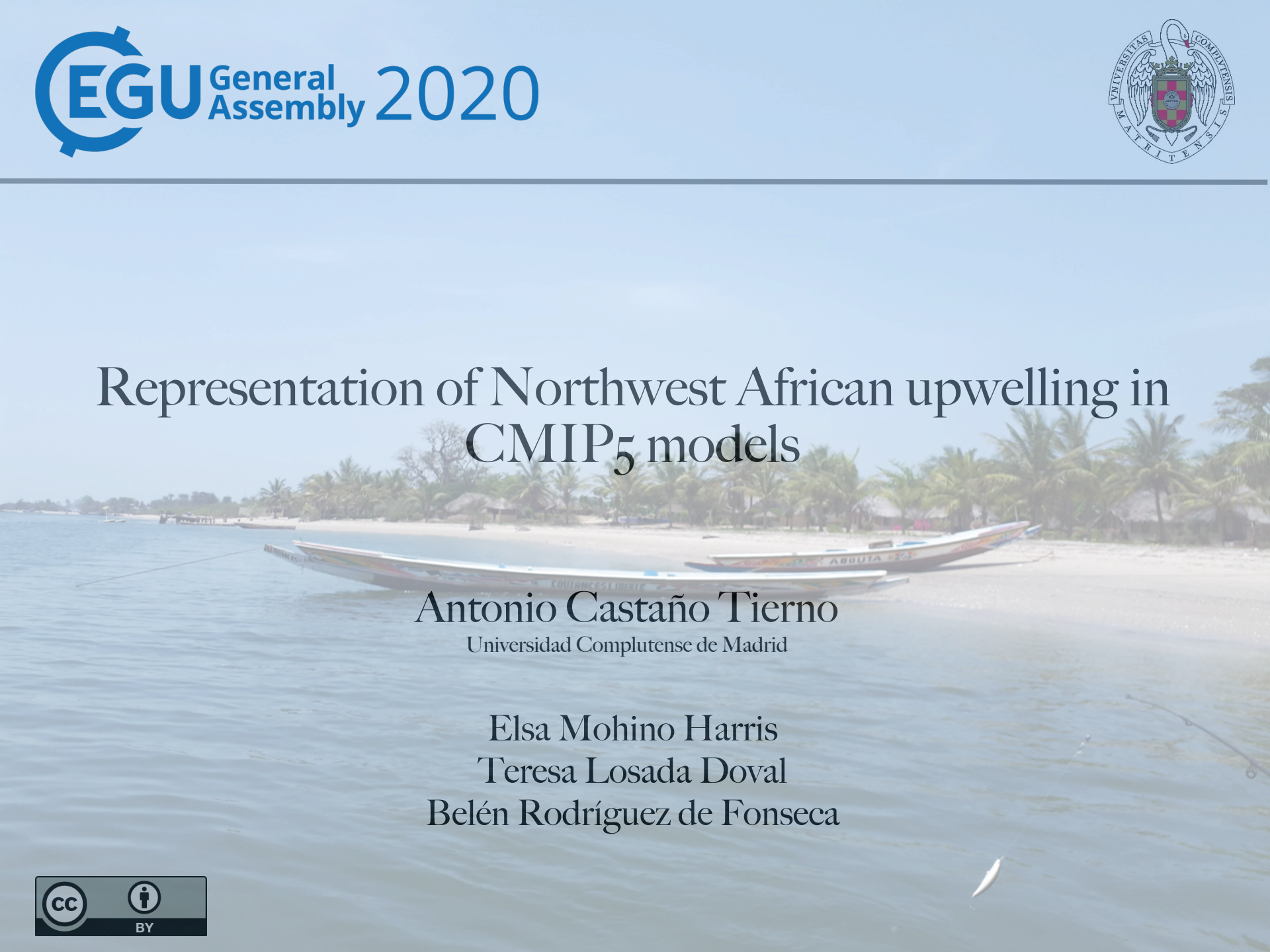

Representation of Northwest African upwelling in CMIP5 models

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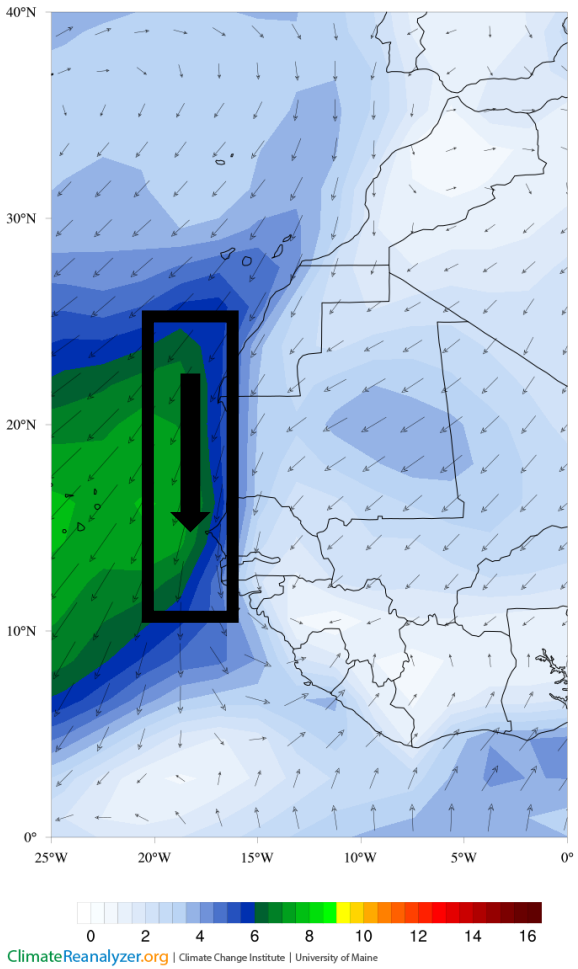
Elsa Mohino Harris
Teresa Losada Doval
Belén Rodríguez de Fonseca

Introduction

NWA coastal upwelling

