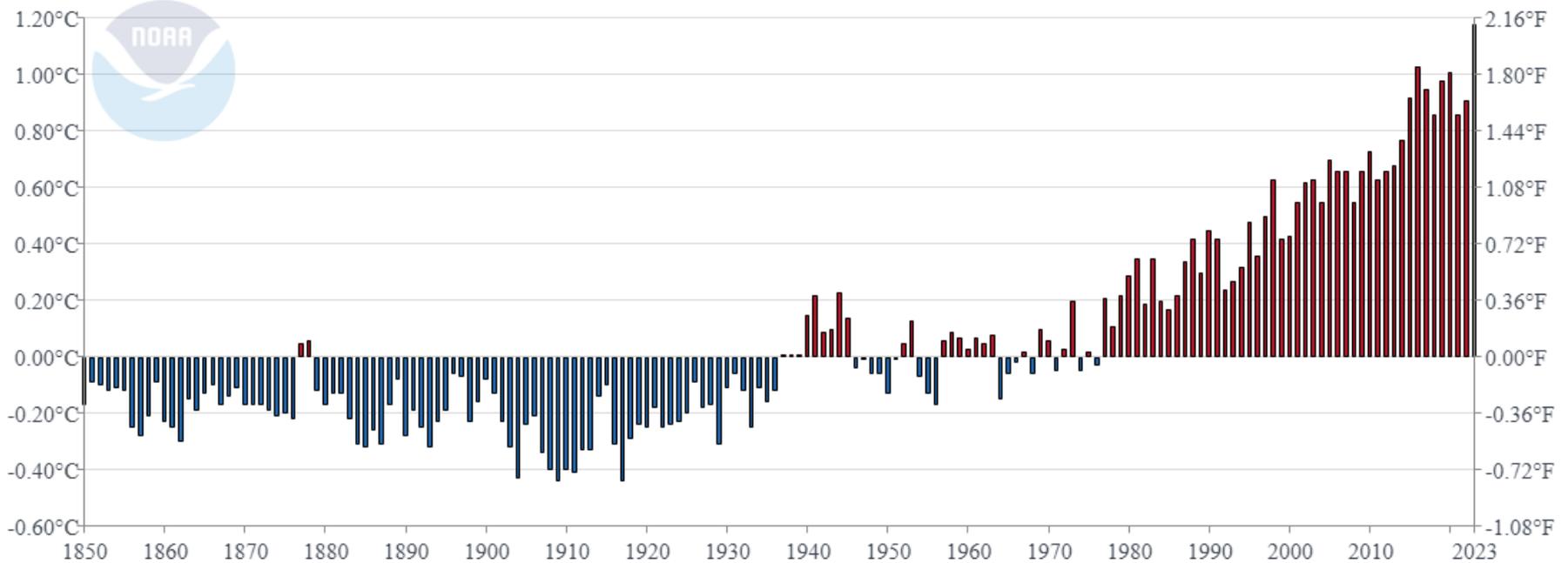
U. S. Fish & Wildlife Service

Honolulu, HI

2023 ended up being the warmest year in the instrumented record

After a few slightly moderating years, 2023 shattered previous records

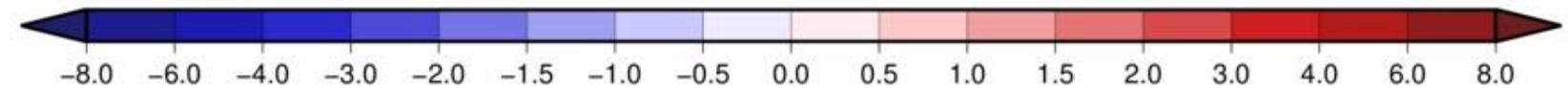
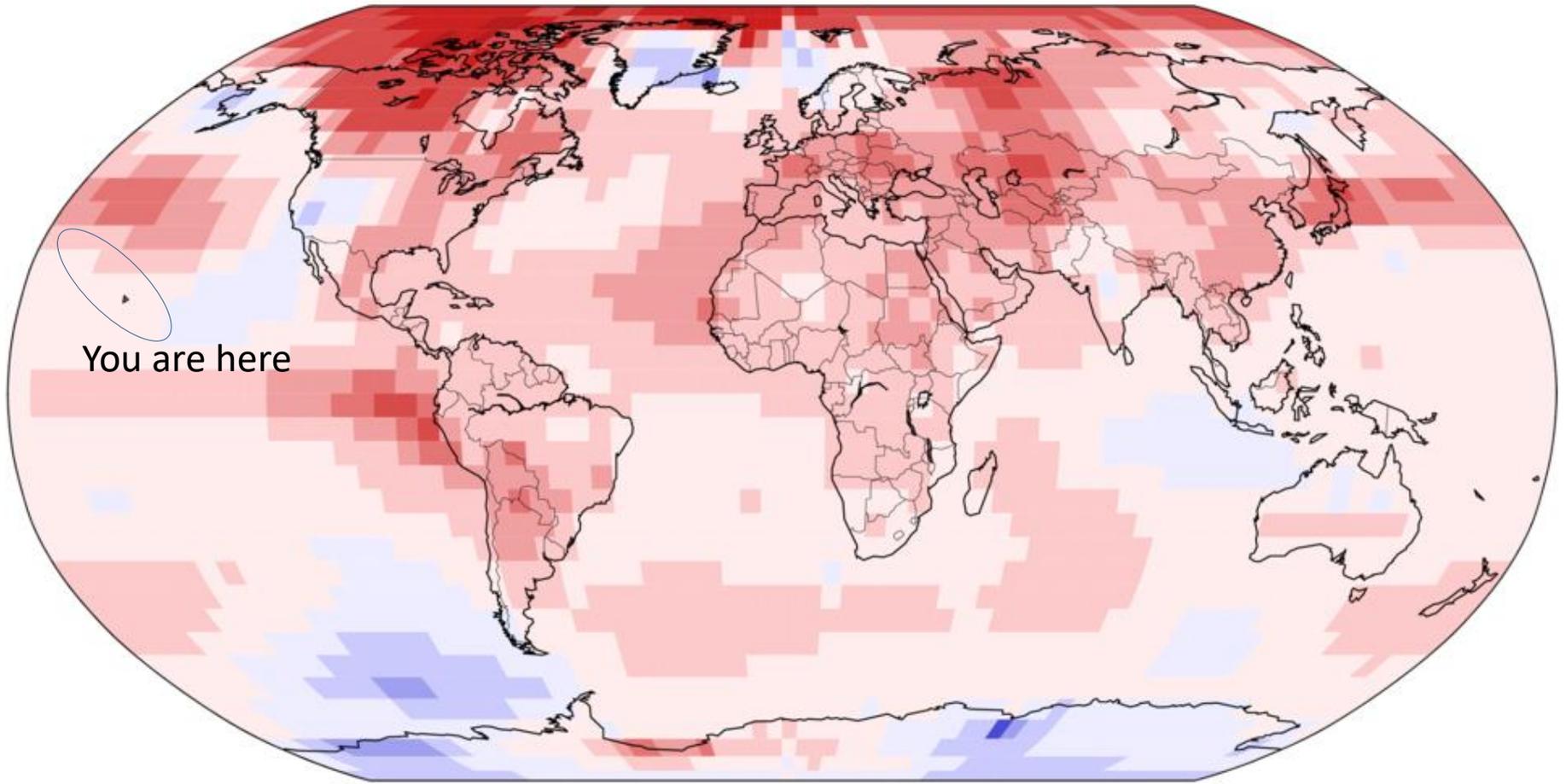
Global Land and Ocean
January-December Temperature Anomalies



The Hawaiian Islands, by contrast, did not experience record warmth

Land & Ocean Temperature Departure from Average Jan–Dec 2023 (with respect to a 1991–2020 base period)

