Australian Government
Great Barrier Reef Marine Park Authority

Reef Authority

EXTREME WEATHER FACT SHEET

How wild weather and natural disasters can affect the Great Barrier Reef.

What is extreme weather?

Extreme weather is a general shift from historical, seasonal weather patterns or conditions, which may occur over time periods ranging from a few hours, to days, weeks and even months in the worst cases.

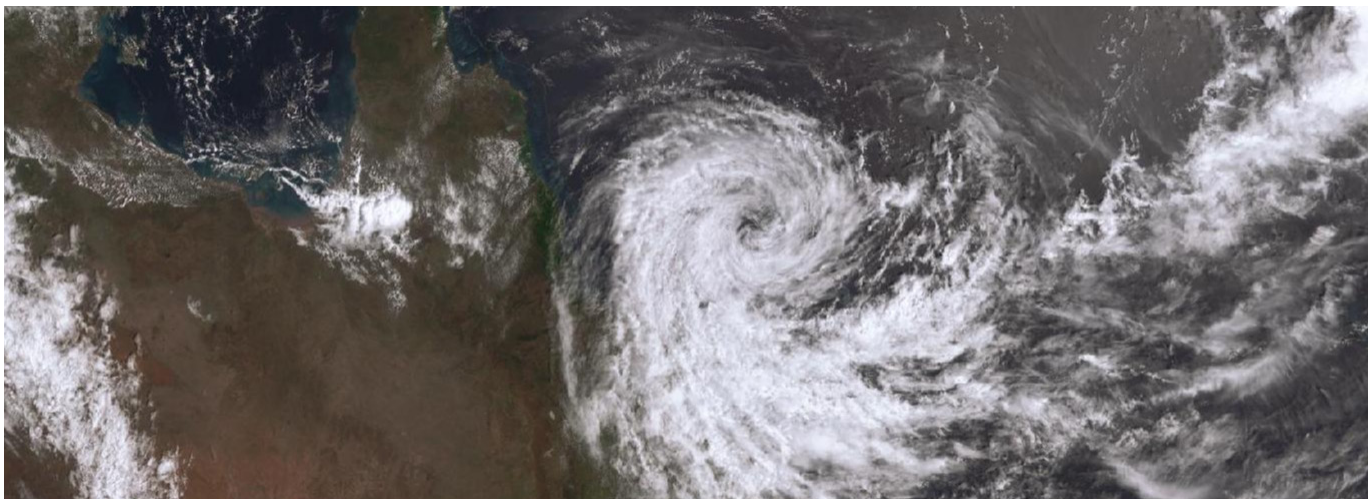
The Great Barrier Reef stretches 2300km along the coast of Queensland, Australia. On average, Queensland has about 300 days of sunshine per year, however it is also subject to extreme weather events including tropical cyclones, heatwaves, bushfires, and flooding caused by torrential rainfall. These events can cause significant environmental damage to delicate marine and island ecosystems, amplifying the effects of climate change.

Cyclones

Tropical cyclones are intense low-pressure systems that develop over the tropical and subtropical oceans around Australia, generally between the months of November and late April. They are ranked in categories from 1 (weakest) to 5 (strongest) based on wind speed. The category of a cyclone doesn't indicate the severity of other hazards the cyclone may bring, such as heavy rain and flooding. These storms can generate very strong winds, large powerful waves, storm surges and intense rainfall, and often follow erratic paths.

They can continue for days, even weeks. Destructive waves generated by cyclones can cause extensive damage to corals and coral reef structure, destroy mangrove forests, and cause damage to islands throughout the Marine Park.

Cyclonic winds can also disrupt the natural balance of a reef ecosystem by altering the distribution of larvae from fish, corals, and other invertebrates; as well as influencing the spread of marine pollution.



Cyclone Jasper, 11th December 2023 9:40AM
Imagery from Himawari-8—a geostationary weather satellite operated by the Japan Meteorological Agency (JMA).

Marine heatwaves

Sea temperature plays a critical role in the life of marine species. If temperatures are warmer than the seasonal average for an extended period, it can have severe and widespread impacts on the Reef ecosystem.