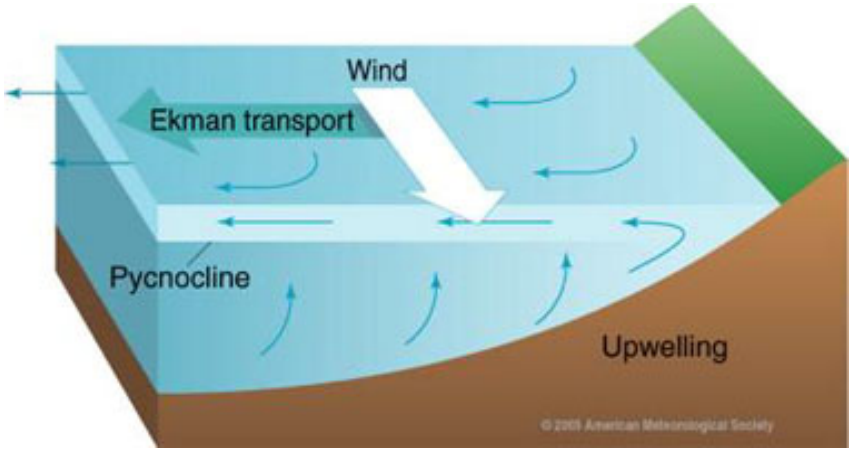
WIND 10 m Feb (1981-2010)



Since wind is meridional, total transport is zonal.

Water displaced replaced by colder water from the bottom.

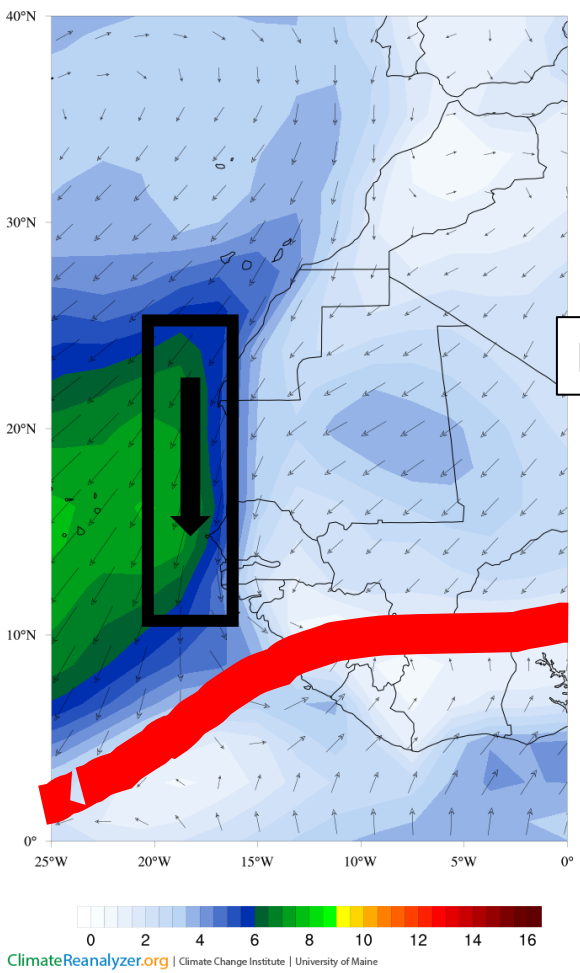
$$U = \frac{\tau_y}{\rho f} \Rightarrow upw.ind. = \frac{\tau_y}{f}$$