Data Source: NOAA GlobalTemp v5.1.0–20240108



Degrees C



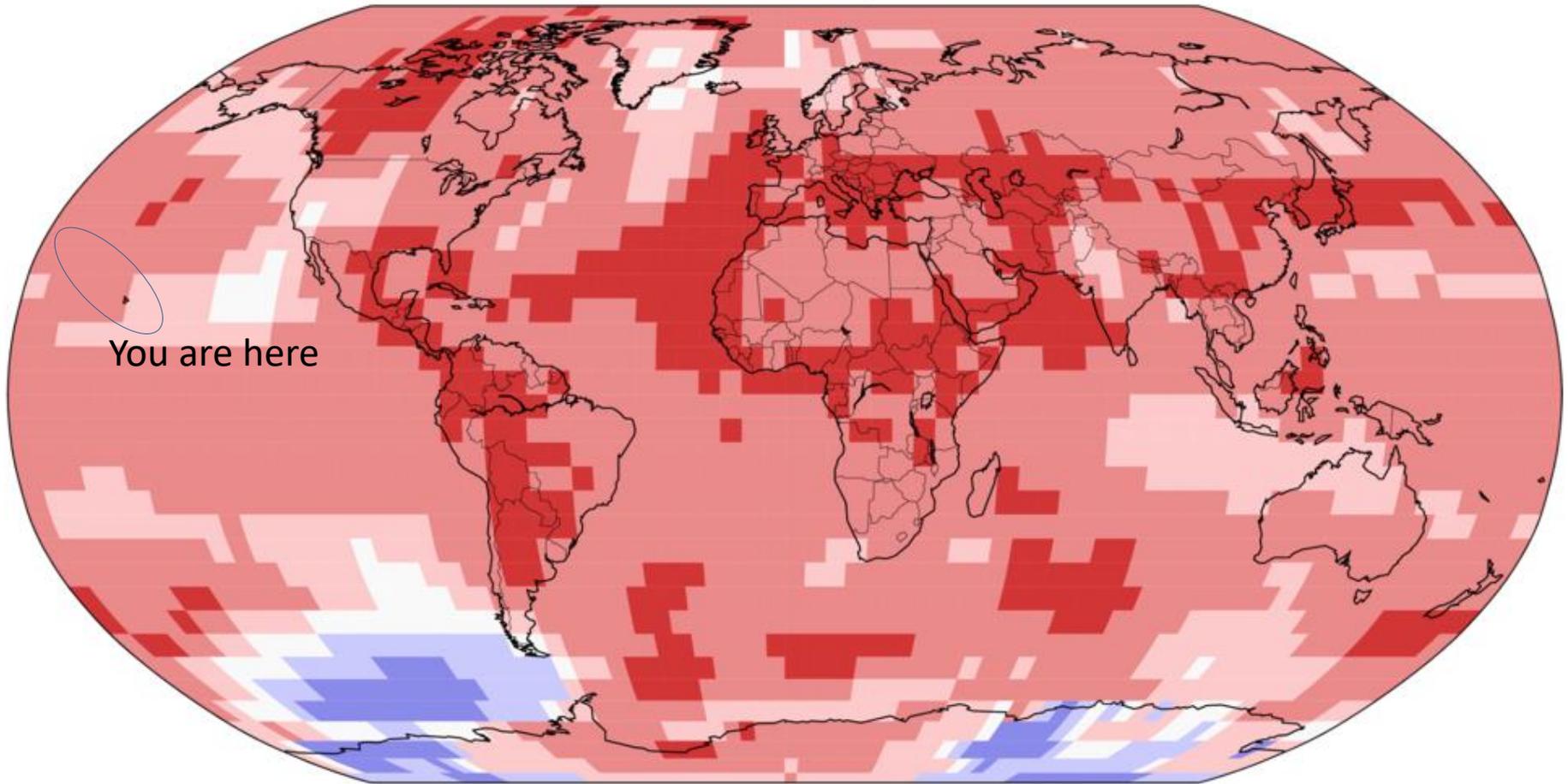
National Centers for Environmental Information

Map Projection: Robinson

Land & Ocean Temperature Percentiles Jan–Dec 2023

NOAA's National Centers for Environmental Information

Data Source: NOAA GlobalTemp v5.1.0–20240108



You are here



**Record
Coldest**



**Much
Cooler than
Average**



**Cooler than
Average**



**Near
Average**



**Warmer than
Average**



**Much
Warmer than
Average**

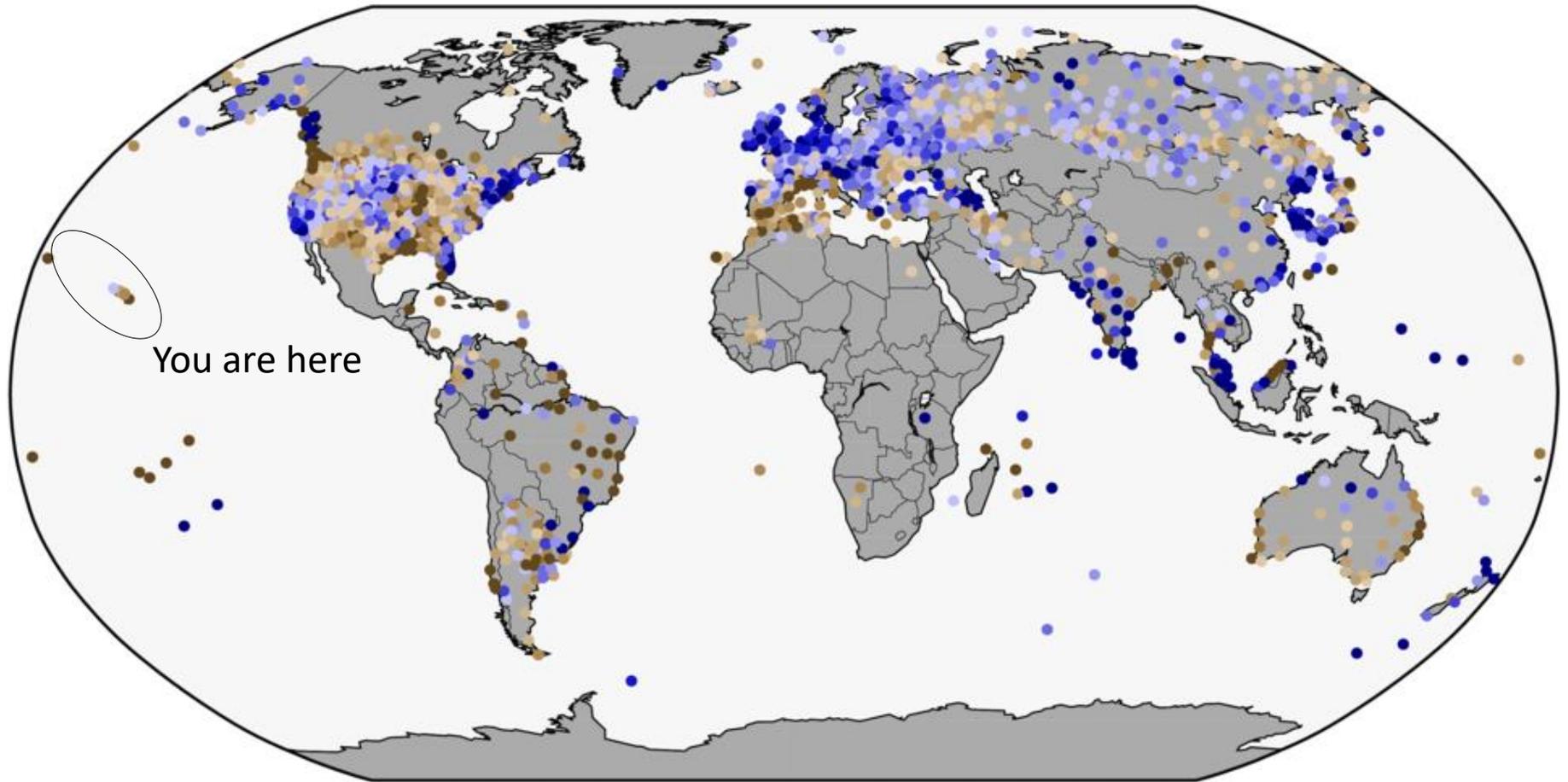


**Record
Warmest**

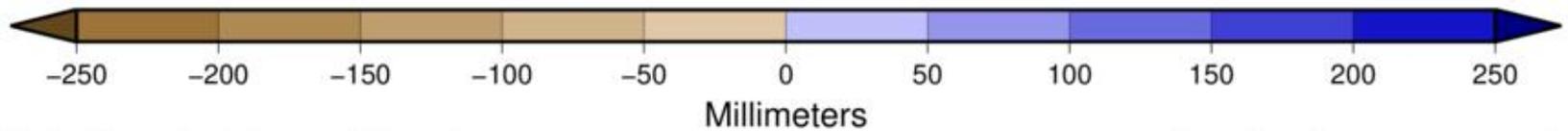


Land-Only Precipitation Anomalies Jan–Dec 2023 (with respect to a 1961–1990 base period)

