Upper ocean response to Very Intense Tropical Cyclones in the South West Indian Ocean

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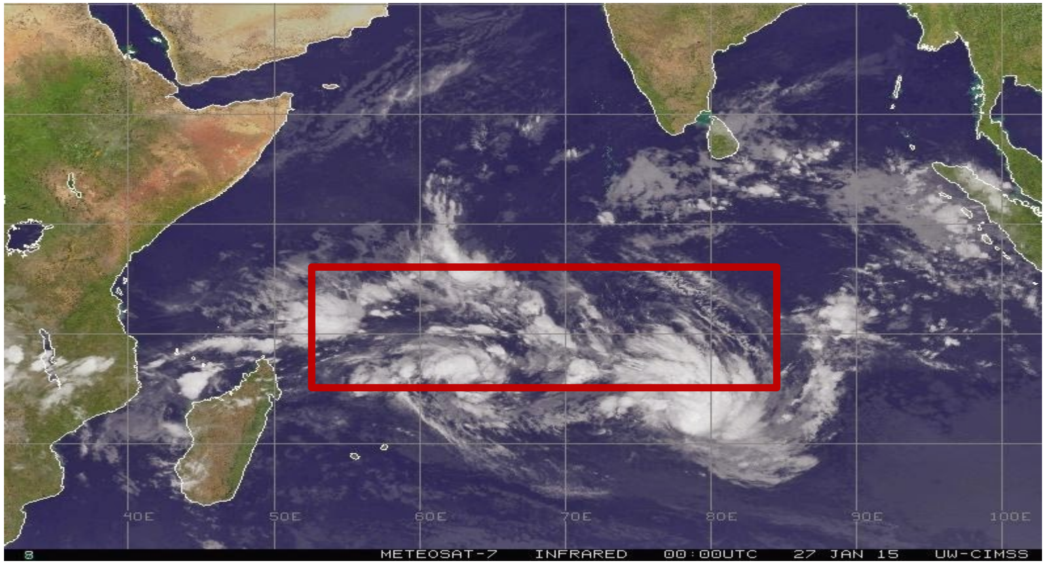
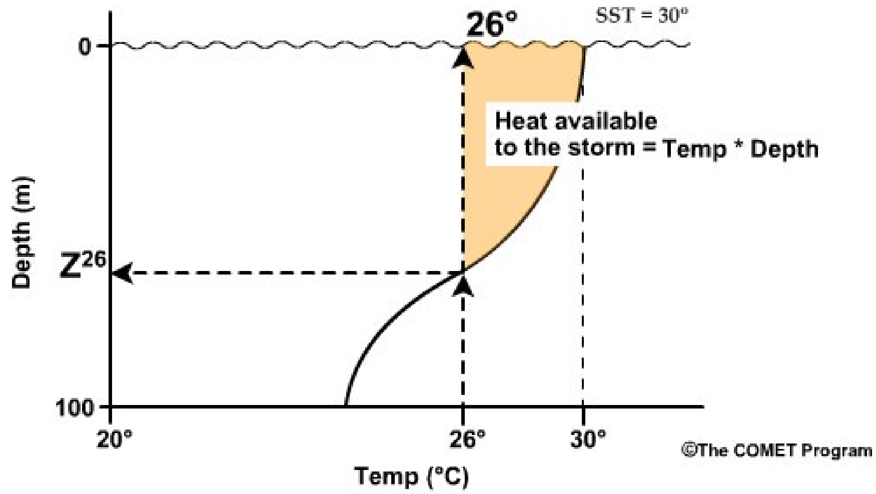


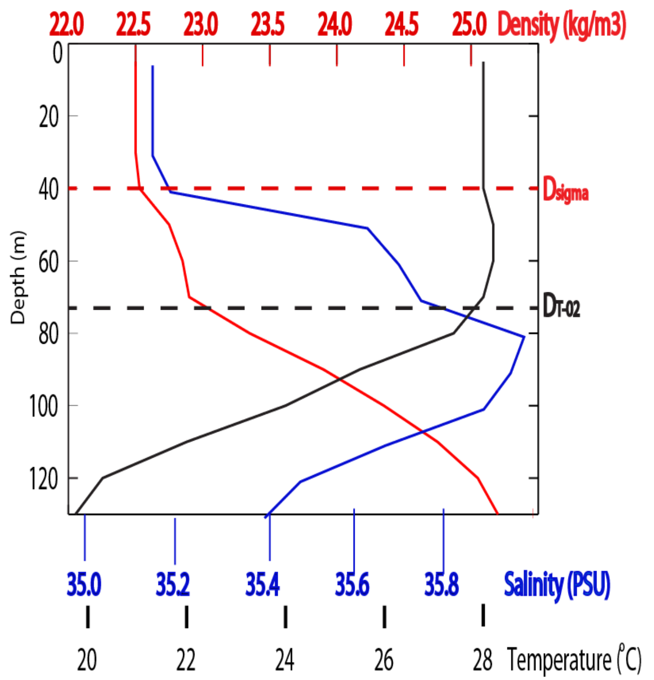
Brief intro ..

