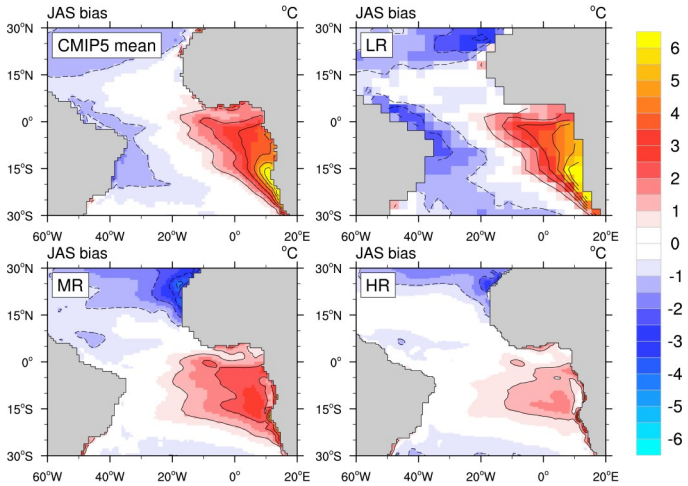
PREFACE HIGHLIGHTS

PREFACE model studies indicate winds errors are the dominant cause of the warm sea surface temperature (SST) bias in climate models in the eastern tropical Atlantic. Increasing atmospheric and oceanic resolution can reduce these errors.



Mean error in summer SST from standard climate change models (CMIP) and the Kiel Climate Model, with increased atmospheric resolution (LR - Low resolution; MR - medium resolution; HR - high resolution). From Harlass *et al.*, 2016.

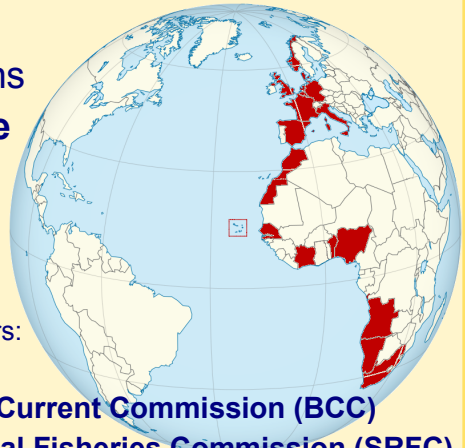
PREFACE novel tools to diagnose model errors and their consequences provide new directions for the wider scientific community using multi-model ensembles.

PREFACE has developed advanced statistical methods to improve climate predictions. We have demonstrated skilful prediction of equatorial Atlantic SST and decadal shifts in Sahel rainfall.

PREFACE focuses on the three highly productive eastern large marine ecosystems (Canary Current, Gulf of Guinea and Benguela Current LMEs). Such improved understanding of tropical Atlantic variability and predictions can have major socio-economic benefits, including for ecosystem and fisheries management.

WHO WE ARE

28 institutions from **Europe** and **Africa**



Supported by 2 associate partners:

The Benguela Current Commission (BCC)
The Subregional Fisheries Commission (SRFC)

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Enhancing PREdiction oF Tropical Atlantic ClimatE and its Impacts

PREFACE

SEVENTH FRAMEWORK PROGRAMME

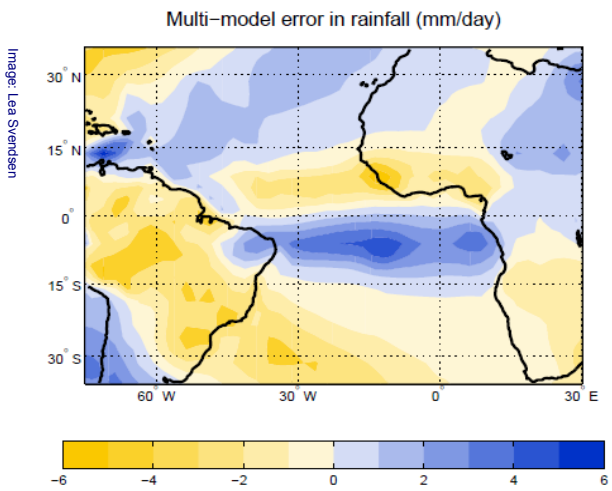
Co-funded by the European Union under FP7-ENVIRONMENT
Project ID: 603521