These events are officially classified as marine heatwaves when temperatures are warmer than 90 per cent of the previous sea surface temperature observations (over a 30-year period) at the same time of year, for at least five days in a row. They can be caused by several factors including natural weather patterns, however human-driven climate change means heatwaves are becoming more prevalent which increases the risk of coral bleaching and other impacts.

Widespread bleaching occurred in 1998 and 2002, however over the past decade four mass coral bleaching events have occurred in 2016, 2017, 2020 and 2022.

The increased frequency of these events is evidence that climate change continues to be the greatest threat to the Great Barrier Reef. Coral bleaching, when it occurs, is rarely uniform across the Reef – which covers an area of more than 344,000 km^2. Bleaching varies from reef to reef, even between sites on the same reef.

Bleached corals can recover. On mildly or moderately bleached reefs, the Reef has a good chance to recover and survive.

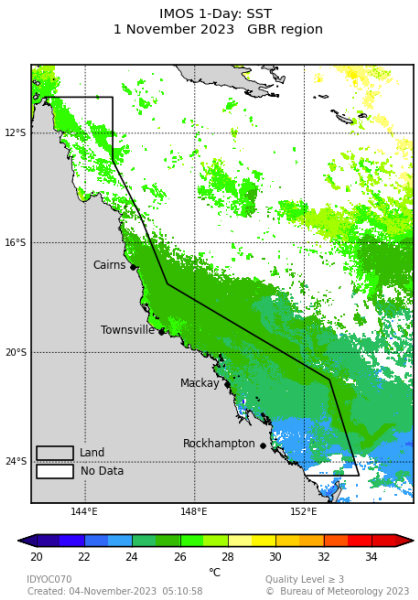
How do heatwaves affect Reef Species?

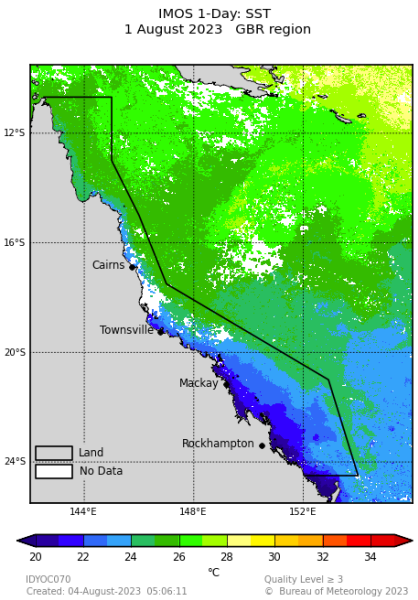
Warmer oceans can affect important biological processes of fish and other marine species, including growth, reproduction, swimming ability and behaviour.

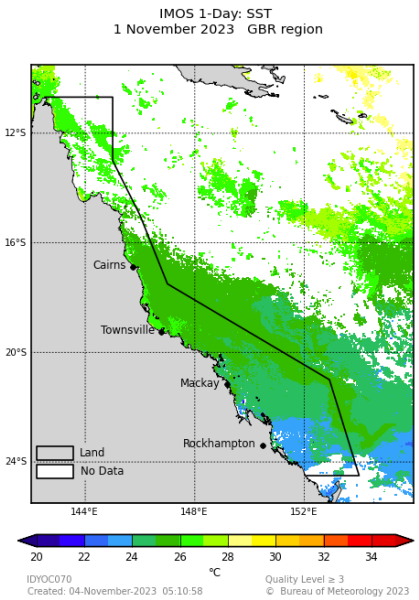
Climate change affects marine turtles, sea snakes and crocodiles because the environmental temperature influences the reptiles' body temperatures. The temperature of the sand, where turtle eggs are laid, also determines the sex of the hatchlings, with higher incubation temperatures leading to a higher proportion of female hatchlings. Air temperature and sea temperature increases can also alter turtle breeding seasons and patterns, egg hatching success and the sex ratio of the populations, which could affect future sustainability.

Changes in temperature can also affect the nesting periods, sex determination and the running and swimming speed of estuarine crocodile hatchlings. Estuarine crocodiles are most likely to be found in the northern parts of the Reef, however higher air and sea temperatures could see populations move further south.

Water temperature can affect the efficiency of photosynthesis rates for seagrass — an important food source for dugongs and green turtles – as well as affect its reproductive patterns. Mangroves are also vulnerable to changes in marine temperatures and can die if water temperatures remain higher than normal for extended periods.







