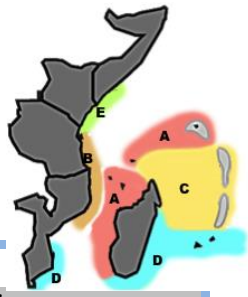
WESTERN INDIAN OCEAN – Regional coral bleaching alert



DATE OF THIS ALERT: 07 January 2020

http://www.cordioea.net/bleachingalert/

Contact: bleaching@cordioea.net

Bleaching Alert Level

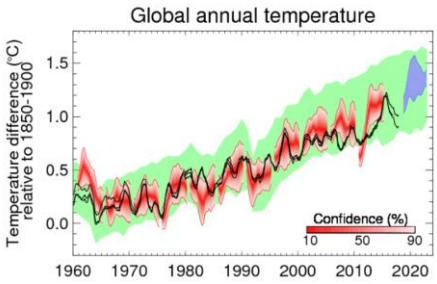
- ***'warning'** – indications of warmer conditions that may result in some bleaching*
- ***'level 1' – moderate bleaching possible***
- ***'level 2' – severe bleaching likely***

*Letters in the brackets under the 'region' column refer to **the WIO climatology regions**, depicted in the map in the top right corner.*

07 January 2020 – Coral bleaching forecast – Western Indian Ocean

Area	Region	Alert	Bleaching observations
S Moz/S Africa	*Cool, south (D1)*	*warning*	
SWIO/E Madag	*Cool, south (D2)*	*moderate*	
SW Madagascar	*Hot, south (A1)*	*moderate*	
South Equat Curr	*Moderate, central (C)*	*moderate*	
East Moz Cha/Comoros	*Hot, central (A2)*	*moderate*	
NW Moz Cha /C Tanz	*Warm, central (B)*	*moderate*	
NW Seychelles	*Hot, north (A3)*	*moderate*	
Kenya-Somalia	*Variable, north (E)*	*moderate*	

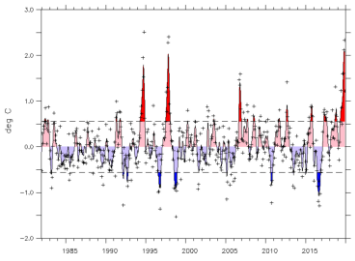
Global & Regional Indicators



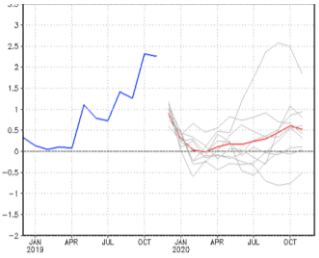
2019 was a record hot year globally, indicated by record conditions during the northern summer across Europe, and the record-breaking heat and fire season in Australia during December 2019. Decadal predictions by the UK Met Dept (right, figure from January 2019) will be updated in January 2020, and may show this by a steep increase in the black lines and red envelopes for 2019. Whether further increases in 2020 can be expected, as predicted by the blue portion, will be clearer when the update is provided.

Indian Ocean Dipole (IOD) 2019-2020

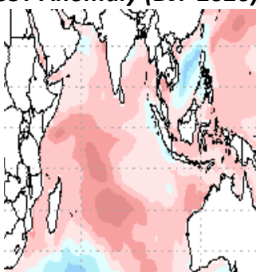
DMI historical (1982-current)



DMI forecast

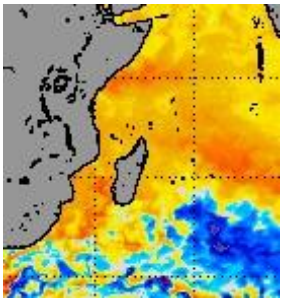


SST Anomaly (DJF 2020)

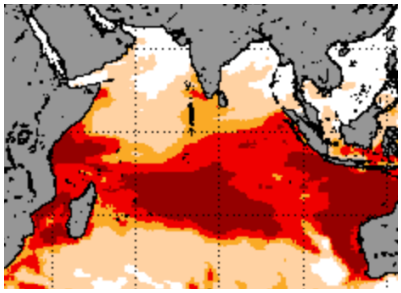


The IOD is at historically high levels (see at right). The DMI forecast (middle) has failed in the last few months as it has predicted severe drops (break between the high current conditions and future forecasts) that have not occurred, as the dipole has intensified. Very hot conditions are predicted in the WIO in the next few months.

NOAA Products – 4 January *2020*

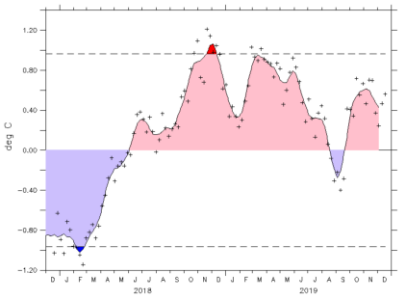


SST Anomaly Season outlook (Jan-Apr 2020)



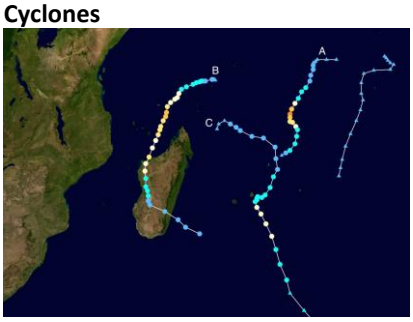
At the beginning of January, temperatures across the entire WIO are 1-2°C warmer than usual for the same time period. The seasonal outlook predicts moderate to high bleaching across the region with greater than 60% probability.