Tropical Cyclone Heat Potential (TCHP)



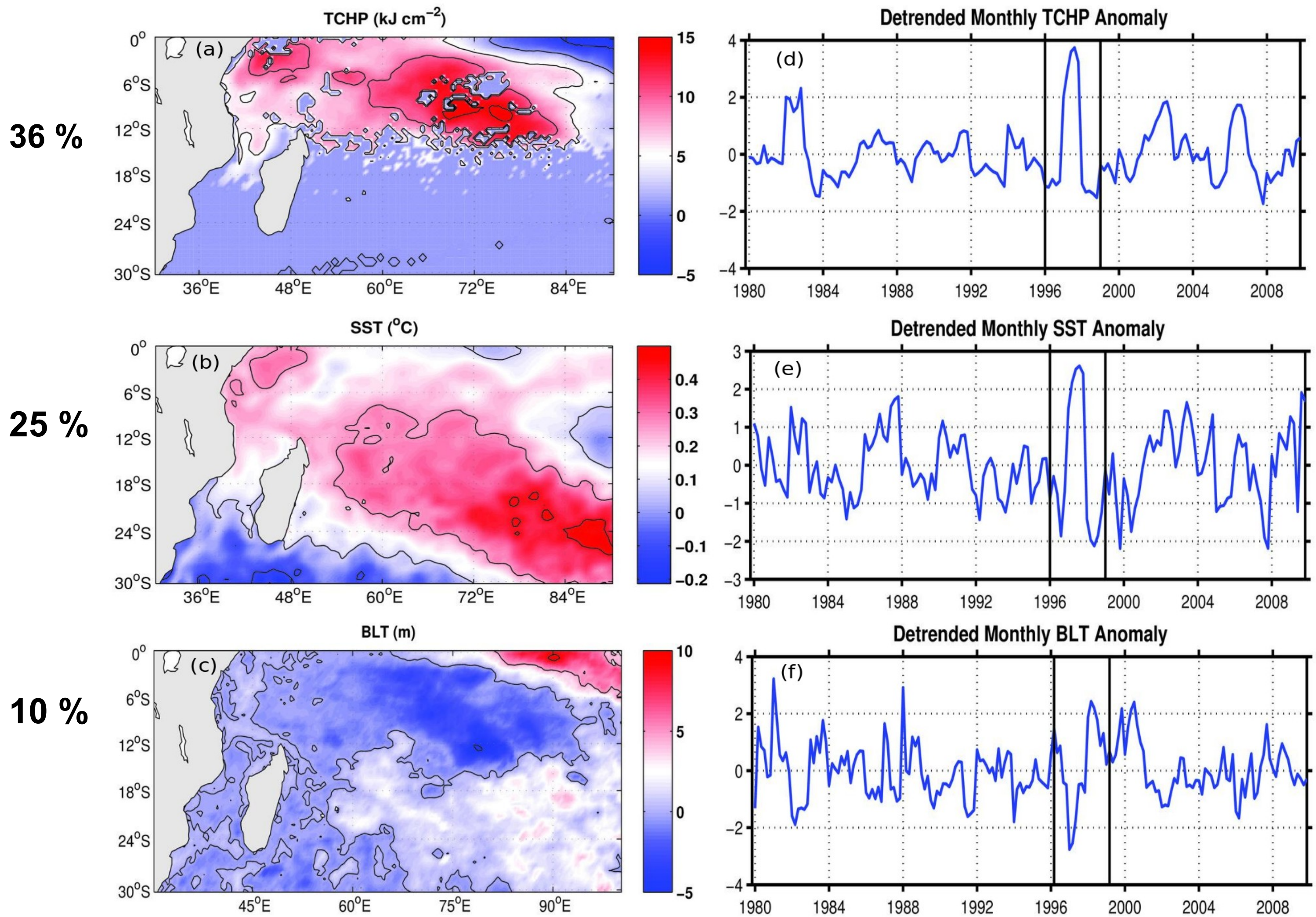
$$TCHP = C_p \int_{z(D_{26})}^{z(0)} (T - 26)\rho dz$$

