PICOF-14

Looking back long-term: Ocean temperature

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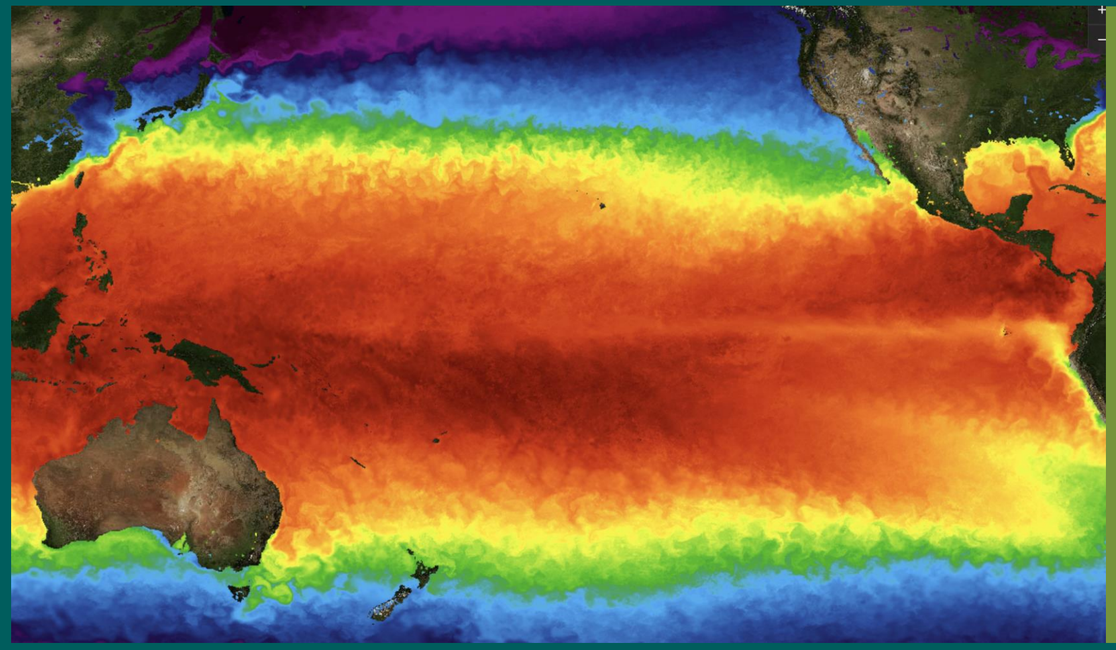
University of Hawaii



Ocean temperature

- Trends
- Heat content
- Heat waves
- Degree heating weeks

RECORD OCEAN HEAT

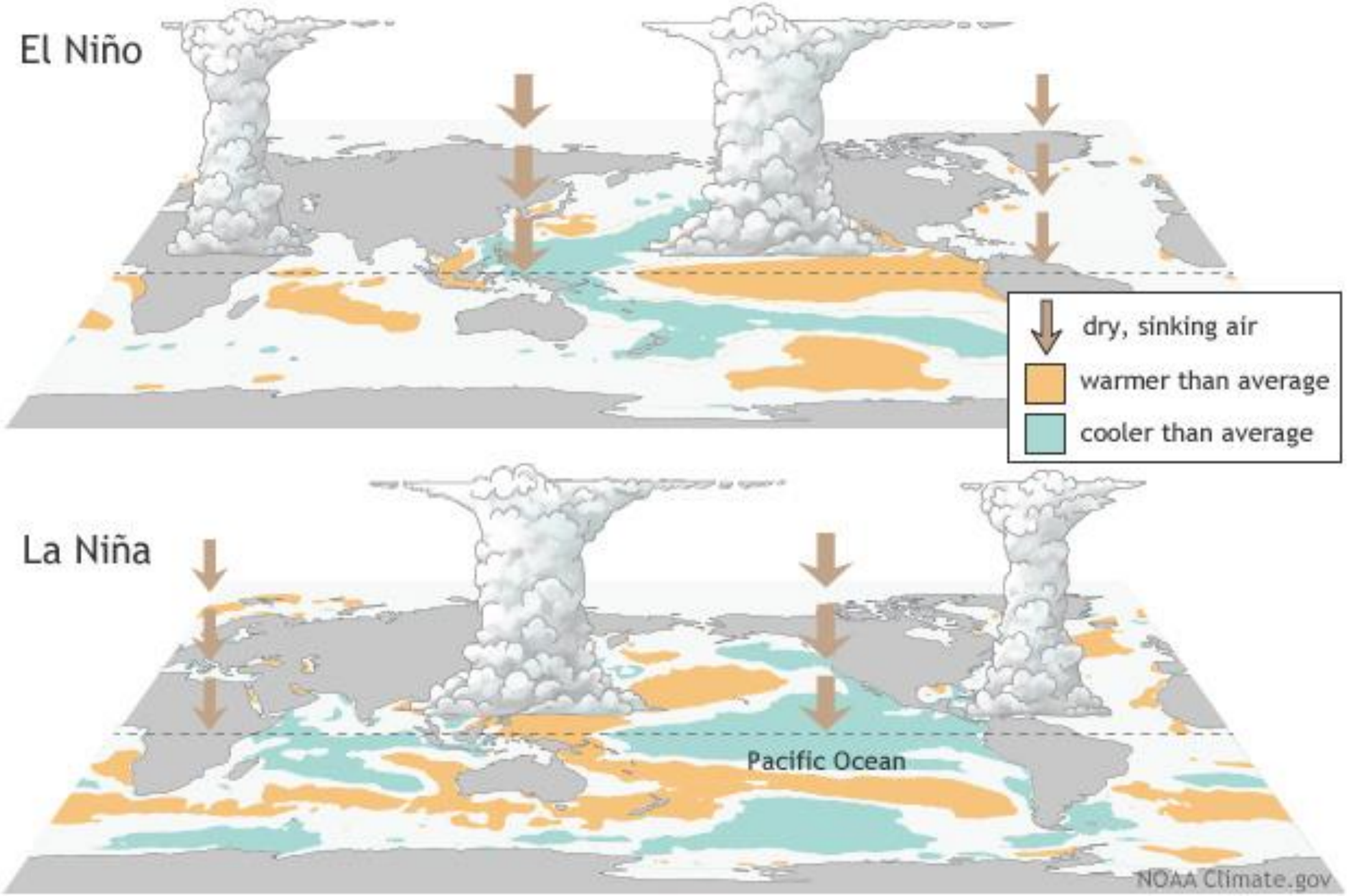
Daily global sea surface temperature (°F)

