



UPWELLING ON WESTERN IBERIA COAST – A MODELLING STUDY

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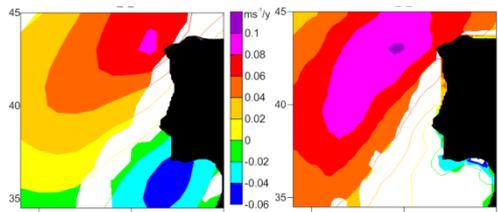
Abstract

The Regional Ocean Modeling System ocean model is used to simulate the decadal evolution of the regional waters offshore Iberia in response to atmospheric fields given by ECMWF ERA-40 (1961–2001) and ERA-Interim (1989–2008) reanalyses. The simulated sea surface temperature (SST) fields are verified against satellite AVHRR SST, and they are analysed to characterise the variability and trends of coastal upwelling in the region. Opposing trends in upwelling frequency are found at the northern limit, where upwelling has been decreasing in recent decades, and at its southern edge, where there is some evidence of increased upwelling. These results confirm previous observational studies and, more importantly, indicate that observed SST trends are not only due to changes in radiative or atmospheric heat fluxes alone but also due to changes in upwelling dynamics, suggesting that such a process may be relevant in climate change scenarios.

Summer meridional wind trend

ERA-Interim

Satellite



North: Weakening of northerly wind
South: Intensification of northerly wind

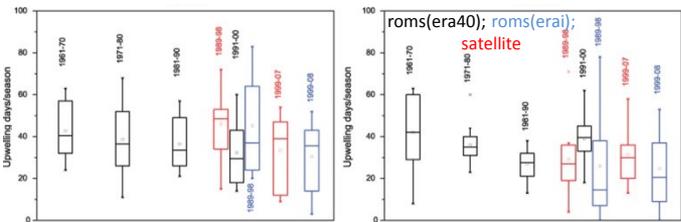
Filled zones have a trend statistically significant at 95%.

Upwelling index

(N° of days with $SST_{coast} - SST_{300km} < -2^{\circ}C$)

Finisterre (NW)

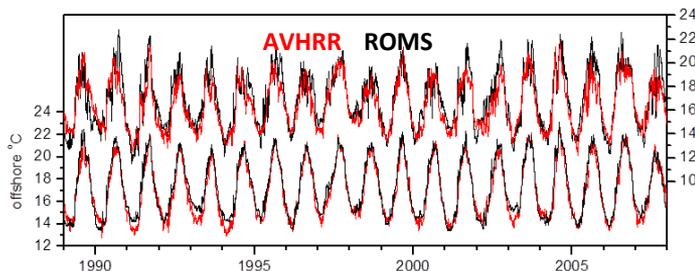
St. Vincent (SW)



Finisterre : Continuous decrease (mean and median)

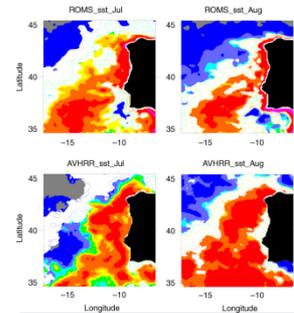
St. Vincent: Decrease until the 80's followed by an increase.

SST validation 1989-2008



ROMS (+ERA-I) reproduces well the observed climate:
Spatial structures and temporal variability

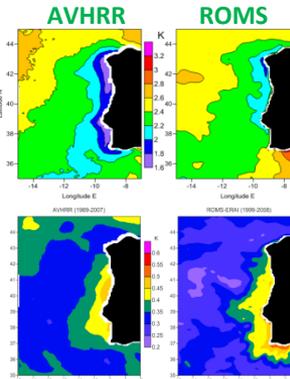
SST trends



Finisterre (NW)
warming,
less upwelling

St. Vincent (SW)
reduced warming or
even cooling,
more upwelling

SST variability



Upwelling zone is characterised by **lower intra-annual SST variability**, due to the low SSTs during summer.

Upwelling zone is characterised by **higher inter-annual SST variability**, due to unsynchronized upwelling events, in duration and intensity, between years.

Conclusions

Recent evolution of summer upwelling off the western coast of Iberia indicates a decrease in upwelling frequency at the northern limit, where the mean SST has been increasing at the fastest regional pace, and by a less significant increase in the south, where mean observed SST shows evidence of mitigated warming. A recent modelling study has found a significant increase in coastal upwelling off western Iberia in a global warming scenario, suggesting that recent trends may also be associated with climate change.

Alves JMR, Miranda PMA (2013) **Variability of Iberian upwelling implied by ERA-40 and ERA-Interim reanalyses**, Tellus A, 65, 19245
Miranda PMA, Alves JMR, Serra N (2013) **Climate change and upwelling: response of Iberian upwelling to atmospheric forcing in a regional climate scenario**. Climate Dynamics, 40, 2813-2824