Barrier Layer Thickness (BLT)



Halocline shallower than the thermocline, a layer is established between the MLD and the ILD called the BLT

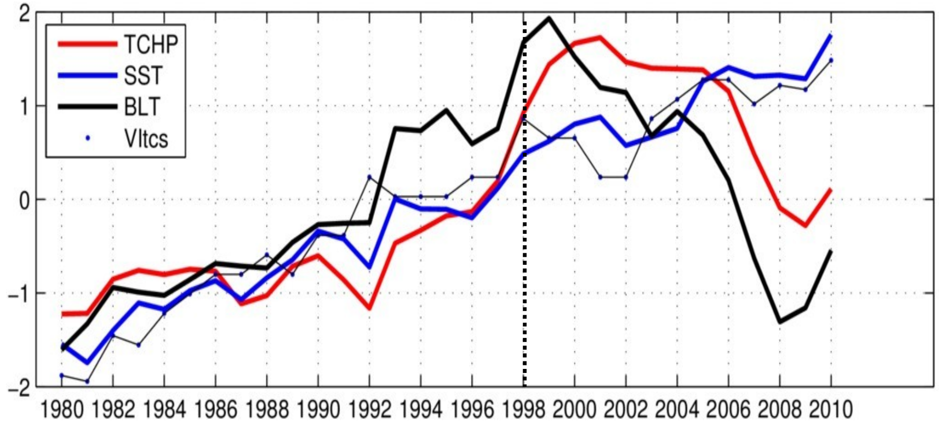
EOF Analysis



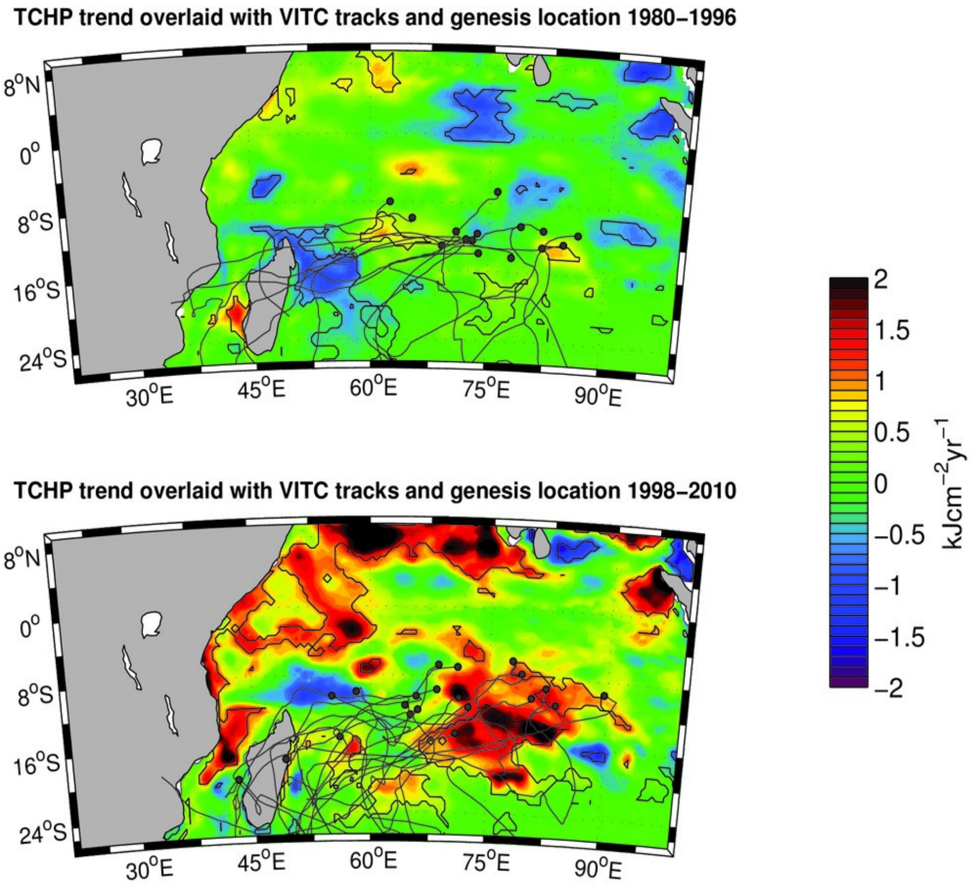
- TCHP exhibits largest variation in the central and eastern SCTR region (r=0.57 with ENSO)
- SST pattern – typical response to ENSO
- BLT shows weak loadings over most of the Southern part except in the SE (r= 0.53 with ENSO)