Source: NOAA OISST

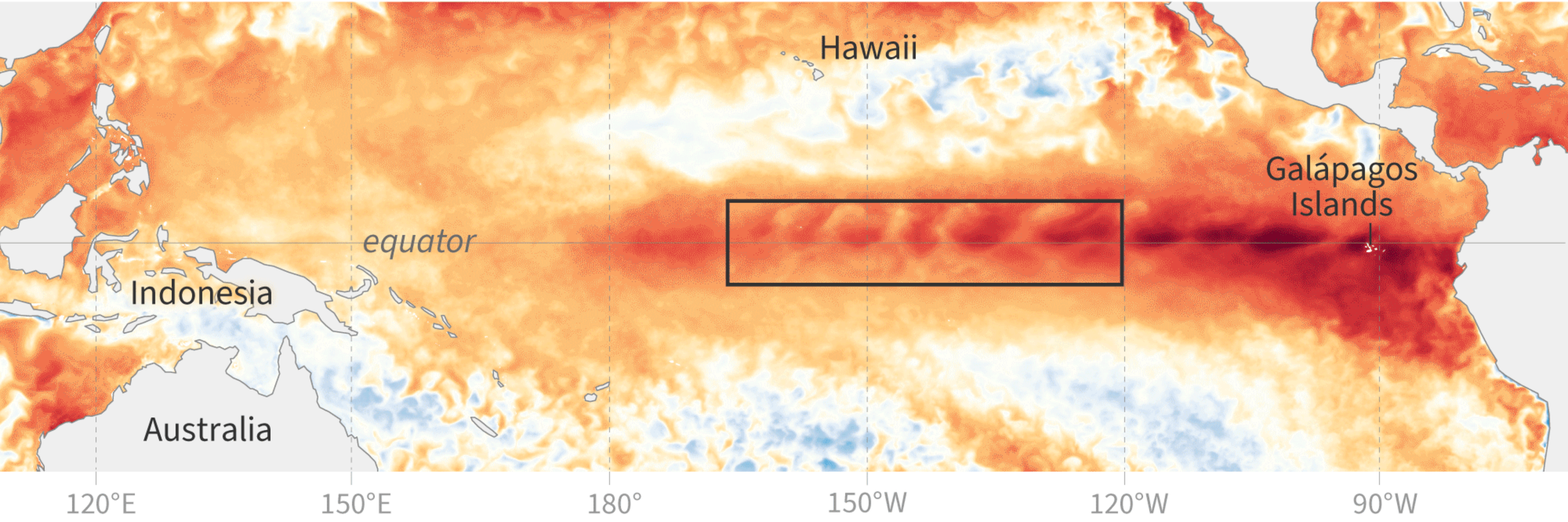
CLIMATE CENTRAL

Ocean Temperature

- Tropical Pacific dominated by ENSO variability
- Upward trend in SST
- Also trend in upper ocean heat content (ocean storing excess heat)
- Serious implications for coral reefs
- Marine heat waves more widespread


El Niño
dry, sinking air
warmer than average
cooler than average
La Niña
Pacific Ocean
NOAA Climate.gov

Weekly sea surface temperature patterns in tropical Pacific (Oct 30, 2023–Jan 7, 2024)

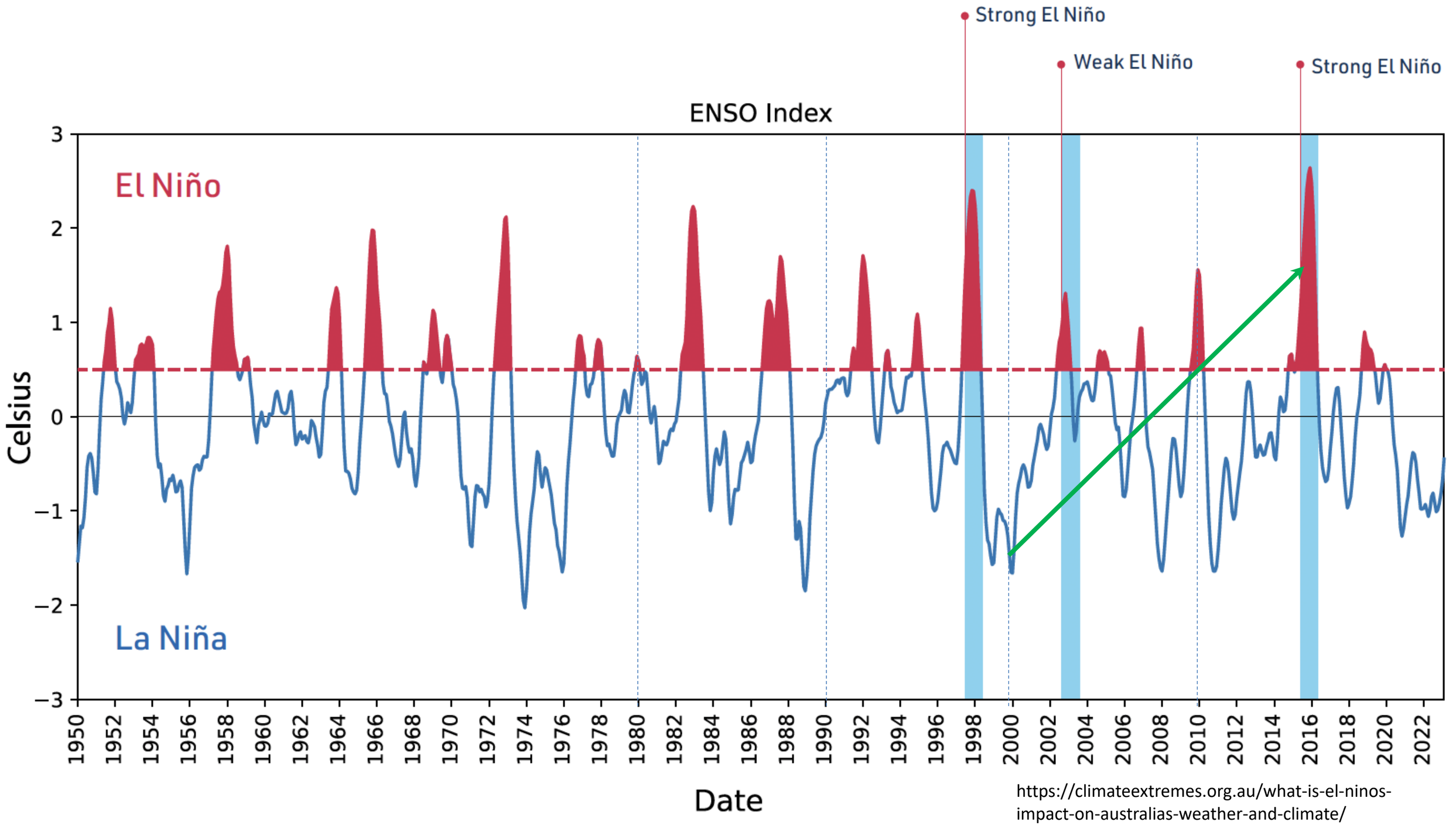


difference from average temperature (°C)