Data Source: GHCN-M version 4beta



You are here



Millimeters



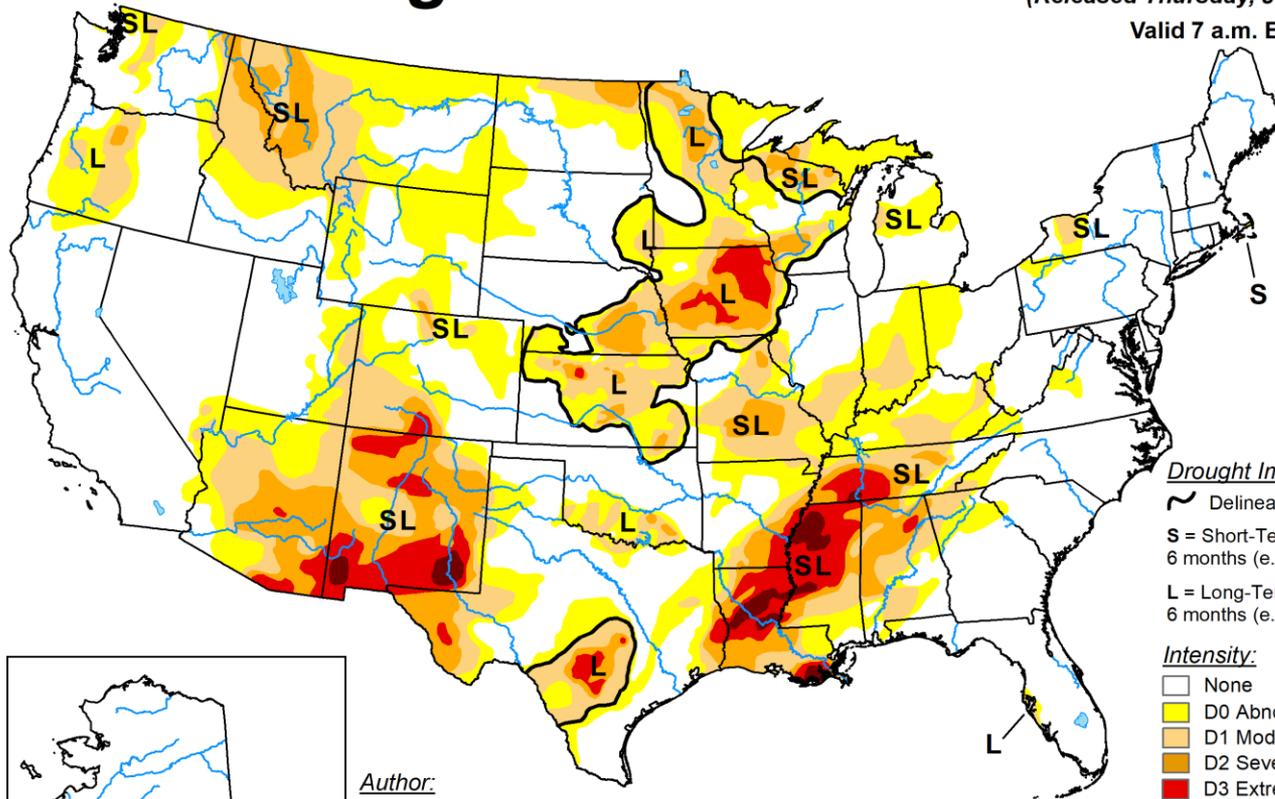
National Centers for Environmental Information

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

U.S. Drought Monitor

January 23, 2024
(Released Thursday, Jan. 25, 2024)

Valid 7 a.m. EST

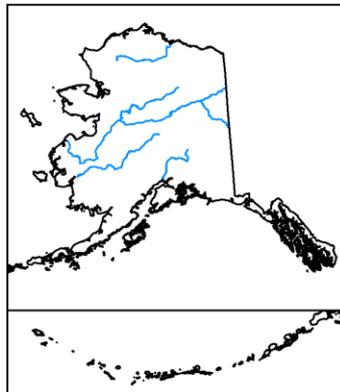


Drought Impact Types:

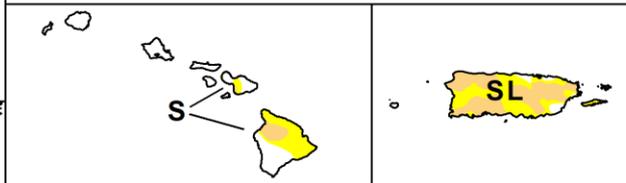
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



Author:
Brian Fuchs
National Drought Mitigation Center



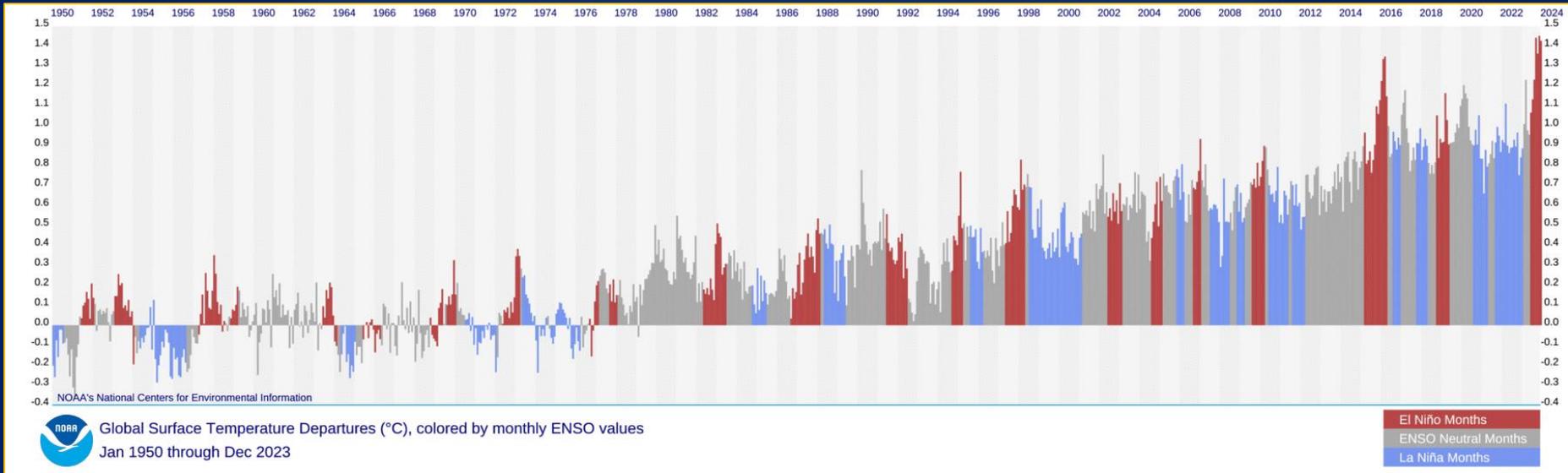
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



droughtmonitor.unl.edu

Annual precipitation was normal in the northwestern sector of the Hawaiian Islands, but drier than average at the southeastern end of the chain, and this pattern continues

Digression #1 - El Niño means heat

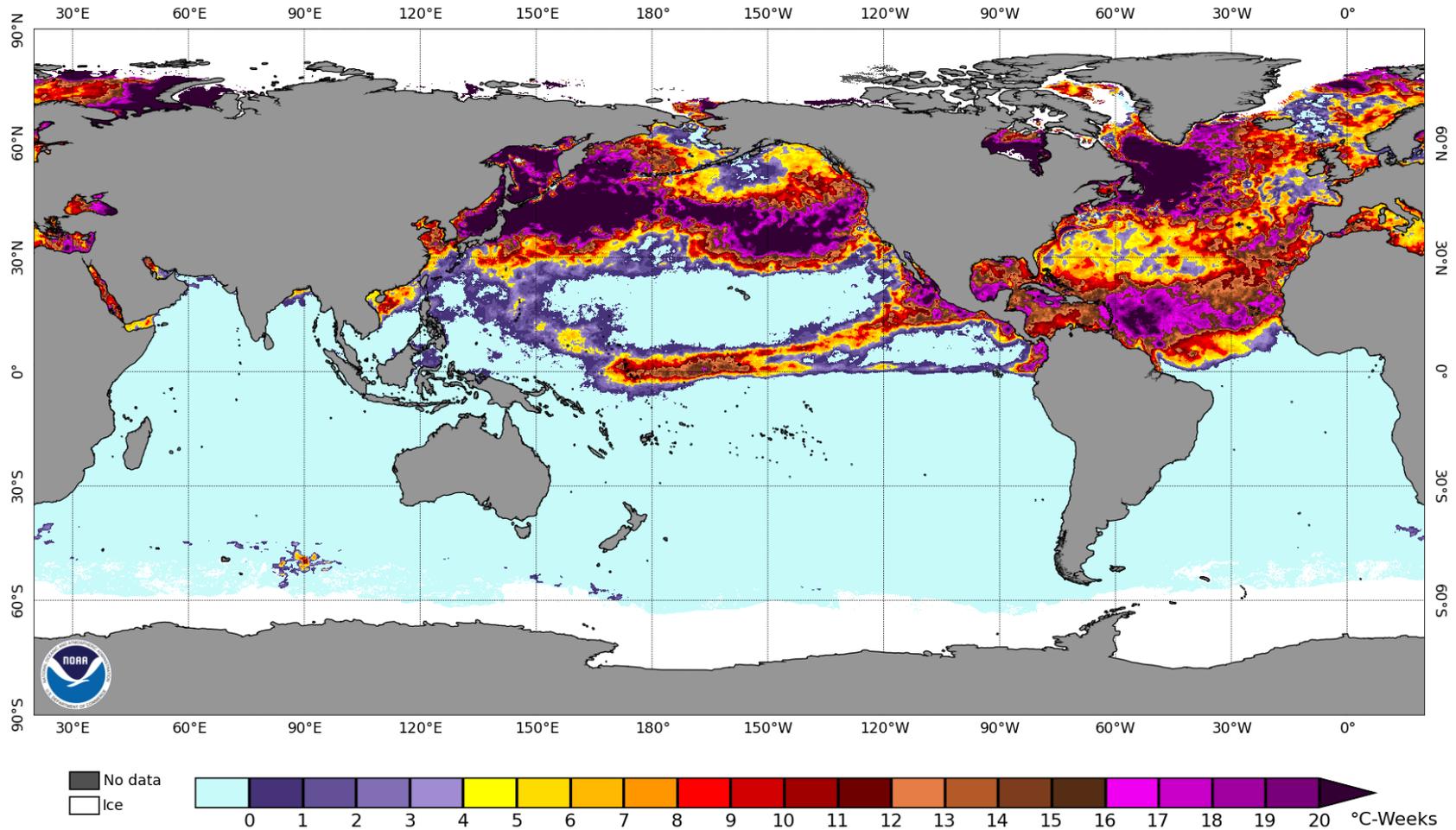


This plot from 1950 to present shows how El Niño years (in red) correspond to progressively higher global temperature spikes over time

