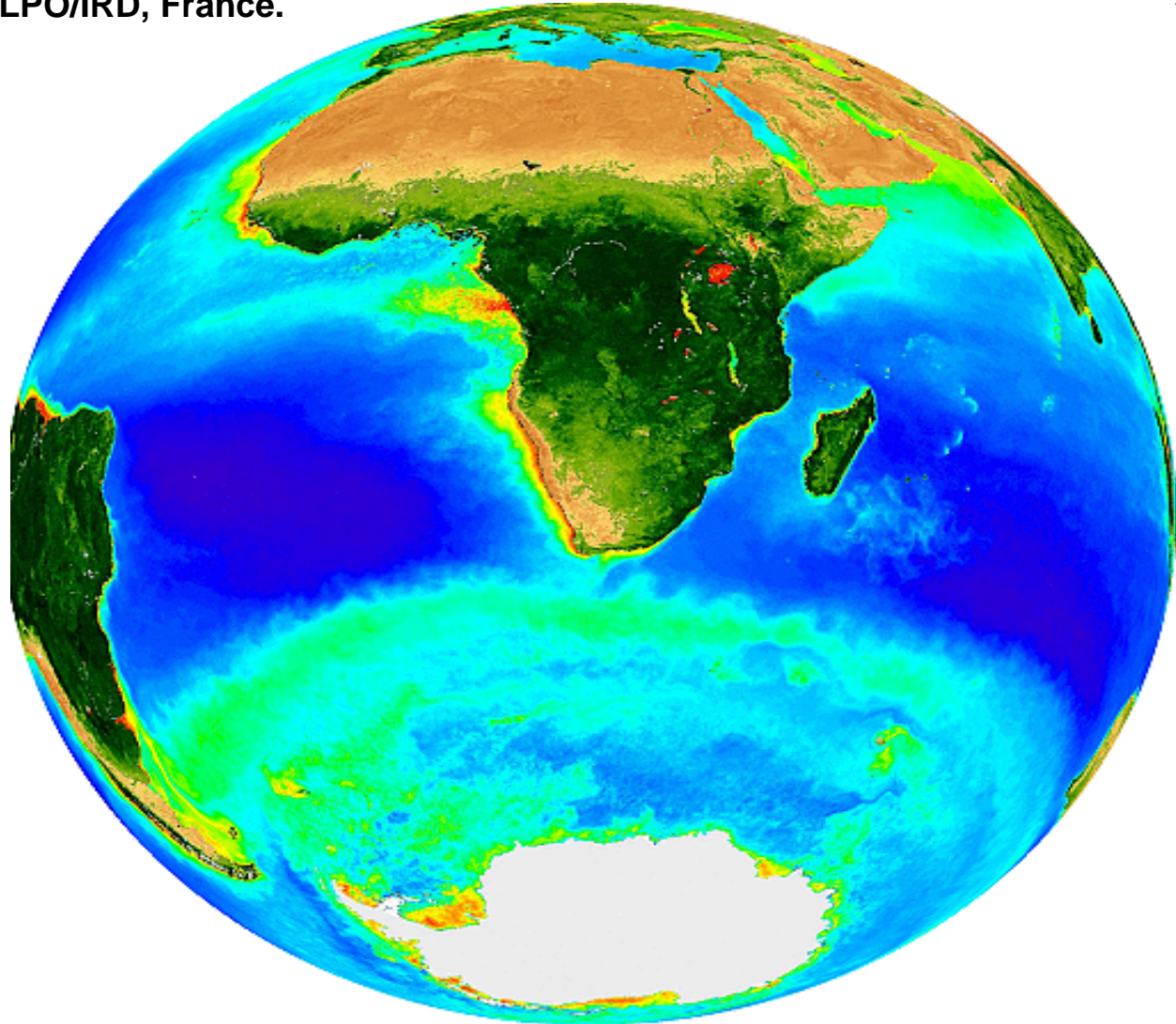


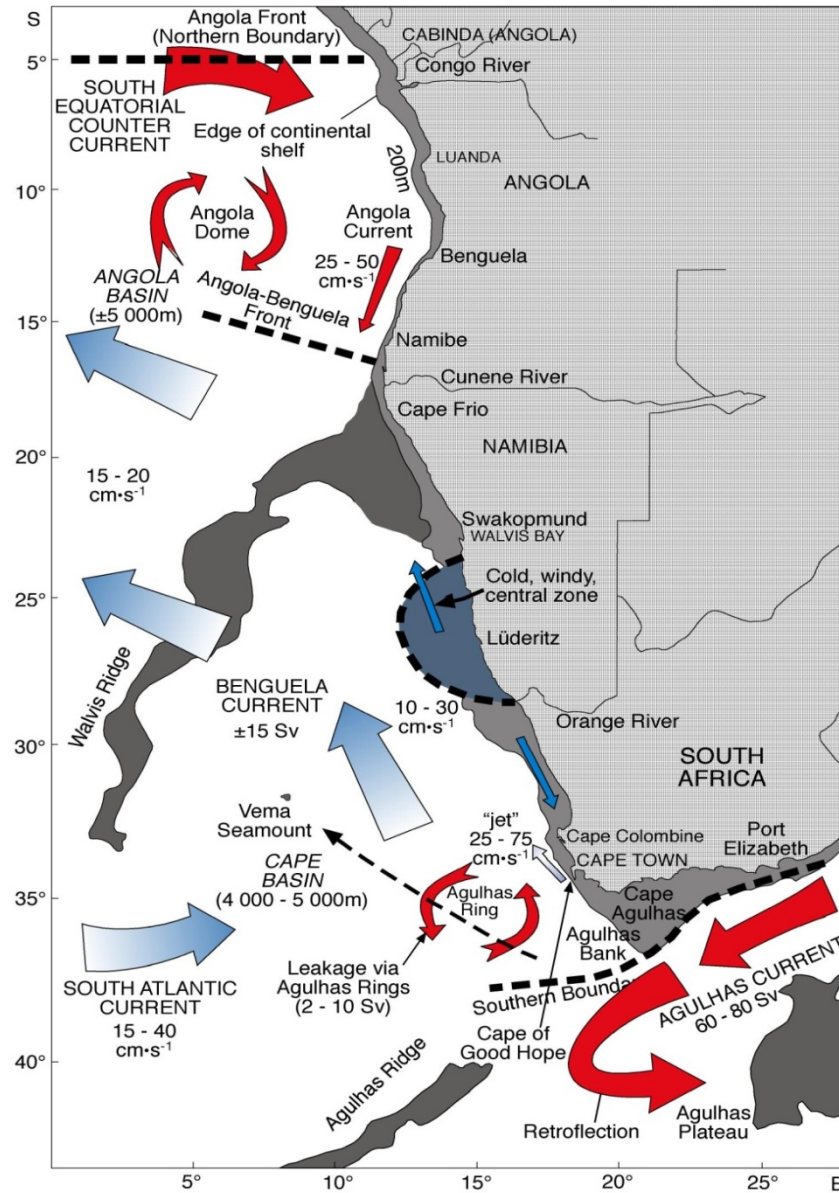
# Recent coastal climate and ecosystem changes in Southern Africa