ENSO index (3.4)



The ENSO has remained weakly positive for over one year, declining in intensity over the period.

Cyclones



Three cyclones already formed in the WIO basin during December 2019, Ambali (3-8/12; the strongest in four years), Belna (2-11/12) and Calvinia (27/12-1/1/20), indicative of the very high sea surface temperatures and potentially a strong cyclone and bleaching season.

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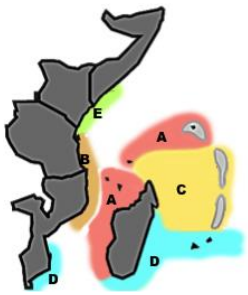
WESTERN INDIAN OCEAN – Regional coral bleaching alert

DATE OF THIS ALERT: 07 January 2020

Explanations

WIO climatology regions



Since 2014, bleaching reporting regions are used as defined by SST analysis from the last decade (2003-2009 as 'background' years, and 2010 as a year of high bleaching), rather than a longer historical record that includes pre-1998 SSTs. Five SST zones were identified:

A – the hottest region; the East Mozambique Channel and Comoros (reported as SW Madagascar and the NE Madagascar Channel) and the NW Seychelles islands. Split into 3 sub-regions.

B – the second hottest region; East African mainland coast from 7-18ºS (Zanzibar/Dar es Salaam to Primeiras/Segundas islands), and including the Northwest Mozambique Channel

C – a moderate/intermediate region; the South Equatorial Current region, comprising the Mascarene Banks, southern Seychelles islands and NE Madagascar

D – the southern cooler regions; SW Indian Ocean islands, E and S Madagascar and S Mozambique and South Africa. Split into 2 sub-regions.

E – the cooler northern but highly variable region; the Kenya-Somali coast, including Pemba island and N Tanzania coast (Tanga).

Because of latitudinal variation (e.g. in A) and geographic splitting (e.g. A and D), we report in 8 sub-regions.

Alert levels

Statistical analysis of alerts from 2007-13 indicated that low confidence is attached to an alert of 'low' bleaching risk (i.e. not zero risk, but not severe). By contrast, predictions of 'mid' and 'high' risk of bleaching were more reliable. Accordingly, the alert is being presented as:

- ***'warning'** – indications of warmer conditions that may result in some bleaching*
- ***'level 1' – moderate bleaching possible***
- ***'level 2' – severe bleaching likely***

These findings match the categories used by NOAA, with 'watch', 'bleaching level 1' and bleaching level 2' categories.

Sea Surface Temperatures (SST)

The surface of the sea heats up by direct insolation, causing stress to corals and other shallow water organisms. Satellites directly measure the skin-temperature of the sea, providing these maps and coral bleaching products for early warning.

Predicted Bleaching

The Bleaching Thermal Stress Outlook is based on sea surface temperature (SST) forecasts generated by the Linear Inverse Model from the NOAA Earth System Research Laboratory. In a normal year, the Outlook forecasts no potential for bleaching. The baseline years for calculations (i.e. the climatology) are 1985-93, excluding 1991 and 1992 due to high atmosphere volcanic dust from Mt. Pinatubo.

Wind-driven mixing

Wind is an important physical factor influencing conditions conducive to coral bleaching. Wind-driven mixing reduces temperature stress and wind generated waves can scatter harmful levels of incoming solar radiation.

- *Cyclones - cause strong mixing, reducing SST.*
- *Doldrums - periods of sustained low wind promote stratification, and heating of the upper layers of water. They therefore promote environmental conditions adverse to corals experiencing thermal and/or light stress.*

El Niño/Southern Oscillation (ENSO)

The El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on interannual time scales.

***Multivariate ENSO Index (MEI**) - Negative values of the MEI represent the cold ENSO phase (La Niña), while positive MEI values represent the warm ENSO phase (El Niño).*

***The Southern Oscillation Index (SOI)** is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin (Note, negative SOI is equivalent to positive MEI).*

***The Nino 3.4 index** is similar to the SOI, but focused on the central Pacific Niño region, straddling the equator and from 170-120ºW. It has been found to be most strongly associated with climatic consequences in the African region, so is used here.*

Indian Ocean Dipole

The Indian Ocean Dipole is analogous to the ENSO, but for the Indian Ocean. It is calculated using the Dipole Mode Index (DMI), which calculates the gradient between the western equatorial Indian Ocean (50E-70E and 10S-10N) and the south eastern equatorial Indian Ocean (90E-110E and 10S-0N).

Global indicators

Local temperatures are affected by global and regional trends. With global warming, temperatures are expected to rise over longer periods (decades), but significant variation can occur between years, and under the influence of regional and multi-year factors such as ocean-atmosphere interactions across the Pacific and Indian Ocean.

Data sources

http://www.metoffice.gov.uk/news/releases/archive/2014/2015-global-temp-forecast
http://coralreefwatch.noaa.gov/
https://en.wikipedia.org/wiki/2017%E2%80%9318_South-West_Indian_Ocean_cyclone_season
http://www.mtotec.com/
http://www.cpc.ncep.noaa.gov/
http://www.ioc-goos-oopc.org/state_of_the_ocean/sur/ind/dmi.php
http://www2.cnrs.fr/en/3148.htm

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