Introduction

NWA upwelling: two regions

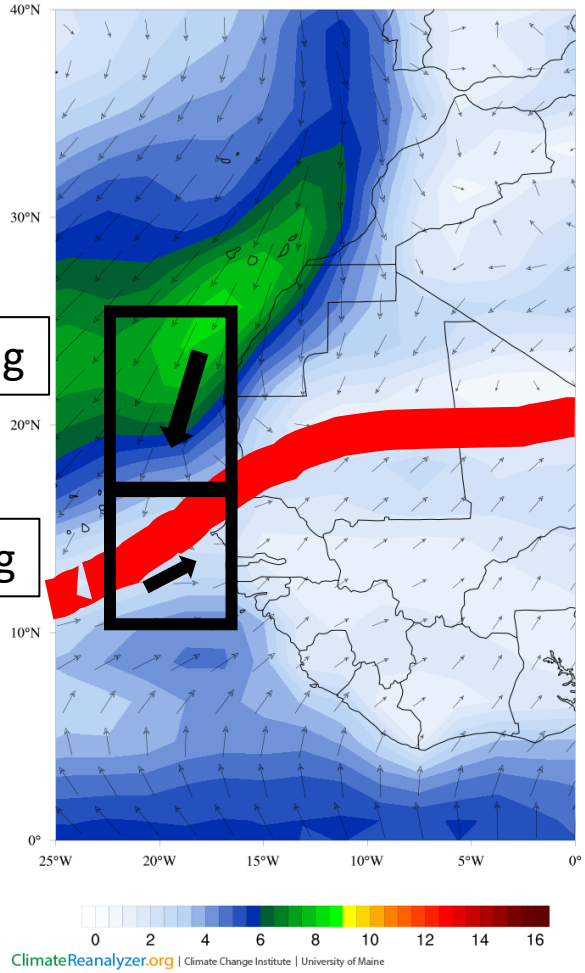
WIND 10 m Feb (1981-2010)



Permanent upwelling

Seasonal upwelling

WIND 10 m Aug (1981-2010)



Introduction

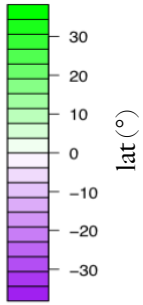
Research questions

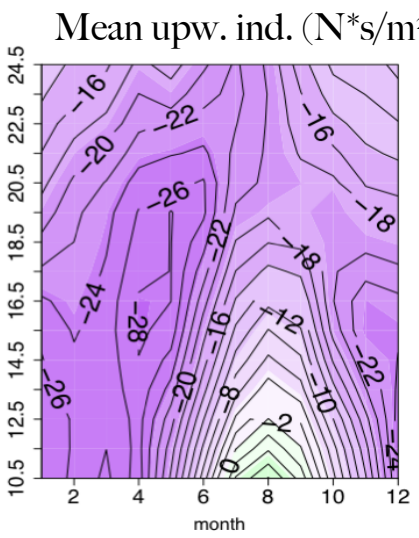
RQ1: How well do coupled models represent the mean seasonal cycle of the wind-driven NWA upwelling?

