Ocean Climate Change and Variability in the Benguela Upwelling

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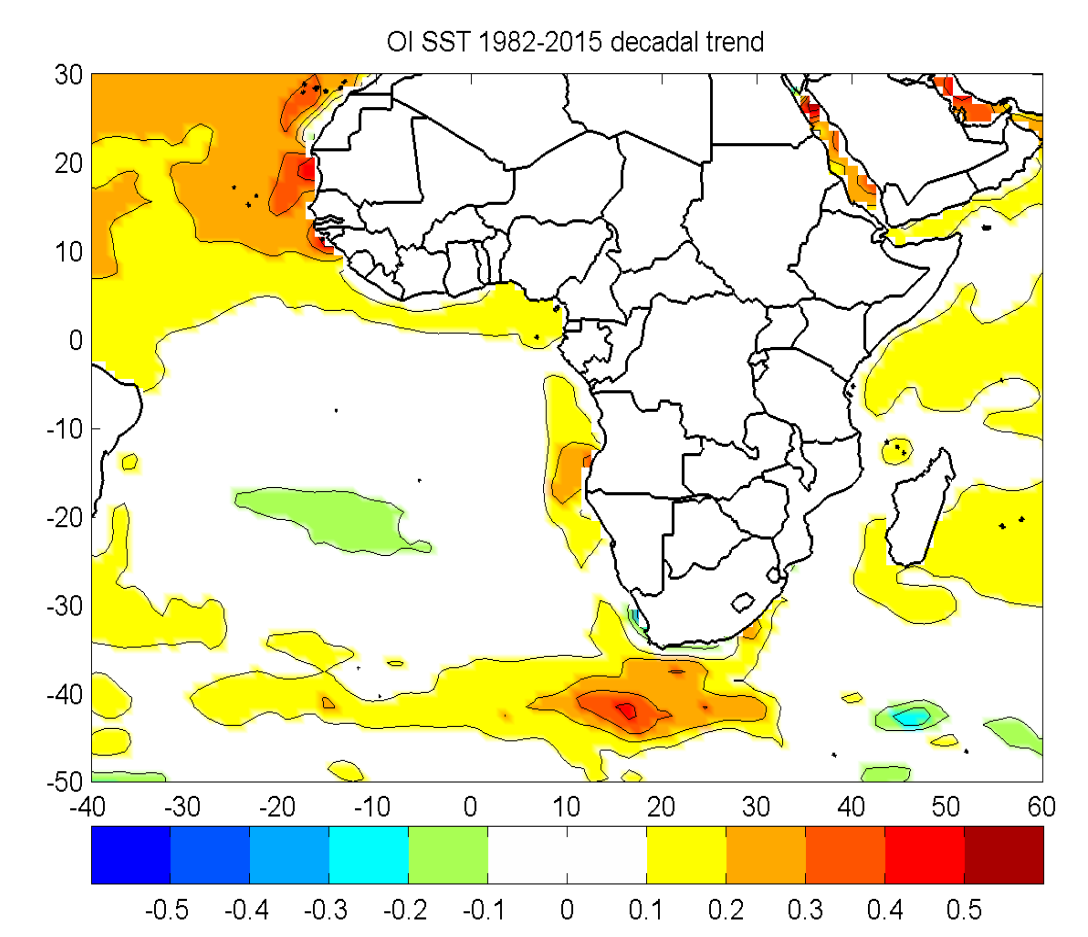


Linear trend Reynolds OI Sea Surface Temperature 1982-2015 in C per decade
(updated from Blamey et al, 2015)

Funding from WRC, NRF, ACCESS, FP7 EU Preface project, Nansen Tutu Center, ESA.

