SEA SURFACE TEMPERATURE IN THE WESTERN AND CENTRAL INDIAN OCEAN

Compiled by: ***David Obura***
CORDIO – East Africa, Mombasa, Kenya

DATA ACKNOWLEDGEMENTS:
Chagos - C. Sheppard; Kenya: 92-94, 97-98: D. Obura. 95-97: S. Mwangi; Maldives – S. Clark; South Africa – L. Celliers; Zanzibar – C. Muhando. SST Anomaly map: NOAA.

LONG TERM RECORDS

Annual peaks in sea temperature occur in the first half of each year, as the sun moves northwards after heating the sea-surface during the southern summer. Long term records in the central Indian Ocean indicate a distinct warming trend (Chagos, Maldives) of almost 1^{o} C over the last 30 to 50 years, leading up to the highest recorded maximum during the El Niño Southern Oscillation in early 1998.

THE EFFECT OF EL NIÑO

The sea surface temperature anomaly map shows the position of the high in April 1998, having moved northwards from a position off Madagascar and Mozambique in February, and finishing in the Gulf of Aden in May.

SHORT TERM RECORDS

Monitoring of water temperatures on reefs started in East Africa in 1992 using hand-held thermometers and subsequently automated temperature loggers. Initially, records were used to document seasonal changes, extending now to daily and even hourly changes (Kirugara, this volume). Distinct daily patterns of warming during the day and cooling at night are the norm, superimposed on tidal and seasonally-influenced changes, and local topographic and current effects.

METHODS

Sea-surface temperature measurements are now being taken by a number of different methods, including spot measurements using thermometers during field visits, automated measurement by *in-situ* temperature loggers, ship-based temperature measurements and satellite remote- sensing of sea-surface temperature. With increasing variety of methods and number of locations monitored, standardization among methods will become more important, to account for differences in resolution in space and time, depth of measurements and daily variations (e.g. see McClanahan, this volume).

LOCAL FACTORS THAT INCREASE TEMPERATURE

Research on a semi-enclosed lagoon in Kenya (Kirugara, this volume) has shown that maximum heat transfer to lagoon waters occurs due to the coincidence of spring low tides with maximum sun height at midday. Exposed reef surfaces heated during spring lows transfer their heat to flooding water resulting in a distinct temperature peak during the flooding tide that persists for several days. The effects of this regular temperature increase on local coral adaptation, and conversely, on the absolute magnitude of an El Niño-related high temperature anomaly, are likely to be important.

LOCAL FACTORS THAT DECREASE TEMPERATURE

Several factors have been identified that might reduce the absolute magnitude of the El Niño-related high temperature anomaly. Understanding where and how these factors might protect sites from bleaching may be important for management and conservation.

1. Upwelling of cooler water due to continental shelf and/or reef bank topography
2. Temperature loss through exchange and mixing of water along fore-reefs and in lagoon channels, and potentially with the air in shallow bays.
3. Cyclones causing reductions in water heating through cloud cover, and mixing with deeper waters due to wind.