

Indian Ocean variability and climate interaction

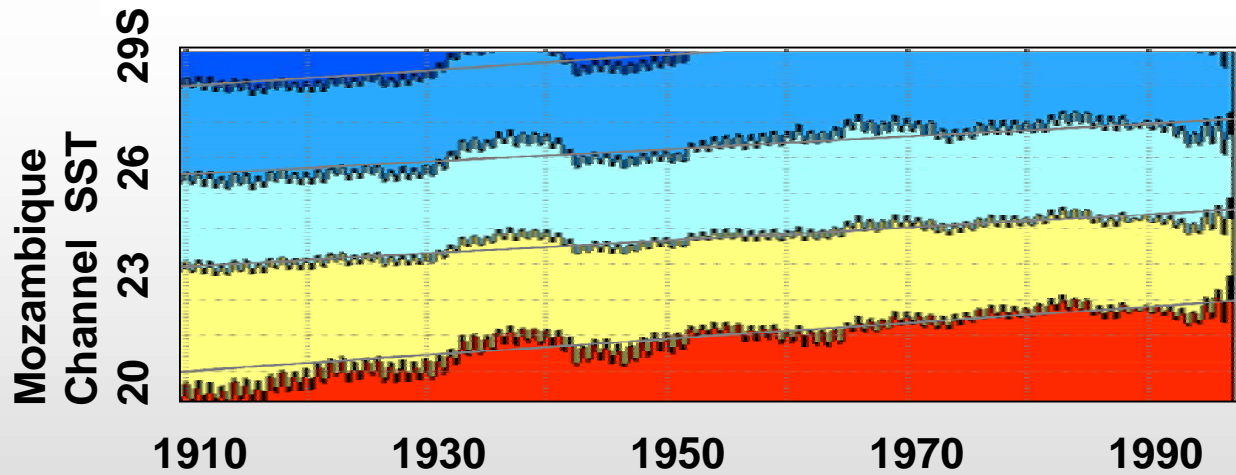
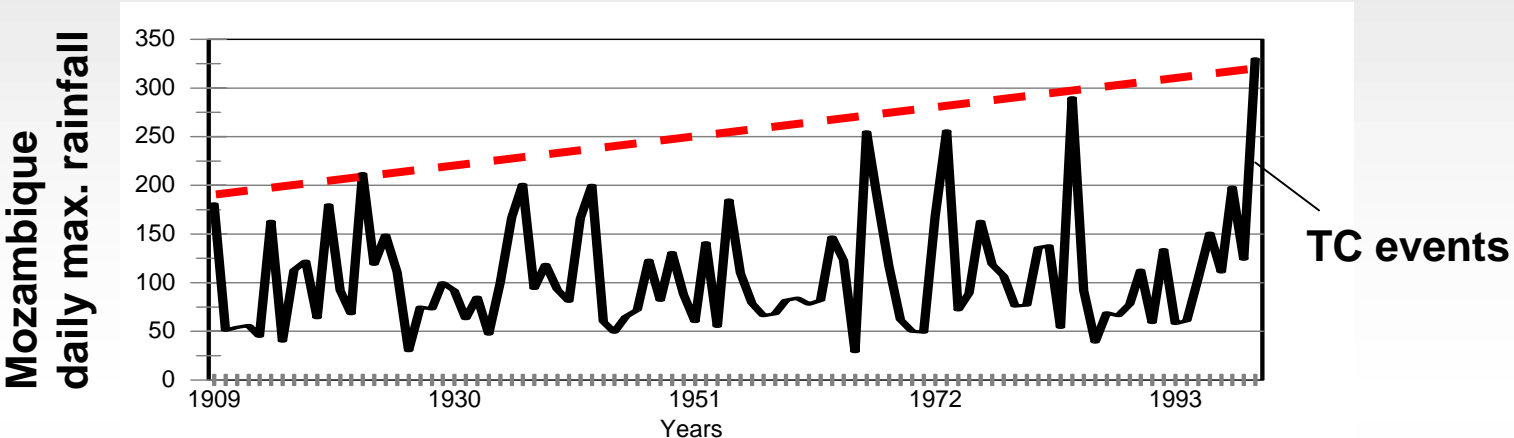
Mark R Jury, Univ Zululand

Although our knowledge of climate variability is advanced:

only a portion is **predictable** and may relate to ocean rossby waves ($L=7000$ km) travelling westward at ~ 0.1 m/s regulating 2-5 year fluctuations in the atmospheric circulation

