

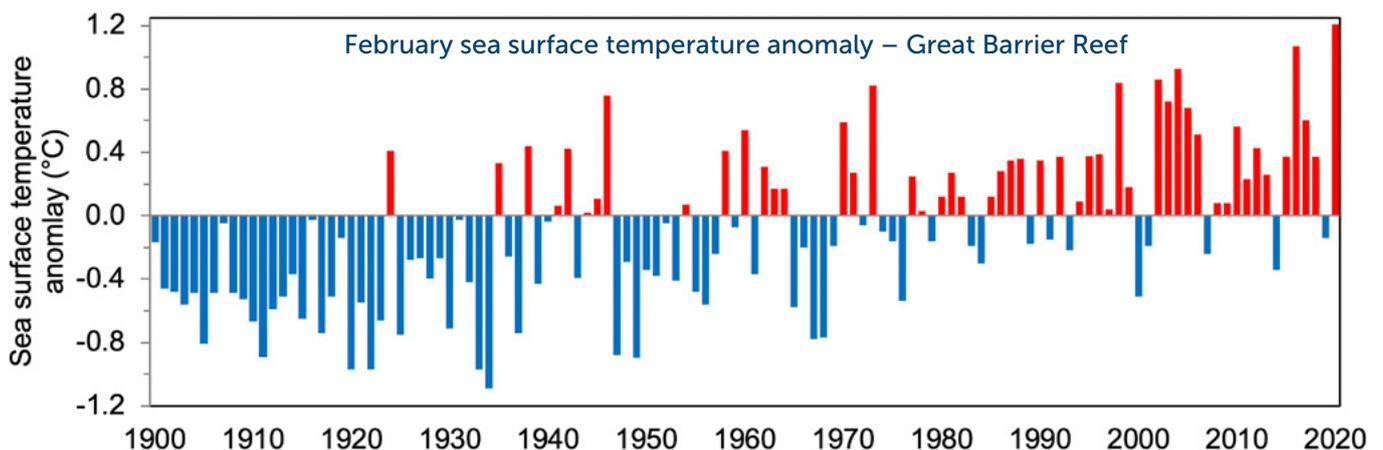


2020 marine heatwave on the Great Barrier Reef



High sea surface temperatures for third summer in the last five years

Sea surface temperatures (SSTs) on the Great Barrier Reef (GBR) during February 2020 were the warmest for any month since instrumental records began in 1900, with temperatures 1.2 °C warmer than the long-term February average (1961–1990). Temperatures were elevated across the whole reef and there were reports of widespread coral bleaching. This event is the third marine heatwave in five years, coming soon after the consecutive events of 2015–16 and 2016–17. There have now been three mass coral bleaching events on the GBR in the past five years.



February mean sea surface temperature anomaly (deviation from normal) compared to the 1961–1990 average. Based on 7 [ERSSTv5](#) grid cells within the Great Barrier Reef Marine Park (the average temperature is 28.0 °C).

What caused record warm ocean temperatures in 2020?

Three factors led to the high ocean temperatures on the Reef:

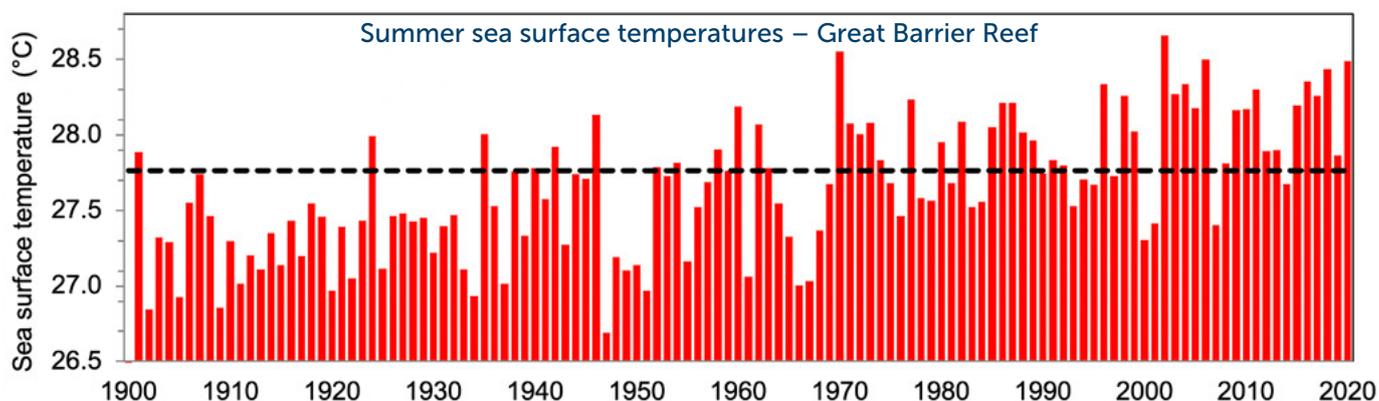
1. Global warming
2. A very strong positive Indian Ocean Dipole (IOD)
3. Local weather patterns