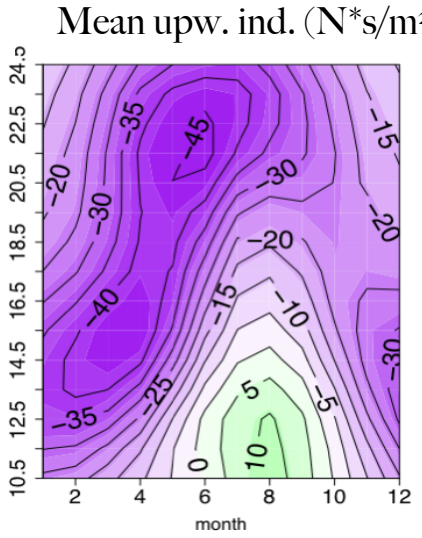
RQ2: Which global features influence differences in wind-driven upwelling representation in coupled models?

Upwelling seasonal cycle

OBS.







CMIP5

Permanent upwelling

Seasonal upwelling

$$\text{upw. index} = \frac{\tau_y}{f}$$

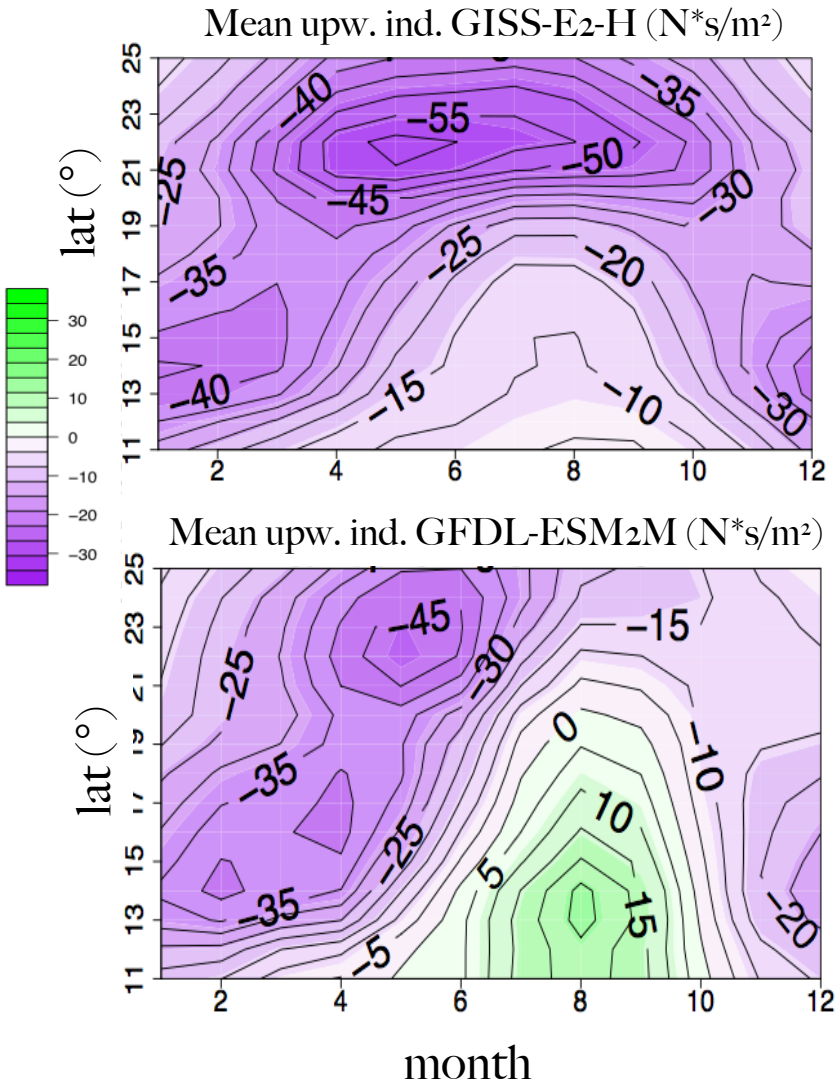
CMIP5 models capture the general seasonal cycle of wind-dependent NWA upwelling, but exaggerate wind-induced upwelling.