climatic trends may induce regime shifts

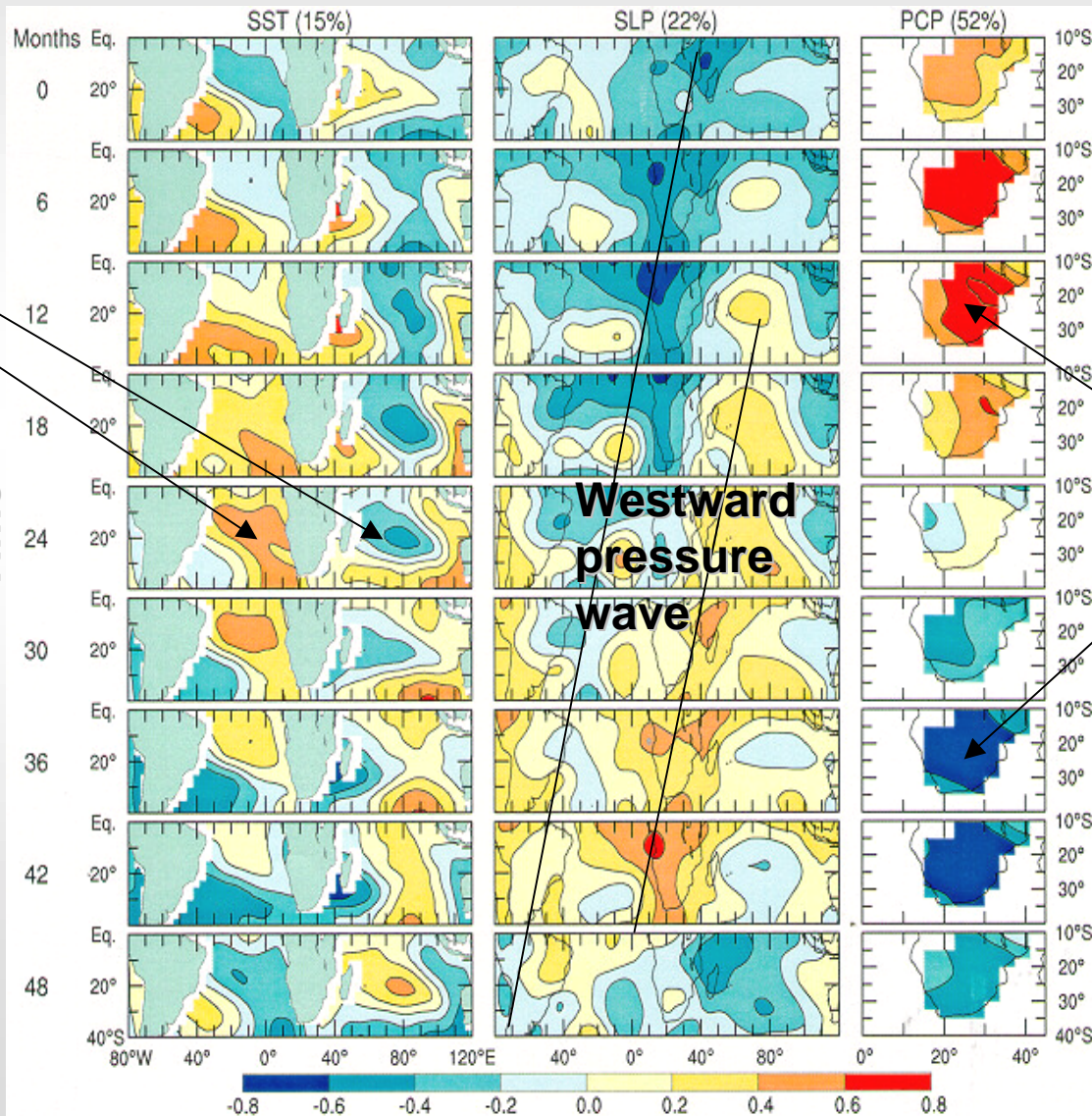
Climate change



Combined eEOF analysis: biennial component

Opposing
response
of Atlantic
and Indian
Oceans

Time

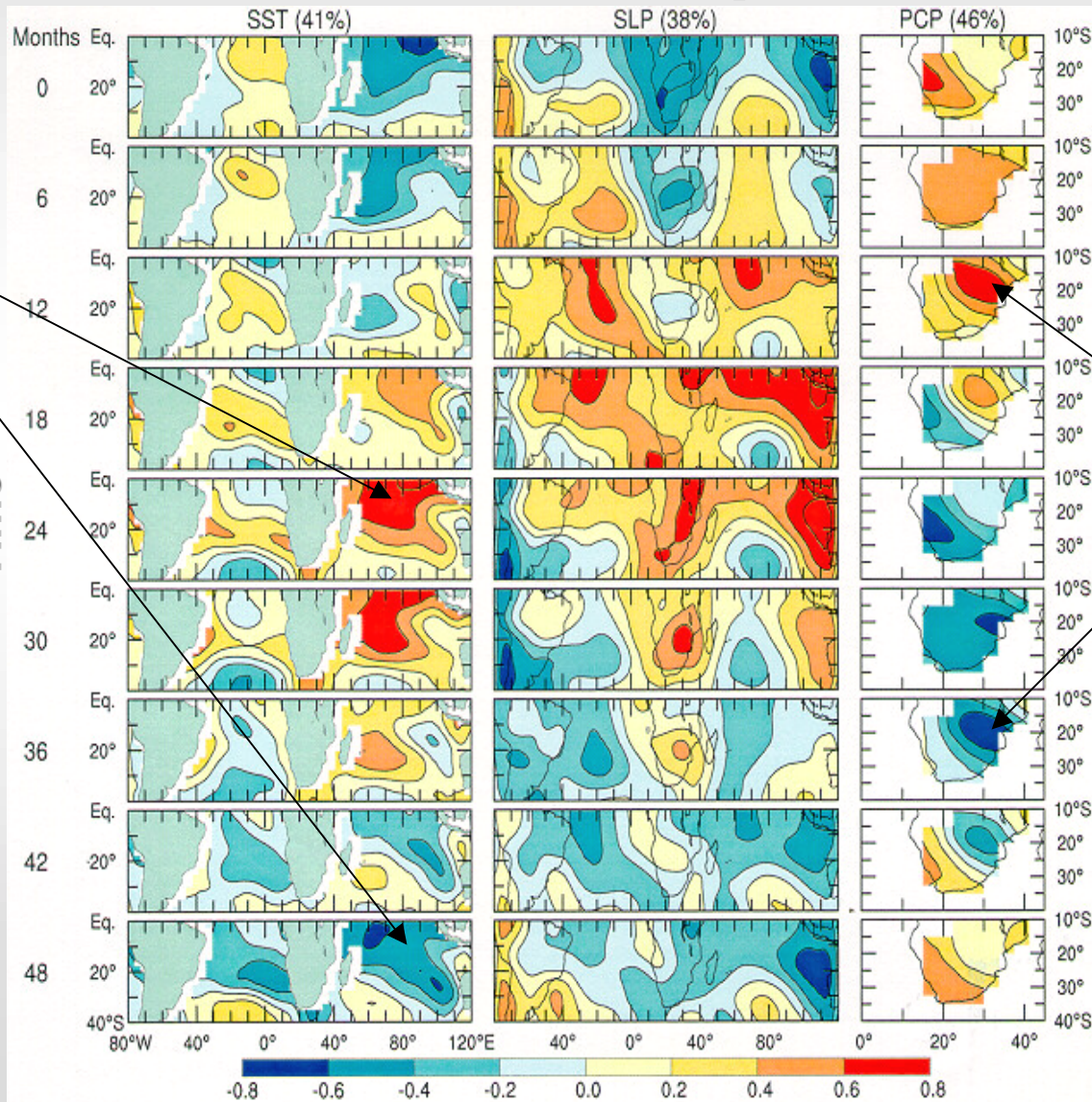


Opposing
phases of
rainfall

Combined eEOF analysis: interannual component