**Mathieu Rouault et Sabrina Speich**

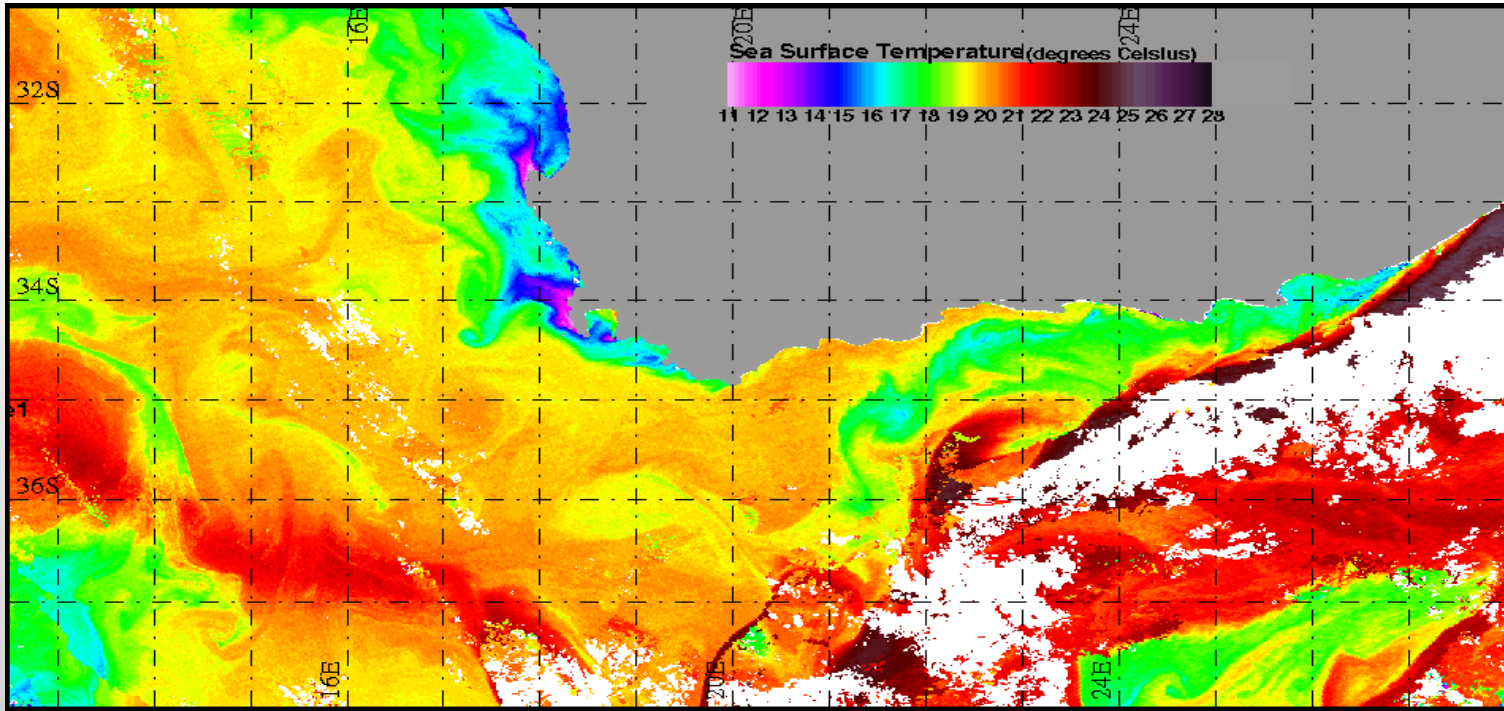
**Department of Oceanography, University of Cape Town, South Africa  
UBO/LPO/IRD, France.**



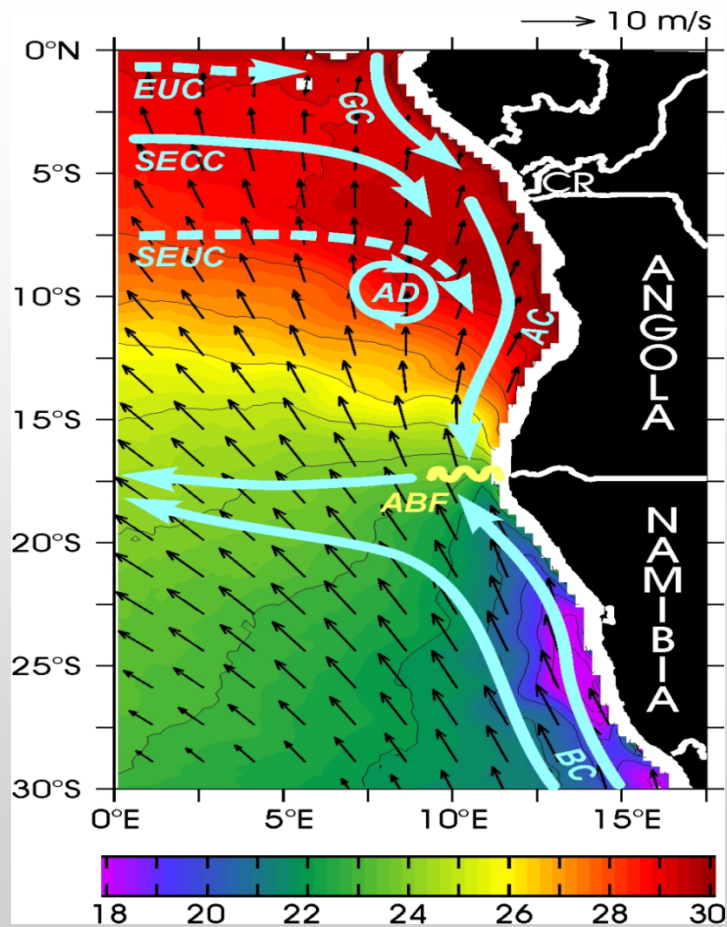
# The Angola Benguela Agulhas current system