These are basically periodic cycles in which the ocean returns accumulated heat to the atmosphere (which also drives cyclone development)

Degree Heating Weeks – 12 Oct. 2023

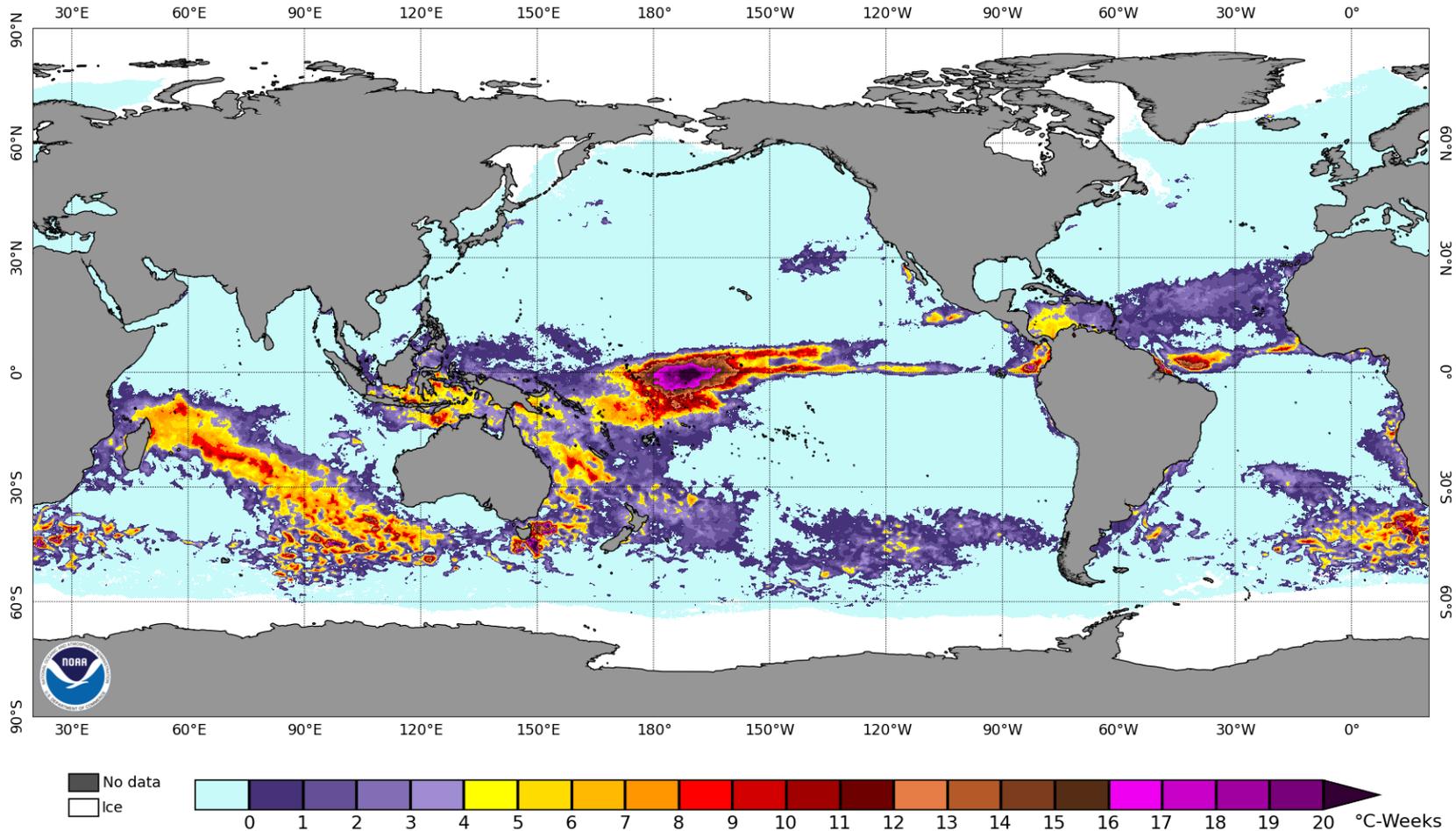
NOAA Coral Reef Watch Daily 5km Degree Heating Weeks (v3.1) 12 Oct 2023



In fall of 2023 Hawaii lay in an anomalous cool ocean pocket surrounded by heat
The accumulation of ocean heat content both north and south of the islands was very evident

Degree Heating Weeks – 25 January 2024

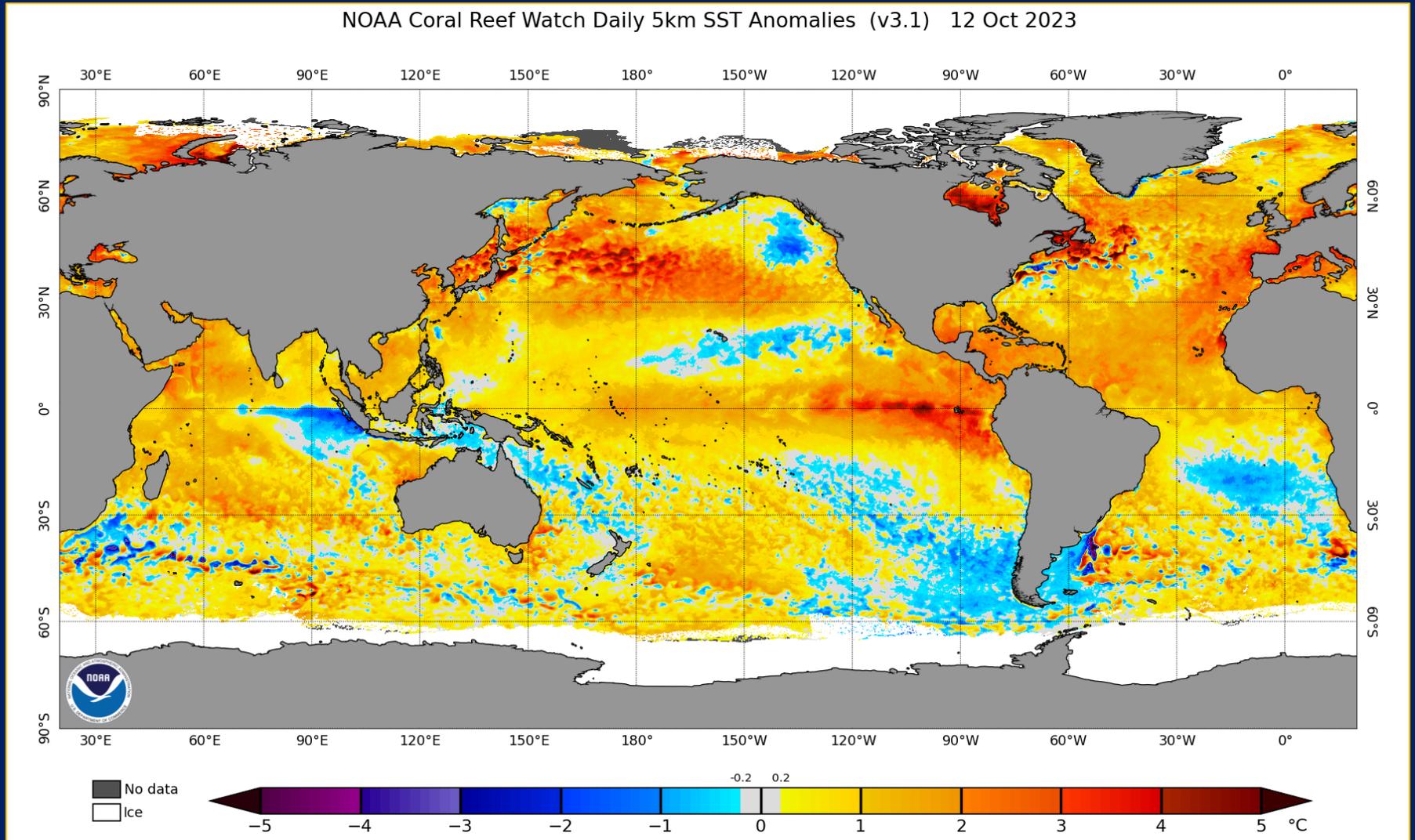
NOAA Coral Reef Watch Daily 5km Degree Heating Weeks (v3.1) 25 Jan 2024