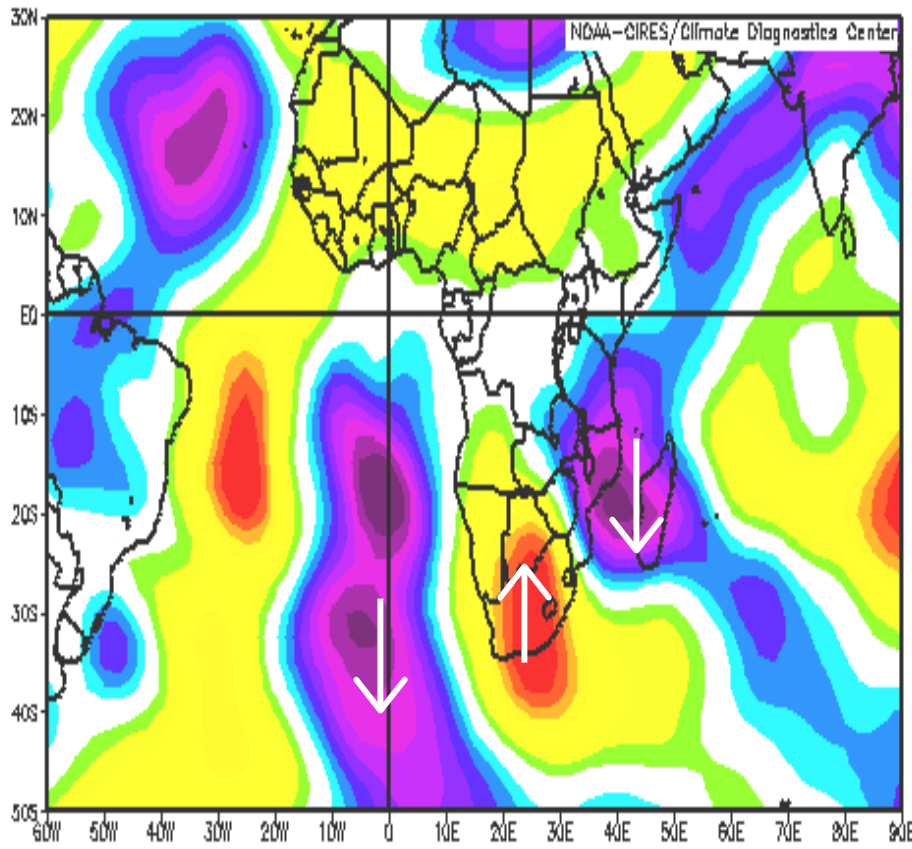
Alternating
response
of Indian
Ocean

Time



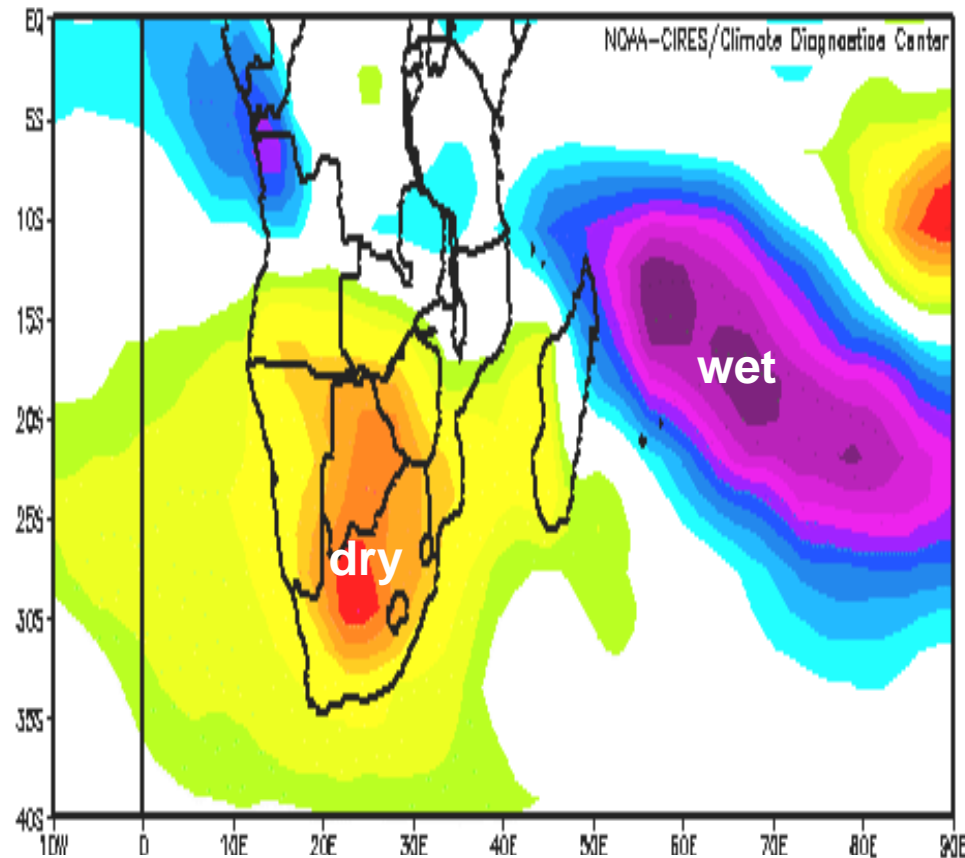
Opposing
phases of
rainfall

Climatic response to ocean rossby wave induced deep thermocline in WIO



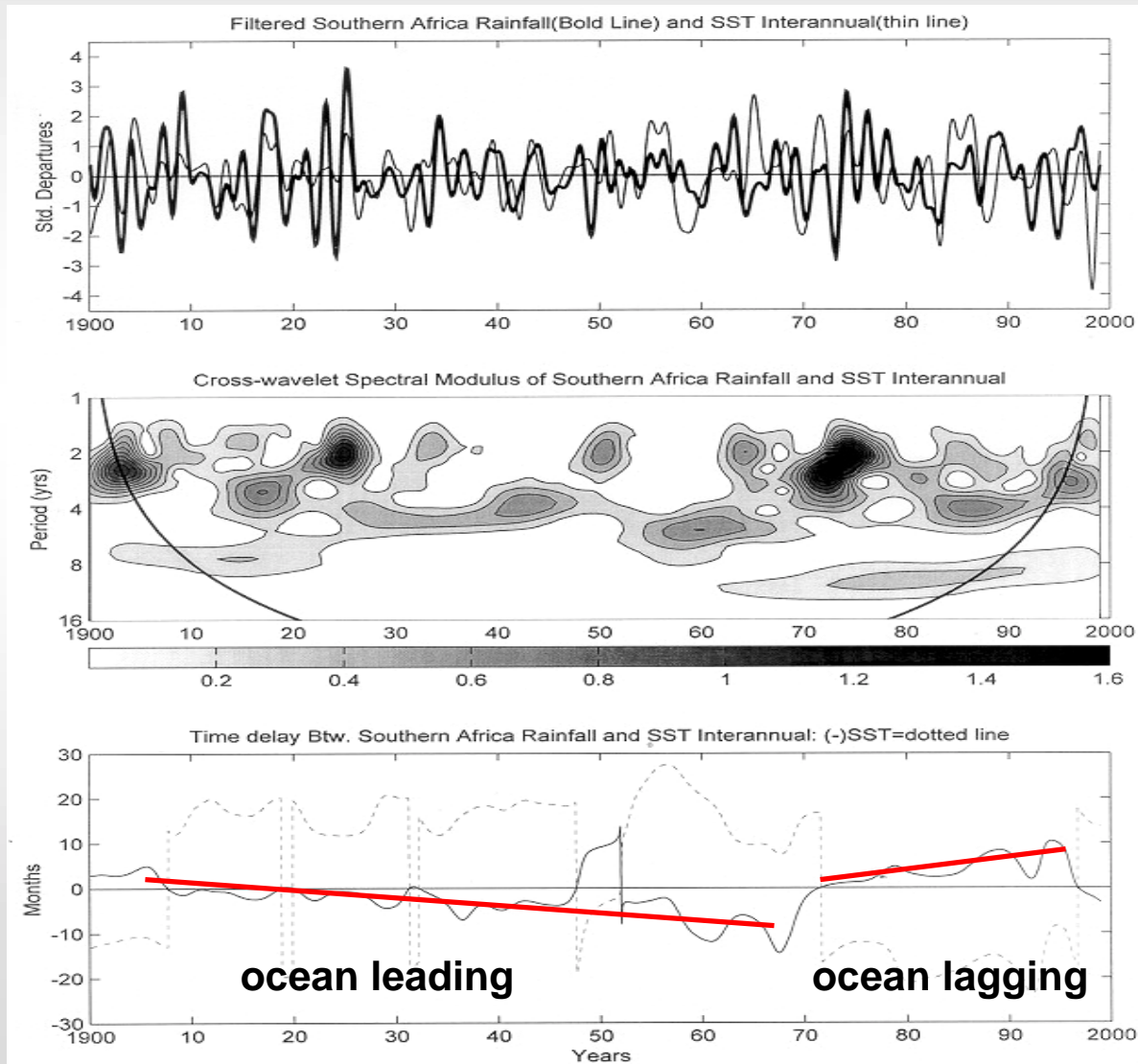
Upper level waves

- in deep phase -

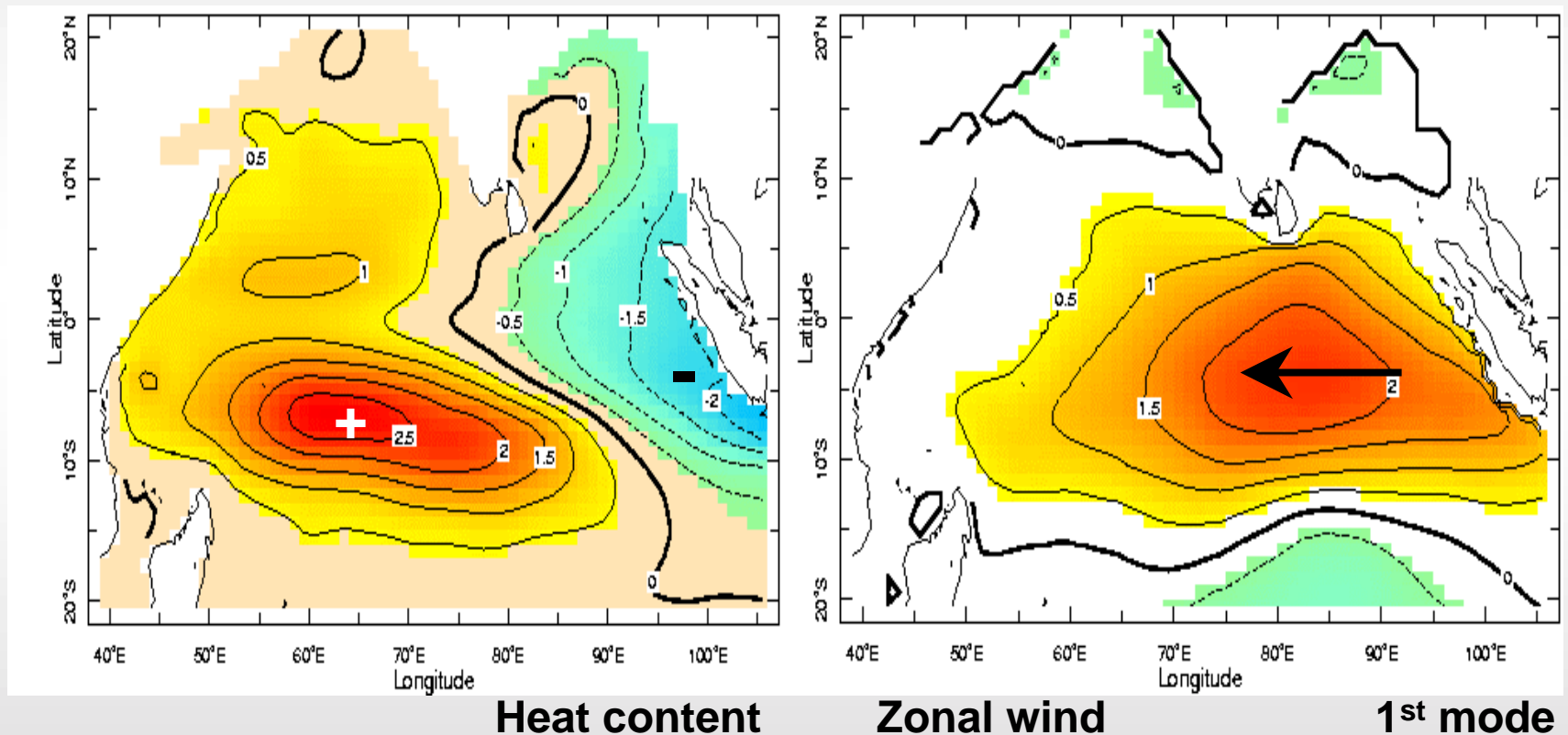