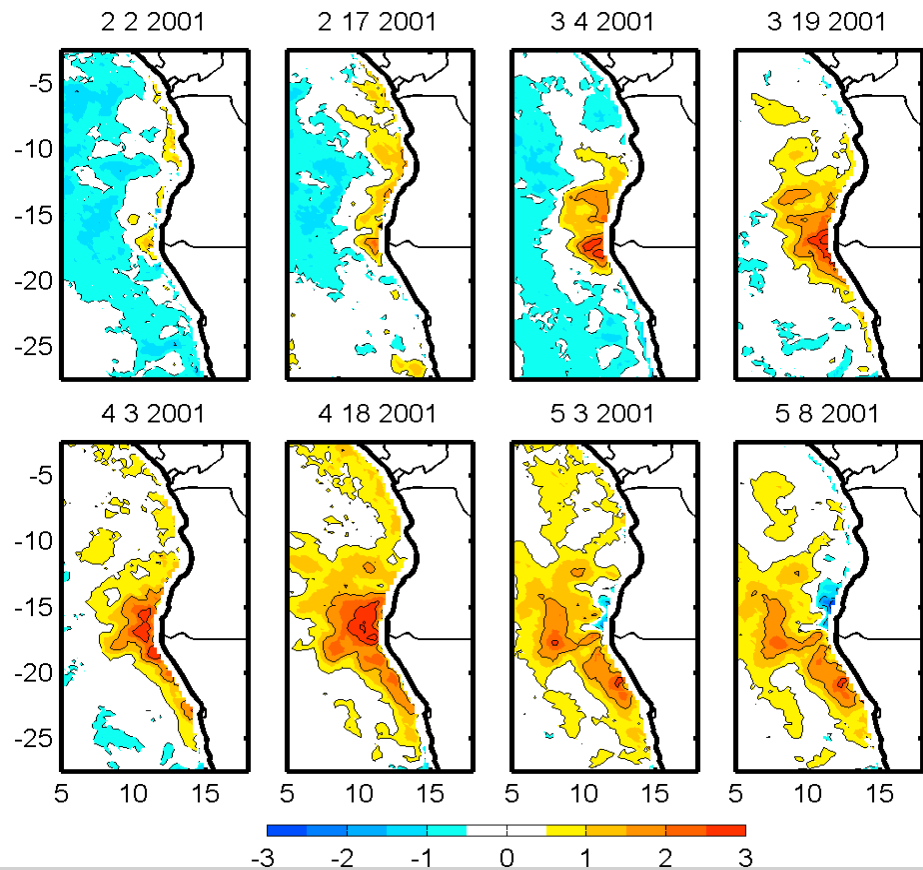
Courtesy BCLME



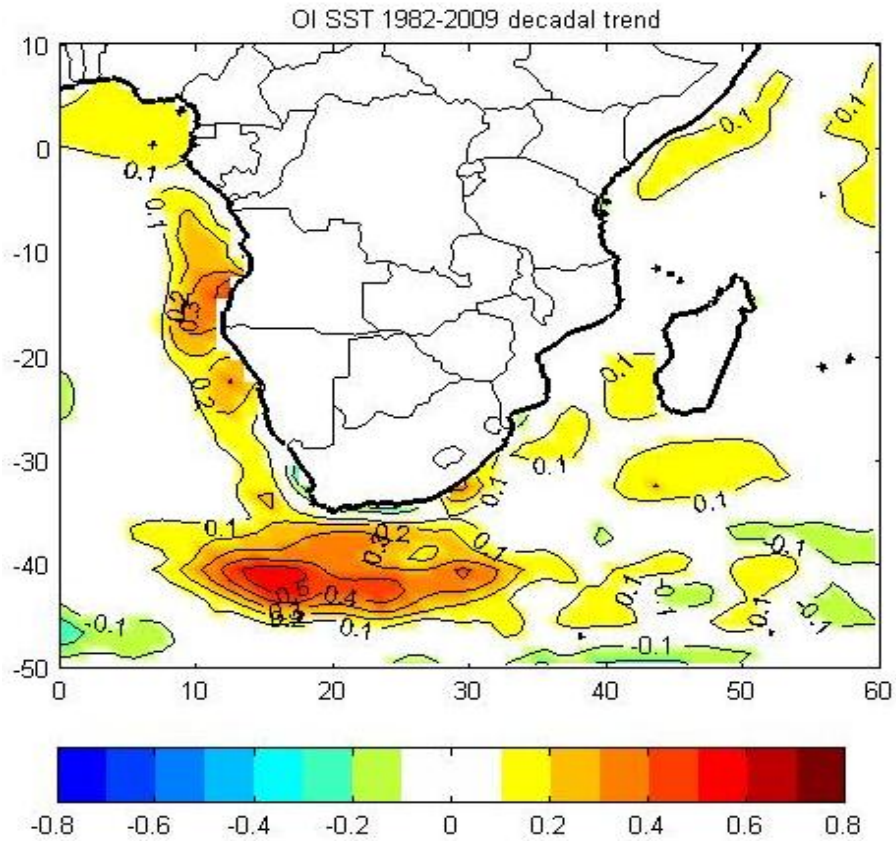
**Temperature de surface de l'océan au sud de L'Afrique estimée par teledetection infrarouge**



Temperature moyenne et vent moyen en Mars dans l'Océan Atlantique Sud Est estimée par teledetection micro-onde

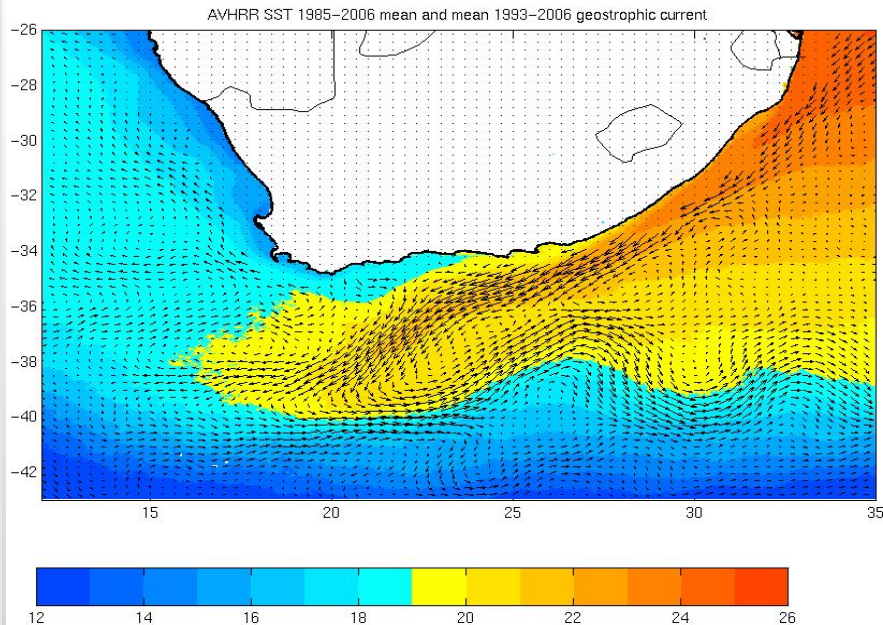


Anomalie de température estimée à partir de TMI sur TRMM (par rapport à une moyenne mensuelle flottante). Données présentées tout les 15 jours de mi février à debut mai