By January nearly all of this heat has dissipated

Unlike the previous several winters, the northern Pacific is not carrying excess heat into spring

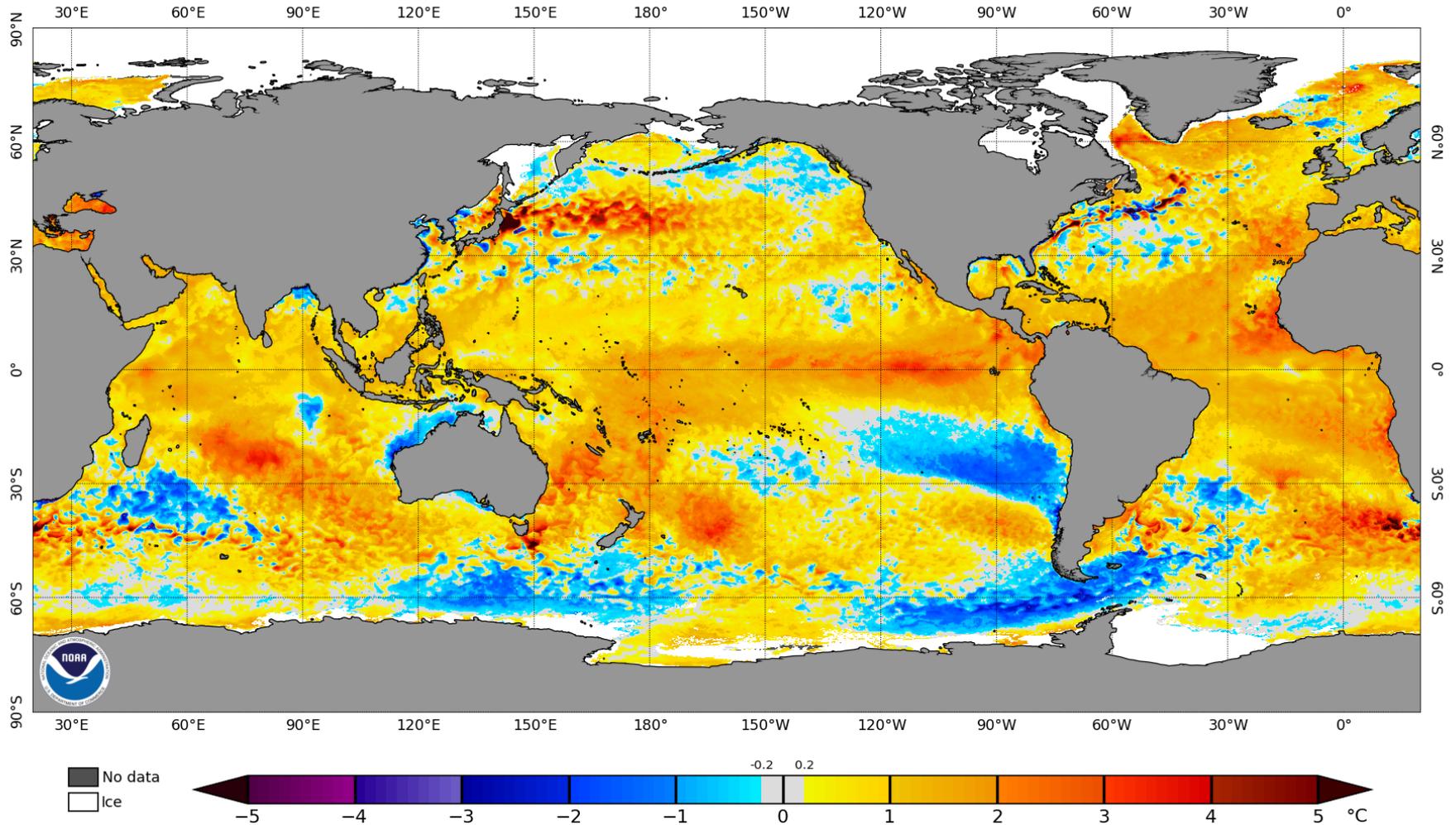
Global Sea Surface Temperature Anomaly – 12 Oct 2023



In October the El Niño pattern was very evident, but Hawaii lay in a pocket of normal ocean temperatures

Global Sea Surface Temperature Anomaly – 25 Jan. 2023

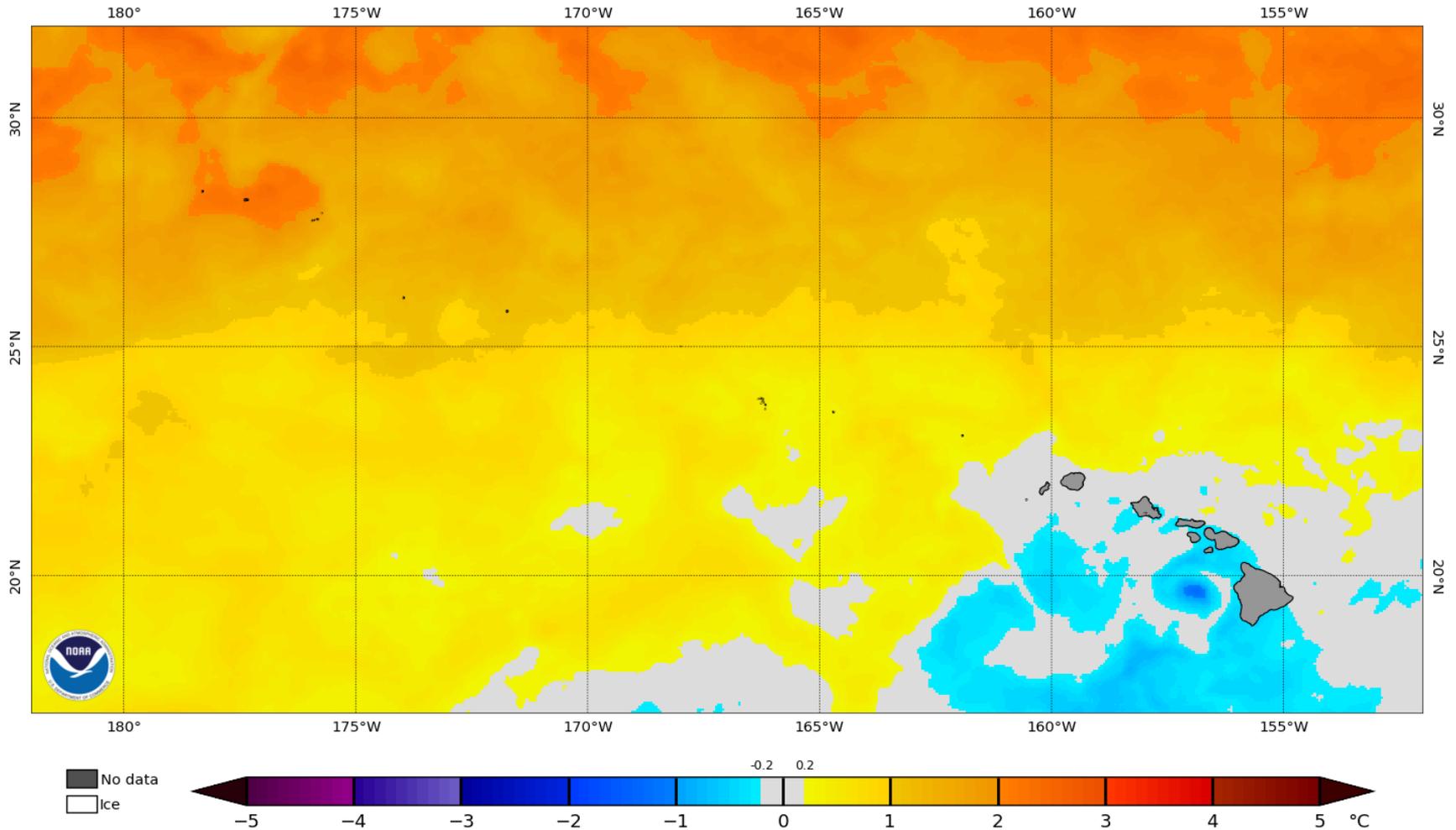
NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 25 Jan 2024



By late January, sea surface temperatures were slightly above normal winter values throughout the Hawaiian Islands, including the Monument, but El Niño was abating