convective anomaly

Southern African rainfall and tropical Indian SST

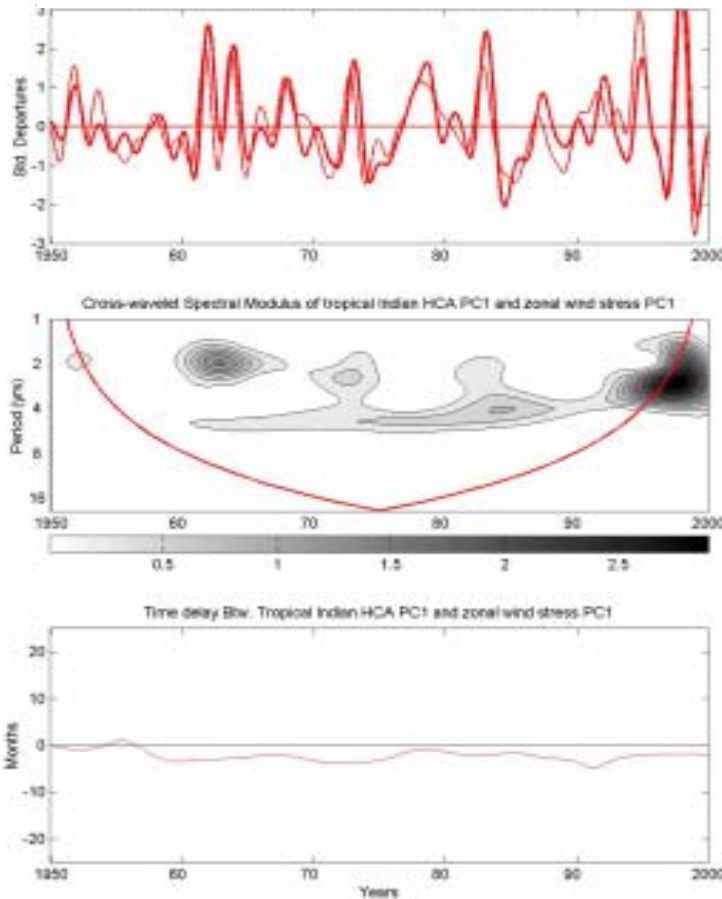


Indian Ocean dipole regulated by wind forced ocean rossby wave



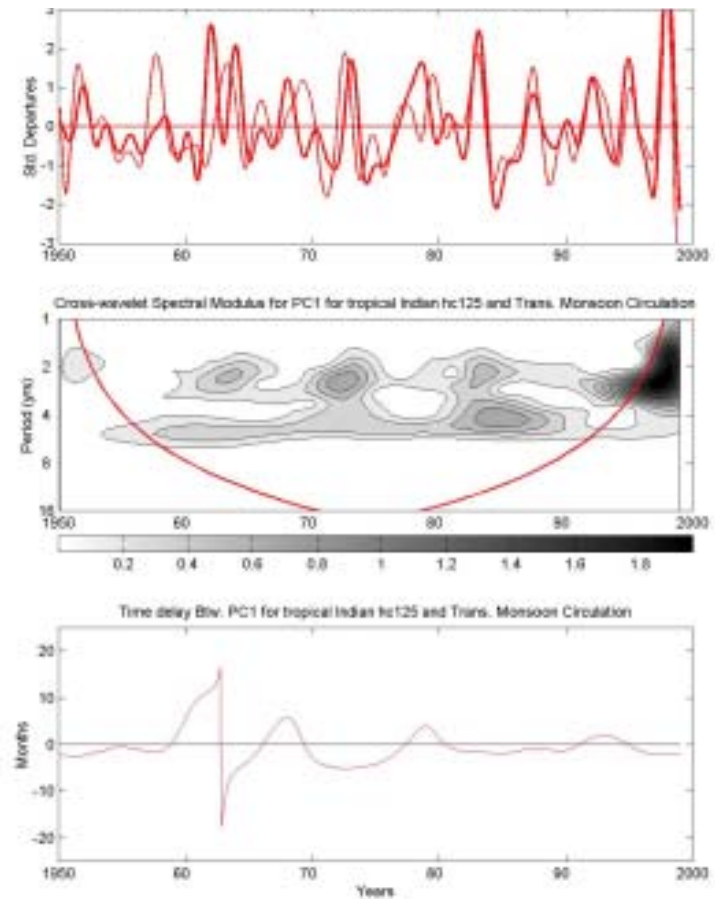
Temporal relationships

Heat content vs U wind



wind leading dipole

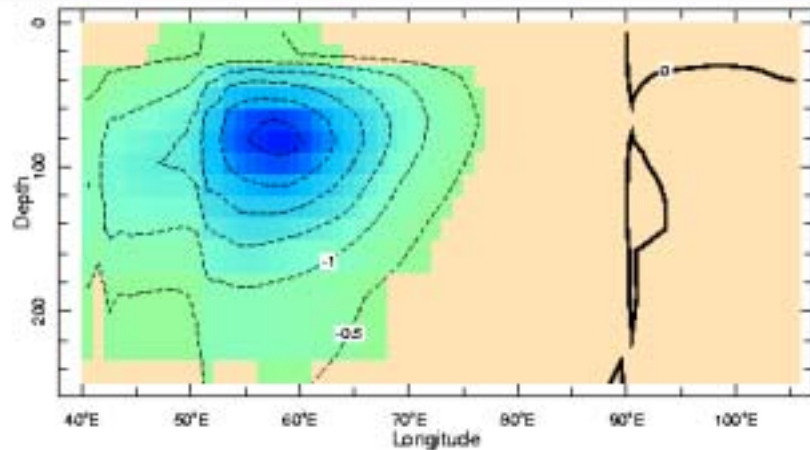