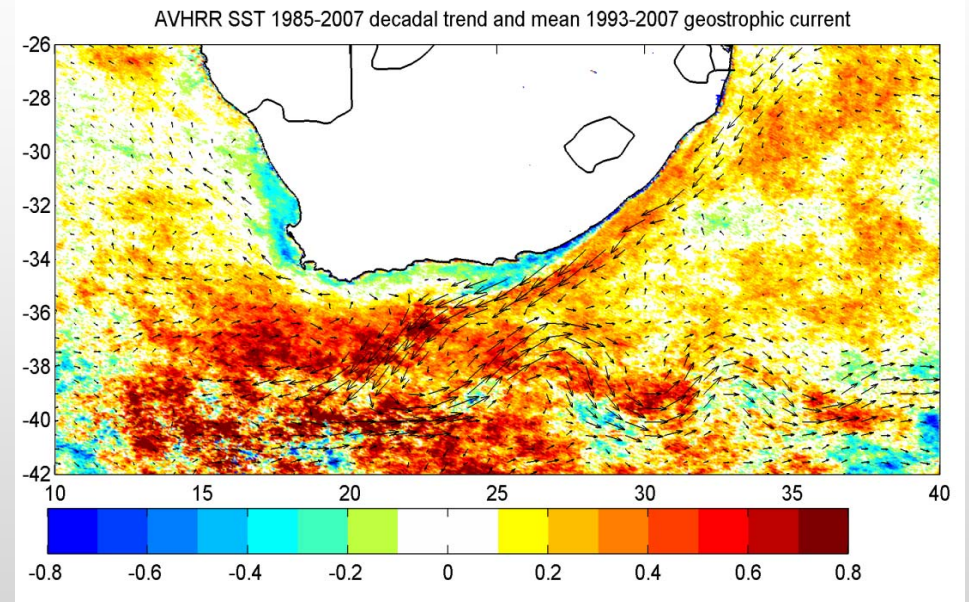


**Sea surface temperature trend since 1982 in degree per 10 year**

## Changements climatique



**Mean sea surface temperature and ocean currents**

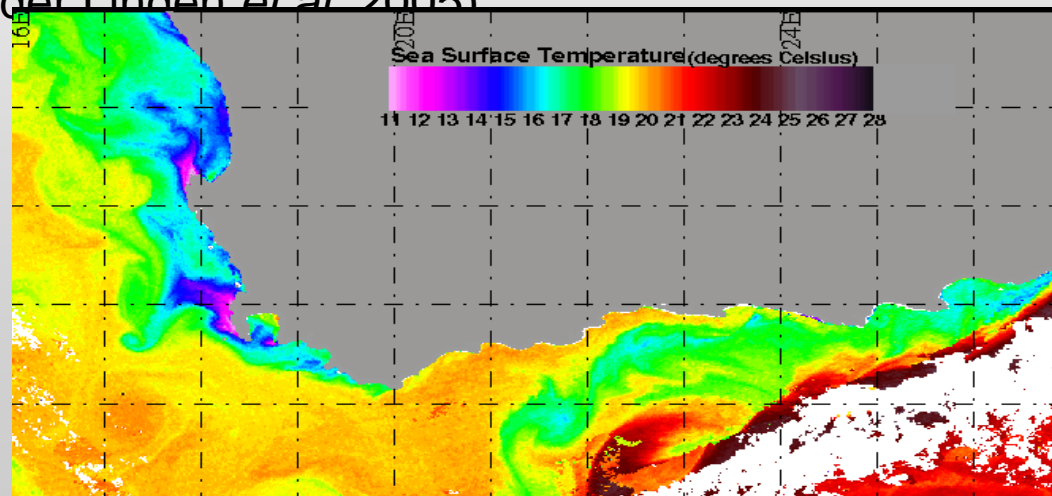


**Change in sea surface temperature from 1985 to 2007 in C per 10-year using 4 km resolution AVHRR only. Superimposed is the mean ocean current (yellow to red: warming, green blue: cooling)**

Sardine, anchovy, west coast rock lobster and horse mackerel have shifted their distributions southwards and eastwards (van der Lingen *et al.* 2006; Cockcroft *et al.* 2008).

In the 1980s and 1990s, anchovy and sardine were concentrated on the west coast (Barange *et al.* 1999). However, in 1996, anchovy spawners shifted in distribution from the western Agulhas Bank to the central and eastern Agulhas Bank (van der Lingen *et al.* 2002). This shift was associated with changes in wind-driven upwelling (Roy *et al.* 2007)

By 1999, the proportion of sardine biomass located to the east of Cape Agulhas exceeded that on the west coast, and by 2004, sardine were found solely in the east (van der Lingen *et al.* 2005)

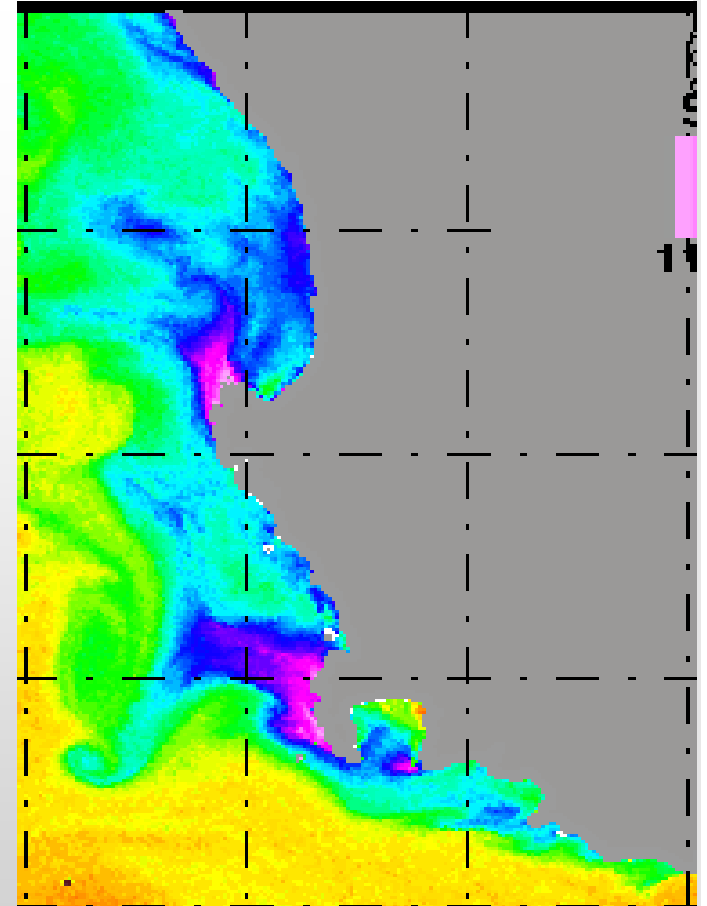


Since the late 1980s, west coast rock lobster have moved southwards into the kelp forests between Cape Hangklip and Danger Point (Tarr *et al.* 1996).

Cold water mussel species and kelp have invaded False Bay (Mead *et al.*, 2010)