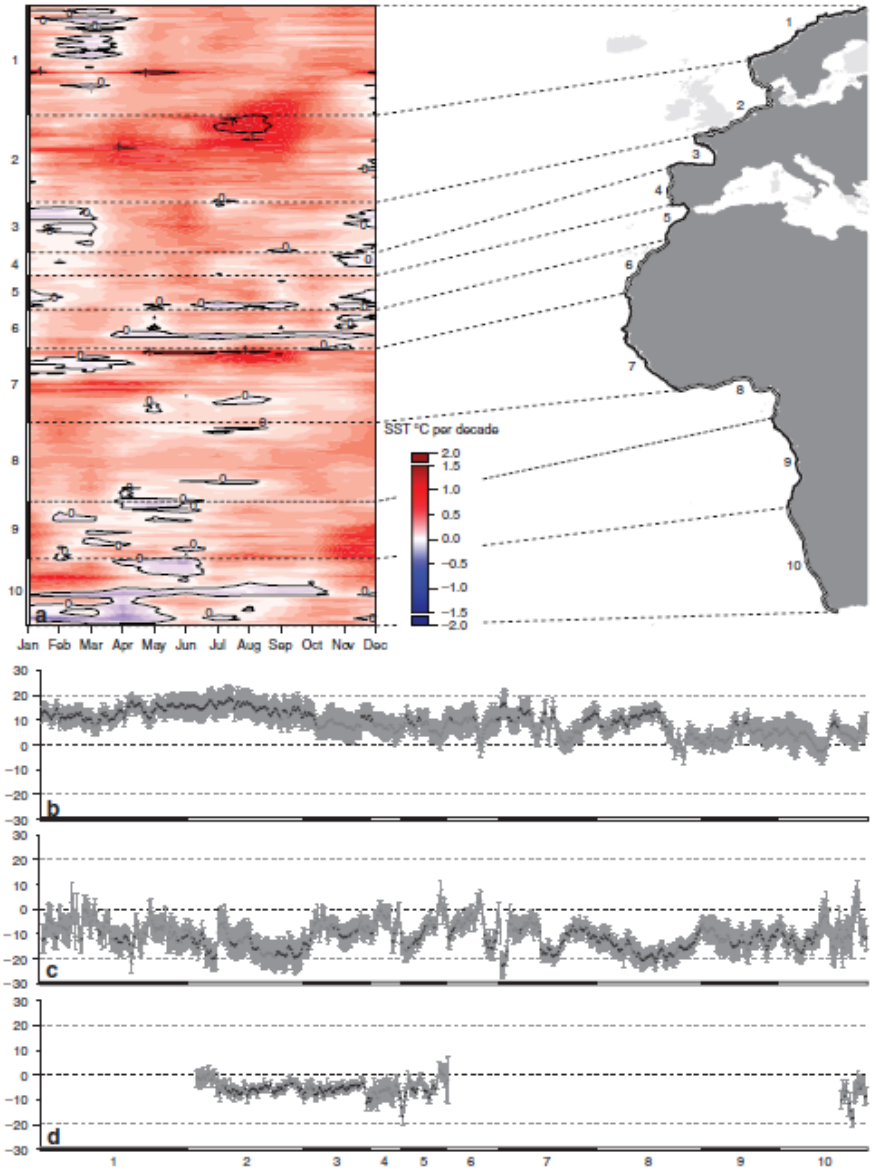
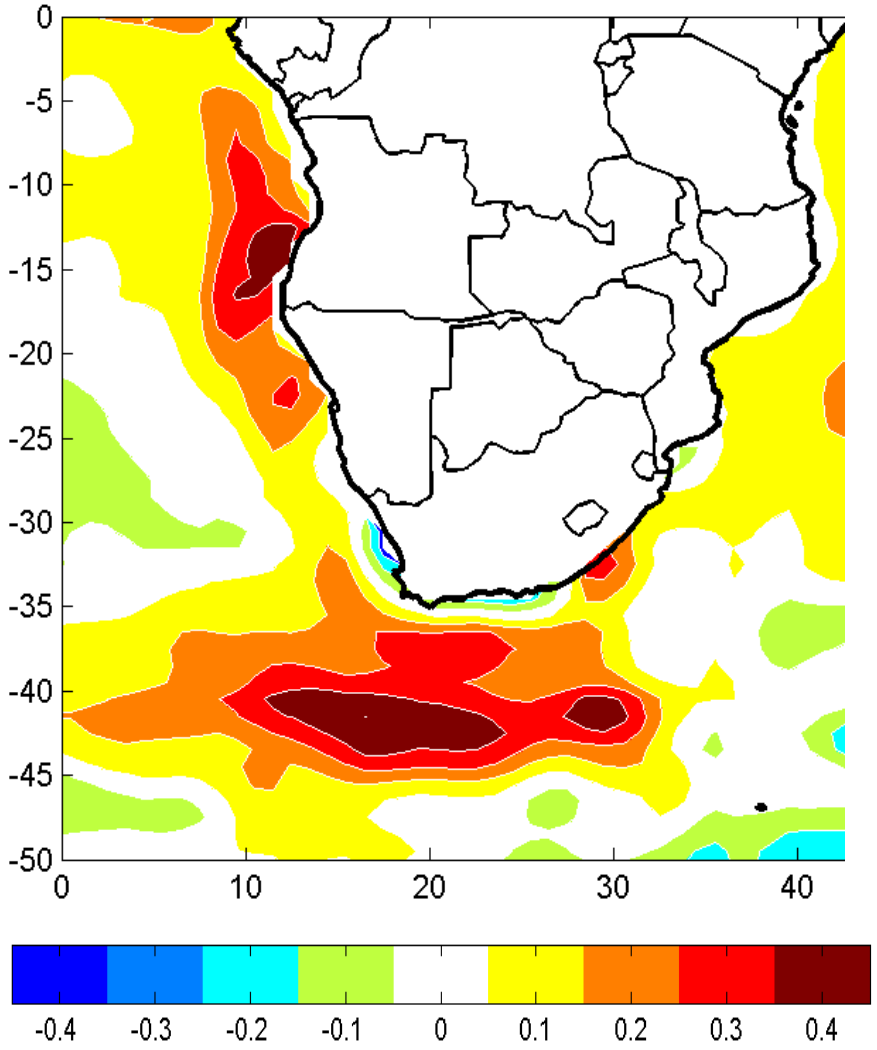


Figure 3 | Latitudinal transect along the Eastern Atlantic Ocean. (**a**) Linear rates of SST change along the Eastern Atlantic coast, expressed in °C per decade. Horizontal axis is month within the year and vertical axis represents location along the coastline. (**b**) Average change in the yearly frequency of extreme hot days, in days per decade. (**c**) Average change in the yearly frequency of extreme cold days, in days per decade. (**d**) Average change in the occurrence of seasonal warming, in days per decade. In **b**, **c** and **d**, significant data are depicted in black and nonsignificant in grey. Numbered black and white portions of the horizontal axis can be used to locate sections of the coastline in the geographical map. Confidence intervals represent s.e.m.

