WESTERN INDIAN OCEAN

Regional coral bleaching alert

DATE OF THIS ALERT: 29 January 2010

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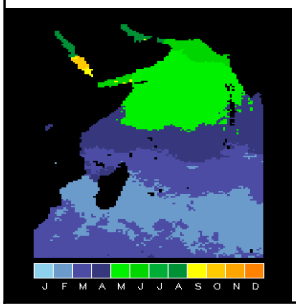

Long-term warmest month – Western Indian Ocean

The long-term warmest month for sea surface temperatures is the one with highest risk for bleaching of corals.

In southern Madagascar/central Mozambique this is in February, and moves northwards with the sun through March and April in Tanzania and Kenya, to May in the northern IO

(Month of Maximum Monthly Mean temperature, source: NOAA/Coral Reef Watch/Scott Heron)

This bleaching alert runs from January to May each year, compiling publicly available information and observations from the field into an accessible document.

The table "Bleaching interpretation" below summarizes all the information to a prediction for low, moderate or high risk of bleaching. See the later pages for more detailed information and original sources.

Bleaching interpretation

High moderate low none expected

Ordered by date

Date	Level	Observation	Alert
15 Jan 10	moderate	Global indicators suggest a warm but not severe year with moderate El Niño conditions. Bleaching predications for the Indian Ocean are relatively high. But hotspot development is so far very low, conflicting with these observations. Cautious prediction of moderate bleaching risk.	NE Madagascar
29 Jan 10	moderate	Increased hotspot intensity in central Mozambique channel and NE Madagascar compared to the past few weeks. Indicators are still for moderate bleaching risk.	Mozambique channel, NE Madagascar & Mauritius

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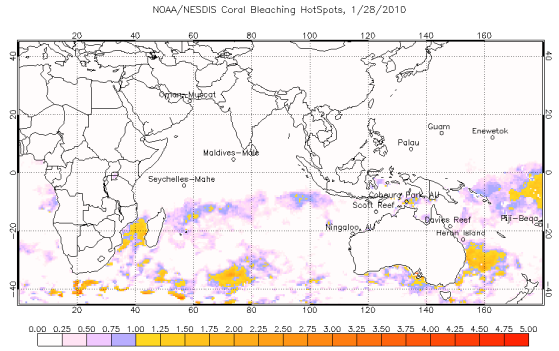
Sea Surface Temperatures

SST maps

SST Hotspots

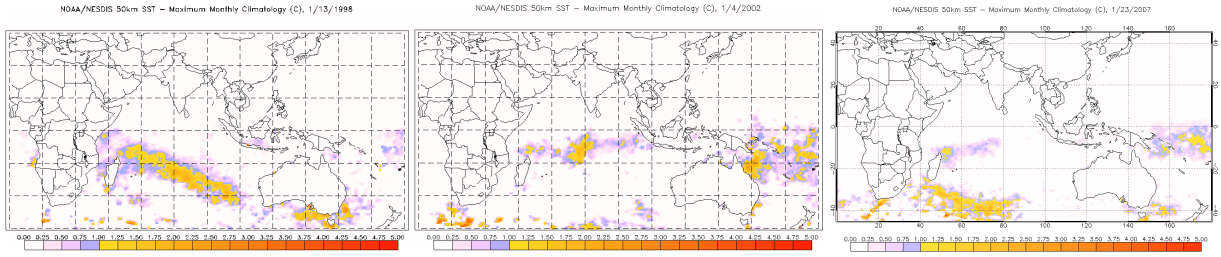


28 Jan 2010.

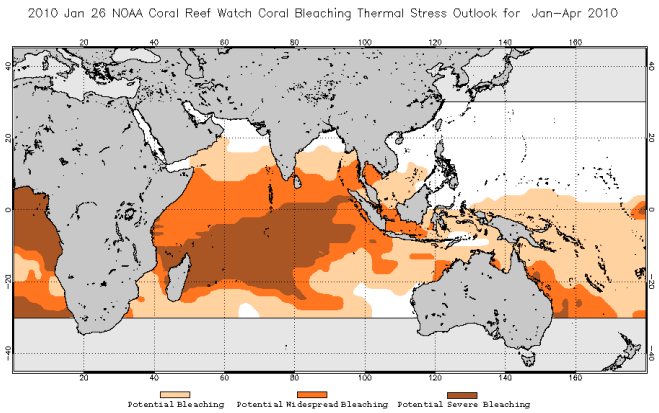
Hotspot development is shown off northeast Madagascar and a large area in the central Mozambique channel.
The central Mozambique channel is experiencing elevated SST thus increased thermal stress.

Comparison with previous years with high bleaching (1998) and no bleaching in 2002 and 2007.