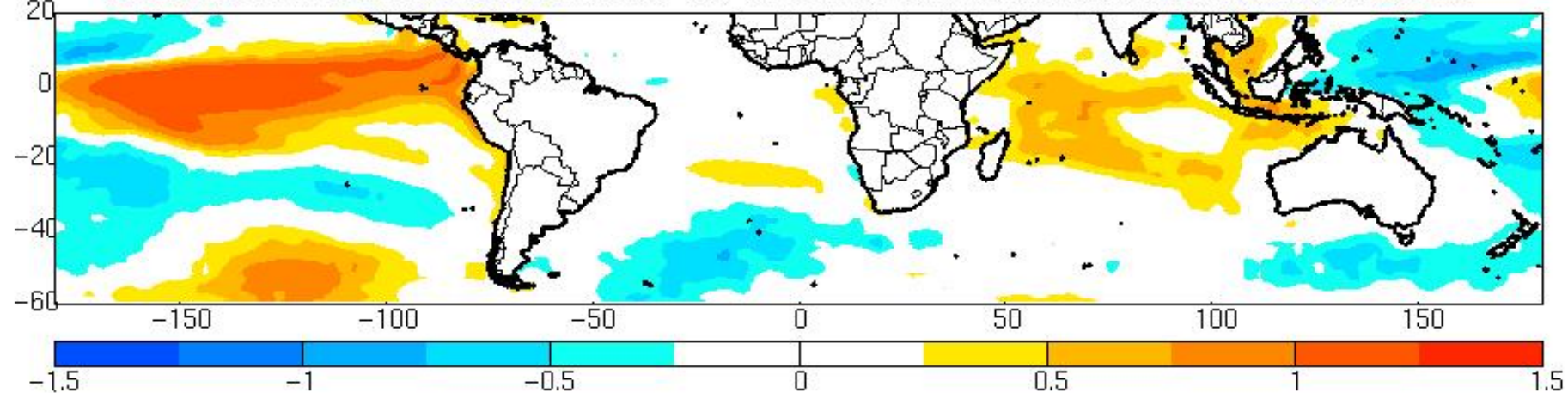
Since rock lobsters prey on sea urchins, the sea urchin population in these invaded areas collapsed. Sea urchins provide shelter for recruiting juvenile abalone and reduce predation on juvenile abalone by rock lobsters. Thus, an area that was previously an important abalone fishing ground has undergone a dramatic shift in community structure.

On the west coast of South Africa, African penguins have halved in numbers between 2007 and 2009, and overall, the South African population of penguins has been reduced to just 37% its level in 2001 (Altwegg *et al.* 2009; Crawford 2009).



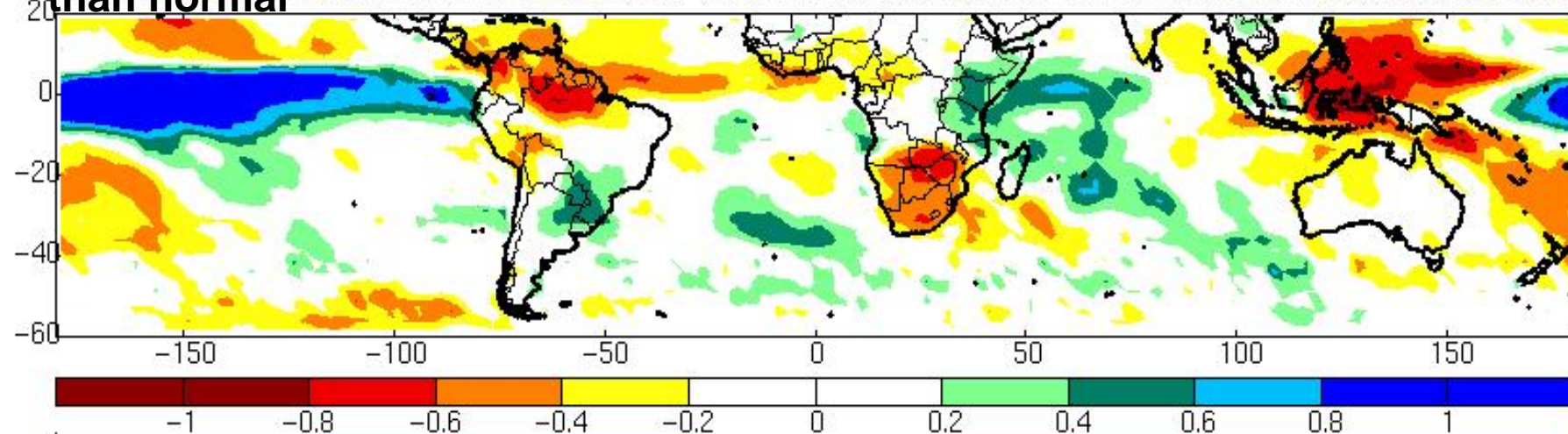


82/83 86/87 91/92 94/95 97/98 02/03 06/07 DJF SST COMPOSITE NORMALISED ANOMALIES FROM MEAN 82-07

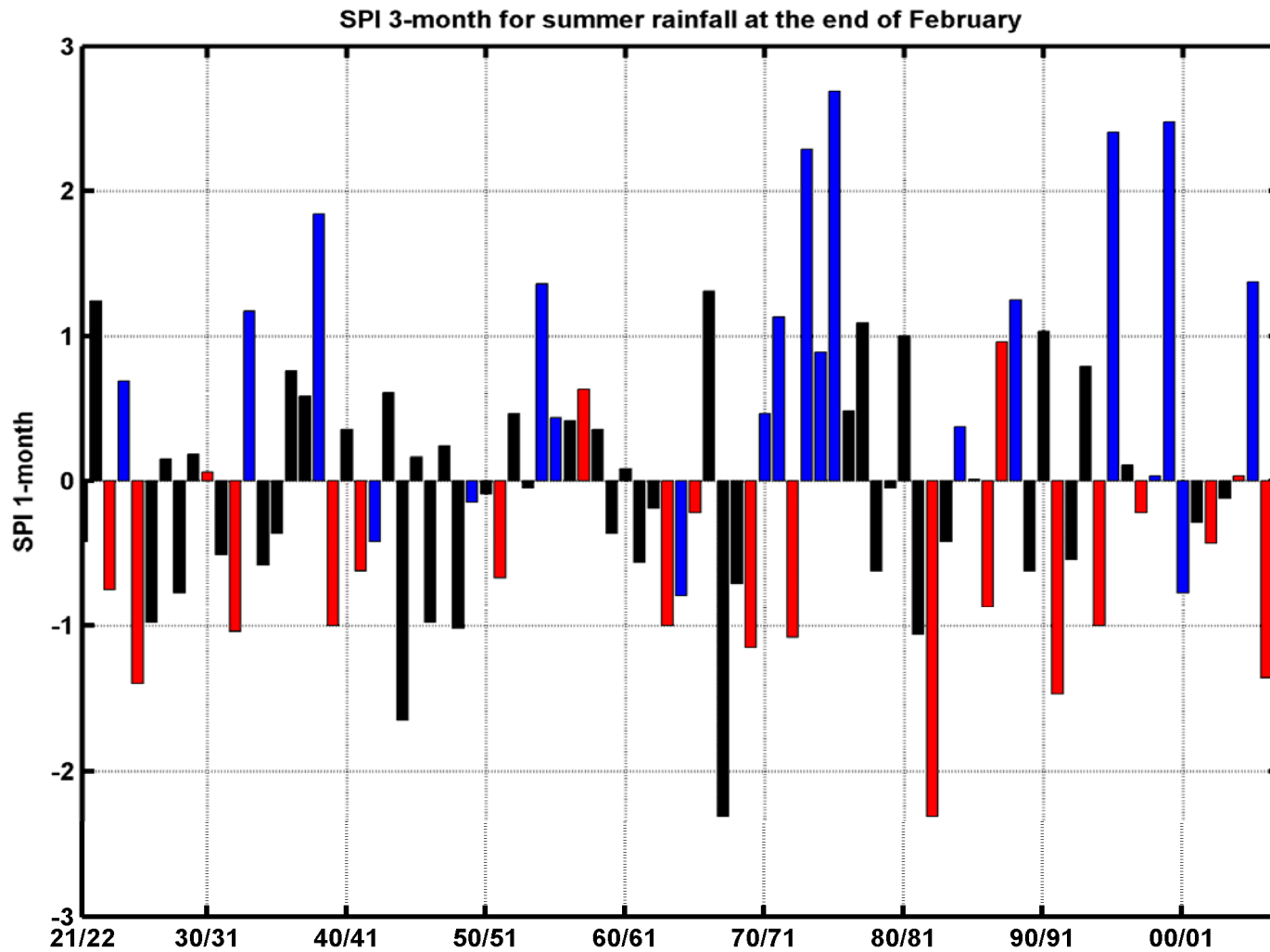


**Average sea surface temperature anomaly from the mean condition during mature phase of EL NINO in austral summer. Orange is warmer than normal blue is colder than normal**