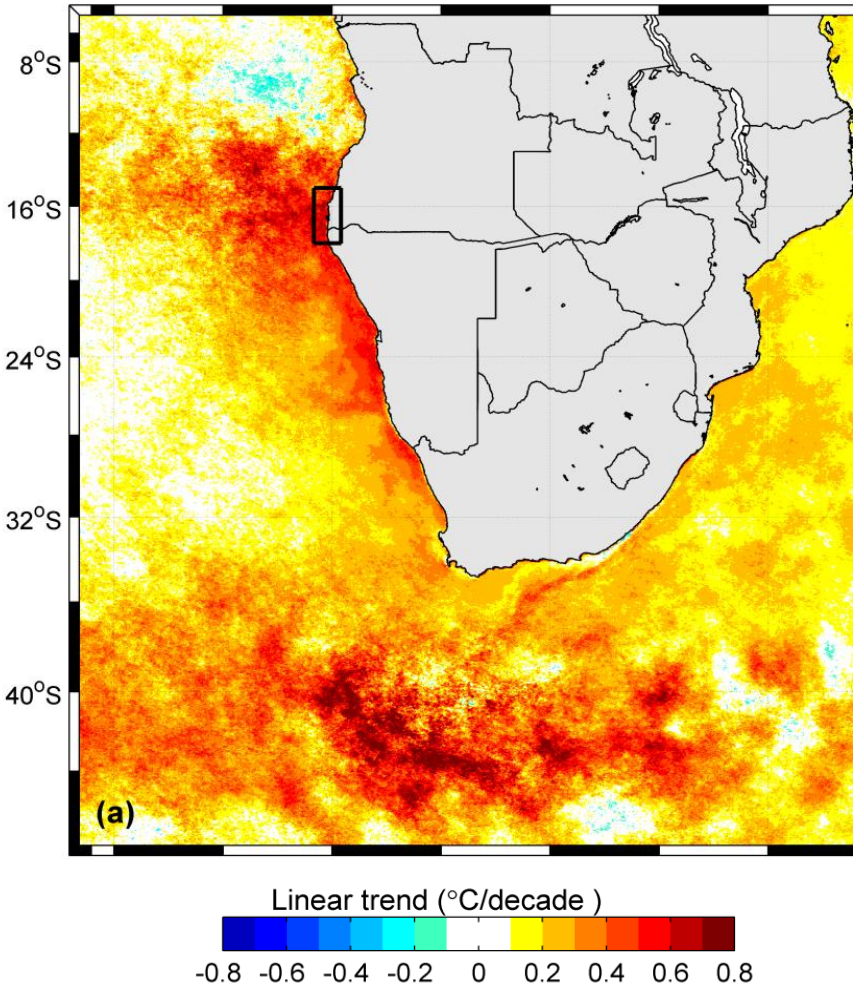
Lima and Weathey 2012

OI AVHRR 0.25x025 Degree resolution

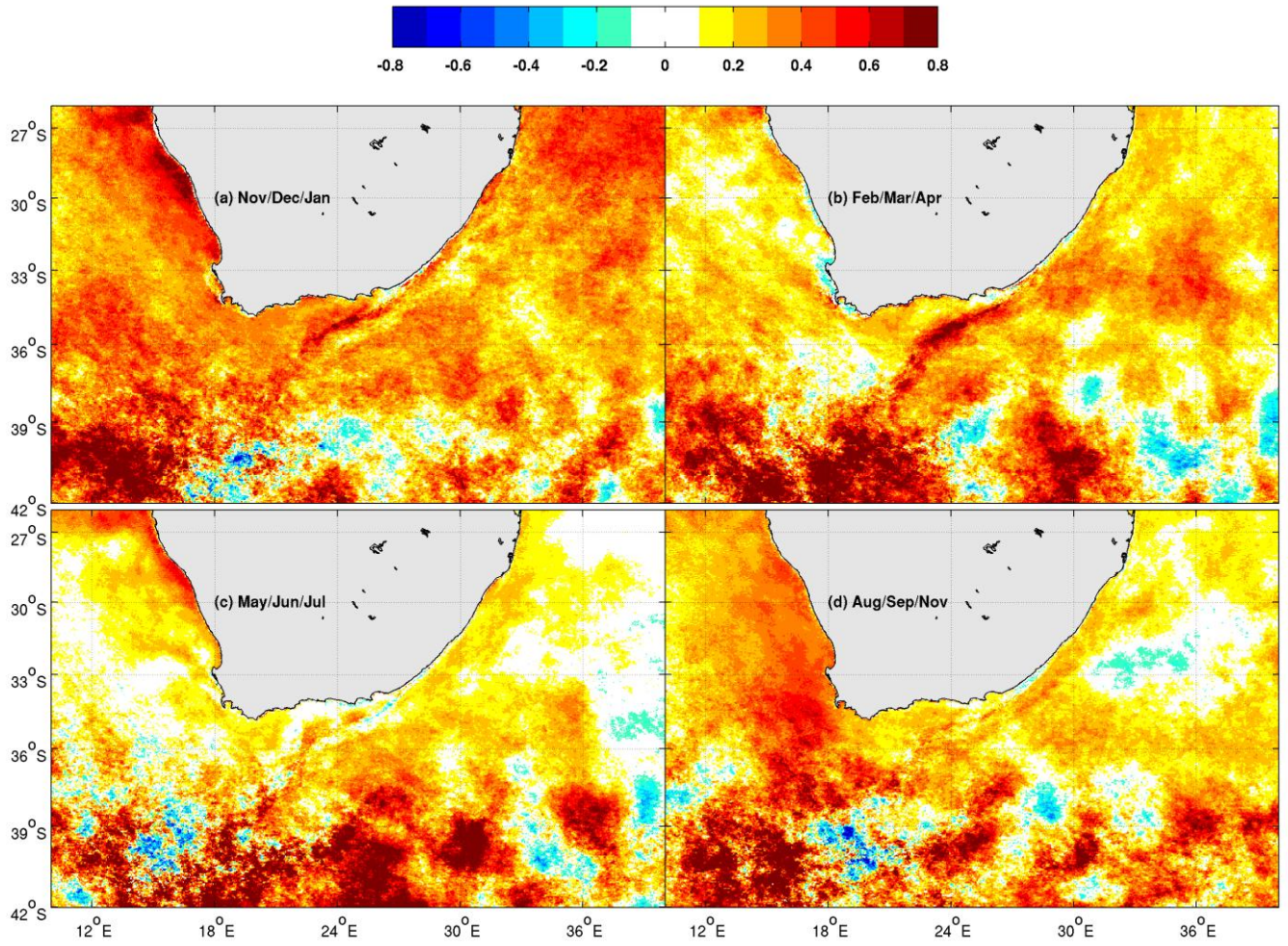
Cause of concern: Regional differences even using satellite based products