Heat content vs T. monsoon



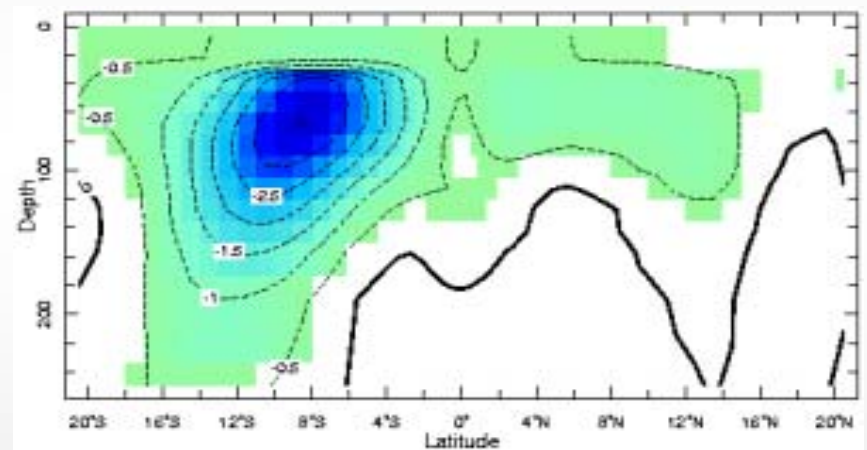
simultaneous association

Leading mode of sub-surface thermal variance:

E-W slice avg. 5-15S

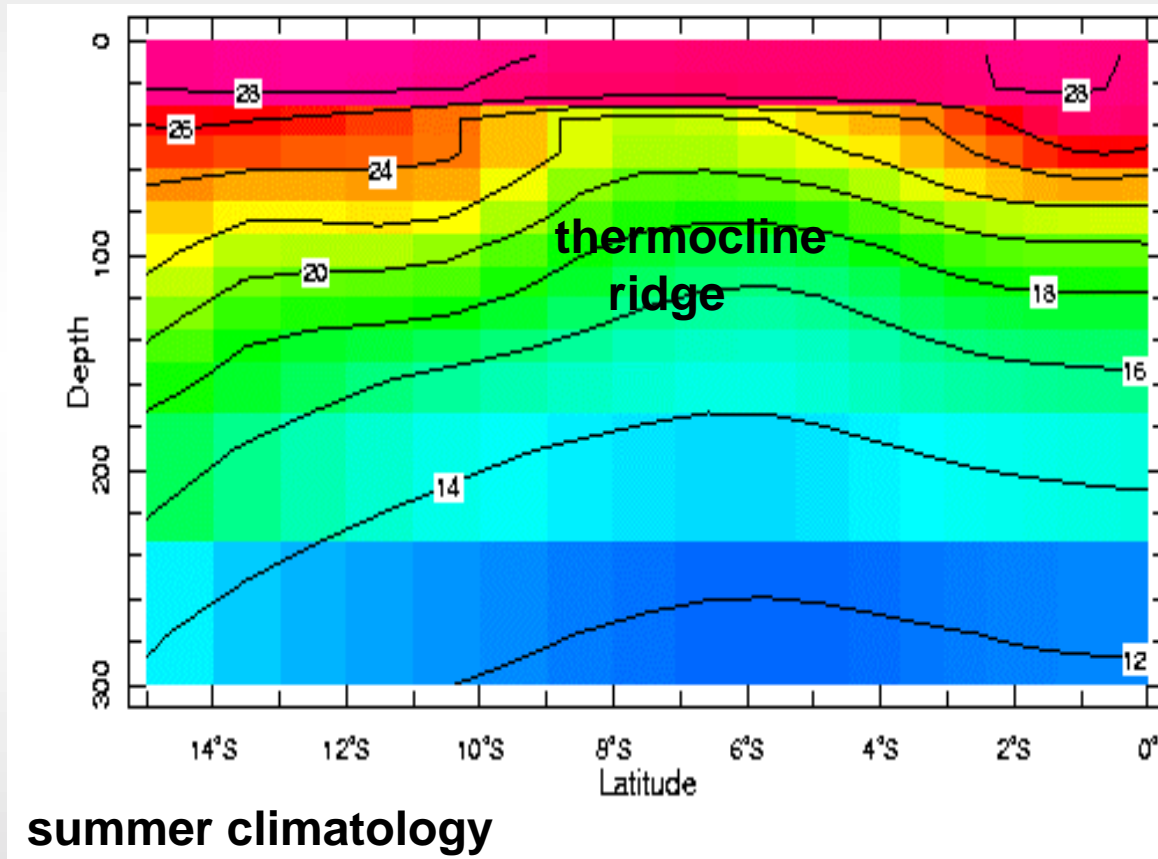


N-S slice avg. 50-70E



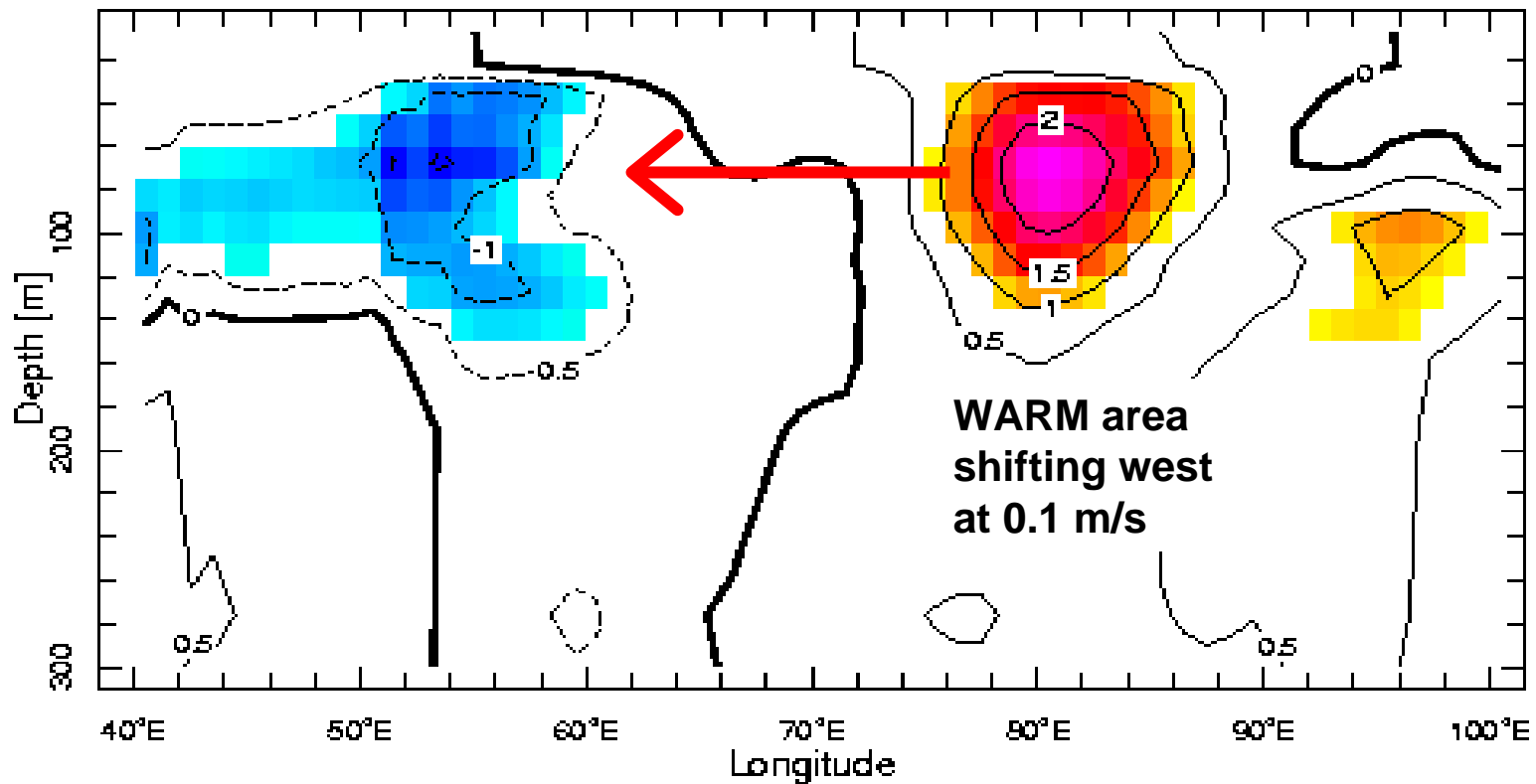
Key area: 6 - 12 S, 55 - 65 E, 60 - 120 m

