Managing physical climate risk:

What data are available?

Australian Government
Bureau of Meteorology

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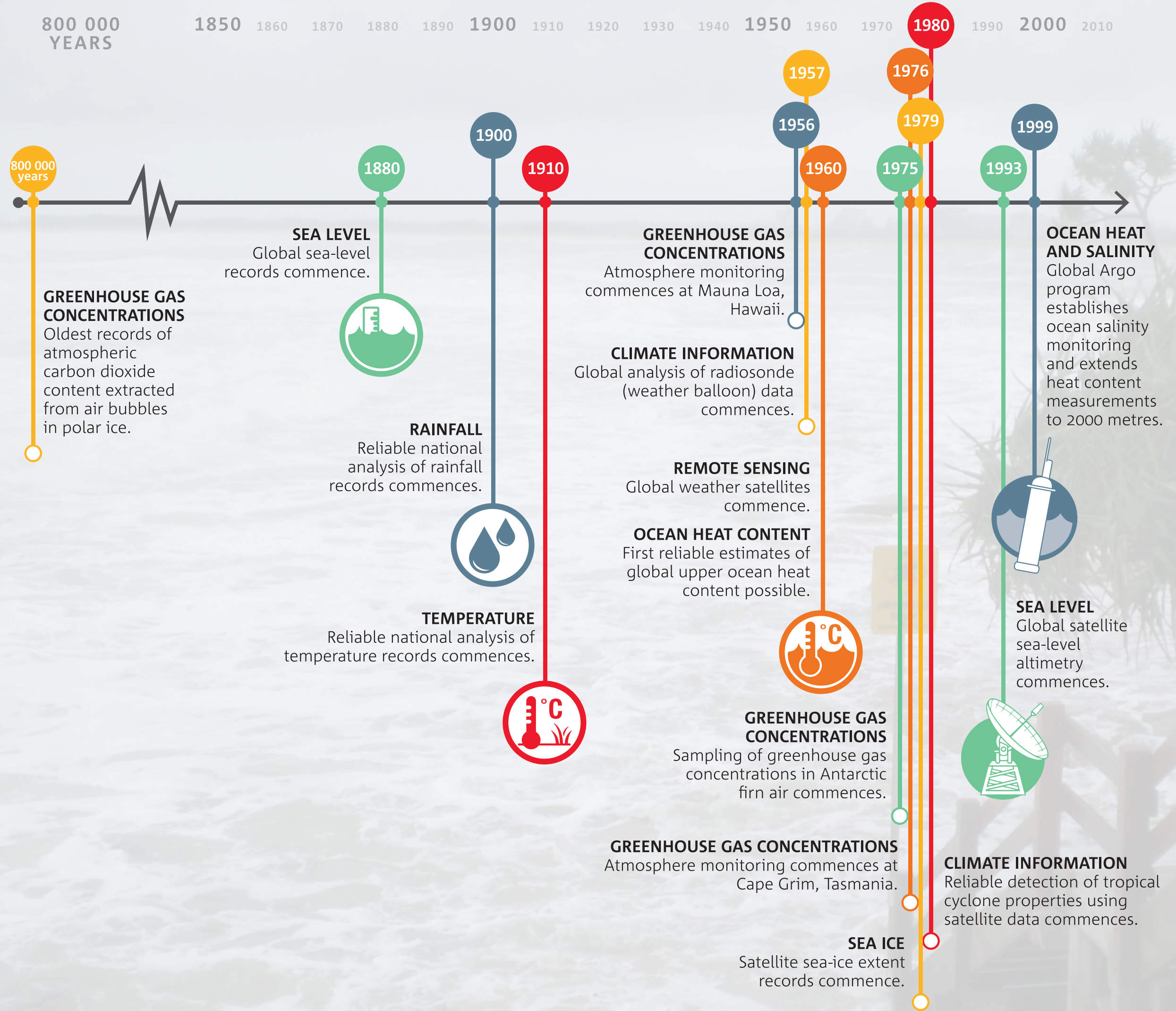
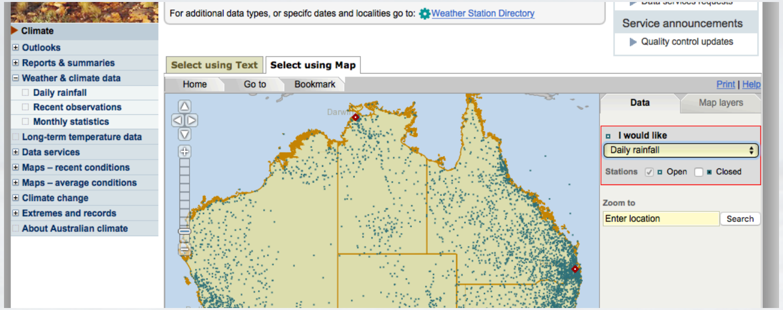