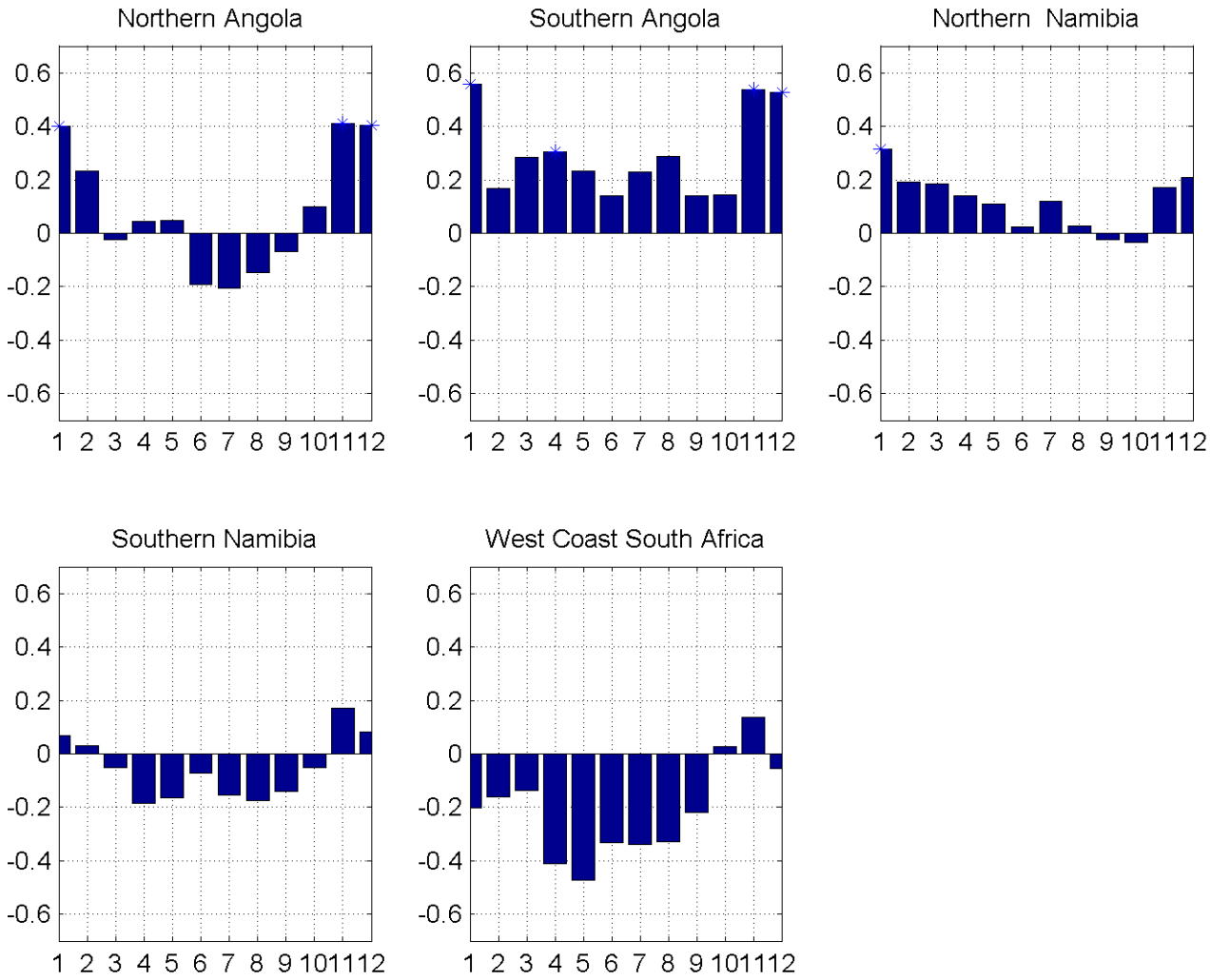
Linear trend Reynolds OI SST 1982-2012 in degree per 10 year (Gros Salvanes et al, 2015)



Linear trend Pathfinder SST 1980-2011 night in degree per 10 year (Blamey et al, 2015)



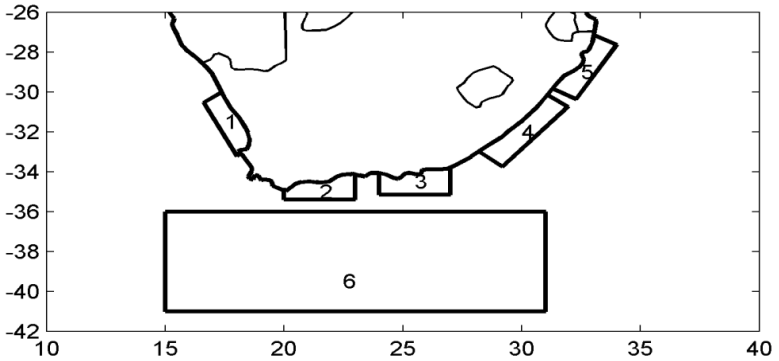
Seasonal trend pathfinder SST V5.2 (Blamey et al 2015)



Linear trend in °C per decade for each month of the year from 1982 to 2016.

Anything above 0.3 C and below - 0.3 C is statistically significant at 95 %

(updated from Rouault et al. 2010).



