Impact of the SST on the Low Level Atmospheric Circulation in the Gulf of Guinea

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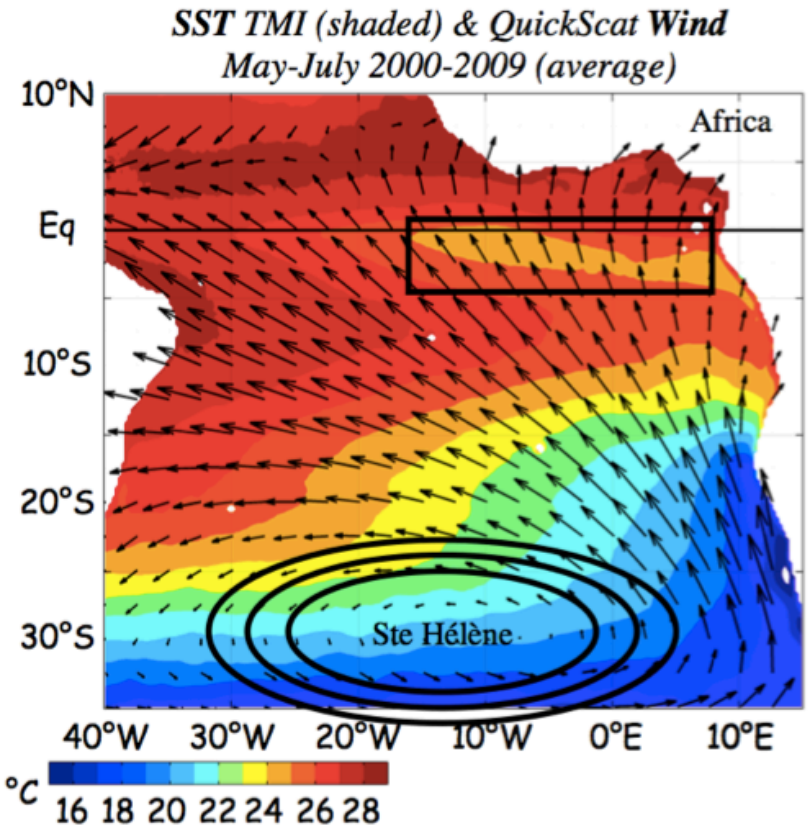
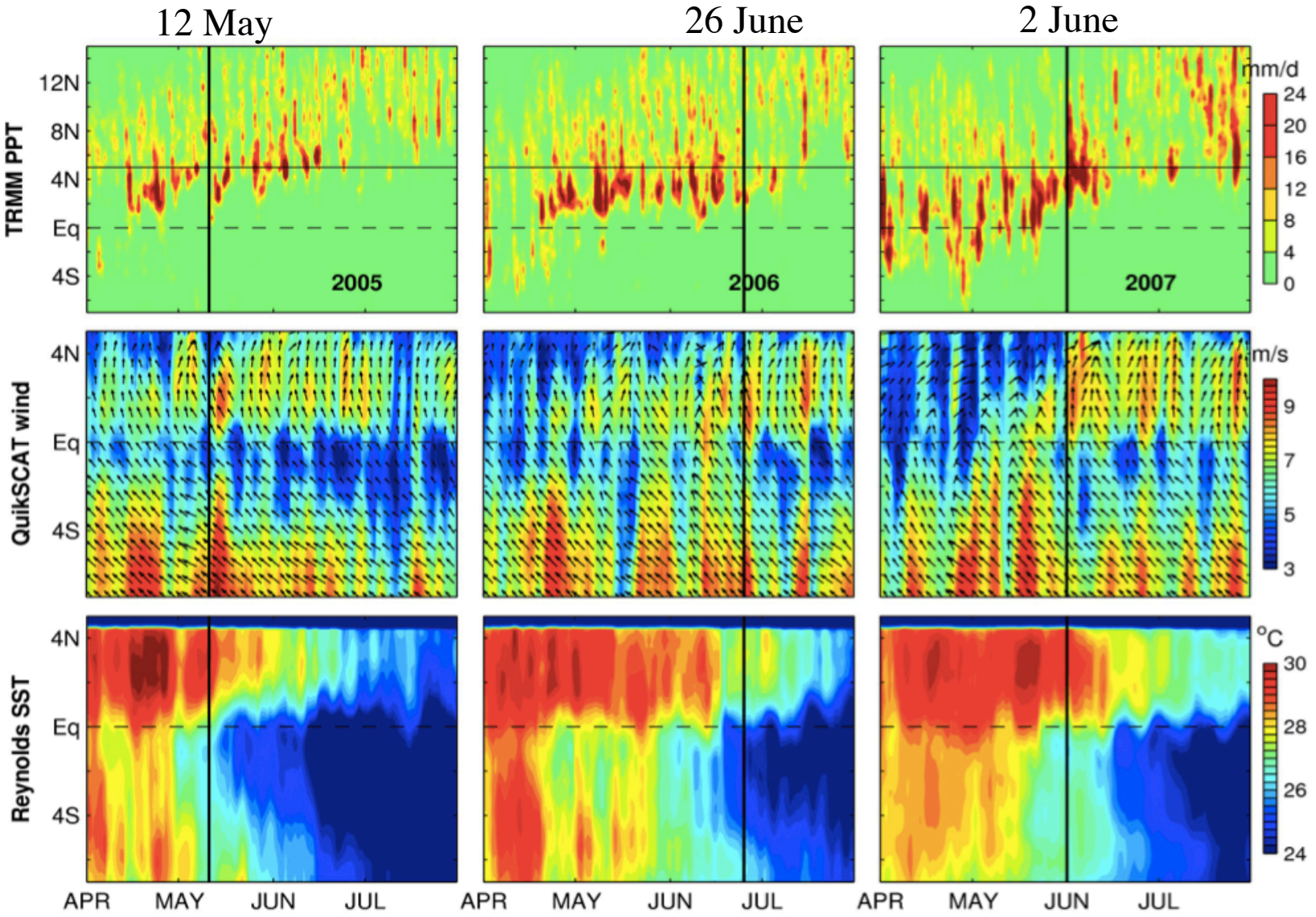