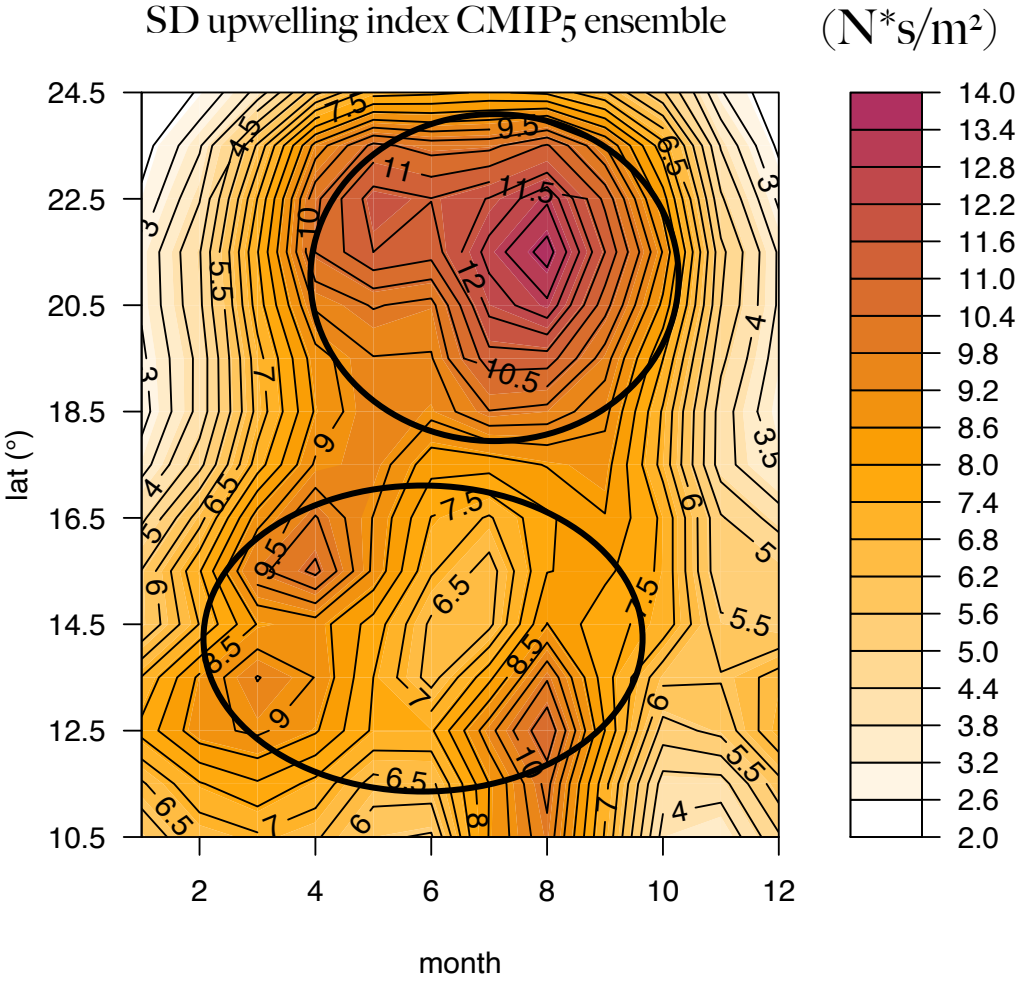
NEGATIVE VALUES OF UPWELLING INDEX: MORE UPWELLING

Back to our questions

RQ2: Which global features influence differences in wind-driven upwelling representation in coupled models?