1, West Coast

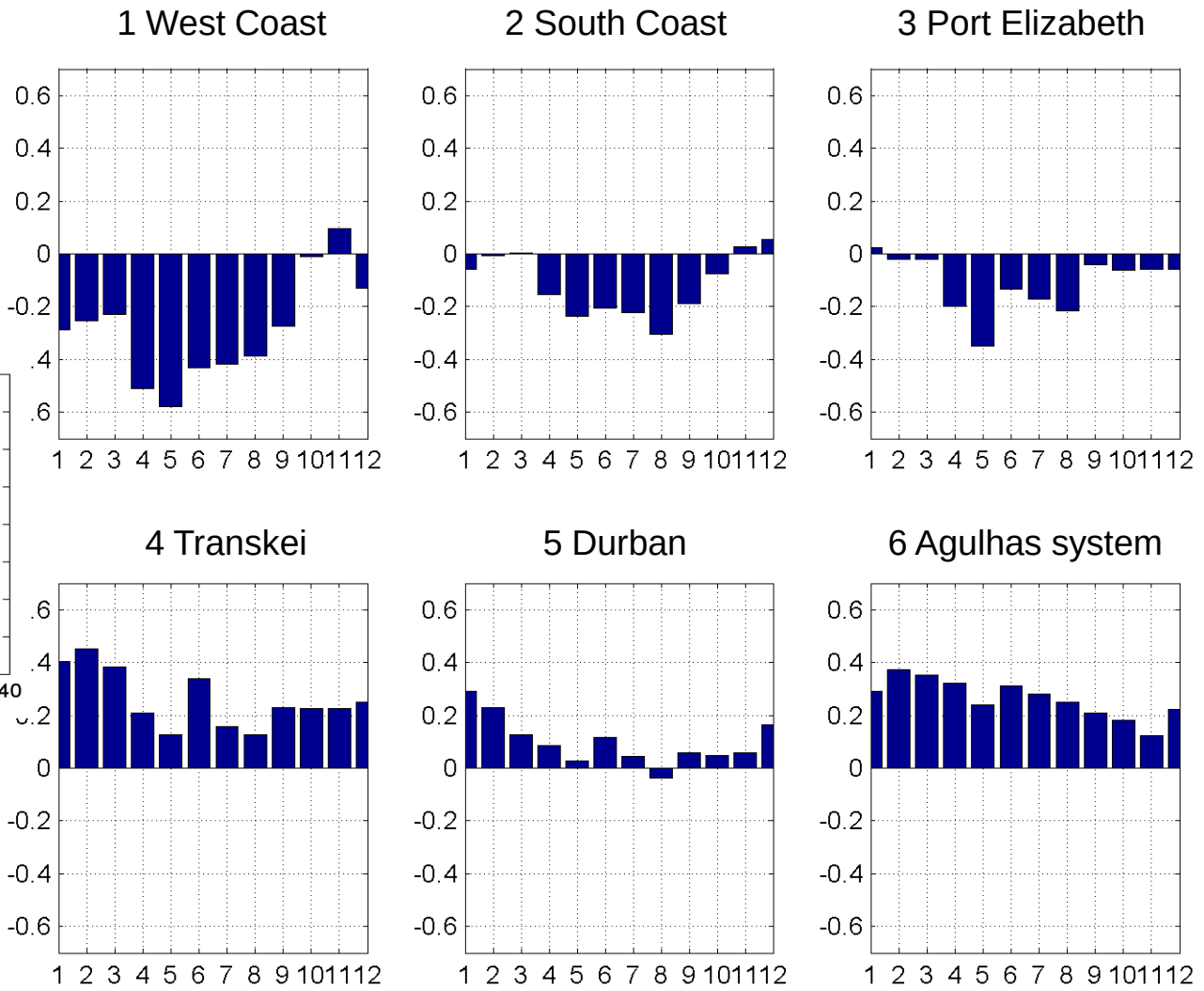
2, South Coast

3, Port Elizabeth/Port Alfred

4, Transkei

5, KwaZulu–Natal

6, Agulhas Current system



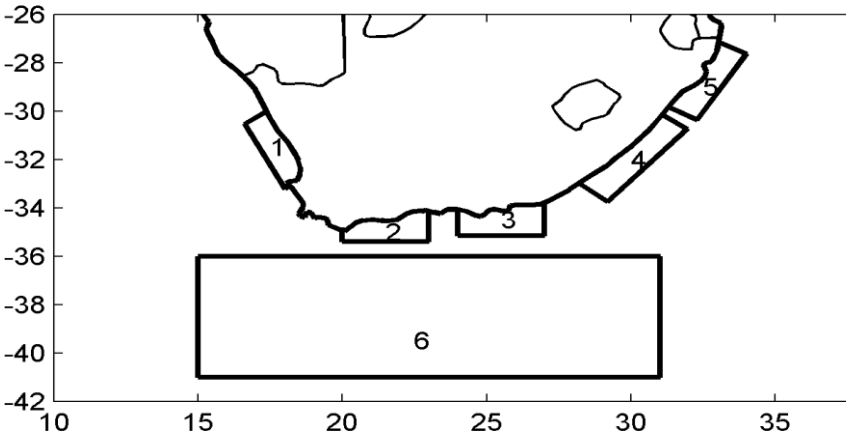
Linear trend in °C per decade for each month of the year from 1982 to 2016