Global warming

The global ocean is warmer than at any time since the instrumental record began in 1900. Around 93% of the excess heat being gained from enhanced greenhouse warming is going directly into the oceans.

Summer (December–February) sea surface temperatures over the GBR have risen substantially over the past century due to climate change. Summer 2019–20 was in the top five hottest summers since 1900, with particularly warm conditions in February.

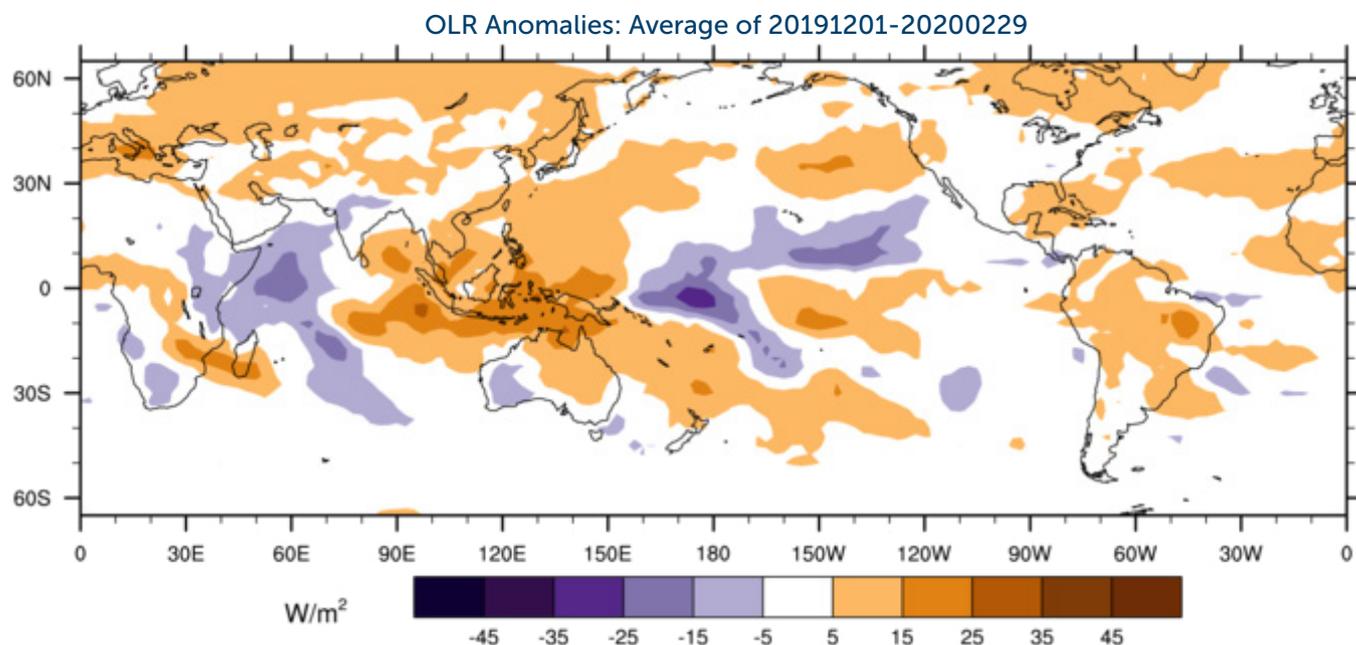
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Summer (December-February) mean sea surface temperatures 1900–2020 (based on 7 [ERSSTv5](#) grid cells within the Great Barrier Reef Marine Park). The black dashed line indicates the summer long term average over the period 1961–1990.

Indian Ocean Dipole and weather patterns

There was less cloud than usual over the GBR in the 2019–20 summer. A strong positive Indian Ocean Dipole (IOD) event delayed the onset of the Australian monsoon, plus there was a northwards shift in weather systems over Australia in early to mid-summer. These combined to reduce cloud cover and weaken winds over the reef, which were further compounded by fewer summer storms. Clear skies and calm conditions over the reef allowed more hours of sunlight to heat surface waters and less mixing by waves of warmer surface waters with cooler waters beneath.