−5 0 5

Oct 30–Nov 5, 2023

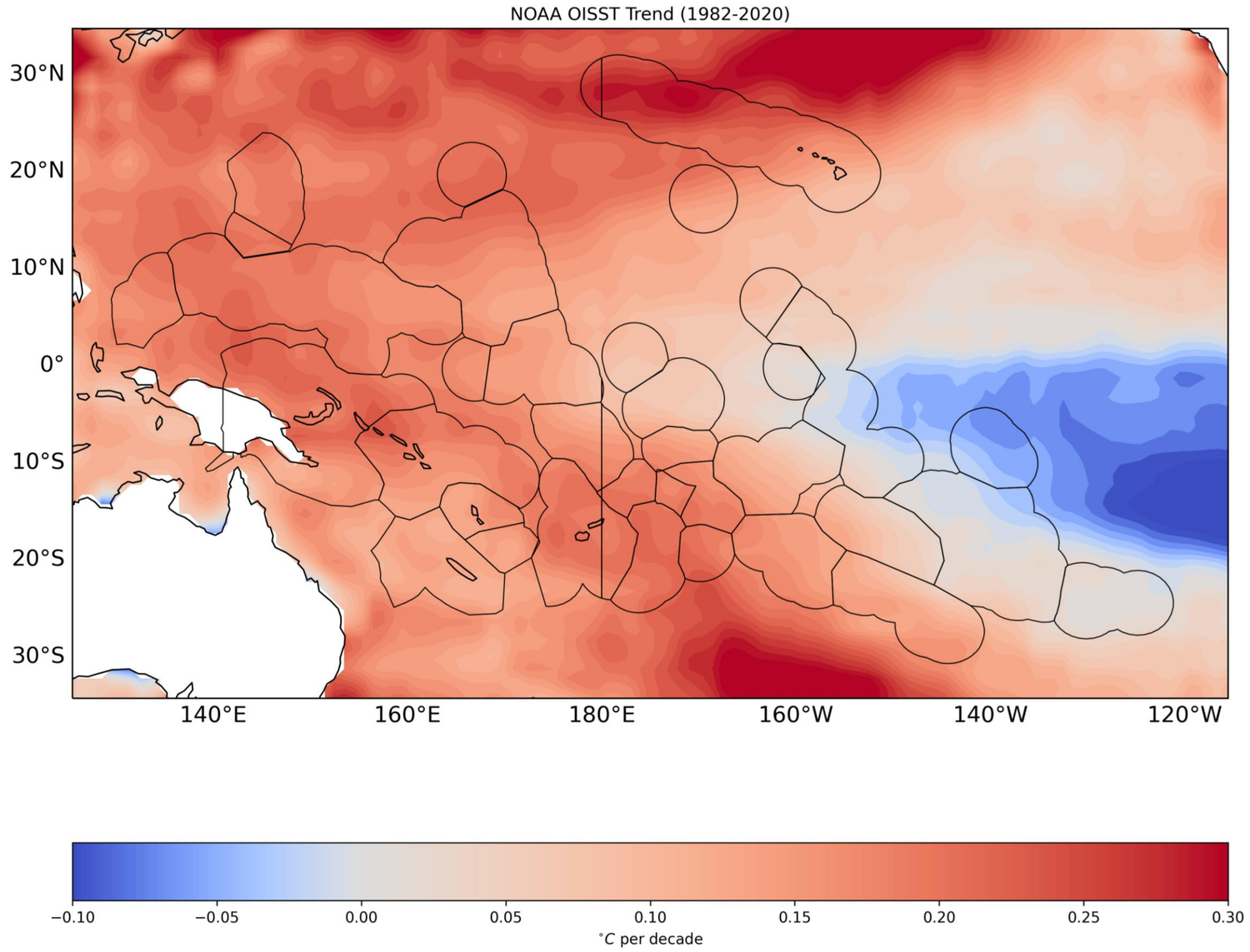
NOAA Climate.gov
Data: NOAA View



https://climateextremes.org.au/what-is-el-ninos-impact-on-australias-weather-and-climate/

Sea Surface Temperature Trend

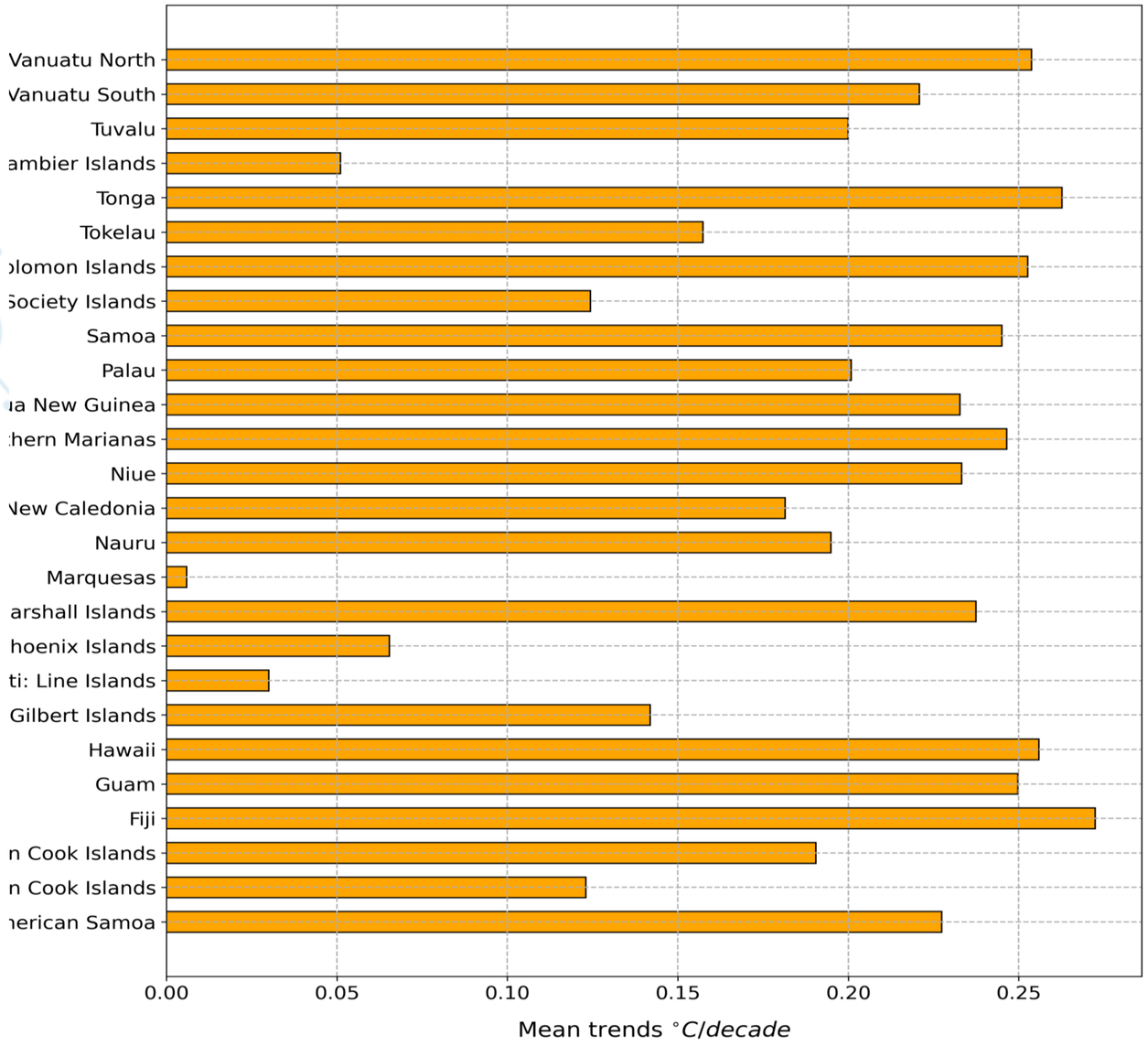
NOAA OISST 1982-2020



- Trend in SST over the period 1982-2020 from NOAA blended product
- Region-wide warming of about 0.1 to 0.2 °C/decade