Raw data

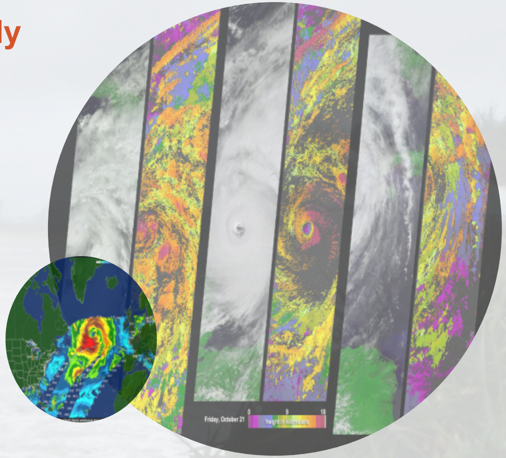


The Bureau has a wealth of digitised station-based observational data in its national climate database.

- Historic records have been digitised at the monthly and daily timescale. Modern sensor records at 1-minute intervals.
- A large amount of data are available to the general public
- There is more data (additional variables, sub-daily observations) available for research and applications

Analysed data

The ‘raw’ observational data are spatially and temporally heterogeneous.

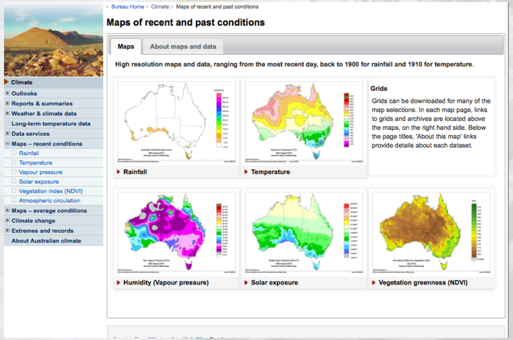


Downstream products spatially analysed onto grids:

- daily surface temperature (maximum and minimum)
- daily rainfall
- daily solar (satellite)
- daily vapour pressure (9am and 3pm)
- monthly satellite vegetation index
- soil moisture
- frost
- cloud
- evaporation
- sunshine hours
- wind
- lightning
- UV
- fire weather indices

Global domains

- sea surface temperature
- sub-surface ocean
- sea level

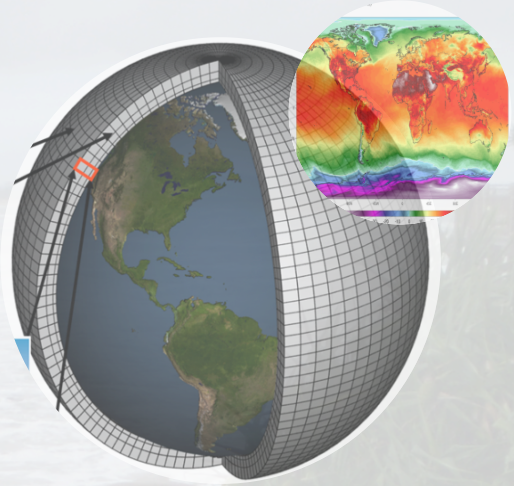


Temporally homogeneous:

- surface temperature
- upper air temperature
- total cloud
- pan evaporation

Reanalysis data

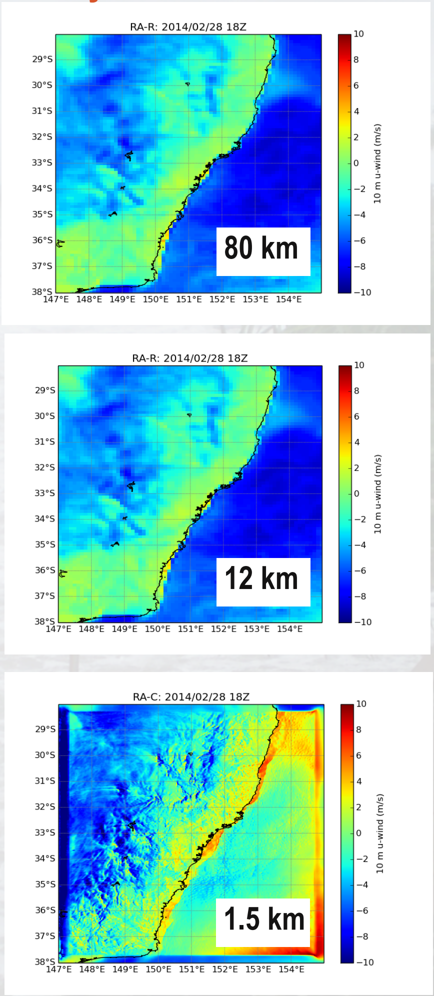
- **Best estimate historical fields.** Four dimensions (latitude, longitude, height, time)
- **A full description of the atmosphere.** Produced by optimally combining observations with a numerical weather model
- **Use of standardised methods.** The model is run in hindcast (retrospective), with the data from all sources, and all times, assimilated into the model in a standard way.
- **Temporal consistency in data.** Consistency of methods leads to consistency in the data — so that the data is suited for defining climatology, anomalies, trends, and extreme event likelihood.



Reanalysis data

- Incorporates real physics rather than empirical relationships
- Includes high-resolution topographic effects (hills, valleys, coastlines).
- Captures variations in land use (urban, veg), and soils.
- Leads to greater precision and (hopefully) greater accuracy in representations of temperature, rainfall, humidity, wind — and extremes of these variables.
- Better representation of convective systems, storms and catchment-based rainfall totals.
- Better representation of the timing of changes in weather

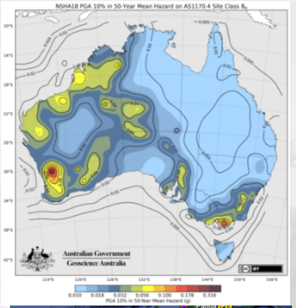
28 February 2014 — 10m zonal wind

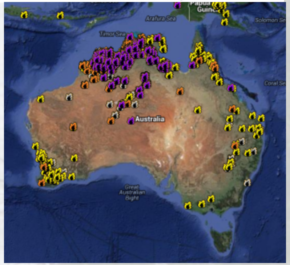


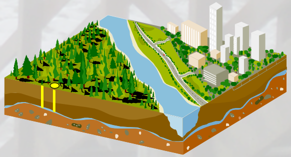
Other relevant data

Geosciences Australia provides:

- National datasets for the probability/severity distribution of natural hazards: earthquake, tsunami and tropical cyclone, as well as seismic sources
- Access to flood study information from across Australia
- Vulnerability models for the built environment, linking hazard severity to damage in residential housing and other infrastructure
- Information resources on the effectiveness of mitigation and adaptation options
- Real-time monitoring data for earthquakes and bushfires
- Nationally consistent datasets characterising the built environment (NEXIS)