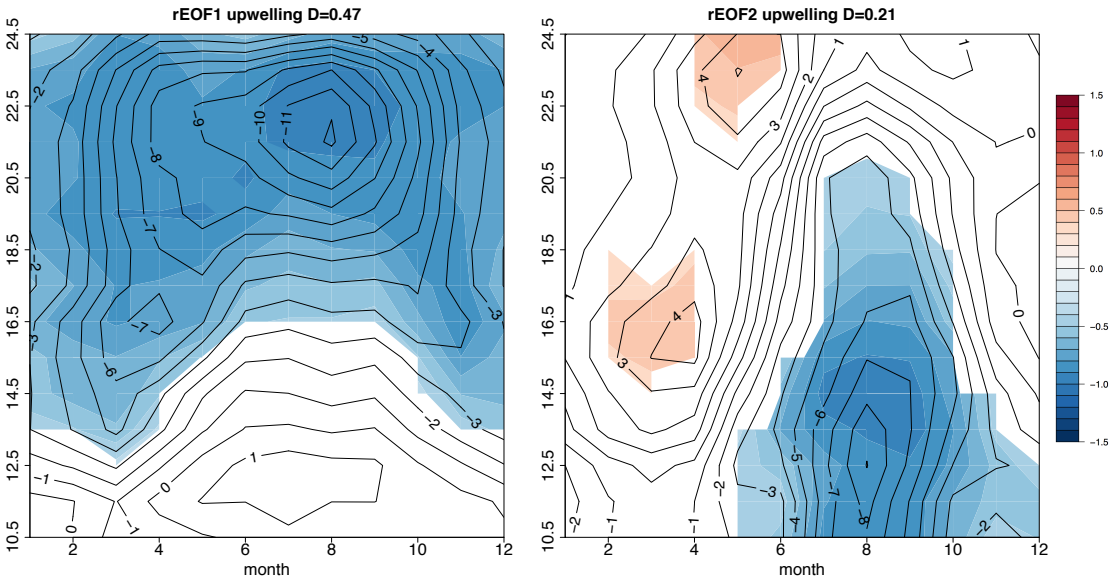
Intermodel upwelling variability

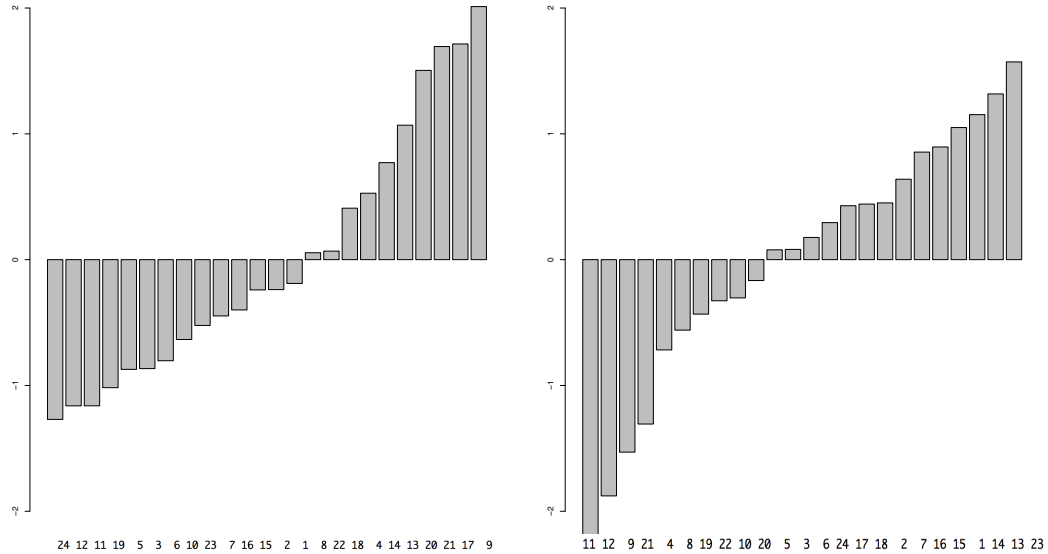




Representation of NWA a upwelling in reanalysis and CMIP5 models

Intermodel upwelling variability

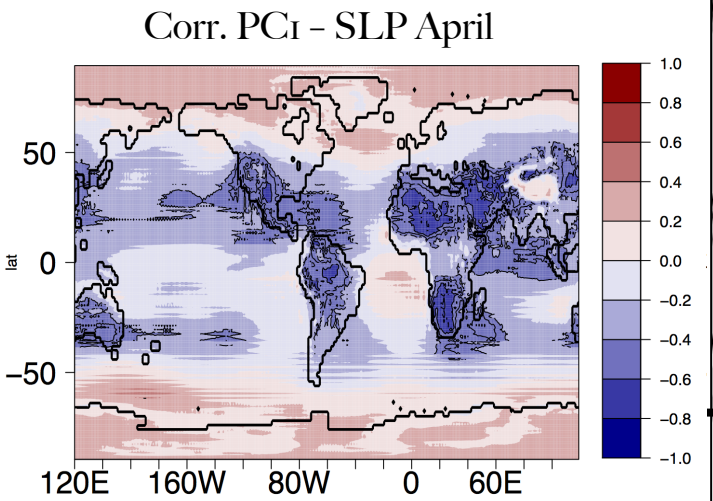


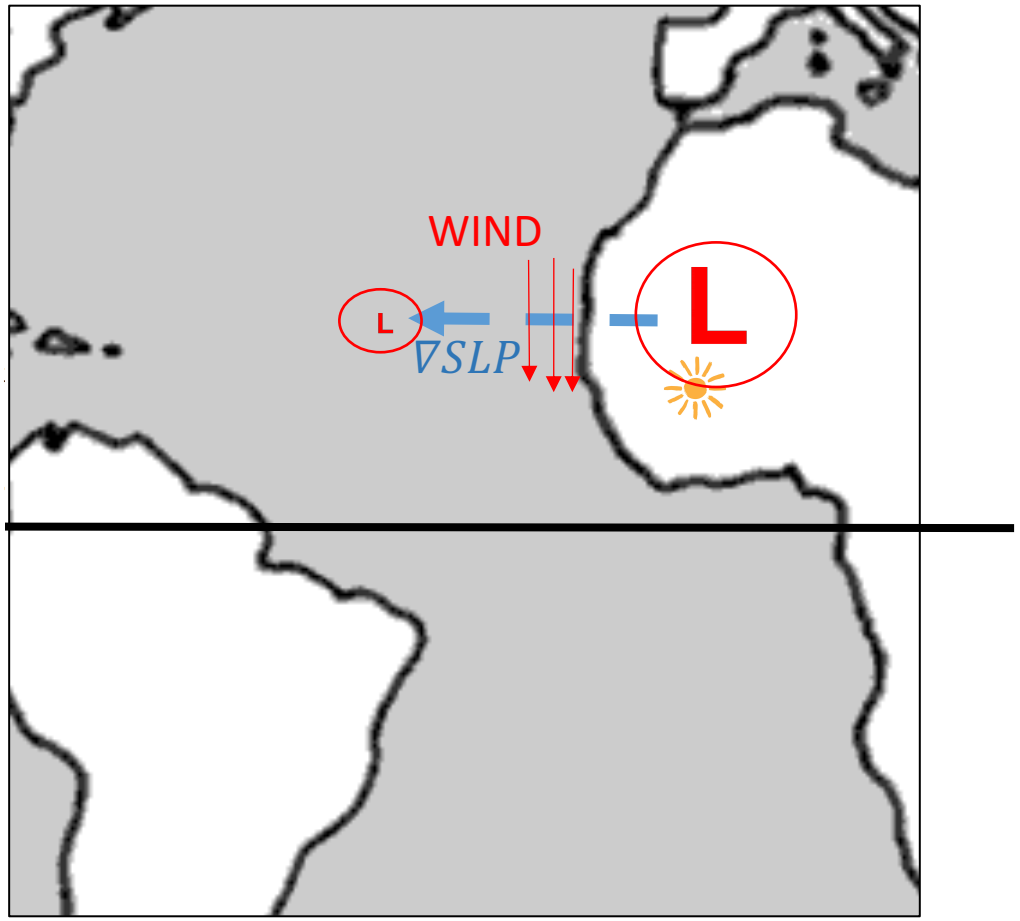


Model (all 200 years)
1. ACCESS1
2. bcc-csm1
3. BNU-ESM
4. CanESM2
5. CCSM4
6. CESM1-CAM5
7. CMCC-CMS
8. CNRM-CM5
9. CSIRO-Mk3-6-0
10. FGOALS-g2
11. GFDL-ESM2G
12. GFDL-ESM2M
13. GISS-E2-H
14. GISS-E2-R
15. HadGEM2-CC
16. HadGEM2-ES
17. inmcm4
18. IPSL-CM5A-LR
19. MIROC-ESM-CHEM (100y)
20. MIROC4h
21. MIROC5
22. MPI-ESM-LR
23. MRI-CGCM3
24. NorESM1-M