GPCP 82/83 86/87 91/92 94/95 97/98 02/03 06/07 DJF RAINFALL COMPOSITE NORMALISED ANOMALIES FROM MEAN 79-07

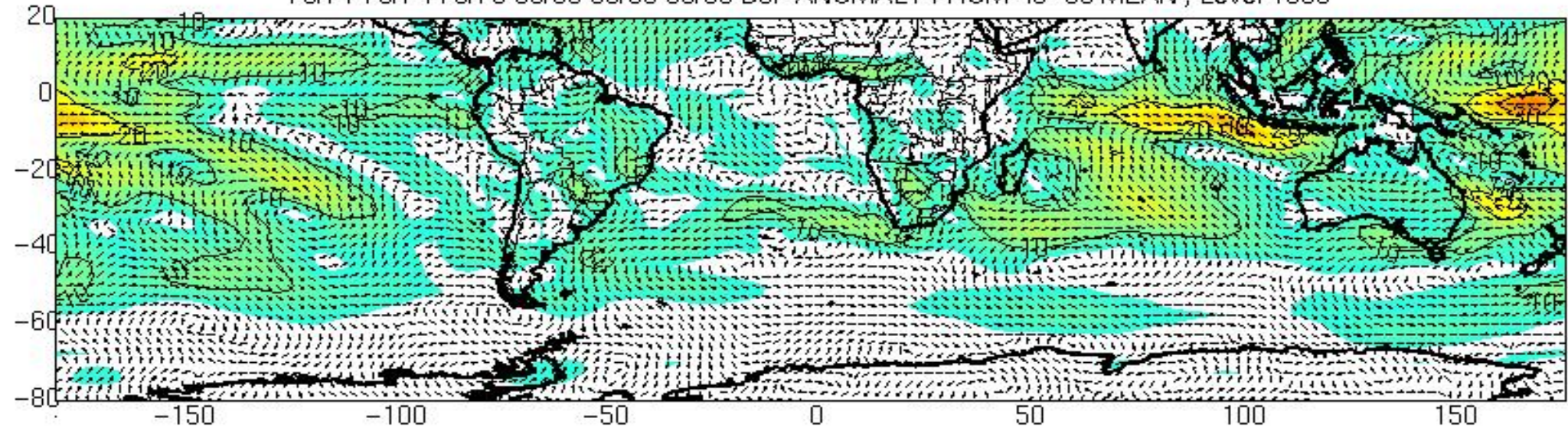


**Global average rainfall standardized anomaly during mature phase of EL NINO in austral summer. Blue/green is wetter than normal, yellow/red is dryer than normal.**



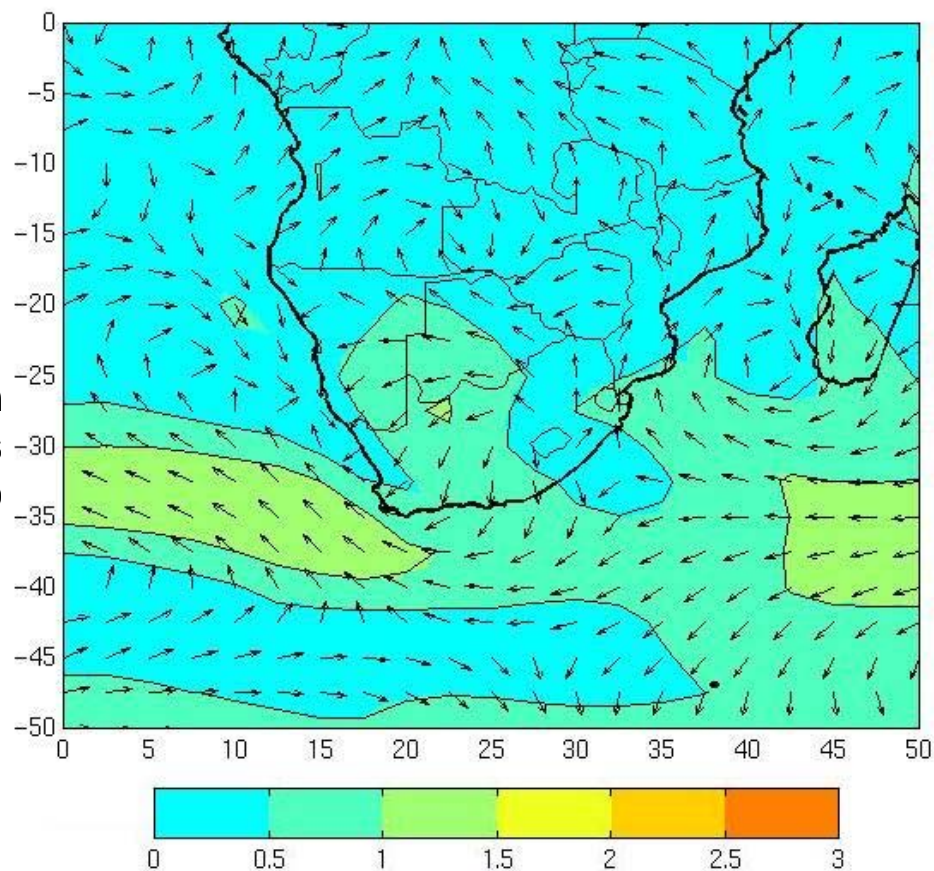
**Summer (DJF) rainfall anomaly from the mean for south Africa summer rainfall region from summer 1921/1922 to 2007/2008. El Niño year in red, La Niña in blue**