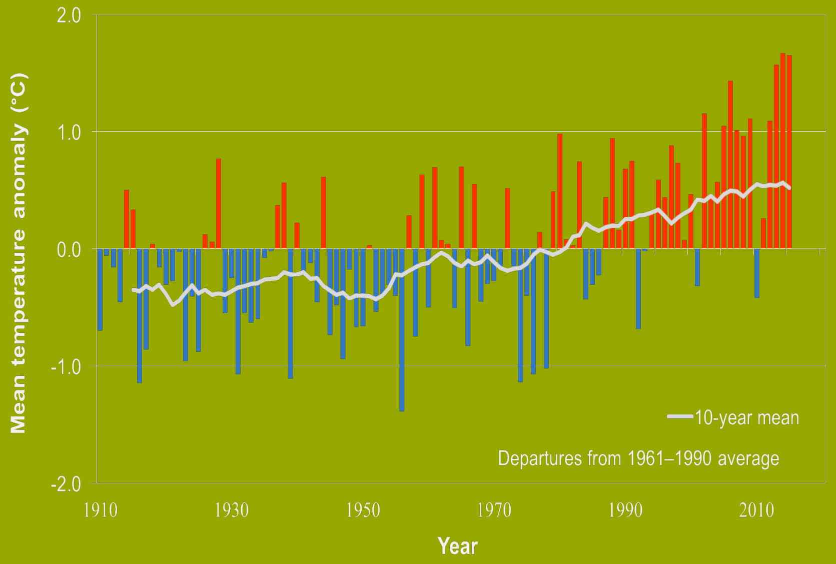


Extreme events

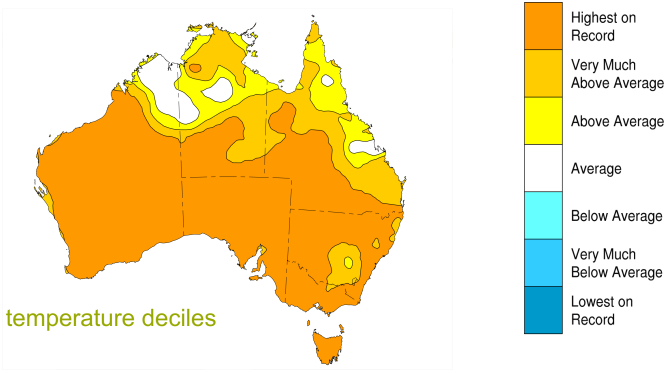
The confluence of trends and extremes — a cumulative risk case study from Tasmania 2015-2016

Tea Tree, north of Hobart, Tasmania, October 6. Source ABC News: Edith Bevin

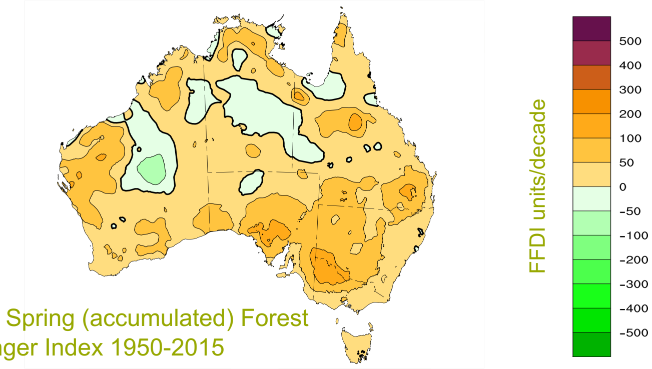
Spring is getting warmer with an accompanying increase in fire danger



Spring mean temperature anomalies



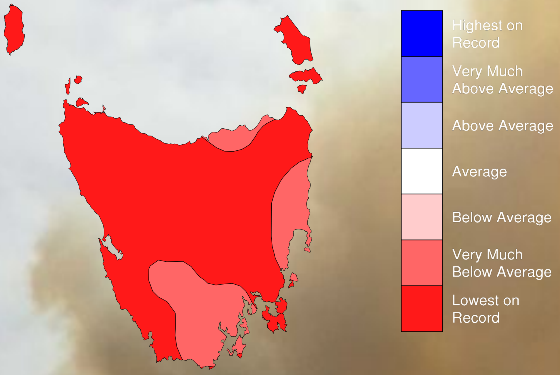
Spring mean temperature deciles 2012-2015