LATMOS LOCEAN LA

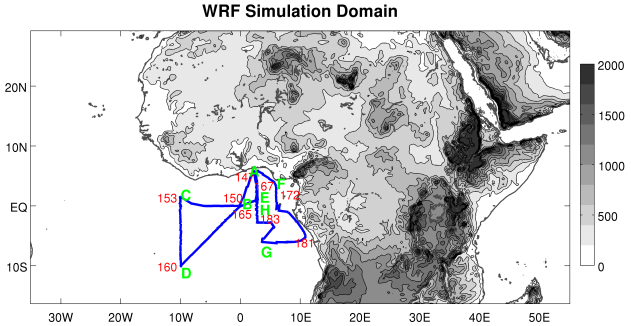
Time-latitude diagram of TRMM precipitation, QuikSCAT surface wind and Reynolds SST, averaged between 10°W-0, in May-June-July-August 2005 (left), 2006 (middle) and 2007 (right).



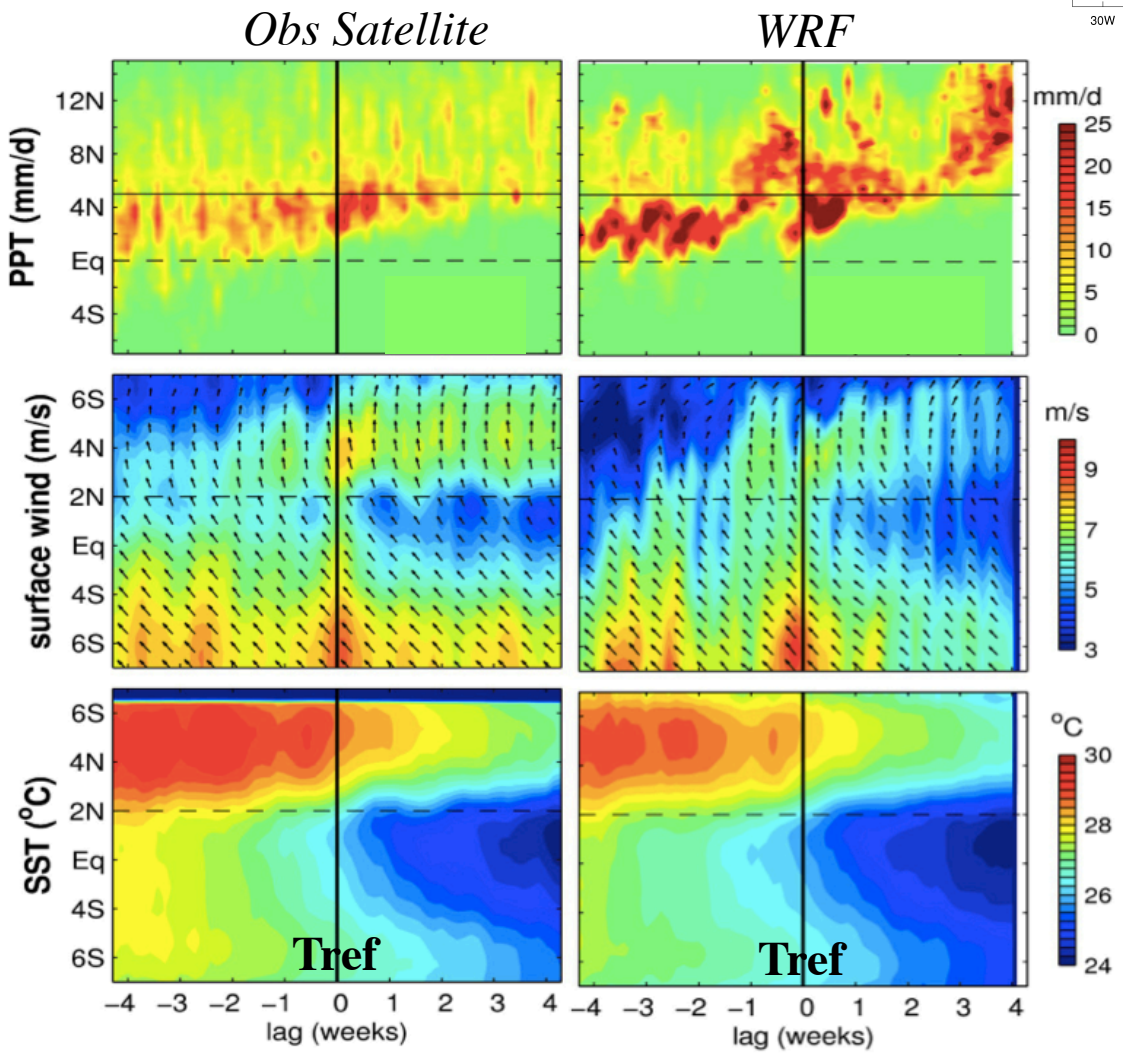
Tref = wind is stronger between the equator and the coast than further south, in the Cold Tongue.

WRF simulations with composite lateral (atmosphere) and surface (SST) forcings

Tref-4 weeks – Tref+ 4 weeks average (2000-2009)
25km x 25km / 35 vertical levels
ERA-Interim initial and lateral forcing (6h)
SST Reynolds forcing (24h)



Meynadier et al 2014, QJRMS



After **Tref**:

- Wind acceleration is found north of the SST front
- Coastal Guinean Rainfall onset