Sea Surface Temperature Trend

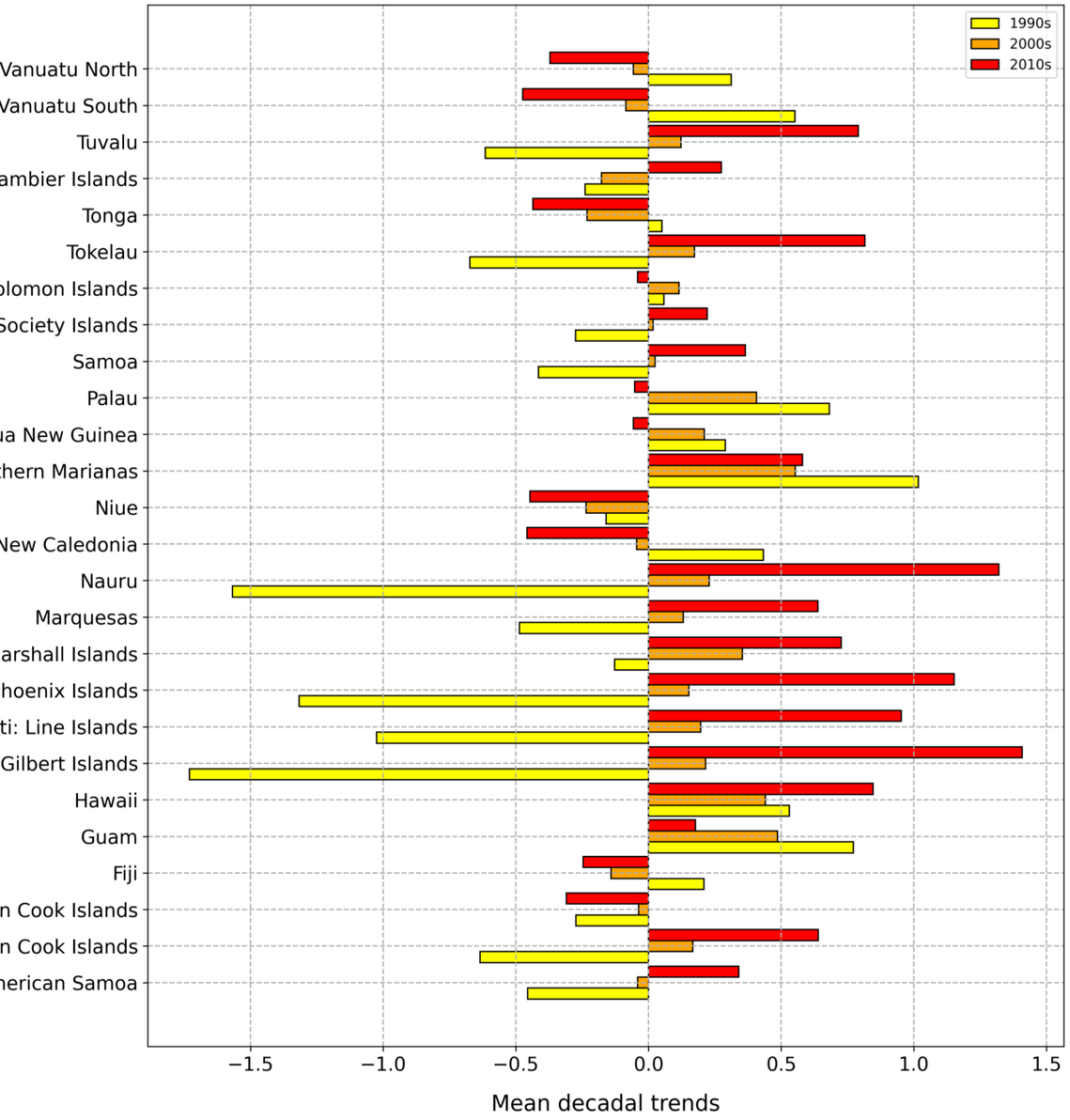
NOAA OISST 1982-2020



- Trends near constant across the region, Marquesas an exception

Sea Surface Temperature Trend

NOAA OISST 1982-2020



- Trends vary by decade, as shown earlier (ENSO)
- Critically important to know the “base” period

Implication of trends

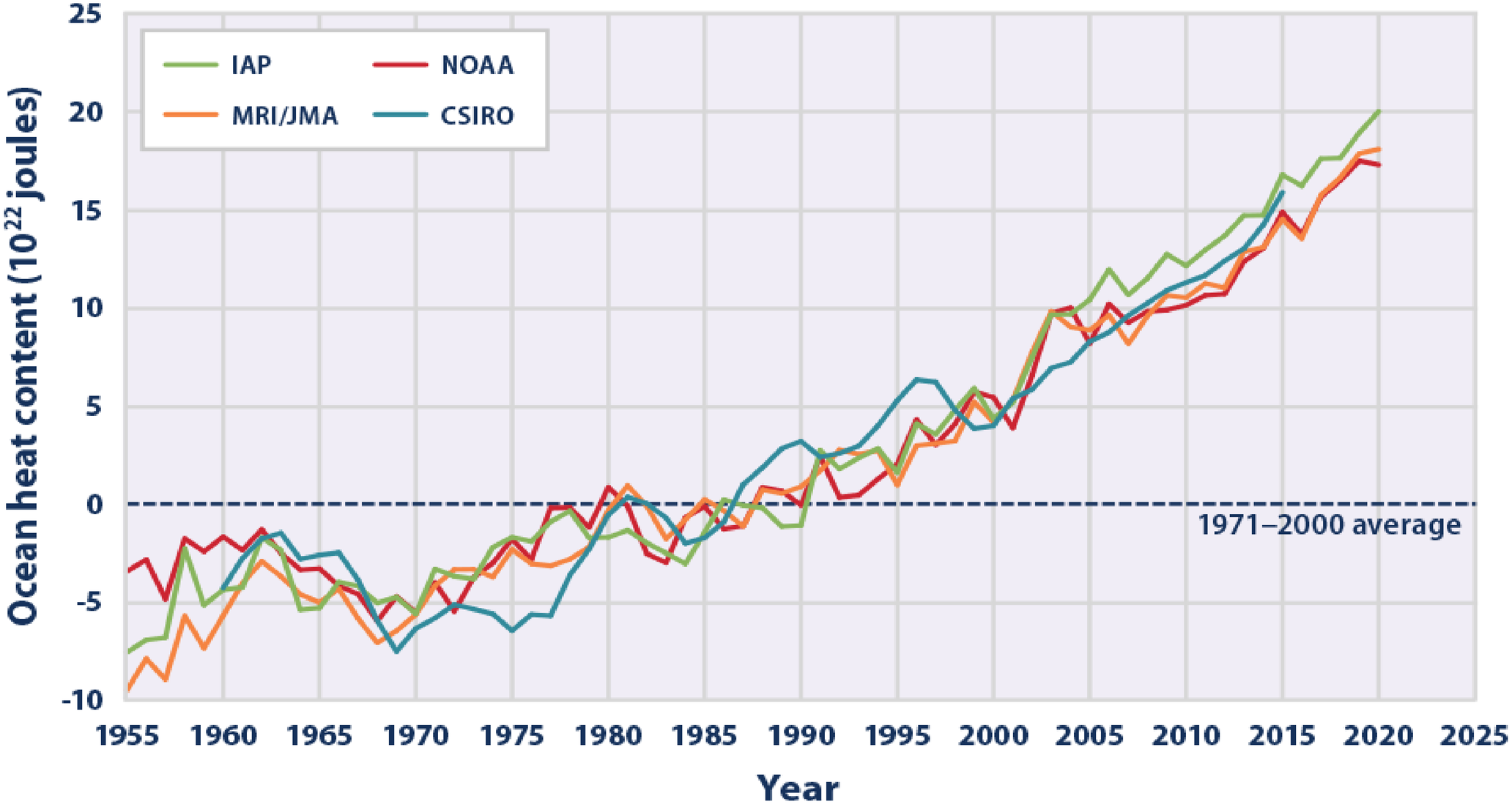
- Upper ocean heat content
- Degree heating weeks
- Marine heat waves

Ocean heat content

- The ocean is storing an estimated 91 percent of the excess heat energy trapped in the Earth's climate system by excess greenhouse gases.
- Averaged over the full depth of the ocean, the 1993–2022 heat-gain rates are approximately 0.64 to 0.83 Watts per square meter averaged over the surface of the Earth.