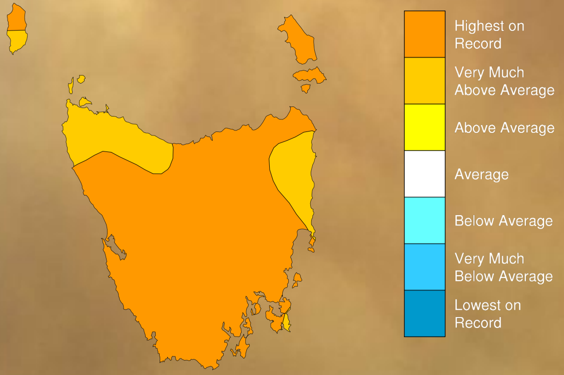
Trend in Spring (accumulated) Forest Fire Danger Index 1950-2015

Extreme events

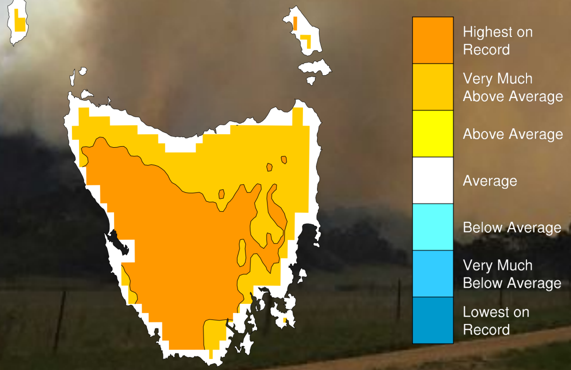
Tasmania in October 2015 — record heat — record low rainfall — record high fire danger



October 2015 Rainfall Deciles



October 2015 Temperature Deciles



October 2015 Forest Fire Danger Index

Tea Tree, north of Hobart, Tasmania, October 6.
Source ABC News: Edith Bevin

CSIRO

Australian Government
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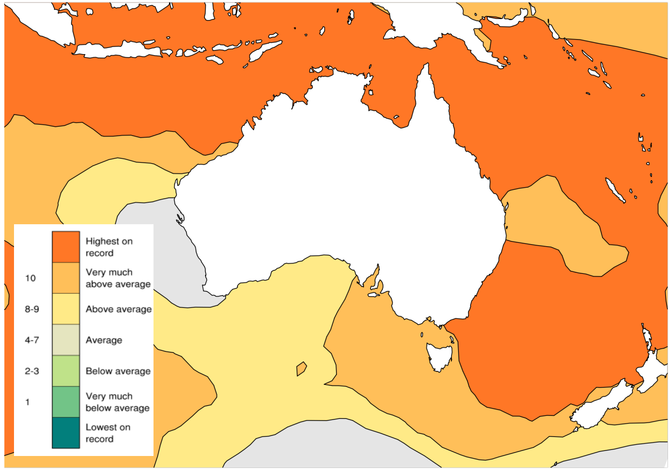
Extreme events

Tasmania in June 2016

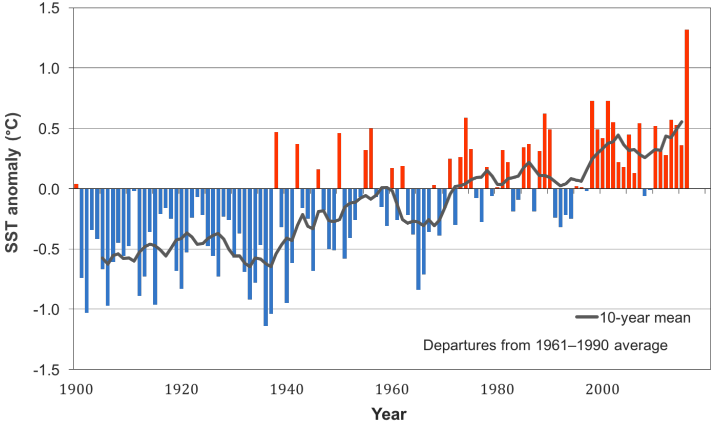
South Esk River Hadspen, Tasmania, 8 June 2016. Source Catherine Jolly, BoM