Flooding

Torrential rain, often caused by tropical storms, can cause localised flooding which can have significant effects on Reef ecosystems. Flood waters can carry increased sediment and pollutants to the Reef. This has been found to slow coral growth and increase the risk of coral disease, smother seagrass meadows, and exacerbate crown-of-thorn starfish outbreaks. Mangroves, which live in the intertidal zones, are also vulnerable to the impacts of flooding due to their aerial root systems which can be smothered by sediment or submerged by fresh water in the event of a flood, causing the plant to die.

Storm over the southern Great Barrier Reef. ©Commonwealth of Australia (Reef Authority). Photographer: Lincoln Bertoli

El Niño Southern Oscillation (ENSO)

ENSO has two distinct phases, or it can be neutral. These phases describe the coupled sea temperature and atmospheric conditions in the Pacific Ocean.

What is El Niño?

An El Niño event is when sea surface temperatures in the central and eastern tropical Pacific Ocean are substantially warmer than average. This generally results in a decrease of regular rainfall in the northern and eastern parts of Australia, often accompanied by warmer, drier conditions. Warmer sea surface temperatures can place significant pressure on the Reef, increasing the risk of coral bleaching and the formation of tropical storms.

In Australia, El Niño conditions typically mean:

- Reduced rainfall
- Warmer temperatures
- Shift in temperature extremes
- Increased frost risk
- Reduced tropical cyclone numbers
- Later monsoon onset
- Increased fire danger in southeast Australia
- Decreased alpine snow depths

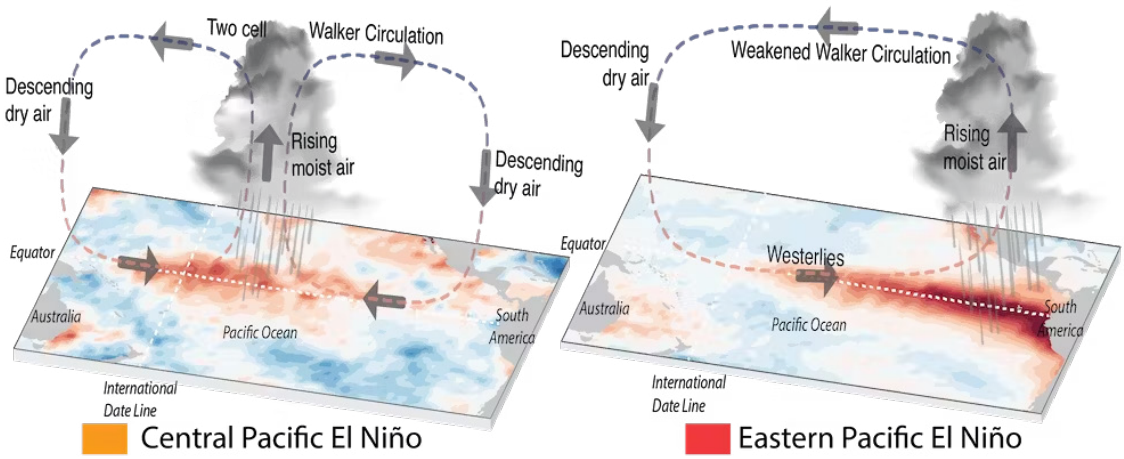
What is La Niña?

La Niña occurs when equatorial trade winds become stronger which can change ocean surface currents. La Niña generally brings increased rainfall which can lead to flooding in some instances, placing pressure on the local Reef ecosystem.

In Australia, La Niña conditions typically mean:

- Increased rainfall across much of Australia
- Cooler daytime temperatures (south of the tropics)
- Warmer overnight temperatures (in the north)
- Shift in temperature extremes
- Decreased frost risk
- Greater tropical cyclone numbers
- Earlier monsoon onset

Developed with resources from the Great Barrier Reef Marine Park Authority Outlook Report 2019, Australian Bureau of Meteorology, and Australian Institute of Marine Science.



El Niño and its global impacts. Schematic of idealised atmospheric and sea surface temperature conditions during Central (top left) and Eastern Pacific events (top right). Many of the hottest years on record coincide with El Niño events. NOAA National Centers for Environmental information, Climate at a Glance: Global Time Series