Impact on atmospheric water cycle : Precipitation and Precipitable WATer content

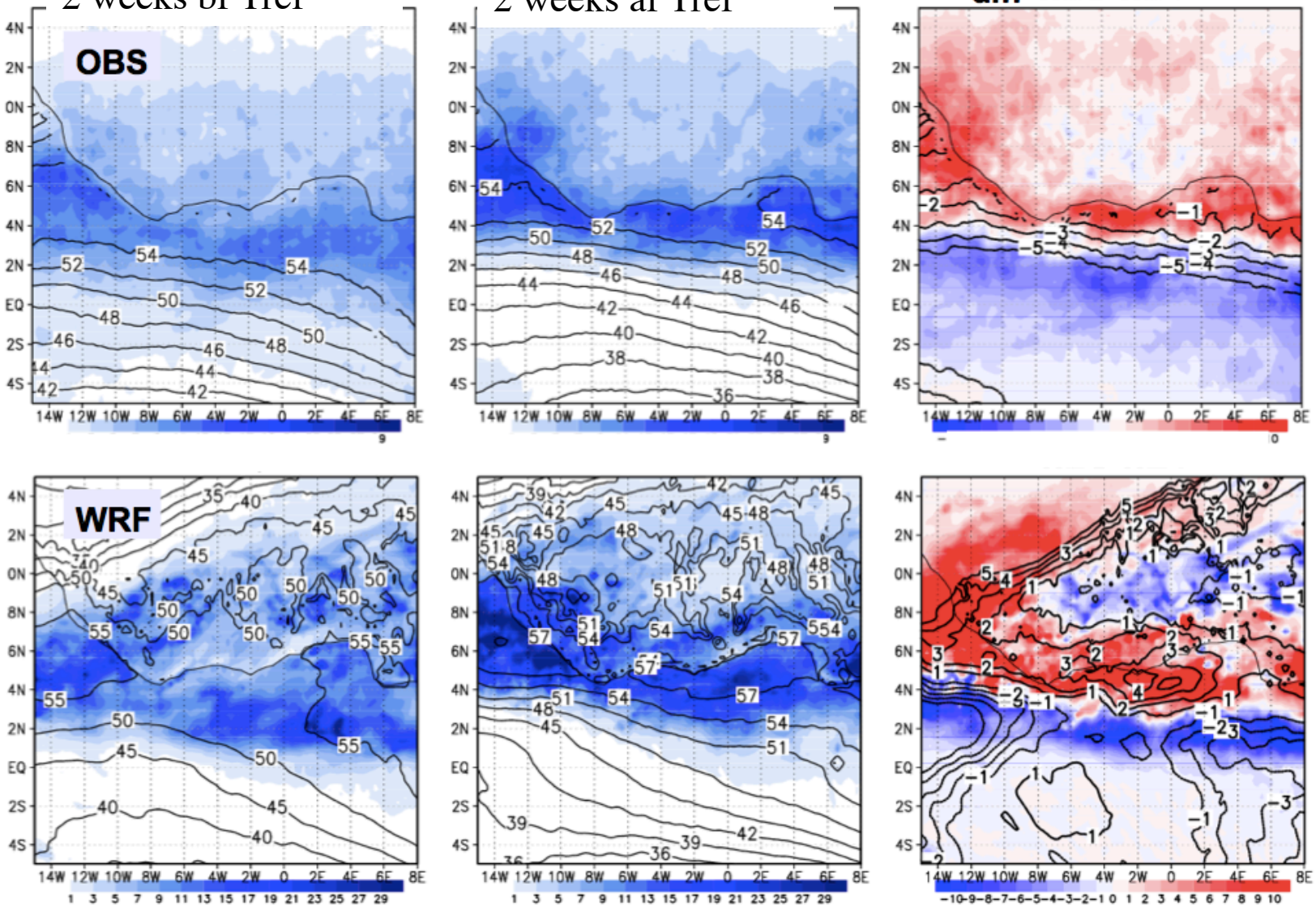
Precip (shadings, mm/d) and PWAT (black contours, kg/m2) :

2000-2009 average

2 weeks bf Tref

2 weeks af Tref

diff



New WRF simulations with *permanent* composite forcing before and after *Tref*