November 2013 - April 2018

www.preface-project.eu

CLIMATE MODELLING

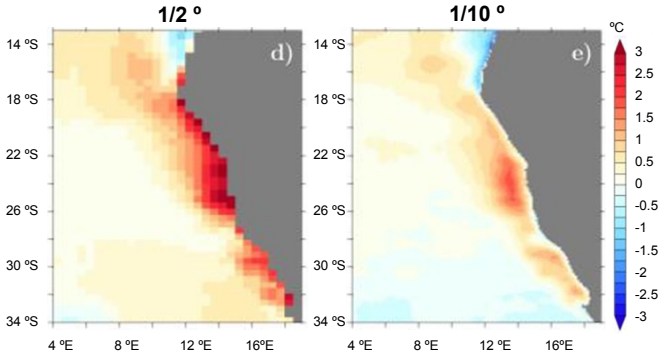
Will heat waves and droughts become more common in the next years? Will oceanic conditions be less favourable to current marine ecosystems? Climate models allow us to better understand how climate may change over the next season and century. Despite great advances during the last decades, these societally important tools still suffer from mean systematic errors (known as bias).



The tropical Atlantic is a key region in which models still exhibit large errors. PREFACE focuses on understanding the cause of these errors and their consequences for predicting tropical Atlantic climate. Through in-depth analysis and targeted numerical experiments, PREFACE has advanced significantly towards enhancing prediction of tropical Atlantic climate and its impacts.

The modelling work in PREFACE has lead to close cooperation and capacity building between Africa and the EU by workshops and summer schools, input into academic programmes, and student and staff exchanges between institutes.

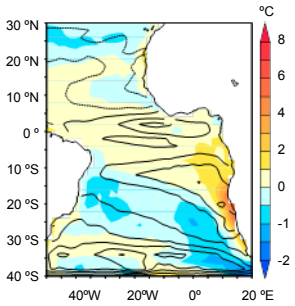
PREFACE has brought the tropical Atlantic into focus for the international modelling community, with collaboration extending beyond Europe and Africa, to South and North America and Asia.



PREFACE regional ocean modelling studies indicate that the warm SST bias in climate models for the three LMEs can be reduced by increasing the ocean model resolution up to 1/10°, using scatterometer wind forcing, accounting for the effect of primary production on ocean turbidity and solar absorption, and near-inertial mixing processes.

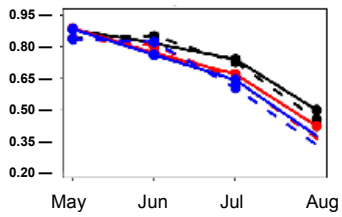
← Mean SST bias for different ocean model horizontal resolutions.

SST bias in the Norwegian Climate Model caused by ocean and local wind errors. From Koseki *et al.* 2016. →



PREFACE has identified key causes of systematic error in climate models for the tropical Atlantic, but the relative roles of wind, cloud-radiative and ocean dynamics differ regionally, seasonally, and among models highlighting the importance of a multi-model approach.
In addition, remote radiative errors from Southern Ocean can drive tropical biases. Reducing model biases through statistical corrections or new model configurations improves the simulations of SST variability, reducing the dominance of thermodynamic processes and enhancing the role ocean dynamics.

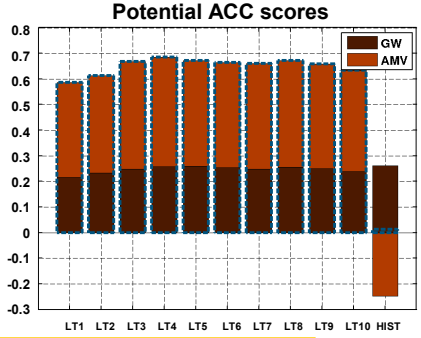
EC-EARTH model: Correlation skill for Atlantic Niño prediction. From Prodhomme *et al.*, 2016.



PREFACE scientists have shown that the interannual variations in equatorial Atlantic SST are linked to the South Atlantic Anticyclone and modulated by Atlantic multidecadal variability. Despite their large biases, climate models capture the Atlantic Niño's impact on the Pacific, and show that it likely enhanced El Niño variability after the 1970's. Some seasonal forecast systems can now predict Atlantic Niño events from May.

Atlantic and Pacific decadal variability and global warming impact African and South American rainfall. Decadal variations in Sahel rainfall can now be predicted based on Atlantic SST. The large uncertainty in future evolution of the West African Monsoon is related to surface temperature and tropospheric winds. Lastly, advanced statistical methods were developed to improve SST and rainfall predictions, and to account for model bias.

Potential skill in predicting Sahel rainfall 1-10 years in advance. From Mohino *et al.*, 2016. →



PREFACE is working towards predictions of future changes in the marine ecosystem to help the sustainable management of fisheries. For example, recent PREFACE results suggest that El Niño could act as a possible large-scale climatic forcing of the NW African fish dynamics. This opens a window of opportunity for the development of an effective seasonal prediction system in the aforementioned region.