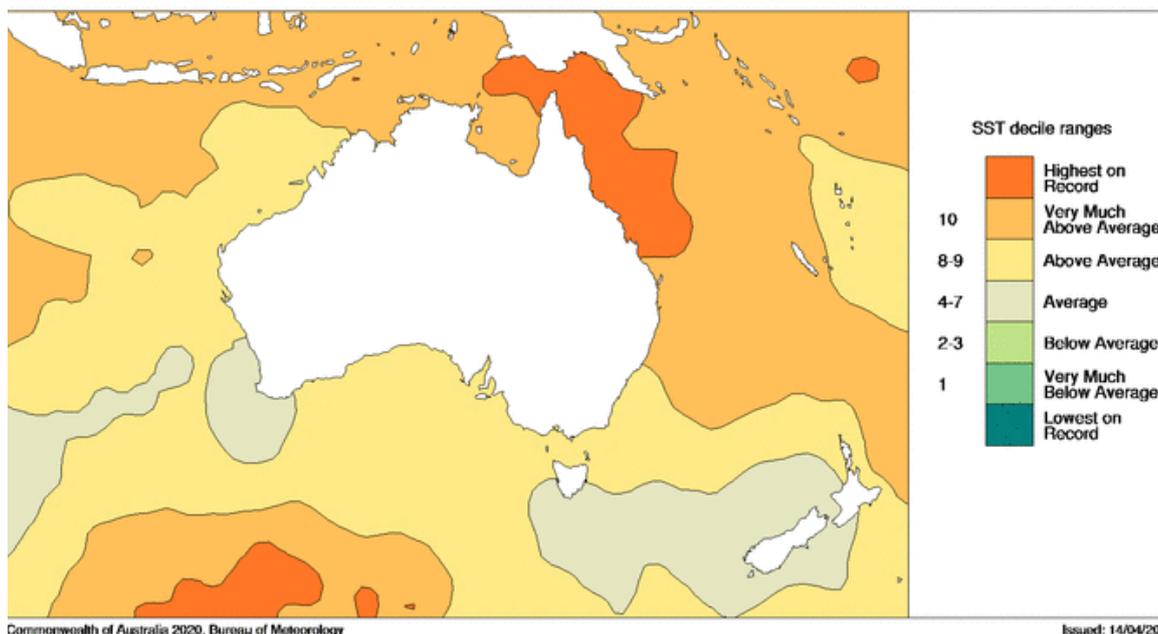


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Positive outgoing longwave radiation (OLR) anomalies (orange-brown) indicate less cloud than normal (data from 1 December 2019 – 29 February 2020)

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ERv5 SST Percentiles February 2020 Distribution based on gridded data



SST percentiles for February 2020 (Data from [ERSST.v5](#)). Dark orange indicates highest SSTs on record since 1900. Light orange indicates SSTs in the top 10% of those observed for that season since 1900.

Comparisons with 2016 and 2017 marine heatwaves

In 2020, mean SSTs over the GBR were 28.6 °C in January, 29.2 °C in February and 28.6 °C in March which is 0.64 °C, 1.22 °C and 0.96 °C warmer than the long-term monthly averages, respectively. SST observations across the reef show that February 2020 was the warmest month on record—warmer than both January 2017 and March 2016.

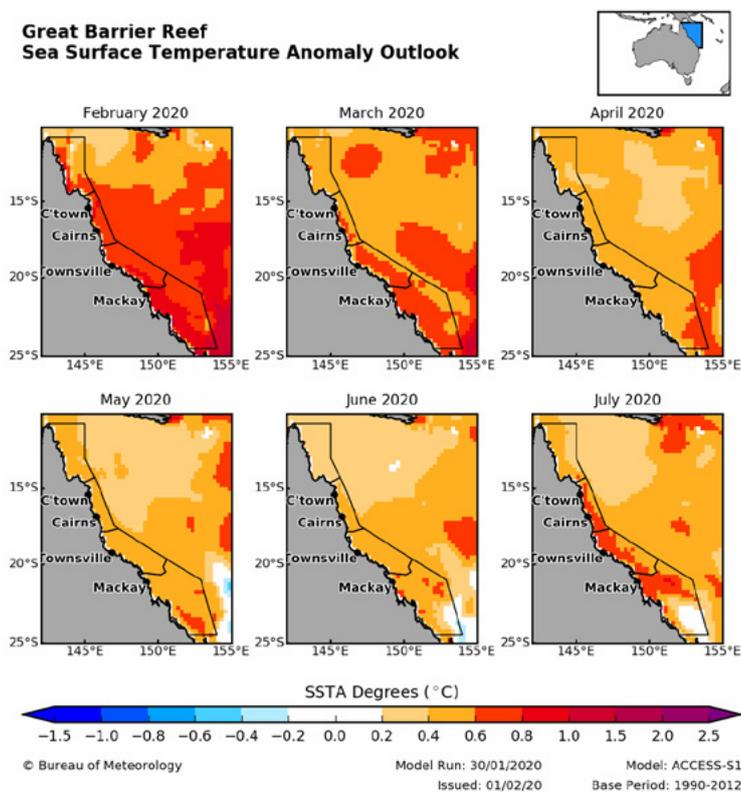
Heat distributions were quite different during the three events. In 2016, the northern GBR experienced the highest levels of thermal stress. In 2017, highest sea surface temperature anomalies occurred around the lower northern and central reef. In this past summer, sea surface temperatures were very warm for coastal waters across the entire reef.