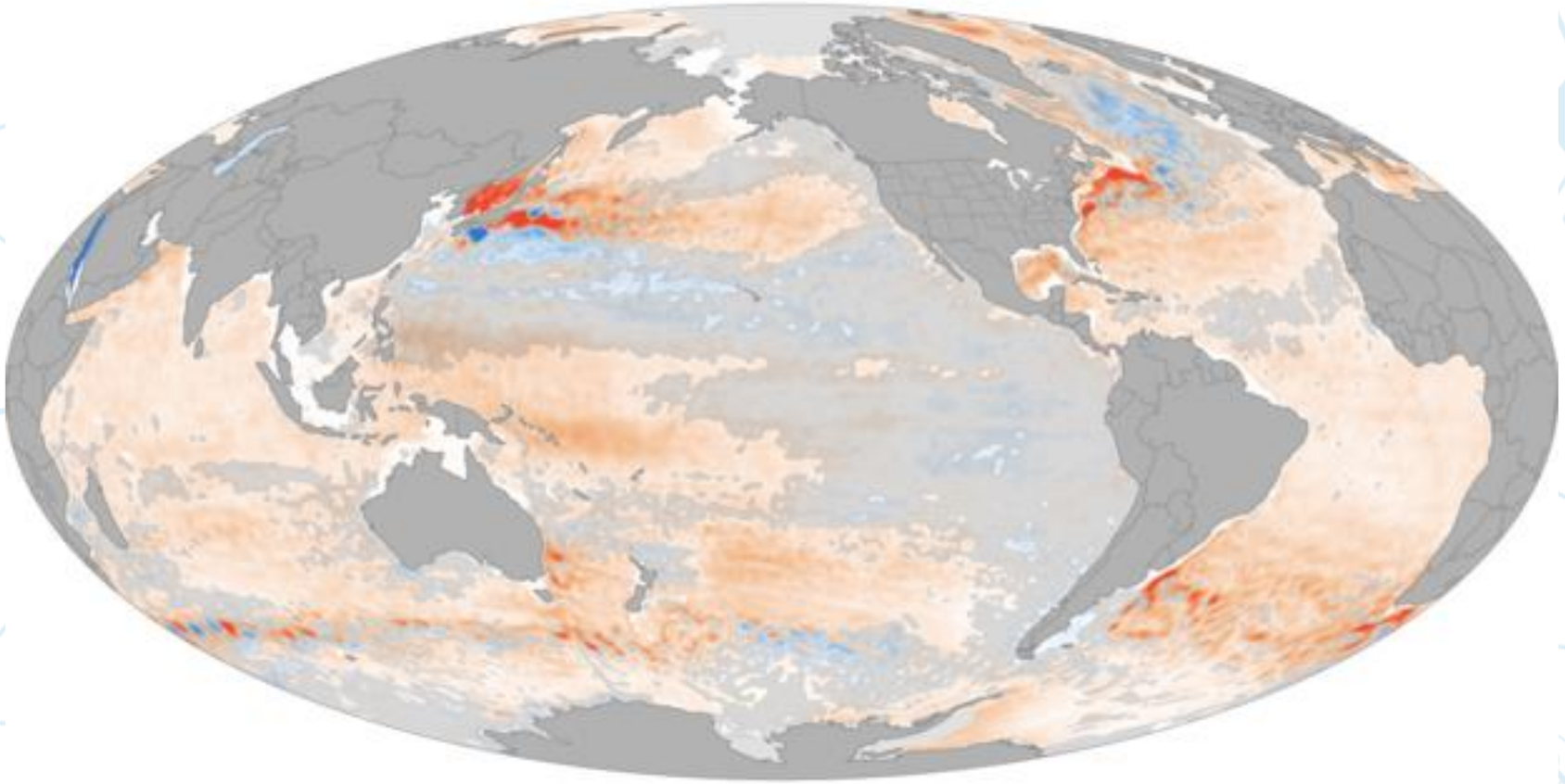
Ocean Heat Content Annual Anomaly

Upper 700m



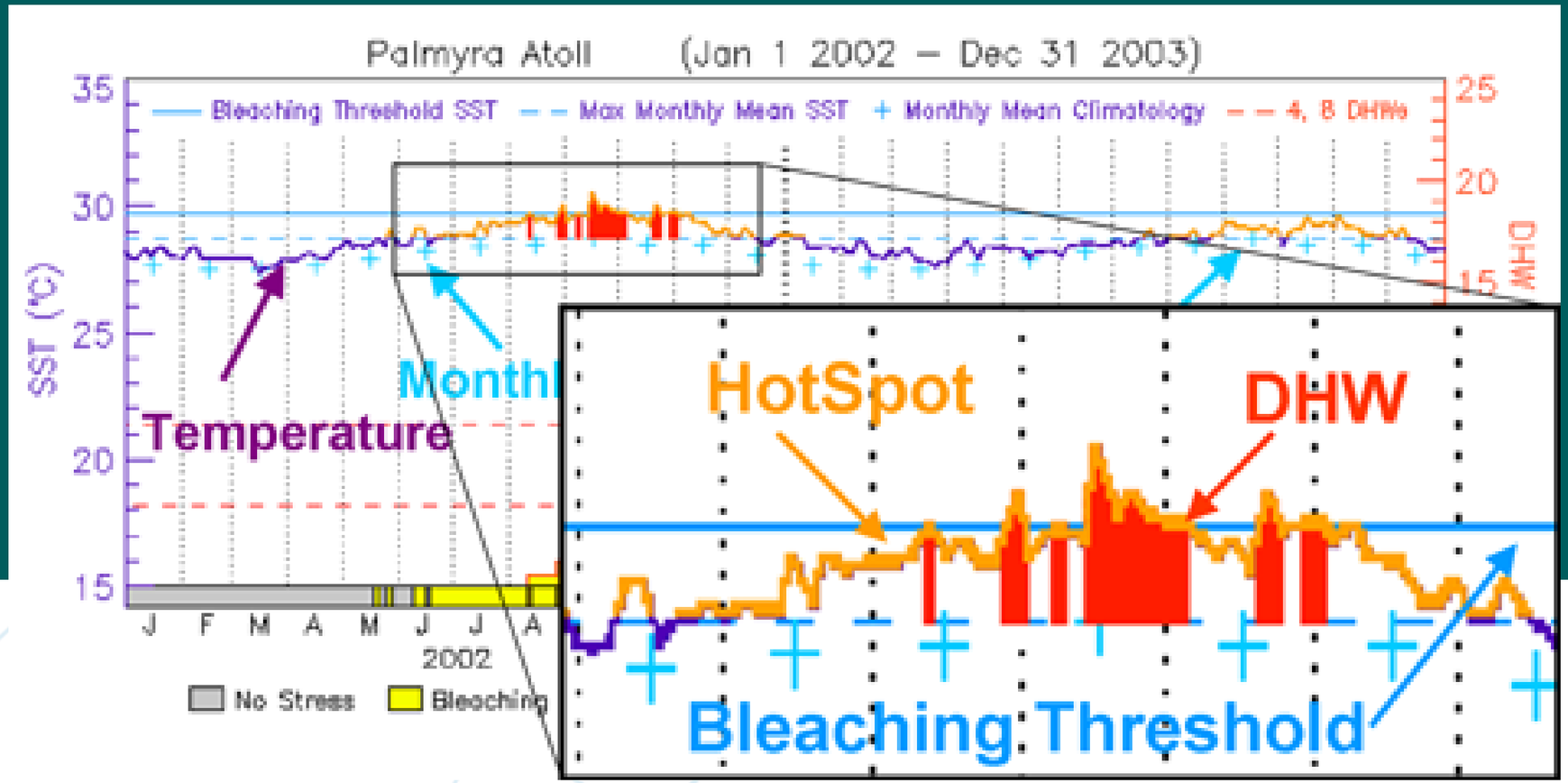
Ocean Heat Content Change

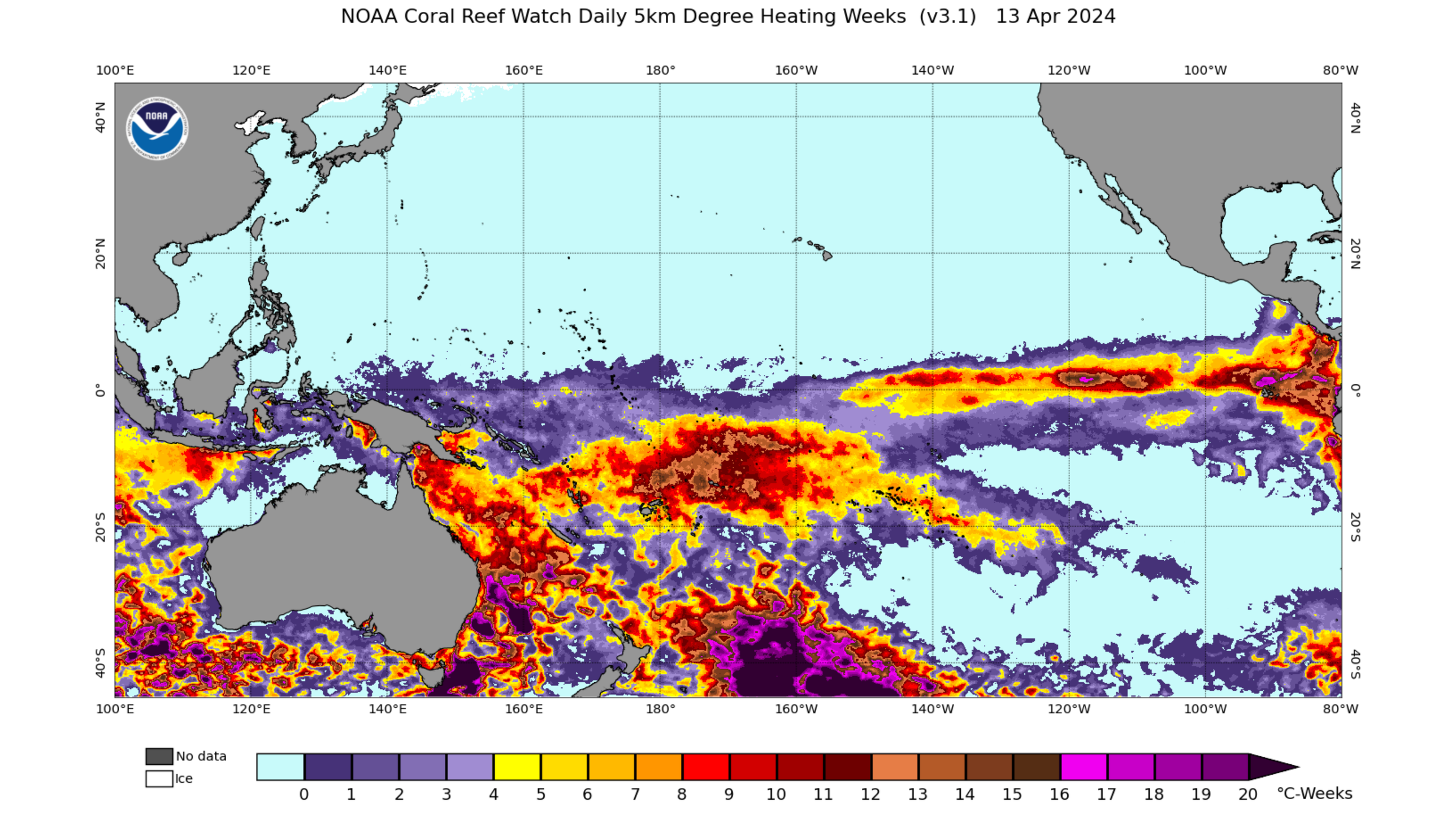
NOAA 1993-2022



Degree Heating Weeks

