

Hydrological changes over the last 30,000 years registered in northwestern Australia and in the eastern Indian Ocean; implications for atmospheric circulation

De Deckker Patrick

Department of Geology, The Australian National University, Canberra ACT 0200

There are three significant climatic modes that operated over the Indo-Pacific Warm Pool since the Last Glacial Maximum. These are based on numerous proxies [faunal analysis of planktic foraminifers and calcareous nannoplankton, clays, pollen, carbonate and trace metal percentages, and stable isotopes) studied on several cores from the eastern Indian Ocean. The first mode, characteristic of the glacial period, saw a reduced extent of the Warm Pool compared to today with increased sea-surface salinity [SSS], the absence of a barrier layer and reduced sea-surface temperatures [SST]. On land, precipitation was reduced by 30 to 40%, and monsoonal climatic conditions were absent. The thermal structure of the upper ocean was different, with a steeper thermocline and a very deep aragonite compensation depth [ACD] compared to today.

The second mode commenced approximately 14 cal ky BP with the onset of monsoonal rains, a change in alkalinity near the surface of the ocean and a progressive increase in SST. The latter reached a maximum at ~ 11 cal ky BP. The thermal structure of the upper ocean was altered and this was paralleled by a change in the nutricline.

The third mode is characteristic of the Holocene which saw monsoonal activity peaking at around 8 cal ky BP, seen by maximum river discharge, a resultant barrier layer with a low salinity cap, a substantial shallowing of the ACD and a significant vegetational change on land. Since that period, climate changed with decreased SST since 6 cal ky BP. The last 3 cal ky saw more contrasting climatic conditions, dune reactivation in northwestern Western Australia, such as seen today with typical ENSO signals [with wet and dry years], an enhanced Leeuwin Current and broad salinity fluctuations.

Contributors to the data obtained from several of the cores are: Barrows, T. T. [ANU, Australia], Gingele, F. [Warnemunde, Germany], Okada, H. [Hokkaido U., Japan], Martinez, I. J. [Medellin, Colombia], Sirocko, F. [U. Mainz, Germany], Takahashi, K. [Hokkaido U., Japan], and van der Kaars, S. [Monash U., Australia].