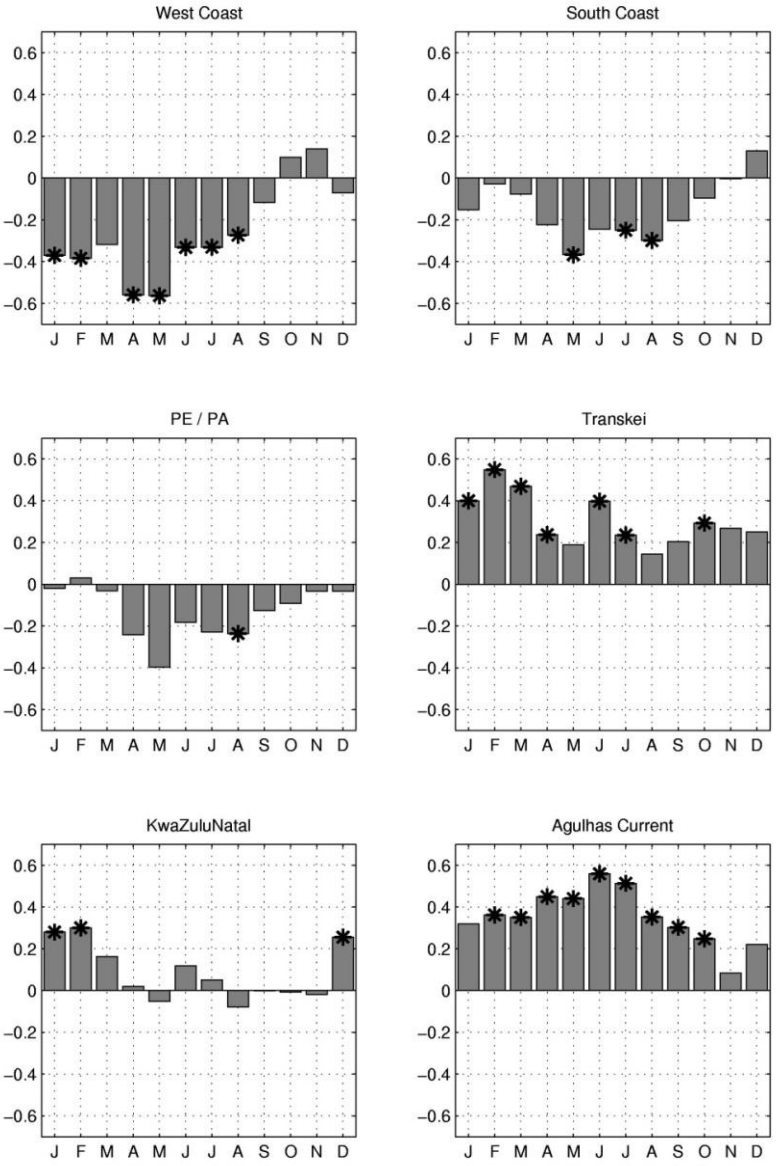
Anything above 0.3 C and below - 0.3 C is statistically significant at 95 %

(updated from Rouault et al. 2010).

Coastal climate change

Linear trend in °C per decade for each month of the year from 1982 to 2009.





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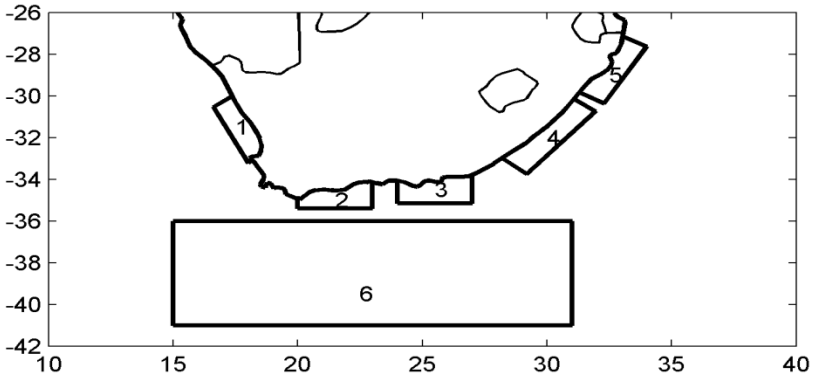
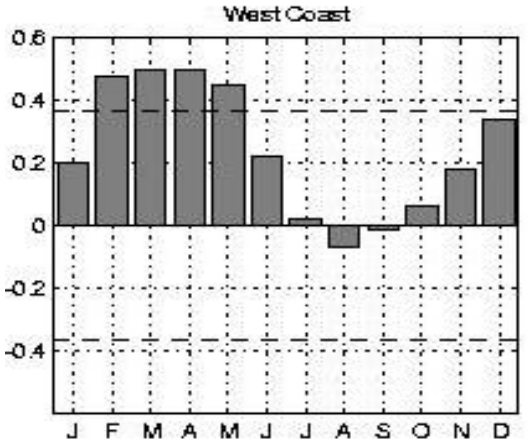
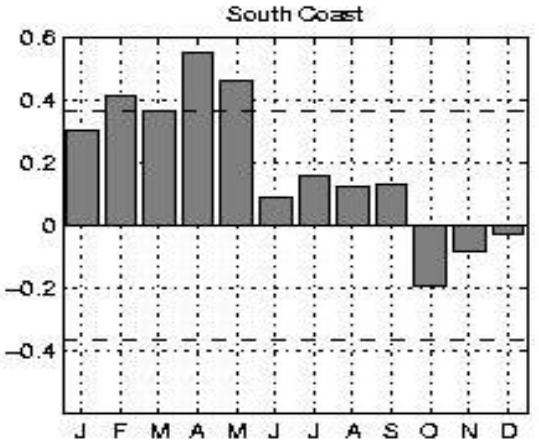
Statistically significant trends are marked with a star

Rouault, Pohl, Penven, 2010

Correlation between ENSO (MEI index) and the Reynolds SST normalized anomalies from 1982 to 2009 (Rouault et al 2010)