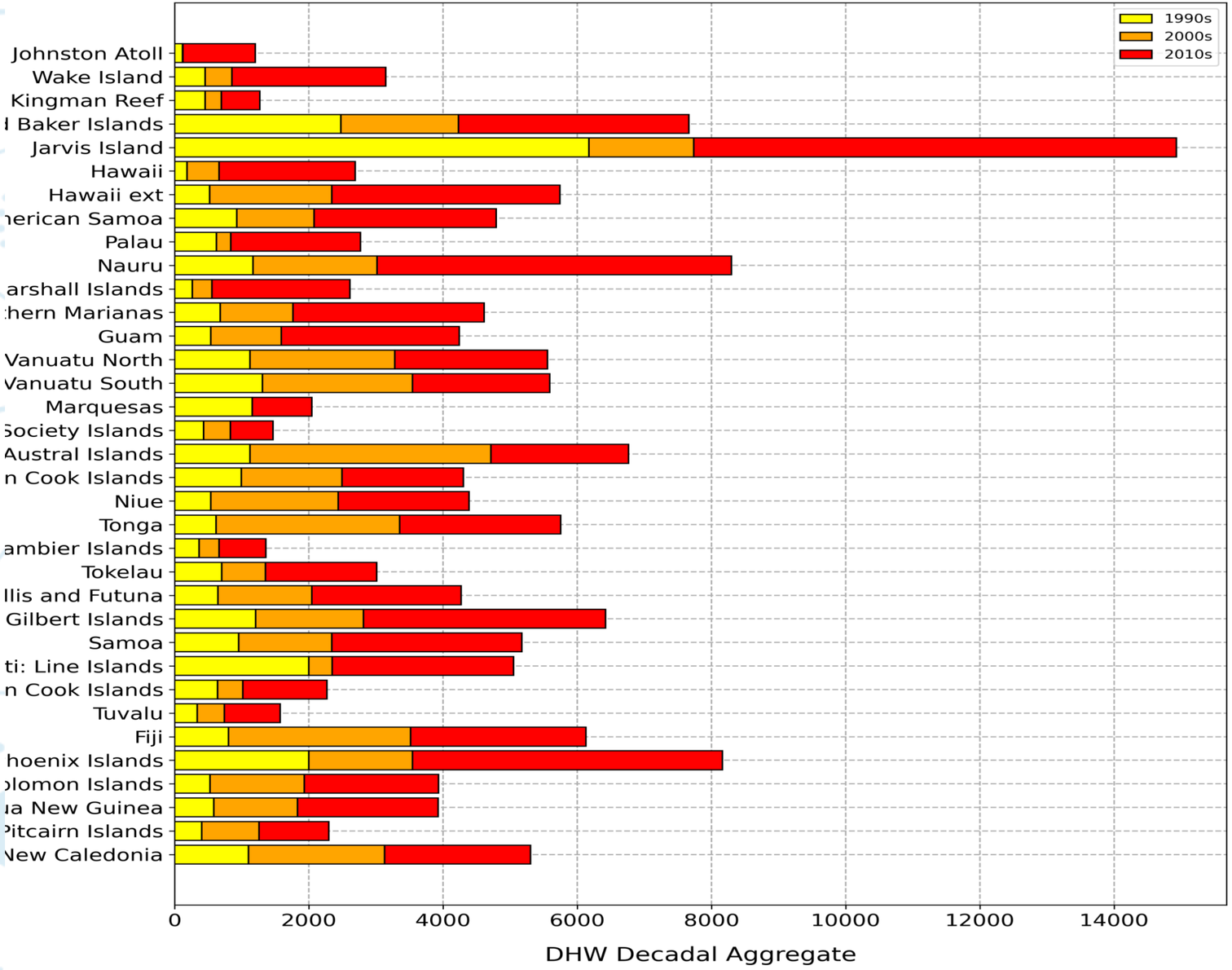
- The DHW shows how much heat stress has accumulated in an area over the past 12 weeks (3 months). In other words, we add up the Coral Bleaching HotSpot values whenever the temperature exceeds the bleaching threshold.