Sea Surface Temperature Anomaly, Hawaii Sector – 12 Oct. 2023

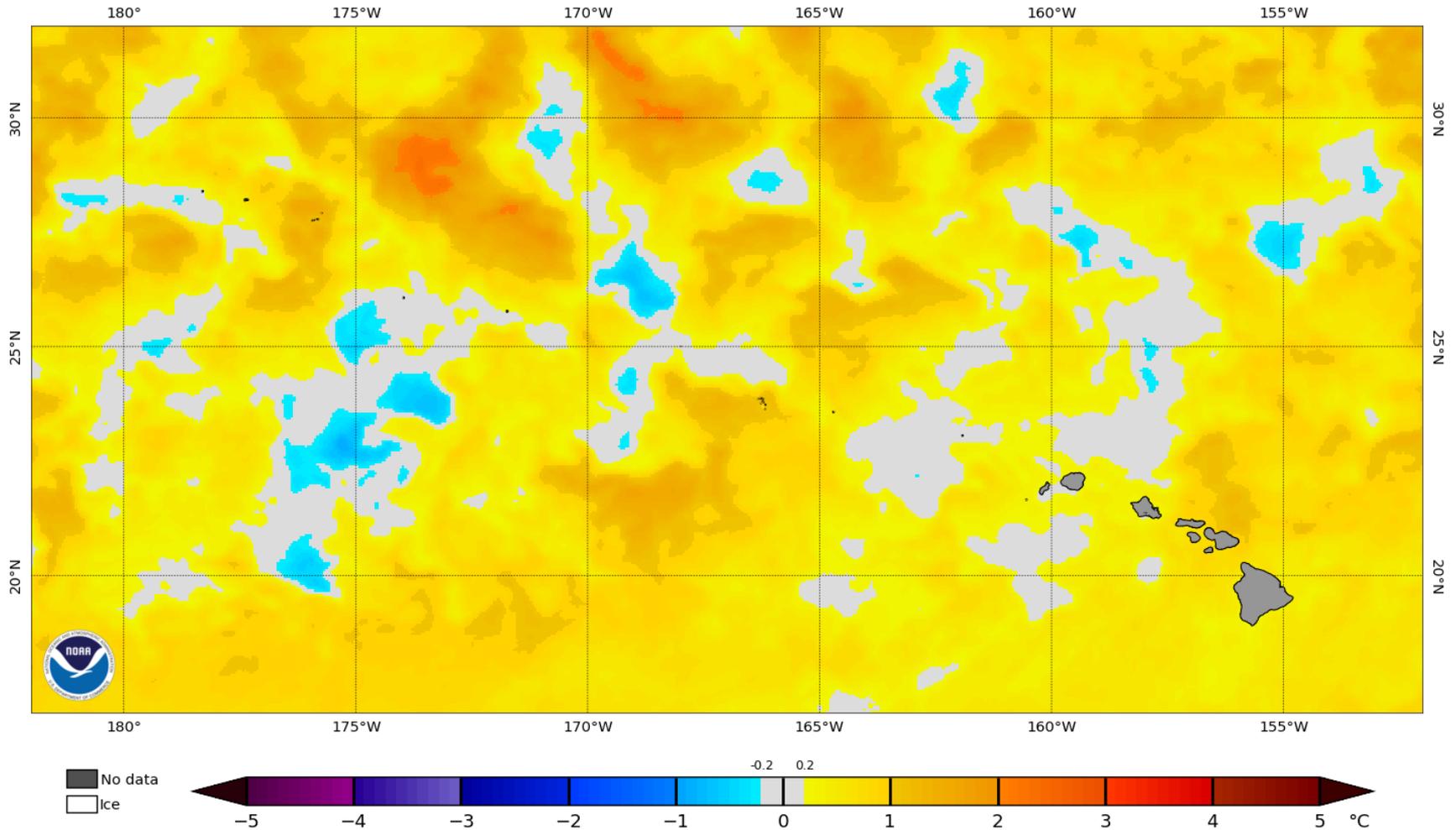
NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 12 Oct 2023



In October 2023 warmer SSTs lay largely north of the Monument, with cool to normal SSTs in the main Hawaiian Islands

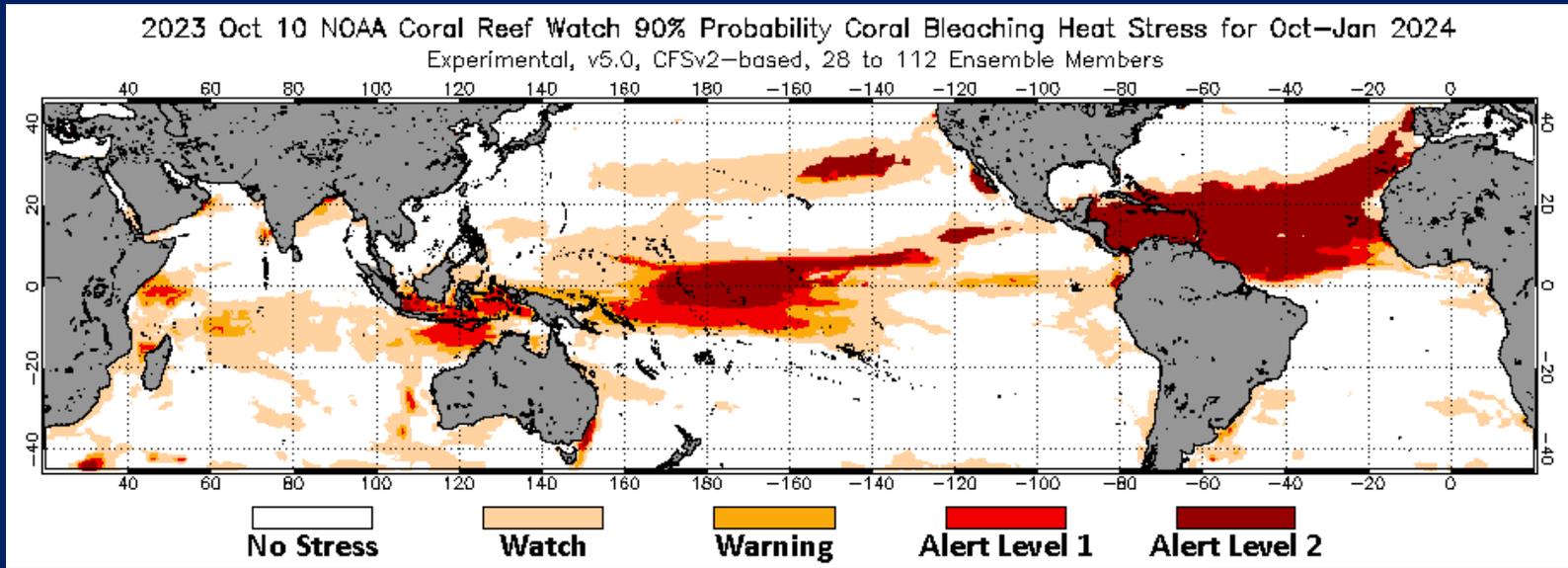
Sea Surface Temperature Anomaly, Hawaii Sector – 25 Jan. 2023

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 25 Jan 2024

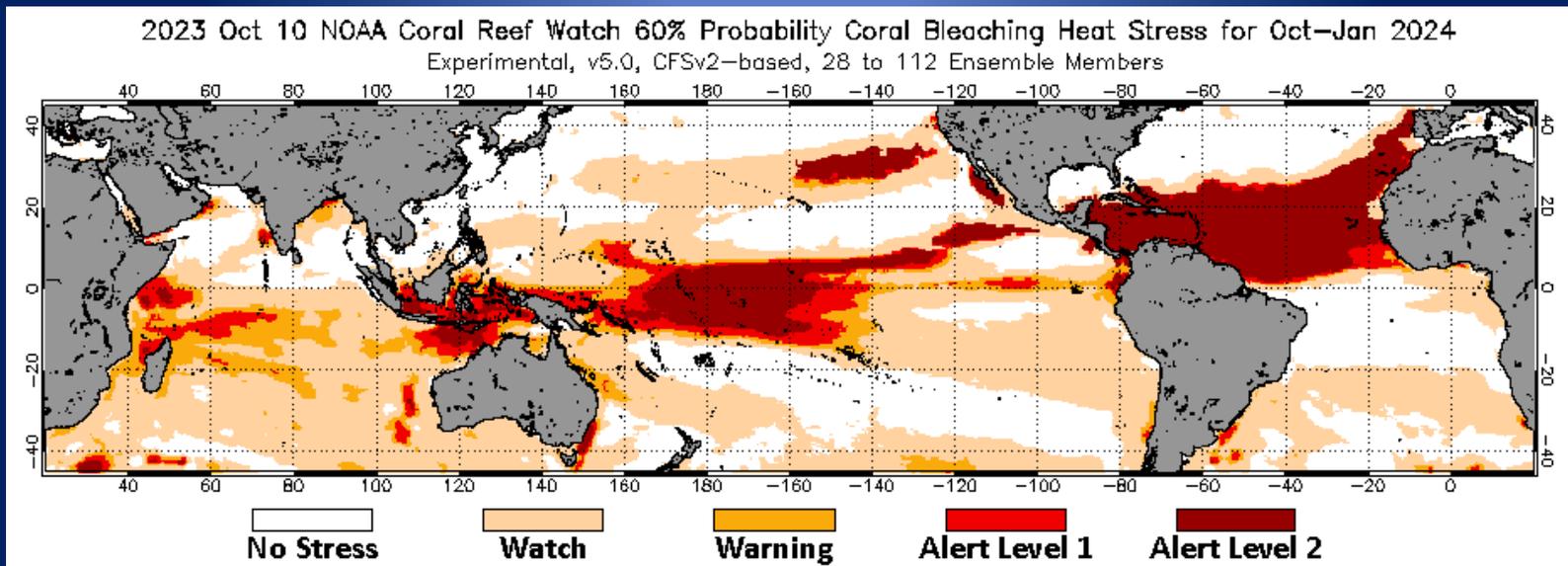


In early January that heat had dissipated, with no major ocean heat content anomalies now present in the Hawaiian Islands sector