70/71 73/74 75/76 88/89 98/99 99/00 DJF ANOMALY FROM 49-99 MEAN , Level 1000



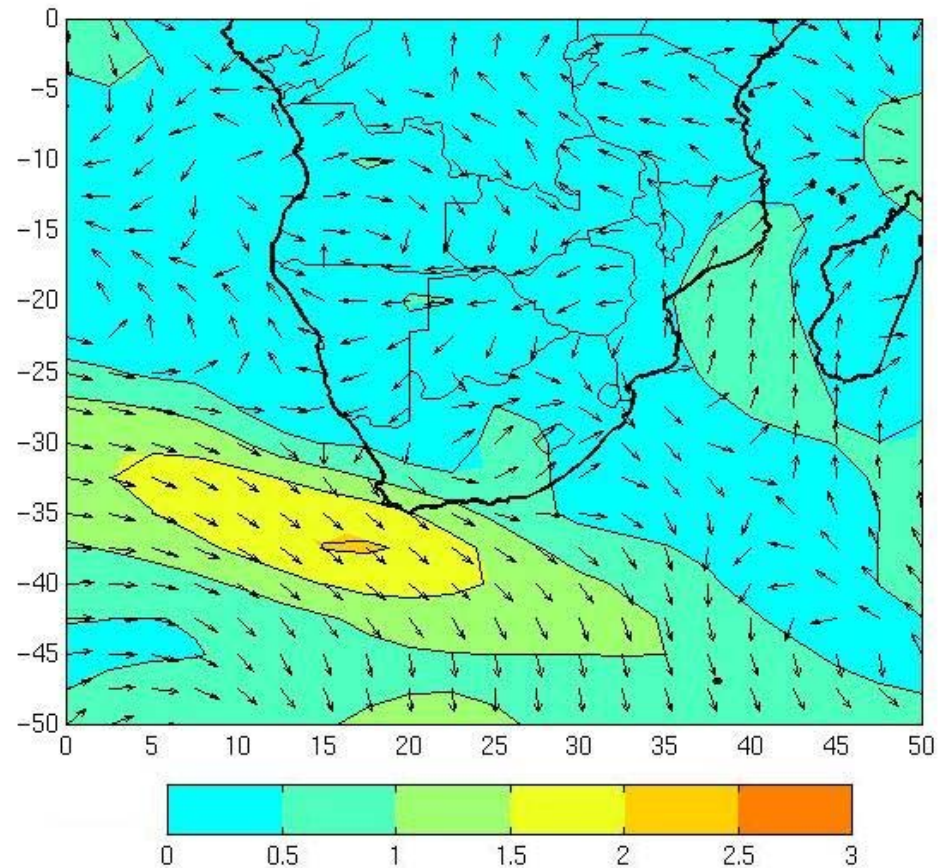
**Composite anomaly from the mean of 6 La Nina event  
in summer (DJF)**

**Increase in Southeasterly win  
in the South Atlantic during L  
Nina using NCEP surface win  
speed**

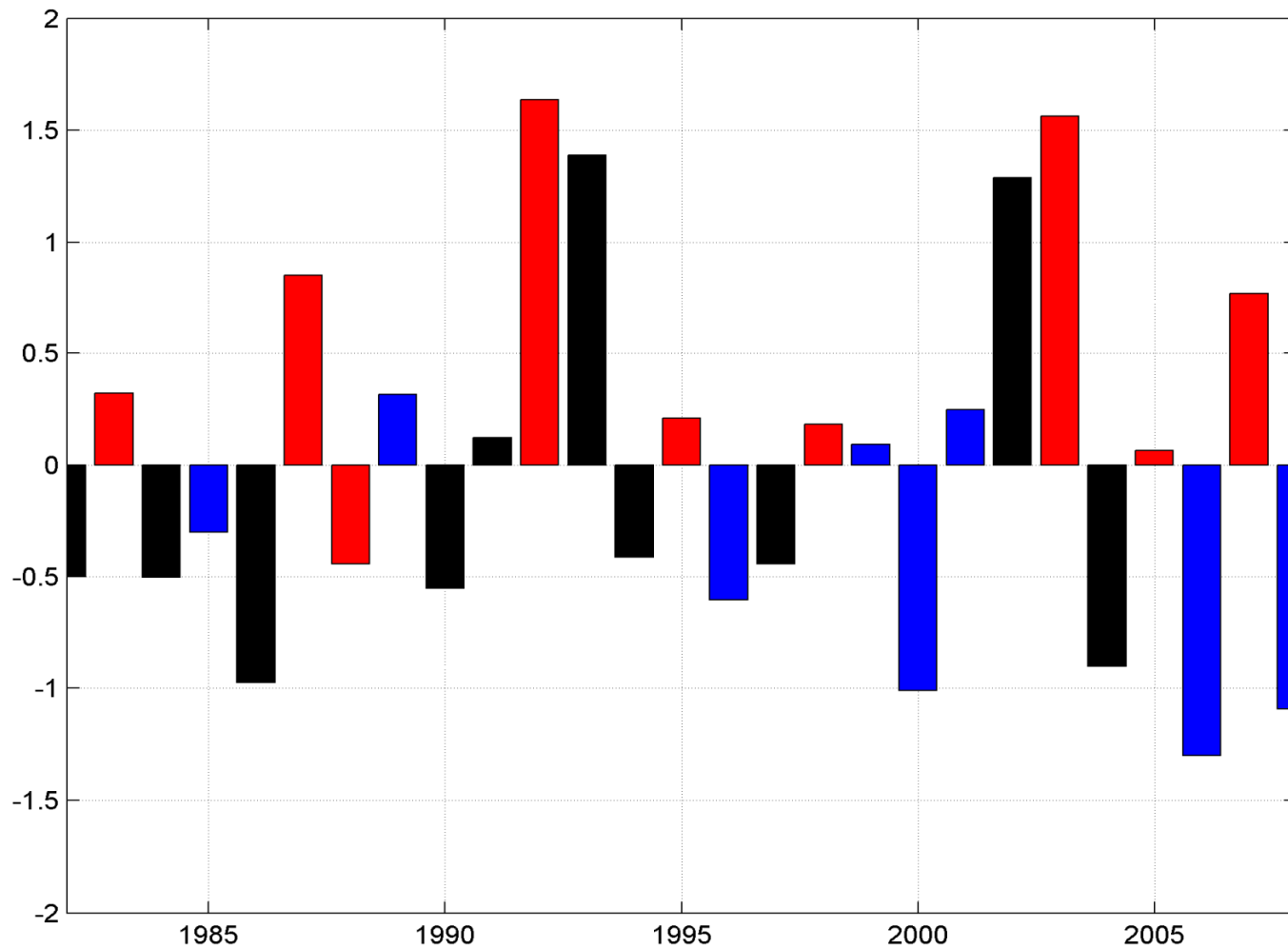


**Composite wind speed and direction anomalies from the mean condition  
during La Nina in austral summer (Rouault, Penven, Pohl, in press)**