Australia's changing marine environment

Sea surface temperatures during May 2016



May 2016



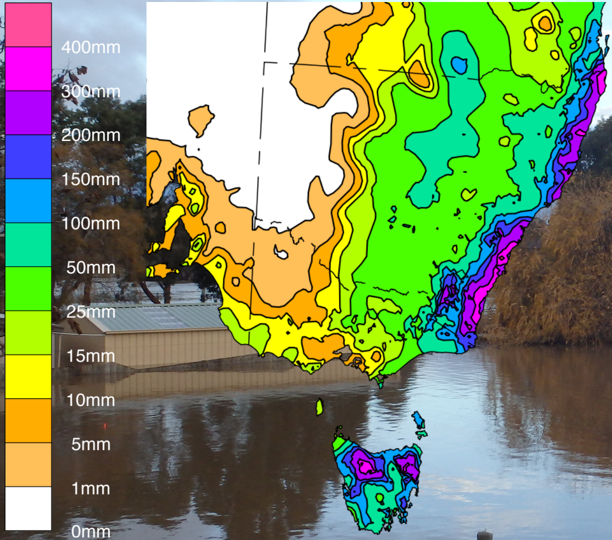
Tasman Sea May sea surface temperature anomalies

Extreme events

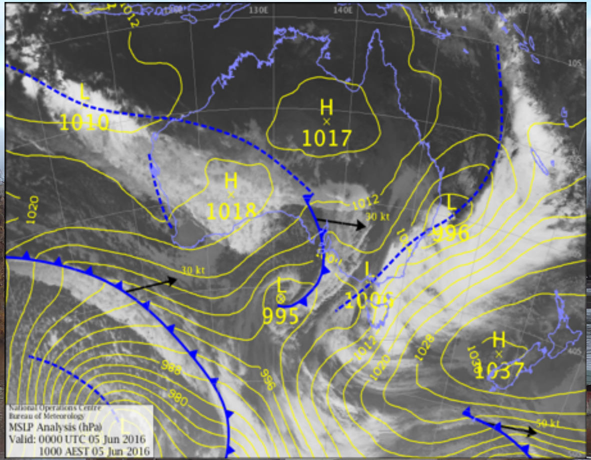
Collaroy Beach, NSW, 6 June 2016

Cataract Gorge, Tasmania, 7 June 2016

Tasmania in June 2016 — record ocean temperatures — record high rainfall



Rainfall anomalies, early June 2016



MSLP and cloud, 5 June 2016

South Esk River, Hadspen, Tasmania, 8 June 2016. Source: Catherine Jolly

The confluence of trends and natural variability

Plausible cumulative risk scenarios for 'stress testing'

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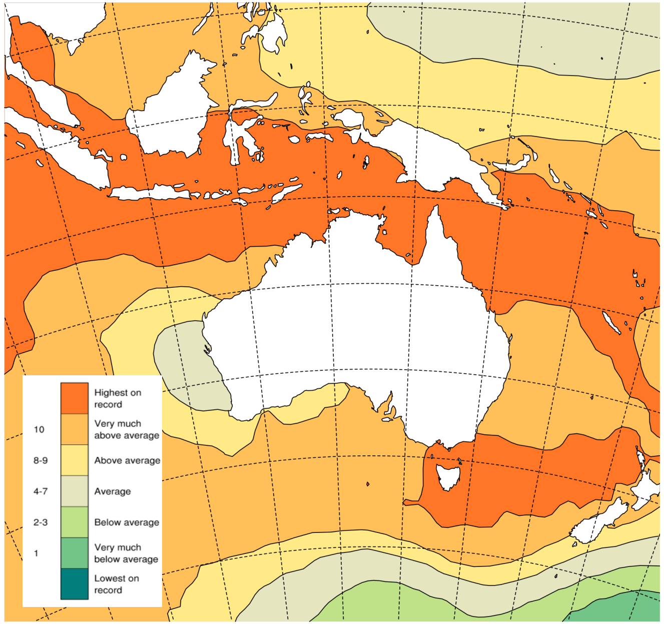
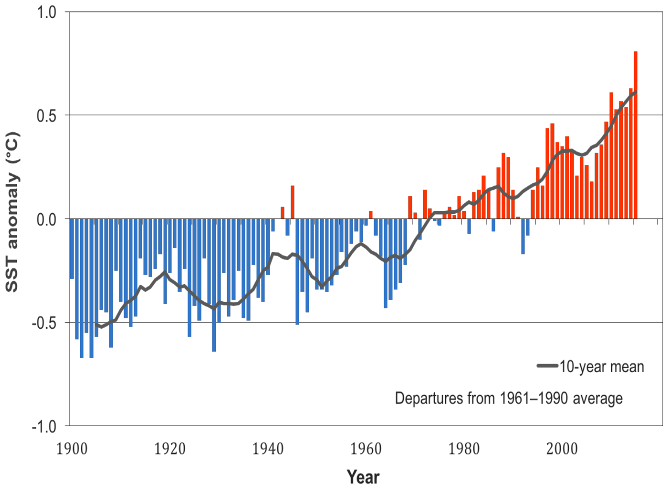
Australia's changing marine environment

