Climate variability and change in the Seychelles-Chagos thermocline ridge of the South West Indian Ocean

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Depth of the thermocline – red is shallower
Tropical cyclone days for Dec-Apr when mixed-layer particularly deep (=high SST) NE of Madagascar (8-12S, 50-70E): More cyclone generation and anomalous rainfall

Climatological mean of number of cyclone days (contours) difference between deep and shallow mixed layer (shading)

WHY?
Dec 06 - Mar 2007: thermocline deeper than average, NE of Madagascar – 10 named tropical storms, several intense TCs, Mozambique flooding. WHY?
NCEP surface net heat fluxes W m$^2$ (positive is heat gain by the ocean), with QuikSCAT wind stress vectors (N m$^2$) overlaid.
Upwelling present throughout the year, more defined in MAM, JJA
QuikSCAT wind stress curl (N m³) with the minimum thermocline depth contours (70, 80, 90 m)

NCEP wind stress curl (N m³) with the minimum thermocline depth contours (70, 80, 90 m)
Upwelling equation:

\[
\frac{1}{\rho_0 f} \text{curl} \mathbf{\tau} + \frac{\beta \tau^x}{\rho_0 f^2}
\]
Rossby waves

Bottom topography
Anomalies in z20 depth for run with NCEP wind forcing

Quikscat wind forcing

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http://realtime.sea.uct.ac.za/realtime/indian

Marjolaine Rouault
Summary

- Region of open ocean upwelling in the tropical South Indian Ocean, showed that the term ridge (Seychelles-Chagos ridge) was more appropriate than dome. Boundaries approx 5-12S, 50-70E, varies throughout the year

- Ridge straddles a complex region of forcing

- Semi-annual signal in upwelling

- Not simply forced by wind stress curl, combination of WSC and Beta effect (meridional gradient of the Coriolis parameter)

- Impact of remotely forced Rossby waves, modified by local wind, both annually and inter-annually. More complex due to change in speed of Rossby wave with latitude

- Shift in South Indian Ocean high will affect the depth of the thermocline either directly or through impact of remote forcing. This is likely to impact on weather and biology.
Further information:

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