	2016	2017	2020
Pacific Ocean state	El Niño	Neutral	Neutral
Cloudiness	Less cloudy than normal	Normal	Less cloudy than normal
Sea surface temperatures	At the time February, March and April hottest since 1900	January third hottest since 1900	February hottest since 1900
Tropical cyclones	None over GBR (but TCs Tatiana and Winston in Coral Sea) Link	Severe TC Debbie late March	Weak TC Gretel in mid-March Link

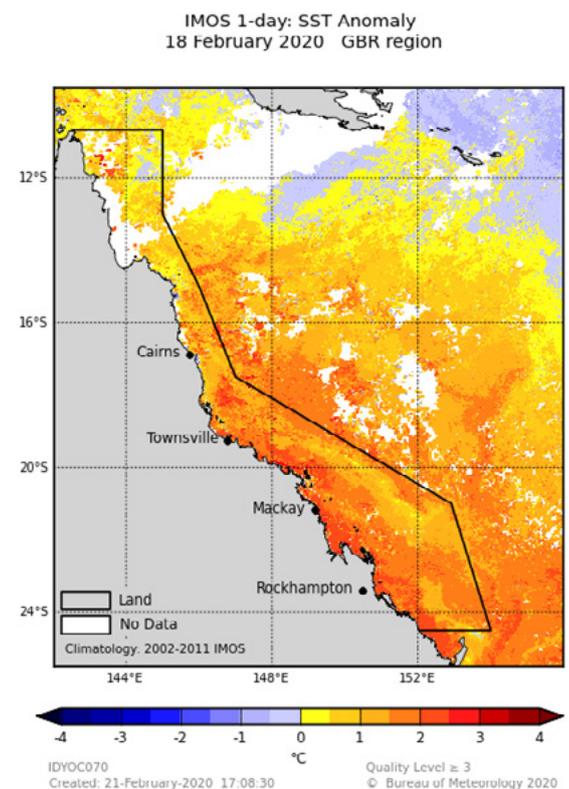
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Services supporting reef management

The Bureau of Meteorology provides [seasonal outlooks of sea surface temperature](#) over the GBR and around Australia for up to six months into the future. The Great Barrier Reef Marine Park Authority (GBRMPA) has been using these forecasts since 2009 to help support the management of the GBR. Additionally, daily observed satellite sea surface temperatures over the reef are available through the Bureau's [ReefTemp Next Generation](#) service, allowing managers to track temperatures in near real time.



Seasonal SST anomaly (deviation from normal) [outlook](#) for February-July 2020 issued on 1 February 2020. Orange-red colours show temperatures warmer than the mean for that month over the period 1990-2012.



[ReefTemp Next Generation](#) SST anomalies (deviation from the long term mean for the period 2002–2011) for 18 February 2020 showing heat distributed across the whole reef. The solid black line denotes the boundary of the Great Barrier Reef Marine Park.

Further information

- [Ocean Temperature Outlooks | Coral Bleaching Risk](#)
The latest seasonal SST anomaly outlooks from the Bureau of Meteorology's dynamical climate model ACCESS-S for the next six months for all Australian waters.
- [ReefTemp Next Generation](#): ReefTemp Next Generation is a set of high-resolution daily satellite SST products from the Bureau of Meteorology that provide information on coral bleaching risk for the GBR region.
- [State of the Climate 2018](#)
- [Great Barrier Reef Marine Park Authority](#)
Coral bleaching resources