Ocean Rossby wave-guide: the thermocline ridge 5 - 10 S



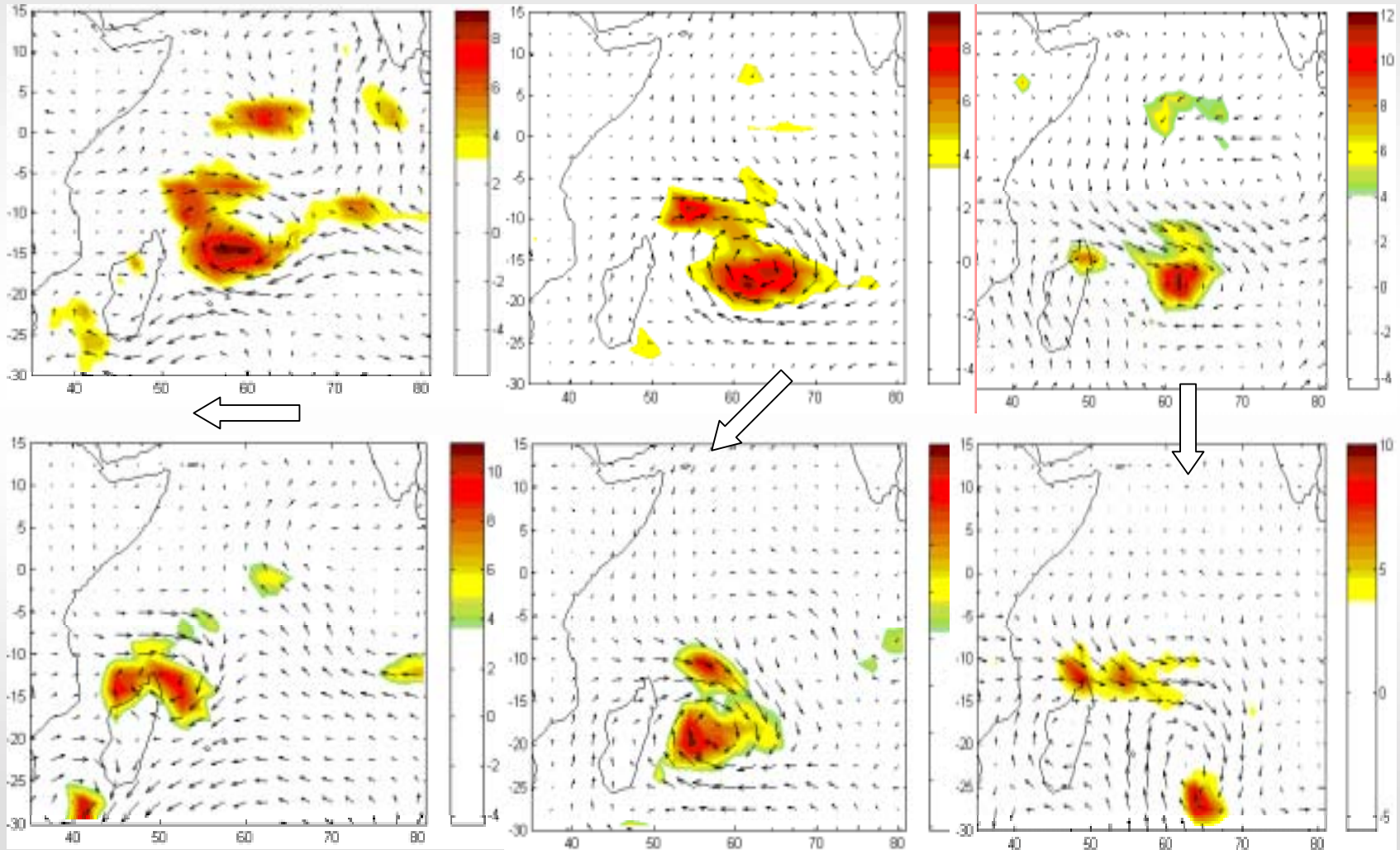
Ocean as predictor:

Sub-surface temperature composite for High – Low tropical cyclone seasons in the SW Indian Ocean for JAS-1