Introduction

Schematic EOF1

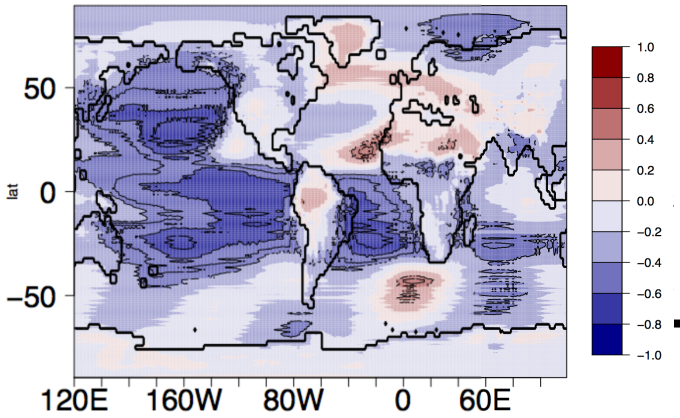


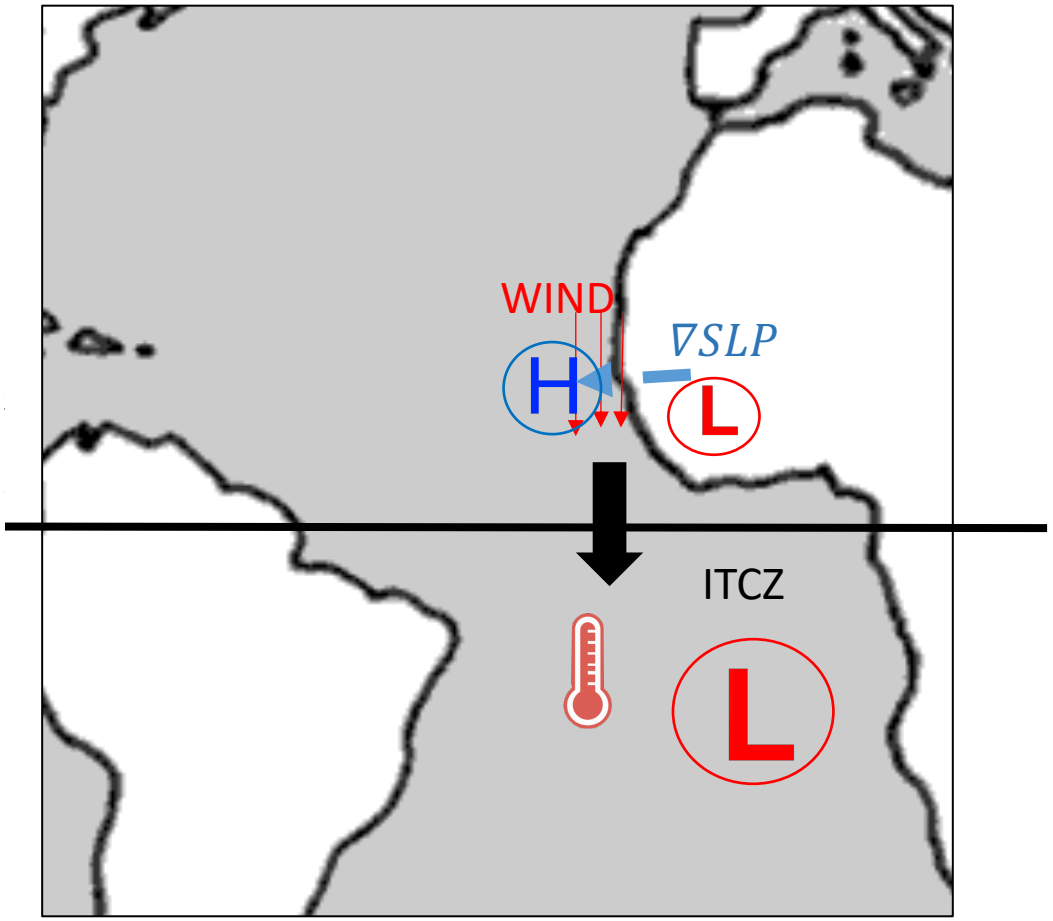


Introduction

Schematic EOF2

Corr. PC2 – SLP August





Conclusions

RQ2: WHICH GLOBAL FEATURES INFLUENCE DIFFERENCES IN WIND-DRIVEN UPWELLING REPRESENTATION IN COUPLED MODELS?

- Intermodel variability: two modes. Depend on land-sea SLP gradients.
  - 1st mode: permanent upwelling enhancement driven by excessive radiation on the continent.
  - 2nd mode: seasonal cycle inhibited by southward shifted ITCZ, driven by SH warming.

Conclusions

1) Ability of CMIP5 models to reproduce NWA upwelling seasonal cycle has been analyzed.

CMIP5 models reproduce the seasonal cycle of NWA upwelling, although they exaggerate it. However, this upwelling do not impact SSTs, due to an excessively strong thermocline.

2) Remote influences on NWA upwelling intermodel variability have been determined.

NWA excessive upwelling on CMIP5 models depends on land-sea SLP gradients, which are driven by excessive radiation on the continent (1st mode) or ITCZ shifts driven by SH warming (2nd mode).