NOAA Coral Reef Watch Daily 5km Degree Heating Weeks (v3.1) 13 Apr 2024
100°E
120°E
140°E
160°E
180°
160°W
140°W
120°W
100°W
80°W
40°N
20°N
0°
20°S
40°S
No data
Ice
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
°C-Weeks

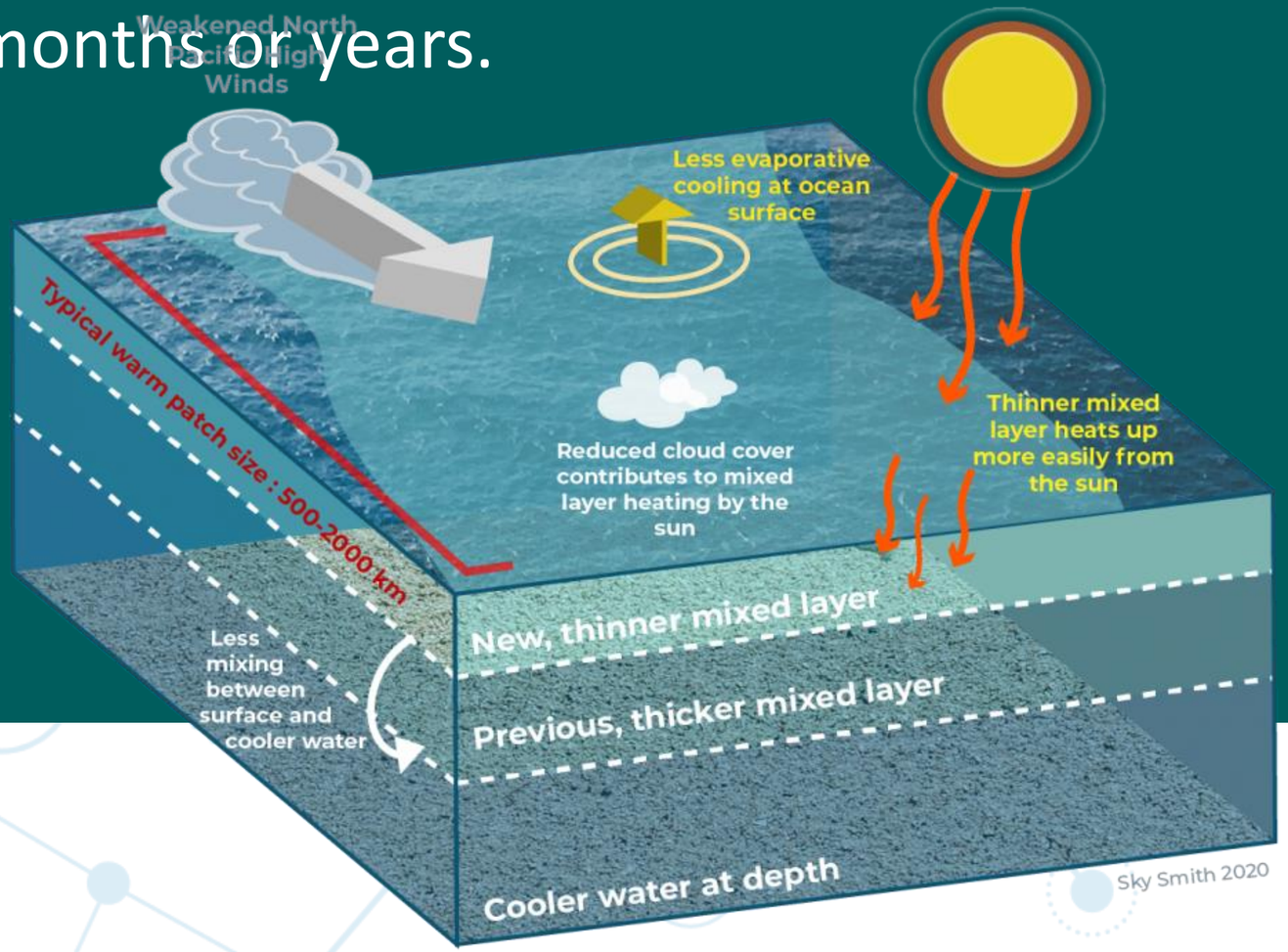
Decadal Aggreged DHW by EEZ

NOAA Coral Reef Watch

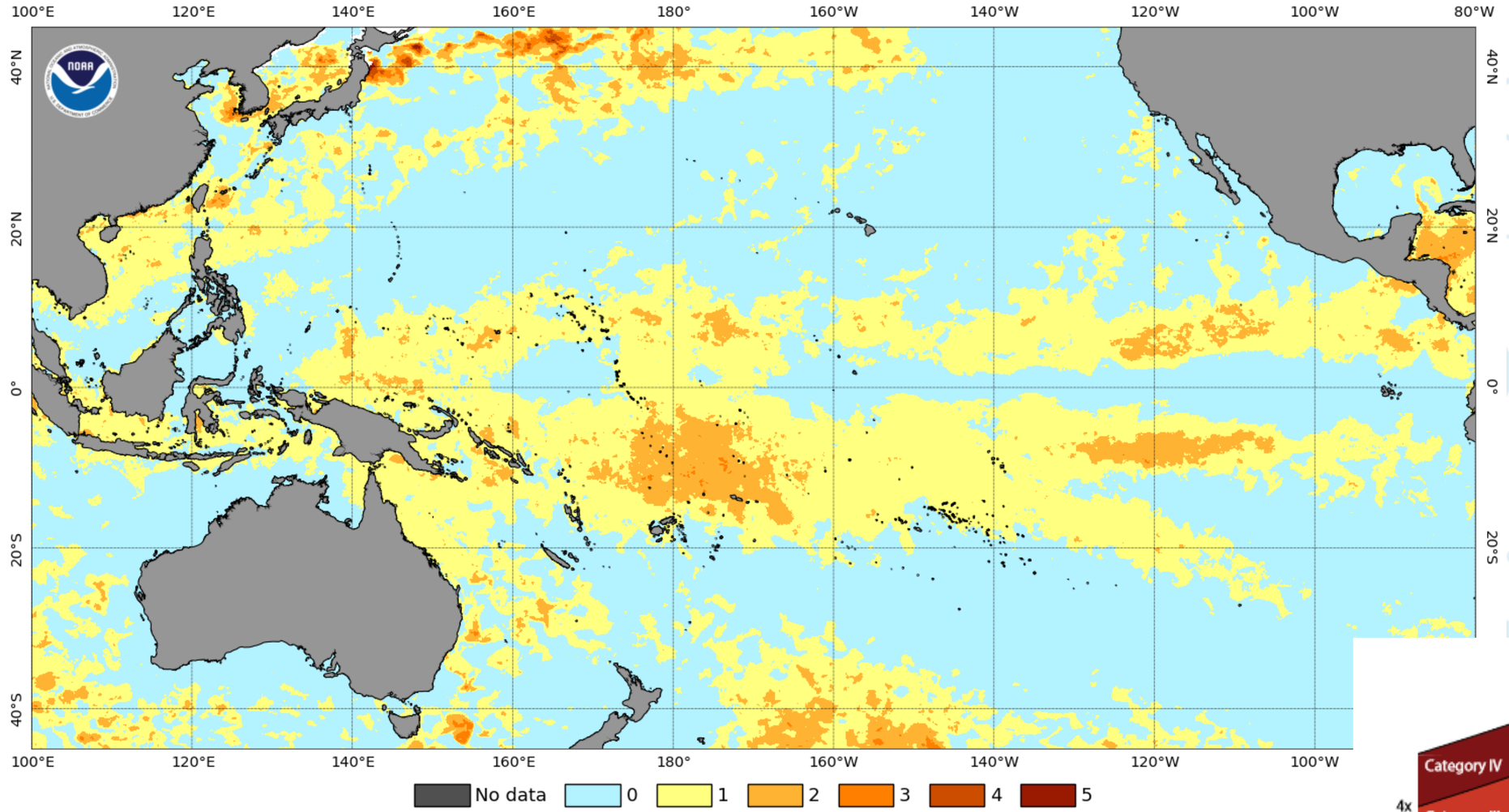


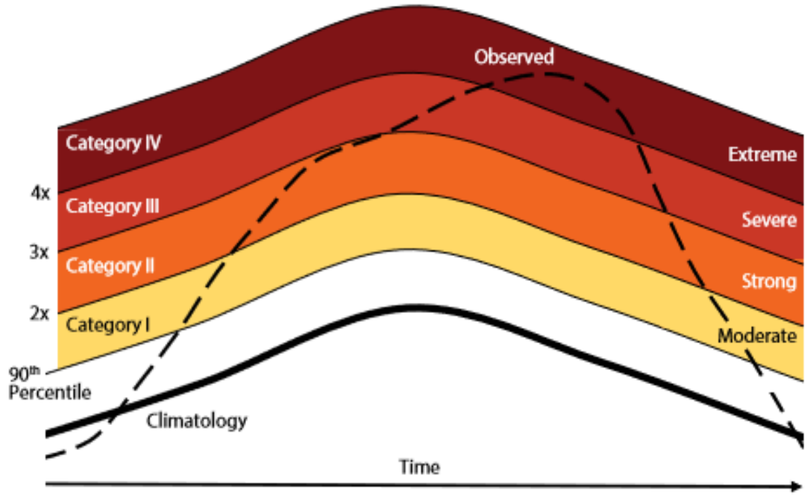
Marine Heat Waves

Marine heat waves are usually defined as any time the ocean temperature is above the 90th percentile for a specific length of time. This means that the temperatures are warmer than 90% of the previous observations for a given time of year. Marine heat waves can last for weeks, months or years.