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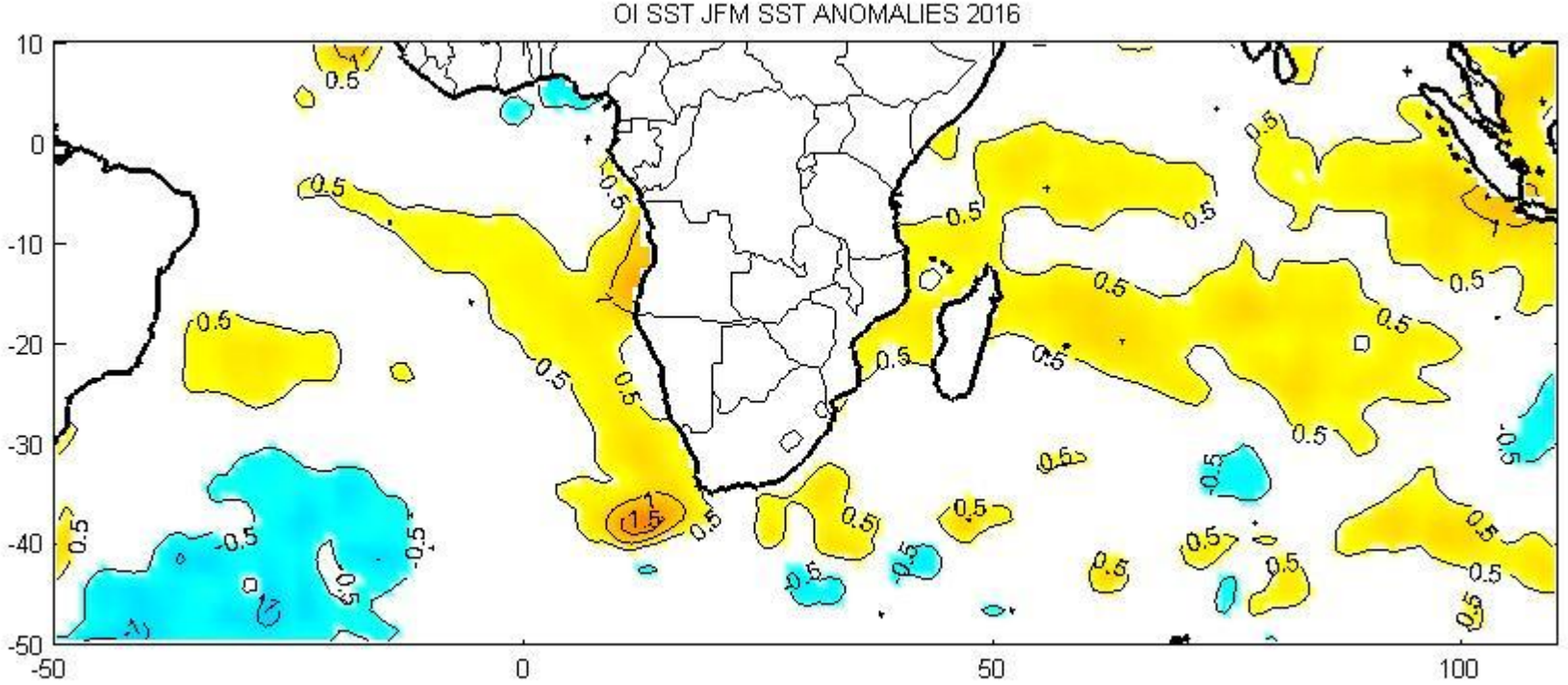
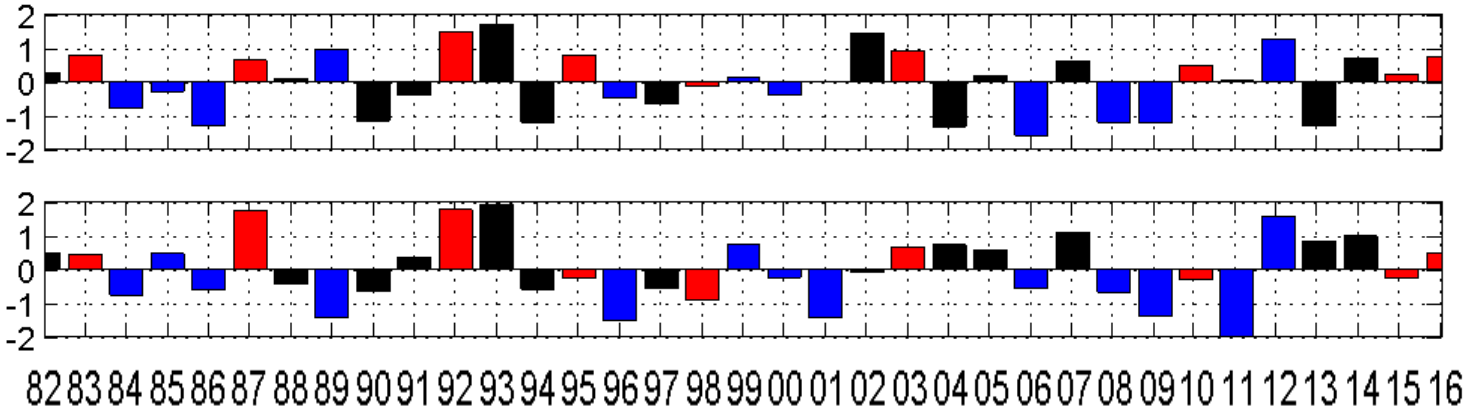
Statistically significant correlation are marked with a dash line


OI SST JFM SST ANOMALIES 2016
10
0
-10
-20
-30
-40
-50
-50
0
50
100



La Nina in blue, El Nino in red, normal year in black. Normalised anomaly from climatology for the mean of January February and March from 1982 to 2016 for West Coast, top and South Coast bottom.