Sea surface temperatures during the northern monsoon



2015-2016 monsoon season

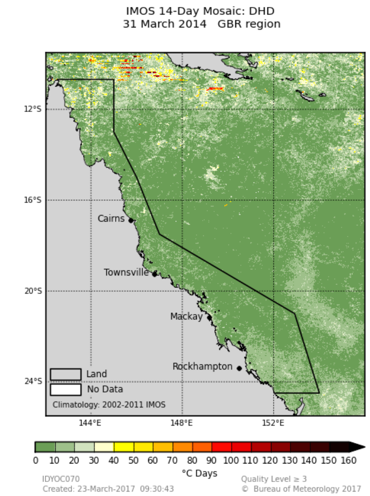


Northern Australia monsoon season sea surface temperature anomalies

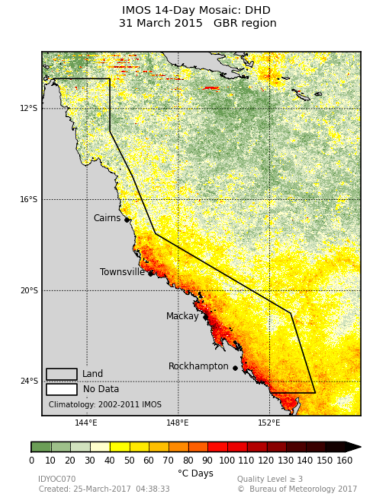
Australia's changing marine environment

Degree Heating Days on the Great Barrier Reef

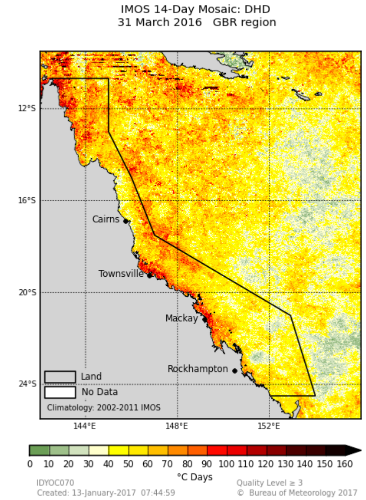
Degree Heating Days (DHD) are the accumulation (sum) of positive SST anomaly values over the summer (1 December to 31 March).