1998 2002 2007



Predicted Bleaching in 2010



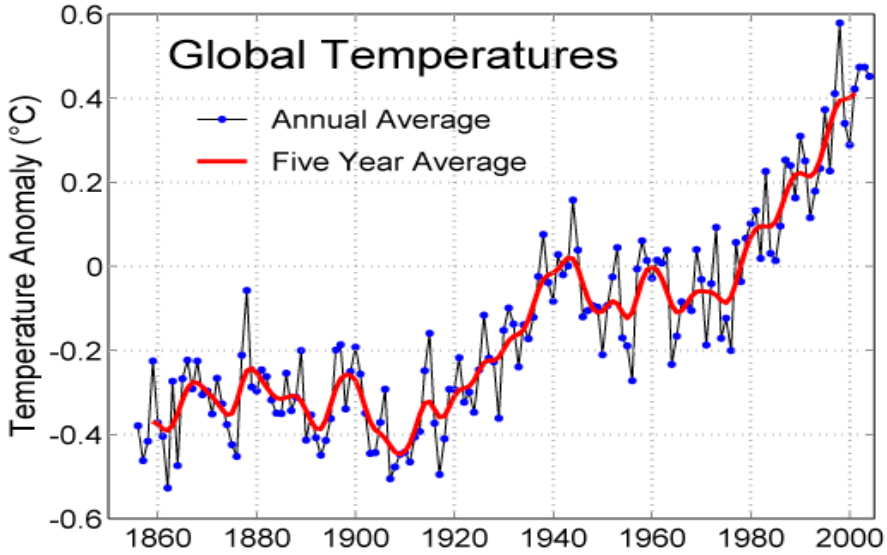
"Potential Widespread Bleaching", in mid-orange, is predicted for most of the Indian Ocean from January to April 2010.

"Potential Severe Bleaching", in dark orange, is predicted for eastern Madagascar and across the central part of the Indian Ocean.

Source:
http://coralreefwatch.noaa.gov/satellite/bleachingoutlook/outlook_messages/bleachingoutlook_current.html

Global indicators, January 2010

Global Temperatures



Sources: http://data.giss.nasa.gov/gistemp/graphs

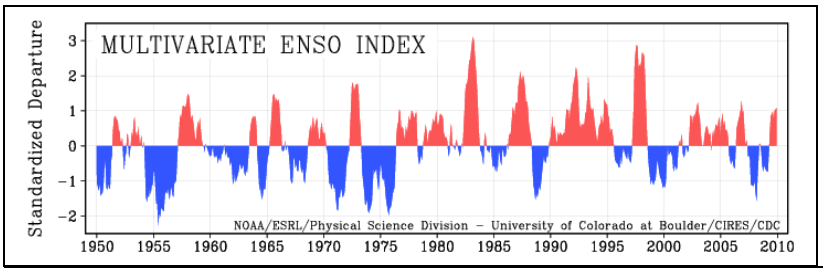
This graph shows actual Global Temperature measurements from 1860 to 2009.

1998 was the hottest year on record.

The record from 2002 to 2009 has been relatively consistent. 2010 is likely to be warm, but not severe.

Multivariate ENSO Index (MEI)

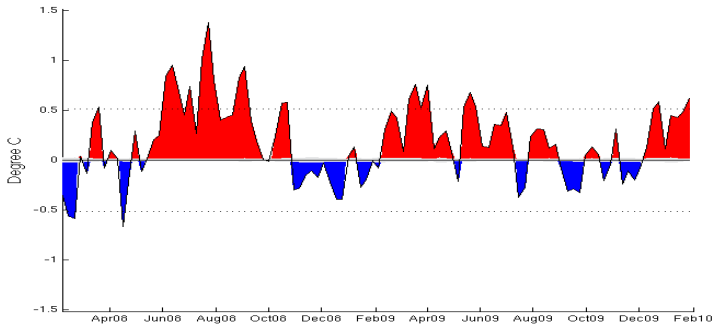
Red (positive) MEI values represent the warm ENSO phase (El Niño).
Blue (Negative) values of the MEI represent the cold ENSO phase (La Niña).



The MEI shows moderate positive values leading into 2010 that indicate an *El Niño* phase, similar to *El Niño* since 2002.

Source: http://www.esrl.noaa.gov/psd/people/klaus.wolter/MEI/

Dipole Mode Index (DMI) – Indian Ocean



The DMI is like an ENSO index for the Indian Ocean. The red (positive) phase is associated with warm sea conditions in the western equatorial Indian Ocean: off the eastern coast of Africa, from the northern half of Madagascar to the northern edge of Somalia.

Source: http://ioc-goos-oopc.org/state_of_the_ocean/sur/ind/dmi.php

Explanations

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. When forecast SST exceeds bleaching thresholds over a long enough period to cause bleaching, the outlook maps display the bleaching potential.

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.*

Global indicators, January 2010

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. Major influences at the beginning of 2010 are summarized here.

Multivariate ENSO Index (MEI)

El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on interannual time scales. Negative values of the MEI represent the cold ENSO phase (La Niña), while positive MEI values represent the warm ENSO phase (El Niño).

Southern Oscillation Index (SOI)

The Southern Oscillation Index (SOI) is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin. A 'deep' and consistently negative SOI pattern (less than about minus 6 over a two month period, with little change over that period) is associated with El Niño conditions. (Note, a negative SOI is equivalent to a positive MEI)

Dipole Mode Index (DMI)

This is a measure of the Indian Ocean Dipole (IOD), the Indian Ocean's equivalent to the Pacific Ocean's ENSO. The Dipole Mode Index (DMI) is a measure of the anomalous SST gradient across the equatorial Indian Ocean from east to west. When the DMI is positive, then the phenomenon is referred as the positive Indian Ocean Dipole (IOD), equivalent to a positive MEI and El Niño.