Extended version of Rouault et al, 2010

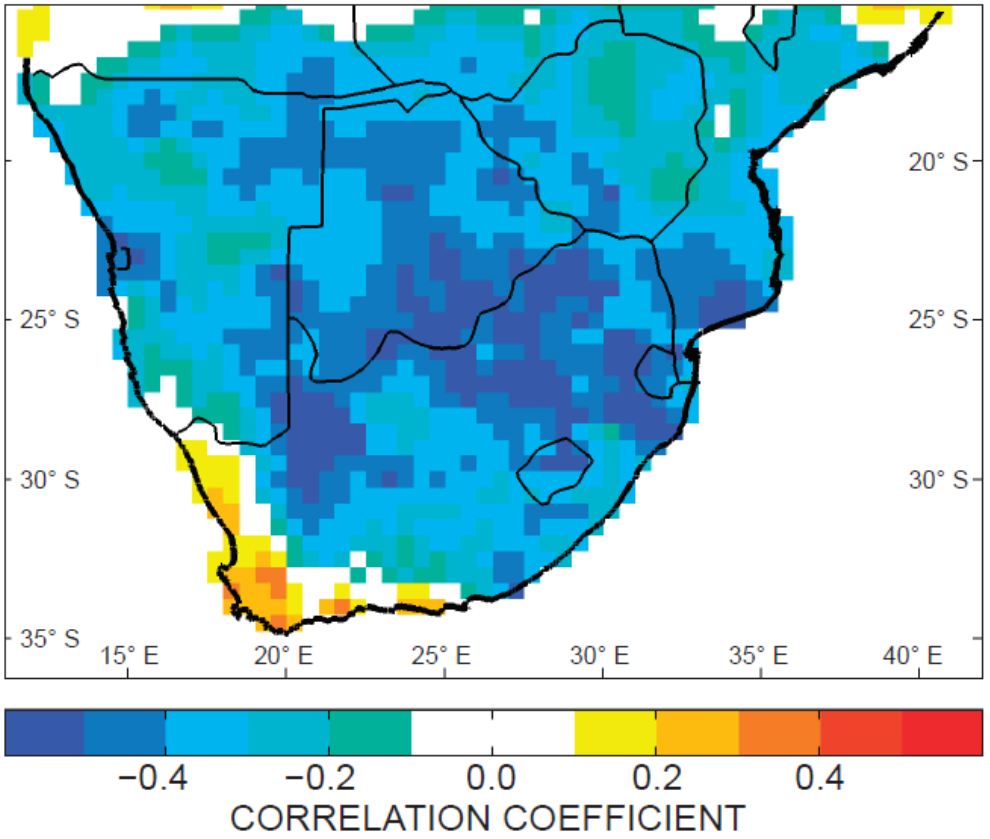


Figure 8: Correlation between the late austral summer (mean of March and April) GPCC rainfall-normalised anomaly and the West Coast SST-normalised anomaly, 1982–2007

Rouault et al, 2010

Decadal variability of Southern African climate in summer rainfall region and winter rainfall region has a common 20 year and 10 year cycle. Summer decadal variability explained by the Pacific

Dieppois, B., Pohl, B., Rouault, M., New, M., Lawler, D. and Keenlyside, N., 2016. Interannual to decadal variability of winter and summer southern African rainfall, and their teleconnections. *Journal of Geophysical Research: Atmospheres*. 2016, vol. 121, , p. 6215-6239.

Climate was less variable from 1940 to 1970 in Southern Africa due little influence of El Nino and La Nina

Fauchereau N., S. Trzaska , M. Rouault , Y. Richard, (2003) : Rainfall Variability and Changes in Southern Africa during the 20th Century in the Global Warming Context, Natural Hazards, Volume 29, Issue 2

False Bay most sensitive to ENSO and wind changes in general to due combined effect of turbulent latent and sensible heat fluxes and intrusion of upwelling water

Dufois, F., Rouault, M., (2012) Sea surface temperature in False Bay (South Africa): Towards a better understanding of its seasonal and interannual variability. Continental Shelf Research,43,24–35,

Coupled model used by IPCC (CMIP5) for global warming scenario do not have the ENSO effect

SST bias of up to 6 C of Angola and Namibia

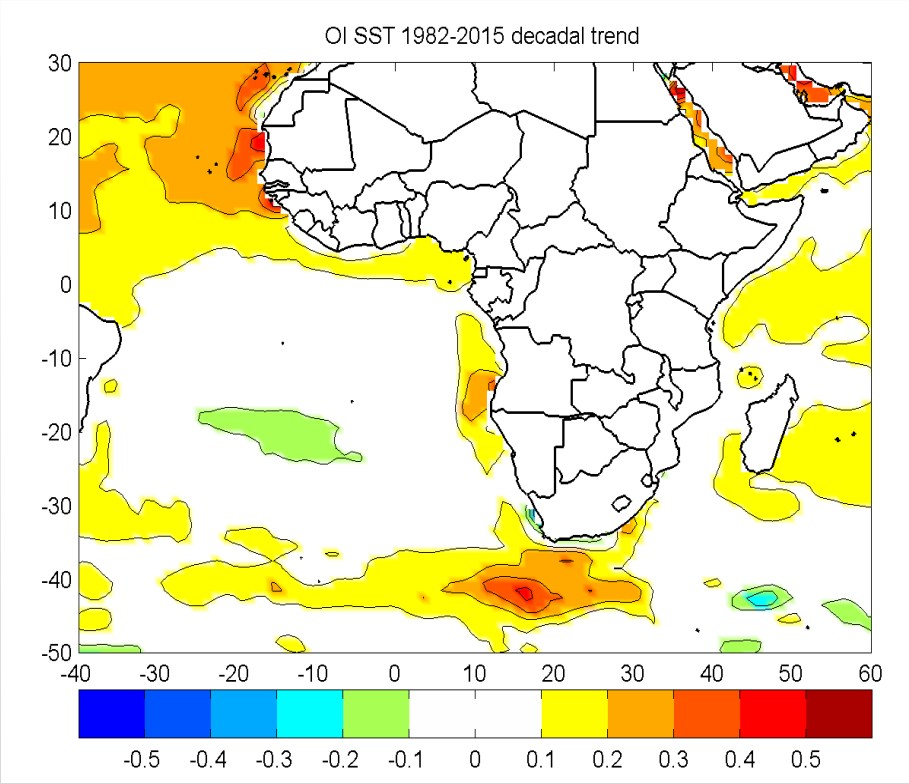
They do not resolve Western Province

No Pacific related Decadal variability

Watch out for paper using those models or regional scenario using those models

Dieppois B, M Rouault and M New. (2015) "The impact of ENSO on Southern African rainfall in CMIP5 ocean atmosphere coupled climate models." Climate Dynamics,45,9, 2425-2442.

- In the absence of a good forecasting system, use persistence
- decadal variability and interannual variability will still play a role .
- Regional scenario for global warming a big challenge.
- Lets monitor properly the system.



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