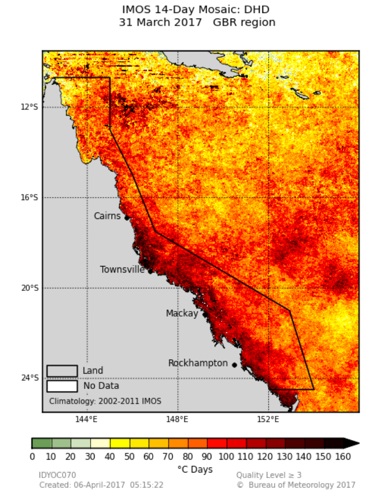
2013-2014



2014-2015



2015-2016

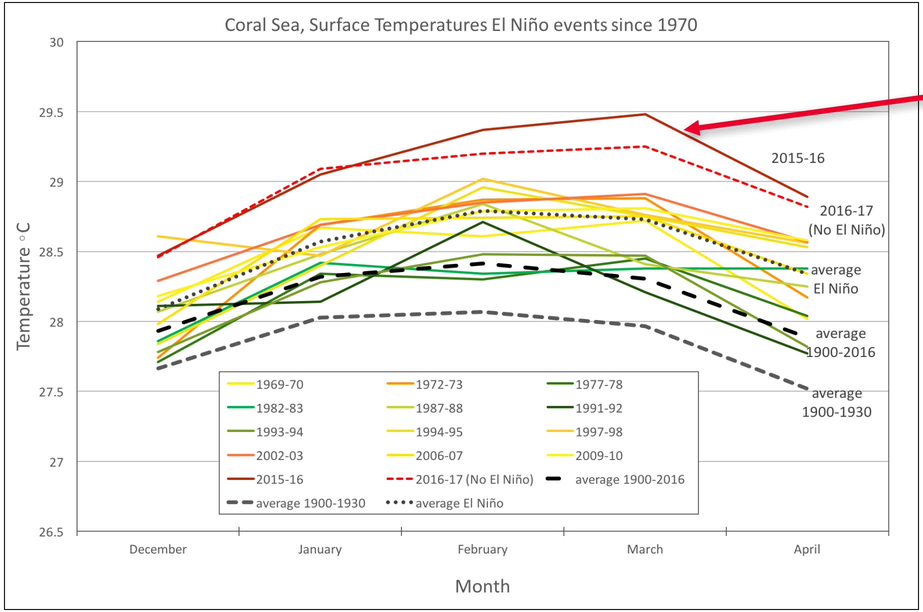


2017-2018

Australia's changing marine environment

Constructing a plausible future extreme scenario

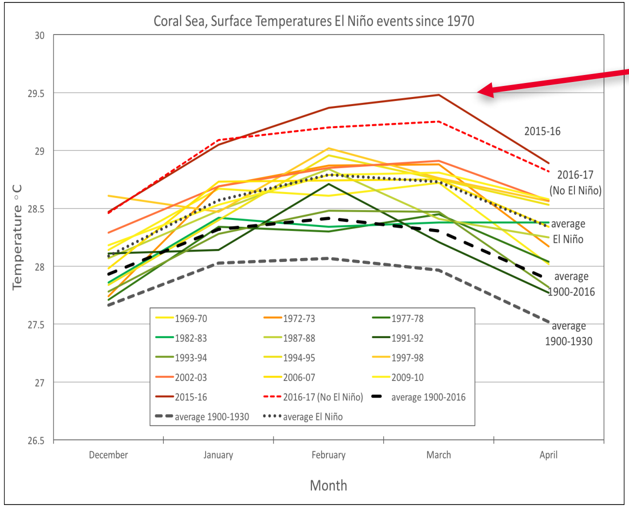
Its important to note that, in terms of magnitude, we have already experienced events that are record-breaking. It is straightforward to place those events in an extreme but plausible climatological and meteorological sequence and setting



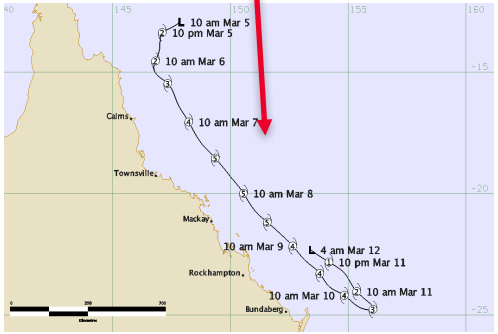
What is the likelihood that we will get three years like this in a row?

Australia's changing marine environment

Constructing a plausible future extreme scenario



What about three record hot years followed by a Tropical Cyclone with a path down the reef?



Thank you

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