90% Stress Level Probability – Oct-Jan 2023

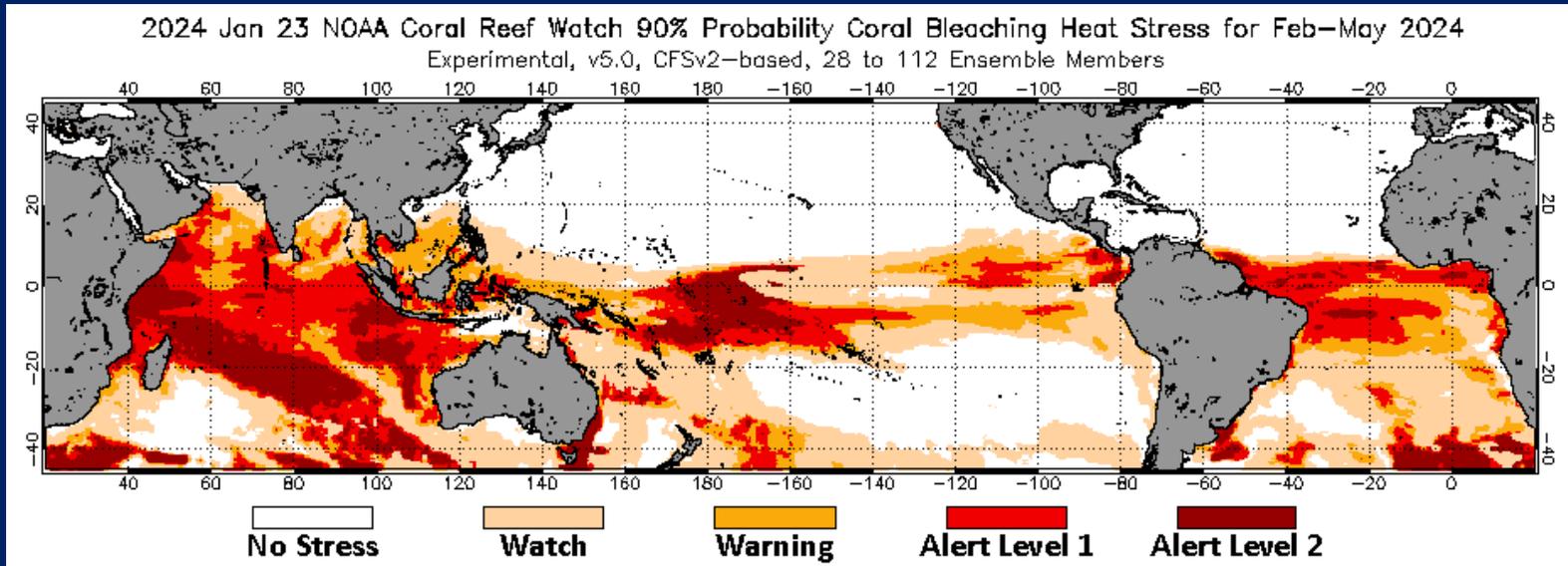


60% Stress Level Probability – Oct-Jan 2023

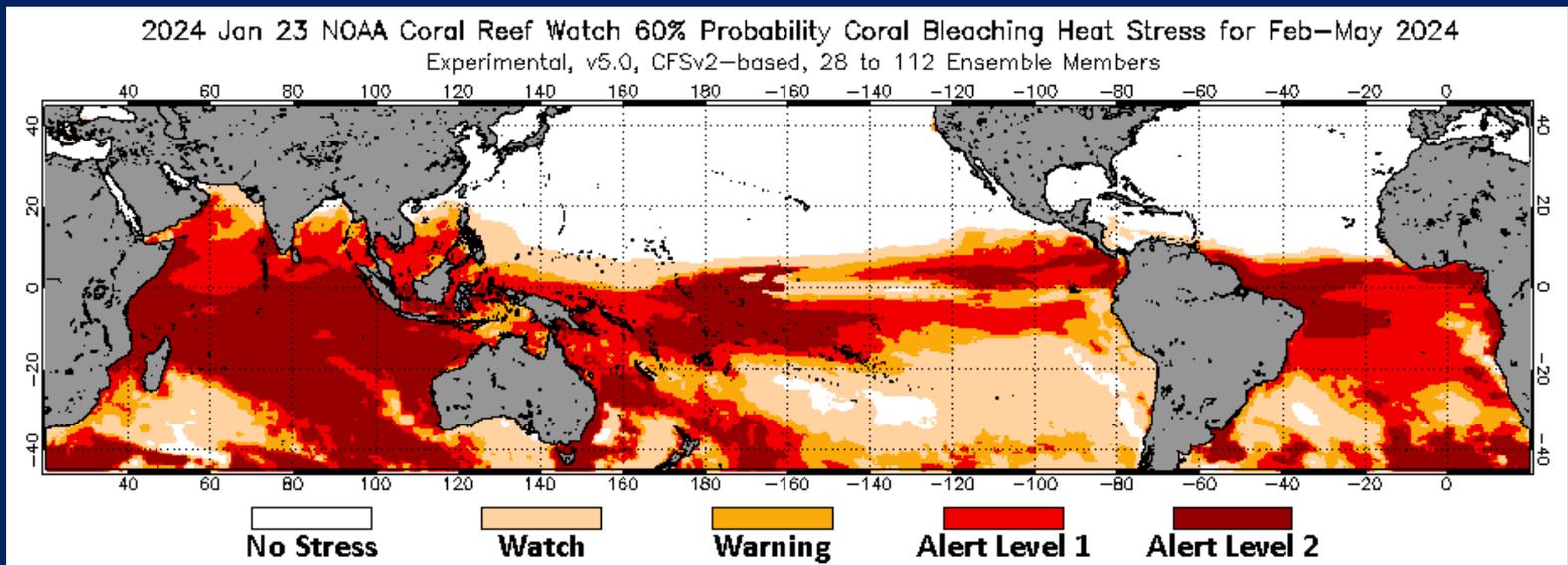


In October, models predicted no bleaching stress in the Monument for 2023

90% Stress Level Probability – Feb.-May 2024



60% Stress Level Probability – Feb.-May 2024

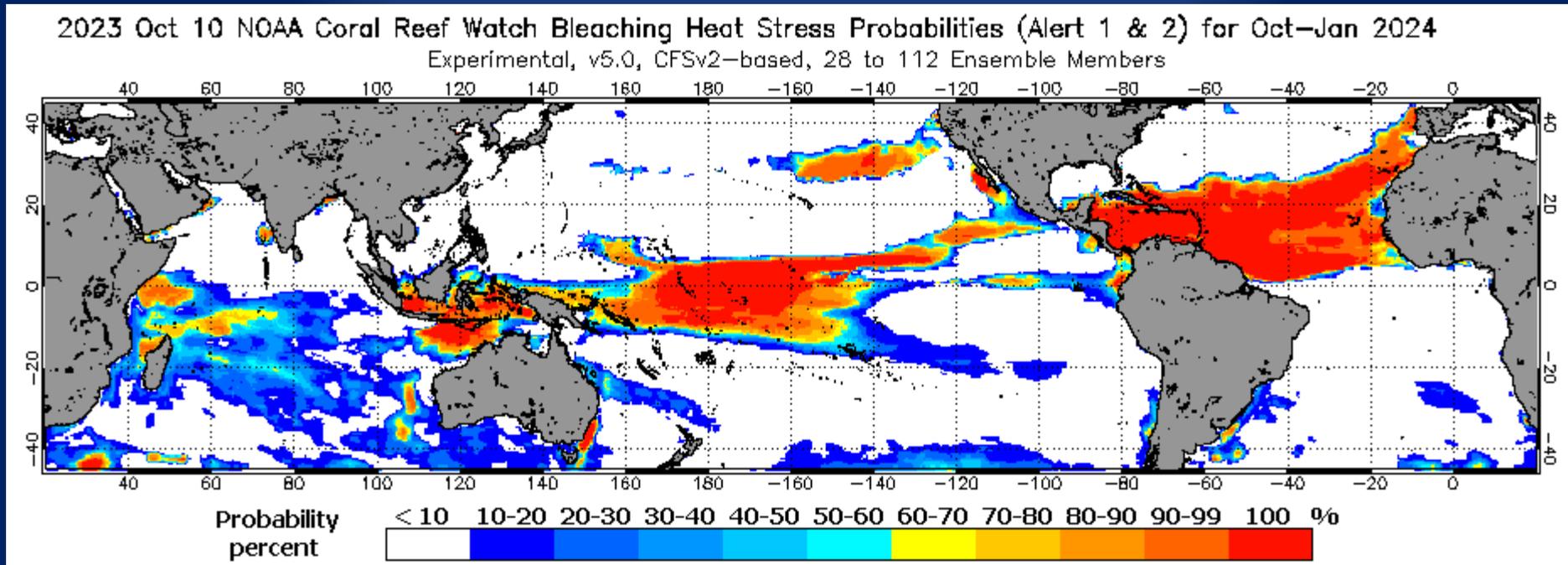


Going forward, there is high thermal stress in the Southern Hemisphere through May, but none in Hawaii