In-season daily analysis: composite TC structure by track

Day -1



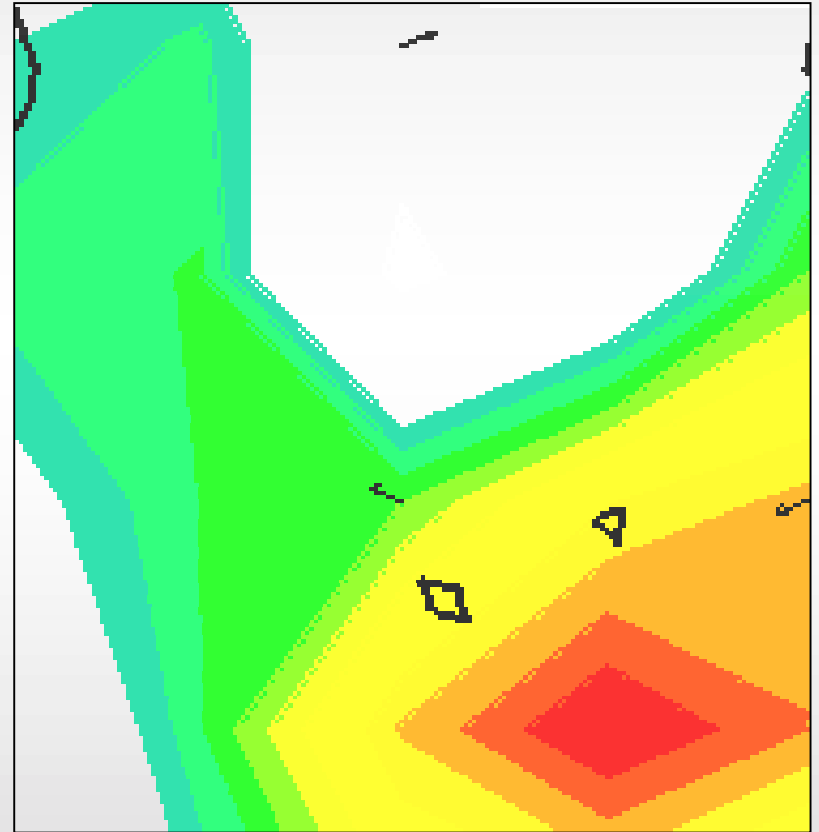
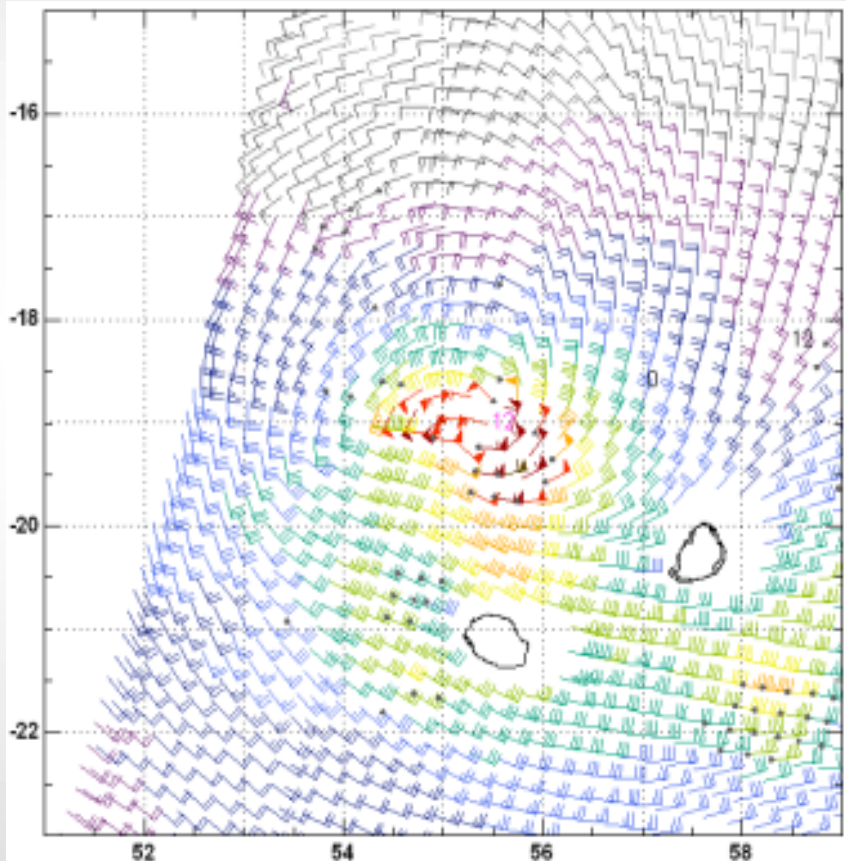
Day +1

trajectory: W

SW

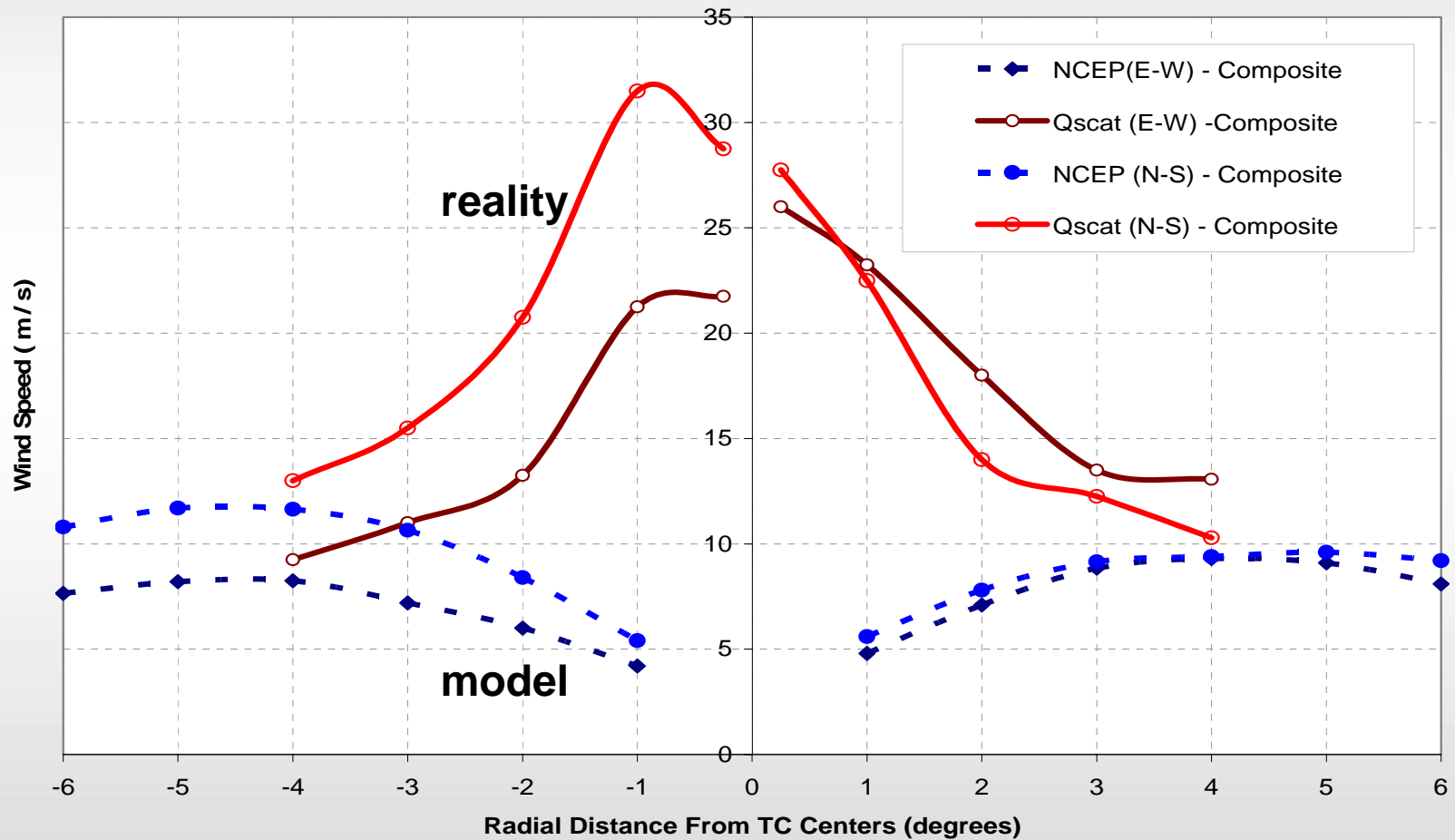
S

Case study comparisons: QuickScat winds vs. NCEP model



TC Eline: NCEP max wind = 10 m/s, QuickScat = 27 m/s
Westerly flow on the north side is absent in NCEP

In-season daily analysis: composite QuickScat winds are 3 x greater than NCEP model



Swells and storm surges are underestimated by a factor of 1.7 by NWP models.