- **SODA reanalysis (monthly output, ½ deg resolution)**
- **Time period : 1980 -2010 – averaged over cyclonic season (Nov - April)**

Variability of TCHP, BLT and Very intense Tropical Cyclone (VITC) intensity



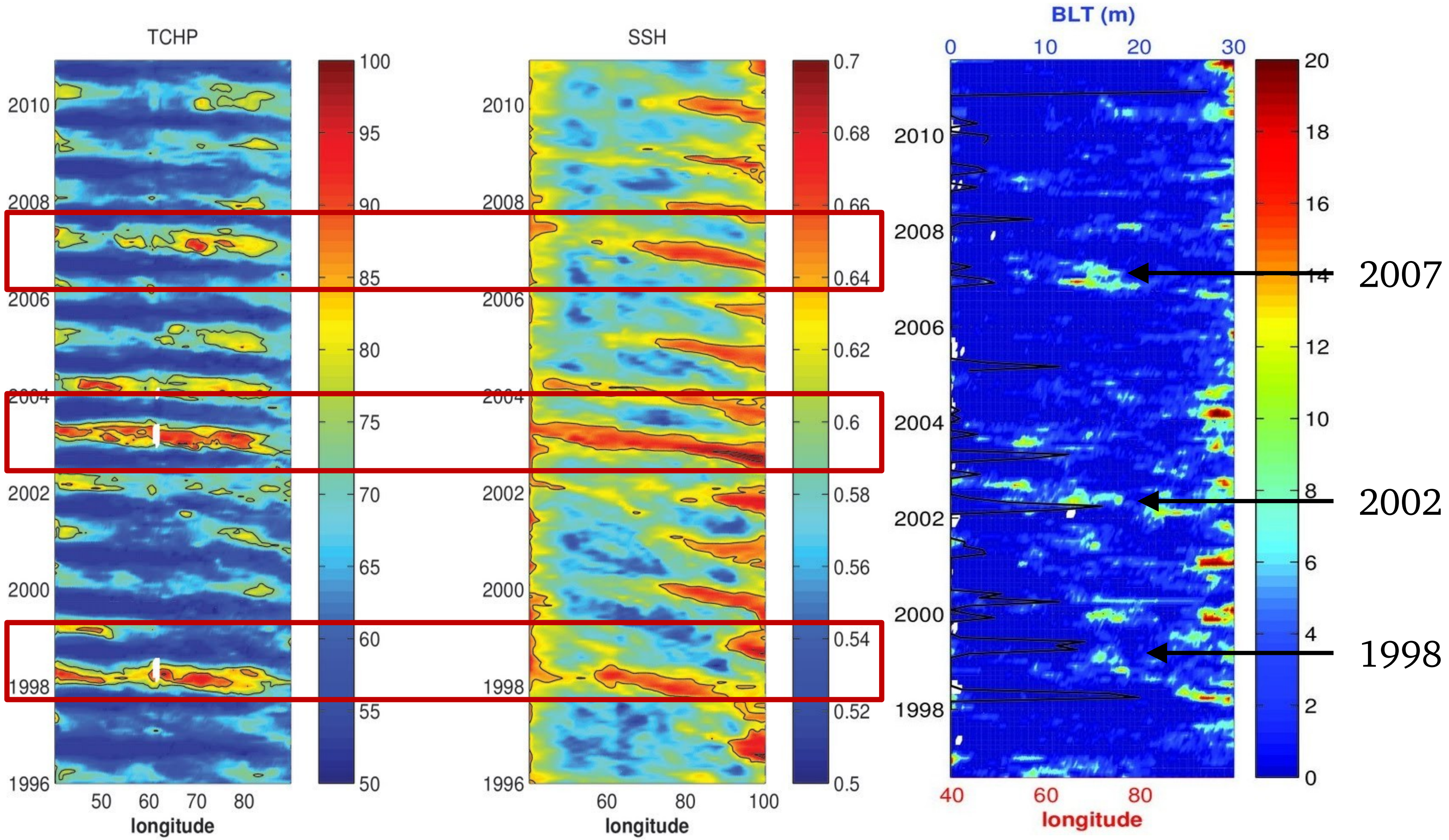
10-year running through the data, SST, TCHP, BLT and VITCs (Nov-April) across SCTR