Where We Were

Bleaching Stress Probability – Oct. 2023-Jan. 2024

Prediction as of 10 October 2023



In October, the Northern Hemisphere was cooling

Bleaching risk remained in French Polynesia and Melanesia due to El Nino

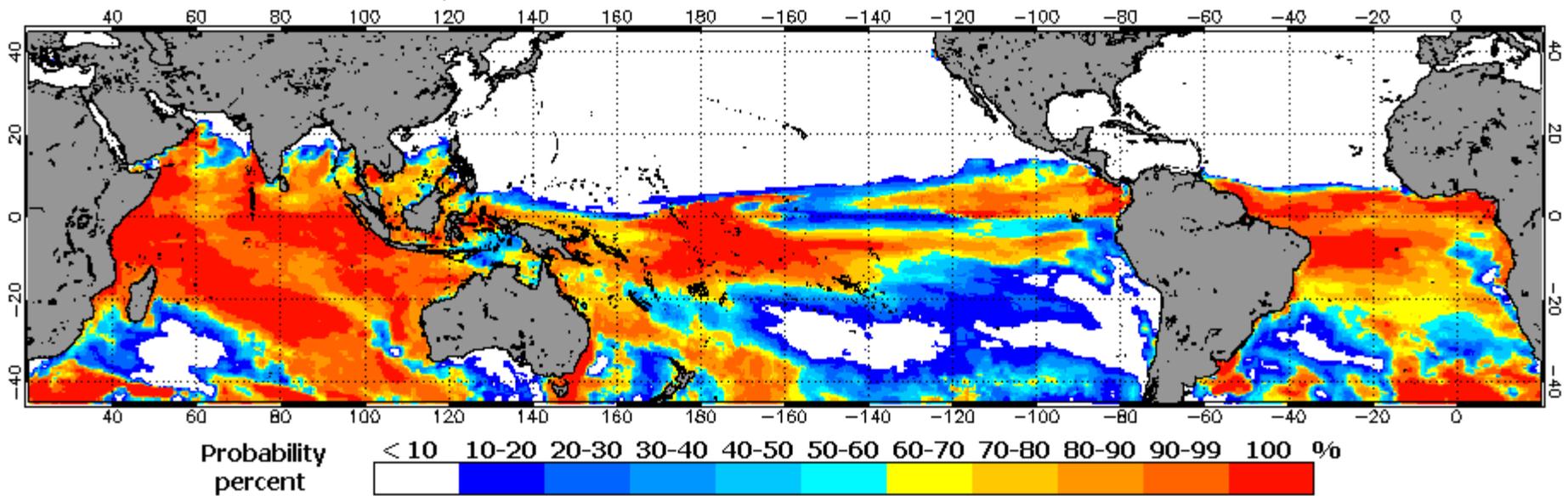
By this point, it was clear that Monument reefs were not likely to bleach in 2023
By contrast, extreme heat and bleaching damage prevailed in the tropical Atlantic

Looking Forward

Bleaching Stress Probability – Feb.-May 2024

Prediction as of 23 January 2024

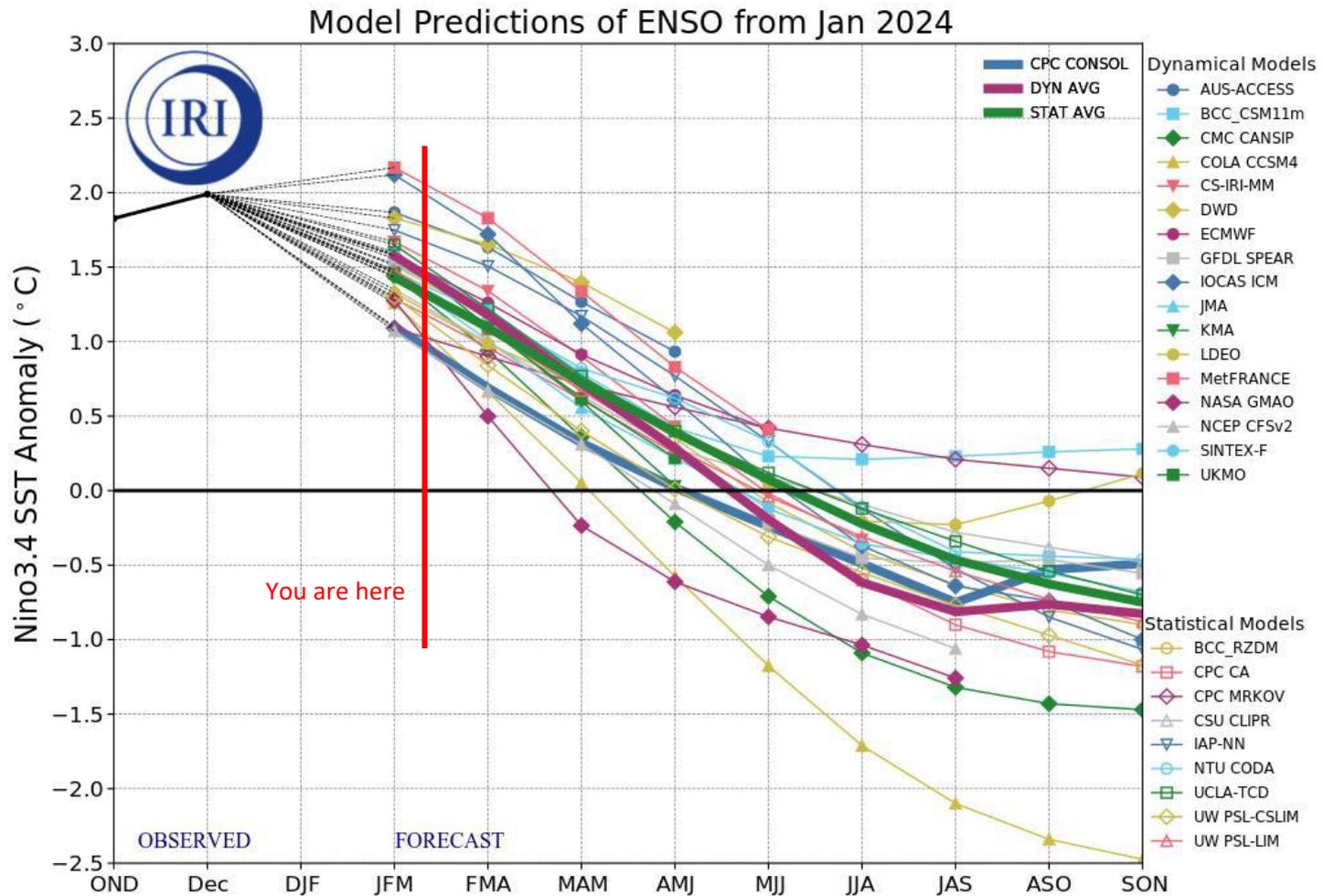
2024 Jan 23 NOAA Coral Reef Watch Bleaching Heat Stress Probabilities (Alert 1 & 2) for Feb–May 2024
Experimental, v5.0, CFSv2–based, 28 to 112 Ensemble Members



At this in January point heating has moved to the equatorial region during Southern Hemisphere summer so Hawaii, the Marianas, and Florida are no longer at any risk
There is a high likelihood of bleaching in the Gilbert and Phoenix islands, with American Samoa on the periphery of this area of high ocean heat; Vanuatu and northern Madagascar are also likely to experience coral bleaching

Looking Forward

An ensemble of 27 climate models are in strong agreement that **El Niño conditions will abate from April to June**, with a 73% chance of ENSO-neutral conditions by summer 2024



Conclusions

2023 was the hottest year on record globally, but the Hawaiian Islands did not experience record heat, or even close to it

Favorable ocean circulation regimes kept the islands only slightly warmer than long-term averages.

The current El Niño event is abating, with a likely transition to ENSO-neutral conditions by late spring or early summer

This is likely to be followed by a transition to cooler La Niña conditions in fall of 2024

Monument coral reefs did not experience bleaching in 2023, due to a fortunate combination of atmospheric and ocean conditions not seen in other areas

Going forward, there is almost zero chance of bleaching through early summer 2023

Tropical cyclone season has ended for the year, and is generally not favored under the ENSO-neutral conditions likely to follow

Late summer 2024 is the next period of potential risk for tropical storm formation, but strong storms are not favored by currently predicted conditions

Sea level continues to rise at 3-5 mm per year, and this trend is increasing

Inundation is a long-term problem that will not go away, with 2-3 feet of additional rise possible by the end of the century (77 years from now)

Thank You