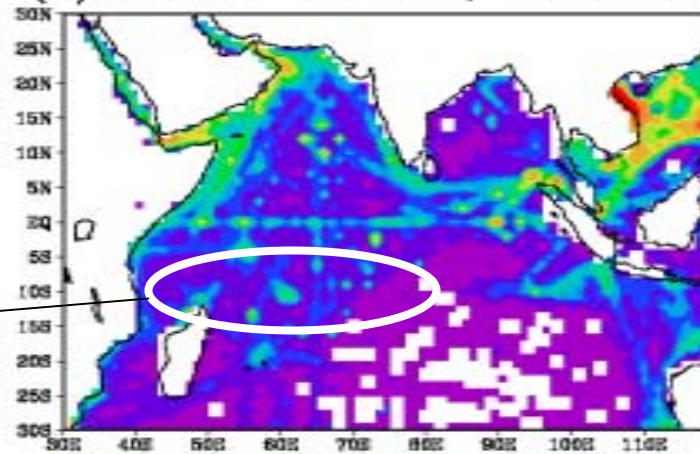
Summary

- Climatic variability in the southwest Indian Ocean is related to the Rossby wave / dipole pattern partially wind-forced via ENSO
- There is a need for greater non-surface data assimilation in the area east of Madagascar / Seychelles.

Subsurface data density over the Indian Ocean

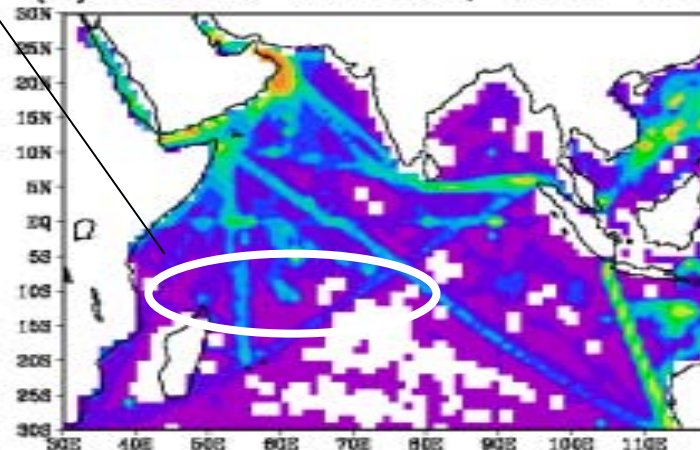
Distribution of Temperature Profiles

(a) Profile Number, 1958–1980

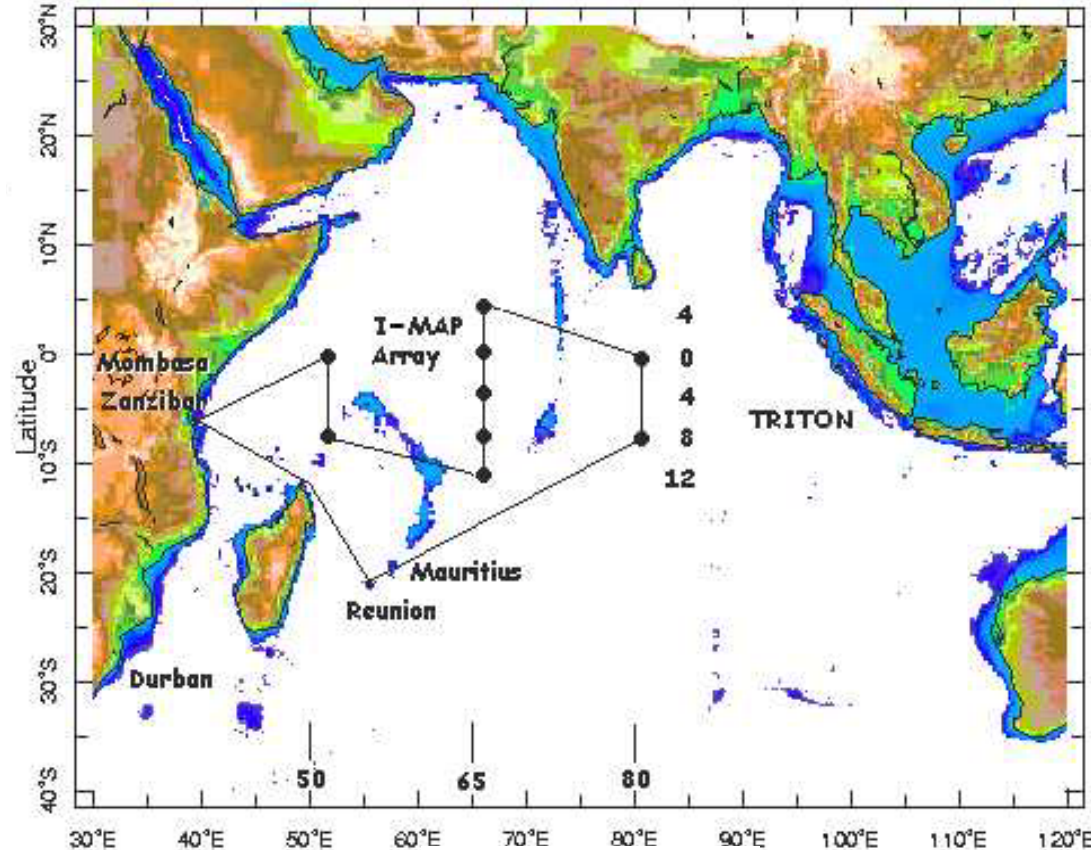
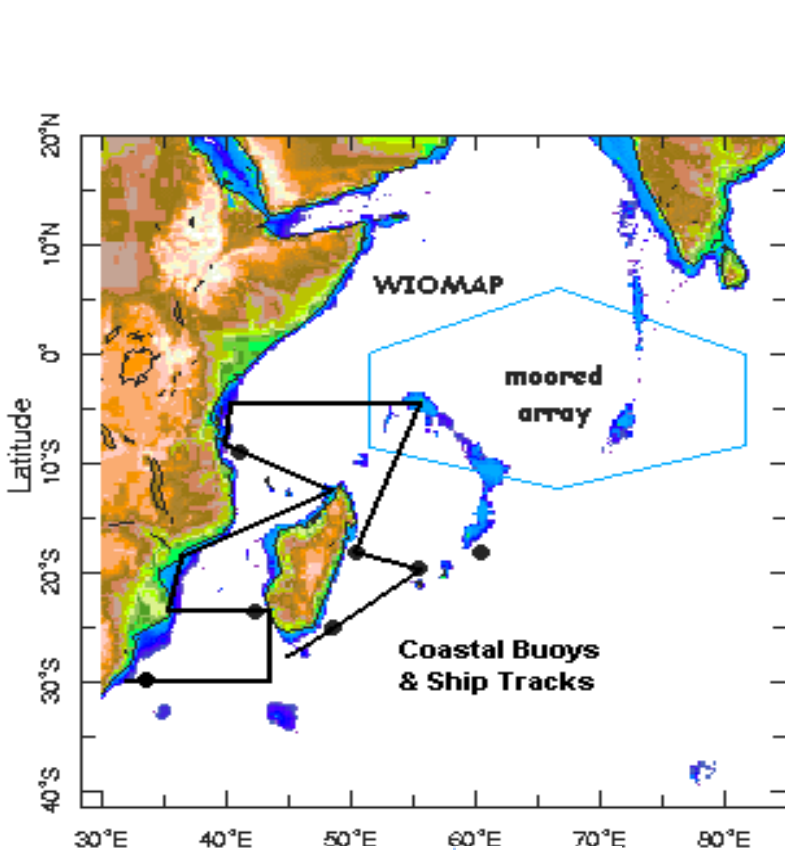


Key area from African perspective

(b) Profile Number, 1981–1998



In the Indian Ocean we need to support two projects



Western area for TC forecasting

- Central area for climate prediction