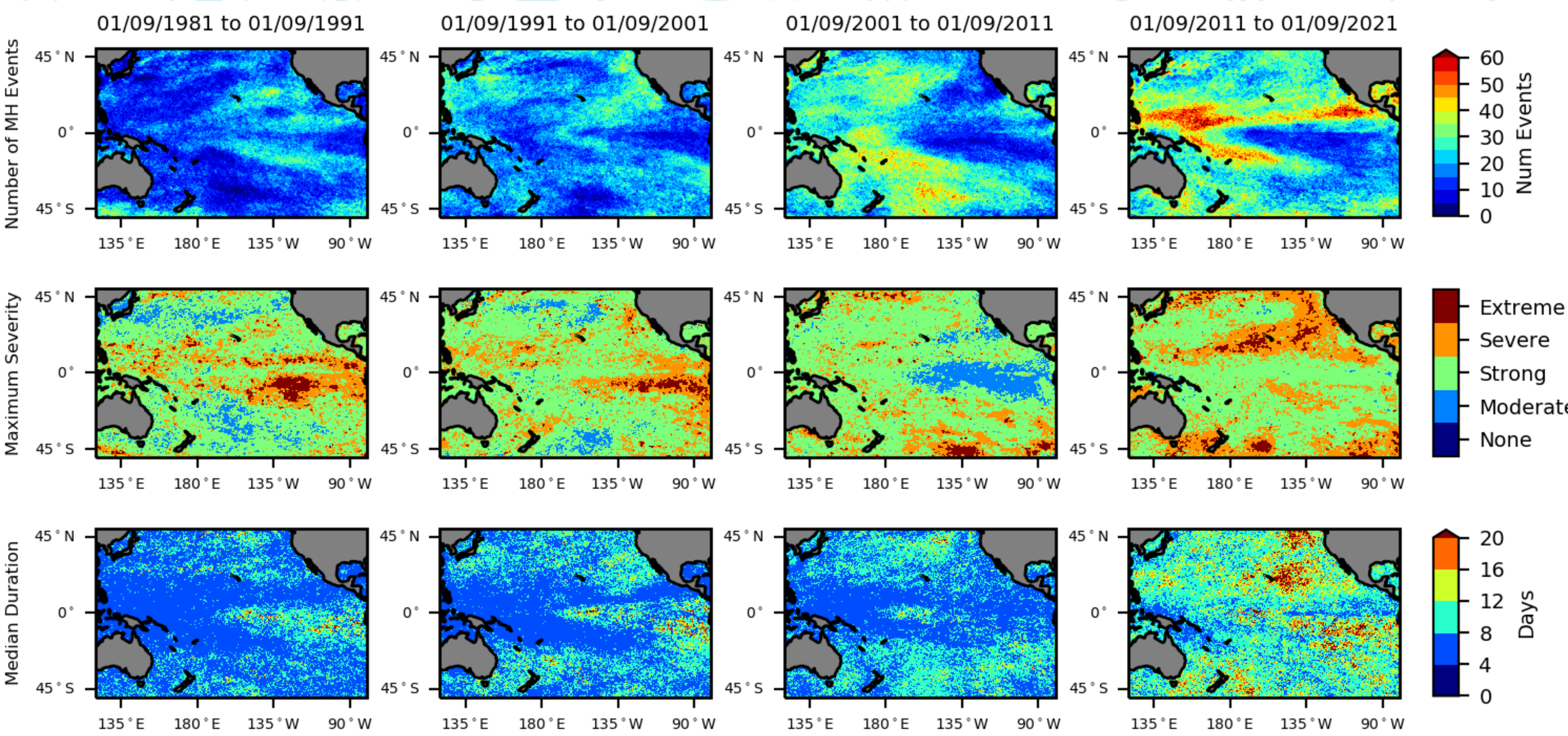
NOAA Coral Reef Watch Daily 5km SST Anomaly Categories for Tracking Marine Heatwaves (v1.0.1) 13 Apr 2024





Marine Heat Waves per Decade

Figure Courtesy Grant Smith BoM



Summary

- Long-term trends in ocean temperatures in the region of about 0.1 to 0.2 ^{o}C per decade
- Trend small compared to interannual variability, however important implications for ocean heat content, marine life
- Degree heating weeks: heat stress on coral
- Marine heat waves: fisheries and climate

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