- 1980 -1998, VITCs seem to increase with increase in SST, TCHP and BLT.
- Post 2000, although a decreasing trend in TCHP and BLT is observed, VITCs seem to increase along with a warming in SST.

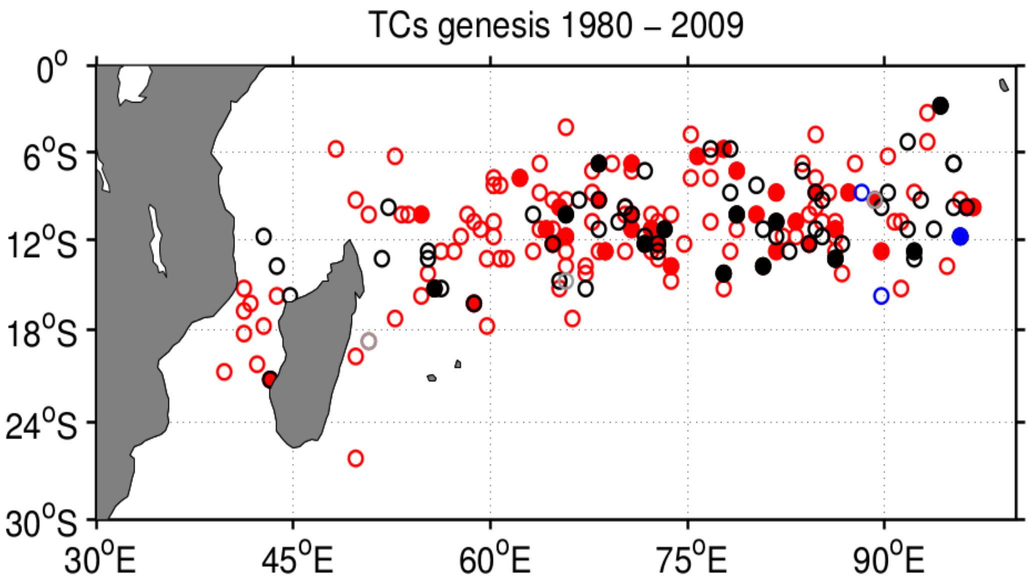
Climate shift after 1998 El Nino event – warming over Indian Ocean

Rossby waves influences



- Westward propagation of rossby waves
- Co-propagation of BLT and TCHP - mechanism of BLT : advection of fresh water from Indonesion throughflow via SEC or heavy precipitation (ITCZ)

Tdy and BLT influences on TC frequency



Red : High TDY

Black : High TDY, High BLT

Blue : High BLT

Empty : TCs in general
Filled : VITCs only

		Strong (-ve)	Moderate (-ve)	Moderate (+ve)	Strong (+ve)
	TDY Ano / **BL Ano**	0	6 - (~ 3%) 2 - (~ 4.3%)	196 – (~88%) 41 - (~87.2%)	20 - (~9%) 4 – (~8.5%)
Strong (-ve)	0				
Moderate (-ve)	153 - (~69%) 33 - (~70%)		3 - (~1,4%) 1 - (~2%)	137 - (~62%) 30 - (~64%)	13 – (6%) 2 – (2%)
Moderate (+ve)	44 - (~20%) 6 - (~13%)		3 - (~1,4%) 1 - (~2%)	39 - (~17%) 5 - (~10%)	2 – (~0.9%) 0
Strong (+ve)	25 – (~11%) 8 – (~17%)		0 0	20 – (9%) 6 – (13%)	5 – (~2.3%) 2 – (4%)

Conclusion

- Cyclone intensification is largely influenced by large TCHP and deep barrier layer.
- TCHP and BLT are well correlated with El Nino and are modulated by rossby waves.
- Overall warming trend in the Indian Ocean after 1997-1998 El Nino.
- Tropical cyclone genesis is more influenced by temperature than salinity effect.