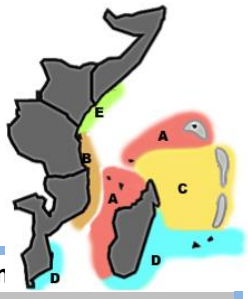
WESTERN INDIAN OCEAN – Regional coral bleaching alert



DATE OF THIS ALERT: 16 January 2018

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***

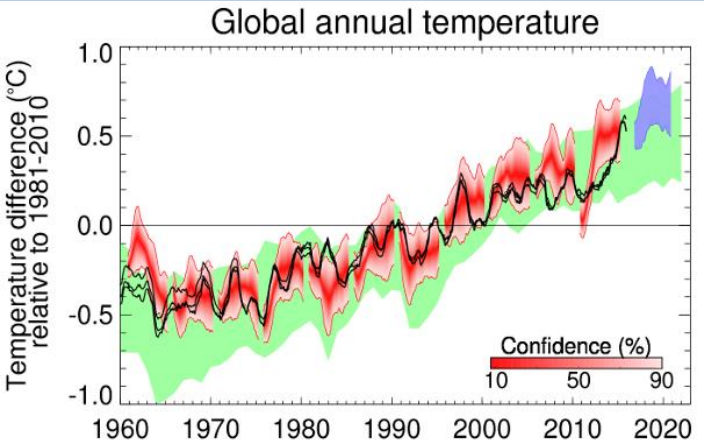
*Letters in the brackets under the 'region' column refer to **the WIO climatology regions**, depicted in the map in the top right corner.*

16 January 2018 – Coral bleaching forecast – Western Indian Ocean

Area	Region	Alert	Bleaching observations
S Moz/S Africa	*Cool, south (D1)*	*none*	
SWIO/E Madag	*Cool, south (D2)*	*none*	
SW Madagascar	*Hot, south (A1)*	*none*	
South Equat Curr	*Moderate, central (C)*	*none*	
East Moz Cha/Comoros	*Hot, central (A2)*	*none*	
NW Moz Cha /C Tanz	*Warm, central (B)*	*none*	
NW Seychelles	*Hot, north (A3)*	*none*	
Kenya-Somalia	*Variable, north (E)*	*none*	

Given the entire WIO is showing abnormally cool conditions, two cyclones have occured by mid-January and both ENSO and IOD indicators are neutral, we expect little bleaching in 2018. Most likely southern locations in the WIO will not experience bleaching stress, but it may develop in more northern locations as the season develops.

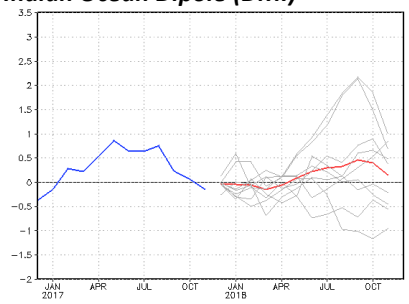
Global & Regional Indicators



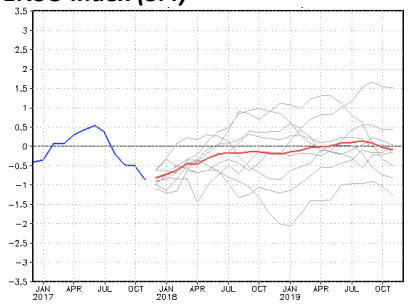
2015-2017 were among the hottest years ever recorded (see red shading and black lines at right), creating the 3-year long 3rd global bleaching event. The Hadley Met. Center projects that "the recent run of consecutive record years is likely to end in 2017 as El Niño declines", so temperatures in 2018 are expected to not exceed preceding years. Nevertheless the five-year forecast (2017-2021, in blue) indicates significantly warmer conditions in coming years. This long range forecast will be updated in late January 2018.

Both the Indian Ocean Dipole and El Niño indices (see right) are neutral or slightly negative, and will continue in this state throughout 2018.

Indian Ocean Dipole (DMI)

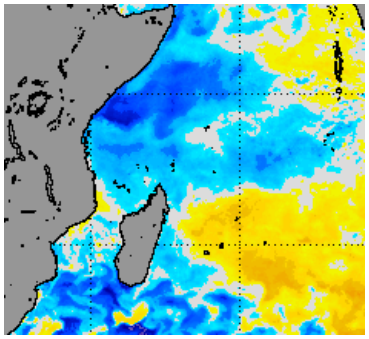


ENSO index (3.4)

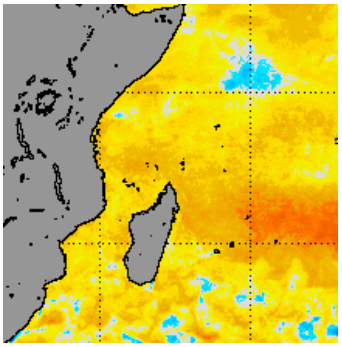


NOAA Products – *SST Anomaly*

14 January *2018*



17 January 2016



Temperatures across the entire WIO are over 1°C colder than they normally are, a marked difference from the same dates in 2016 when the region was uniformly hot, and significant thermal stress and bleaching were experienced. The NE monsoon wind is currently strong.

Bleaching observations – Jan 2018

None

Cyclones

Cyclone Ava traversed down the east coast of Madagascar from 3 - 8 January, cooling a strip of coastal waters visible at left.

Cyclone Berguitta passed north of Rodrigues on 14 January, and is currently predicted to pass over Mauritius and Reunion.

NOAA Virtual stations, 14 Jan 2018

Eight virtual stations are on the lowest alert level "watch" due to warmer conditions in early January, but likely to reduce in status with the cooler Mozambique channel waters and current cyclones.

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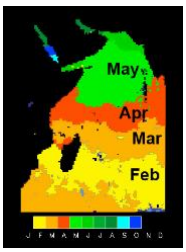

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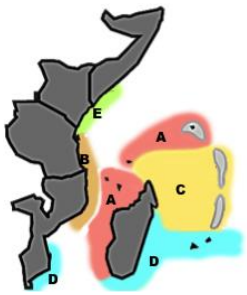
Explanations

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 Madagascar Channel and Comoros (reported as SW Madagascar and the NE Madagascar Channel) and the NW Seychelles islands. Split into 3 subregions.

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

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 splitting geographically (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 (ie. 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 bleachaing 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 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/
http://australiasevereweather.com/cyclones/index.html
http://www.mtotec.com/
http://www.cpc.ncep.noaa.gov/
http://www.ioc-goos-oopc.org/state_of_the_ocean/sur/ind/dmi.php

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