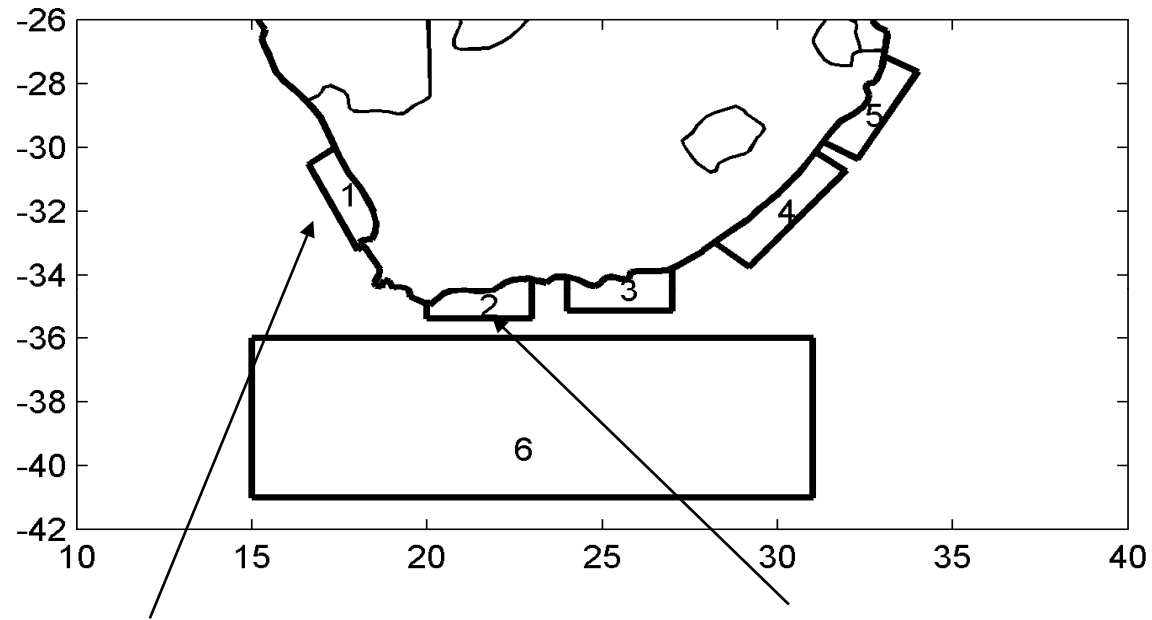
**Decrease in  
Southeasterly wind  
in the South Atlantic  
during El Nino (JFM)  
using NCEP surface  
wind speed**



**Composite wind speed and direction anomalies from the mean condition during mature phase of EL NINO in austral summer (Rouault, Penven, Pohl, in press)**

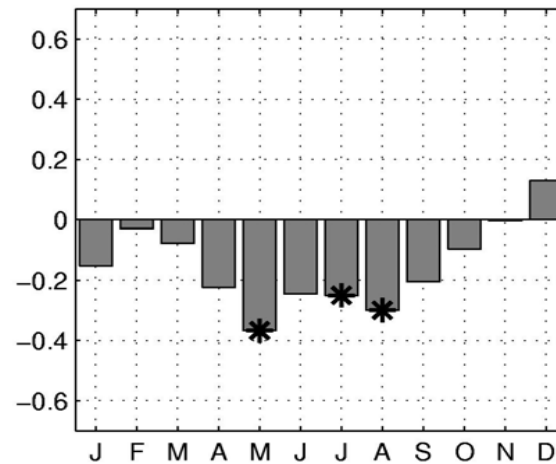
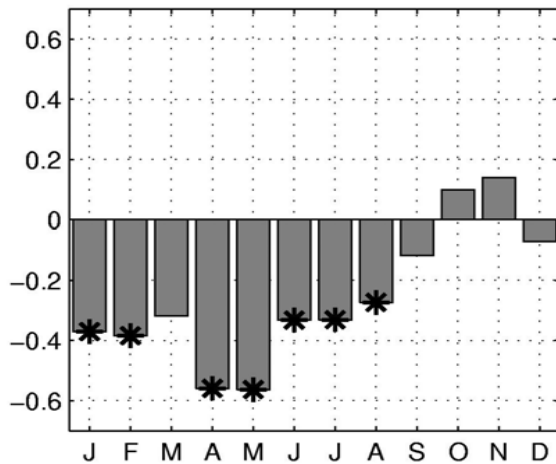


**Anomaly from climatology for the mean of February, March and April from 1982 to 2008 for SST1 (West Coast). La Nina in Blue, El Niño in red (Rouault, Penven, Pohl, in press)**

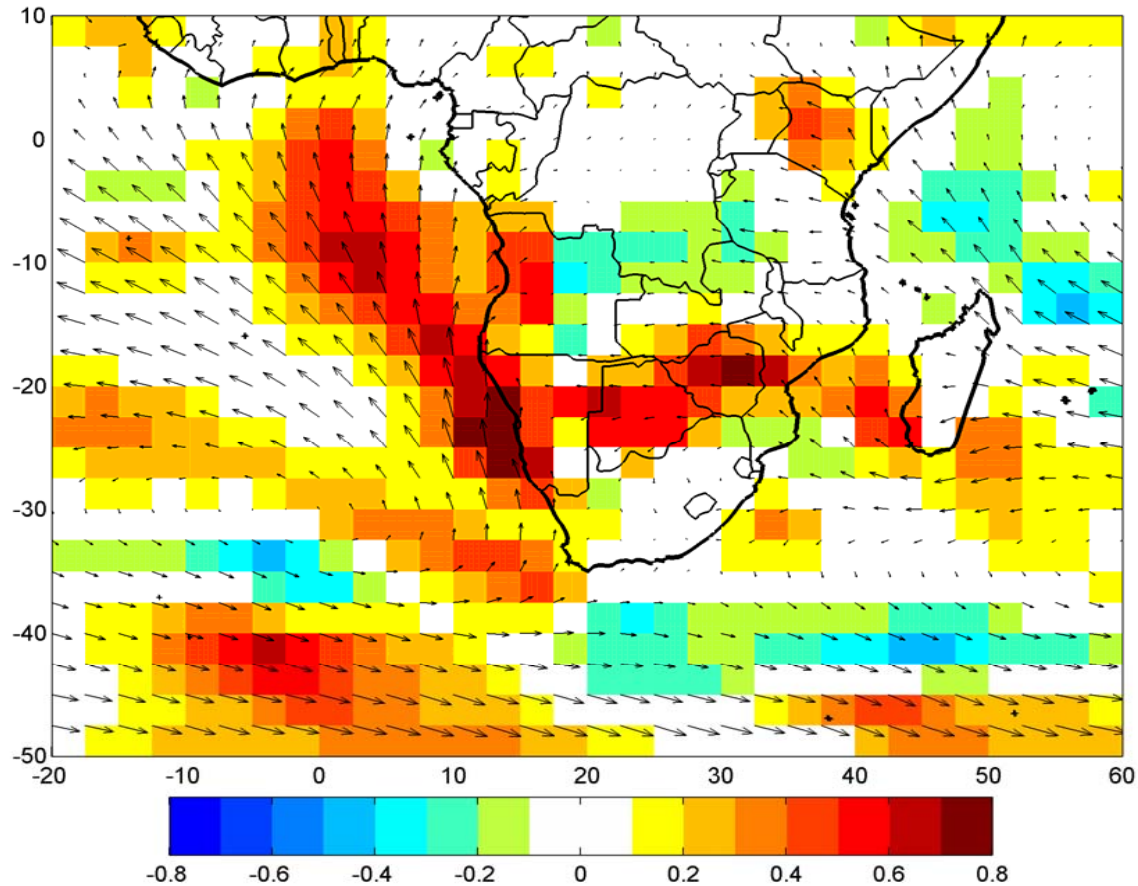


West Coast

South Coast



**Linear trend in C per 10 year at each month of the year using OI Reynolds SST in domain 3 degree wide and extending 1 degree offshore (Rouault, Penven, Pohl, in press)**



**NCEP 1982–2009 linear trend in surface wind speed (colour) with, superimposed, the climatological mean wind speed and direction (arrows) (Rouault, Penven, Pohl, in press)**