***Permanent* = same forcing every day for the lateral boundary (LB) and surface (SST) conditions -- 2 months-long simulations**

CTL-simulations

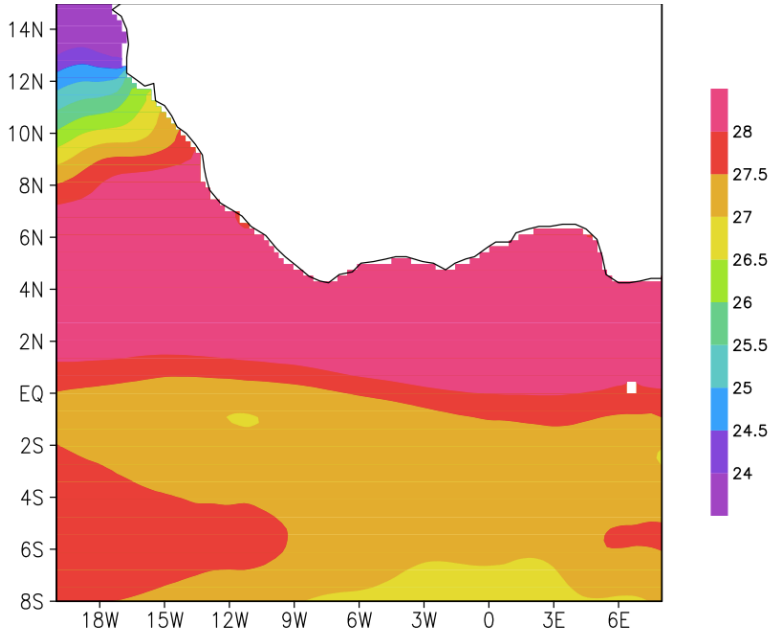
- **Case 1 *LB1_SST1* : LB and SST averaged 2 weeks before Tref (2000-2009)**
- **Case 2 *LB2_SST2*: LB and SST averaged 2 weeks after Tref (2000-2009)**

Cross-simulations

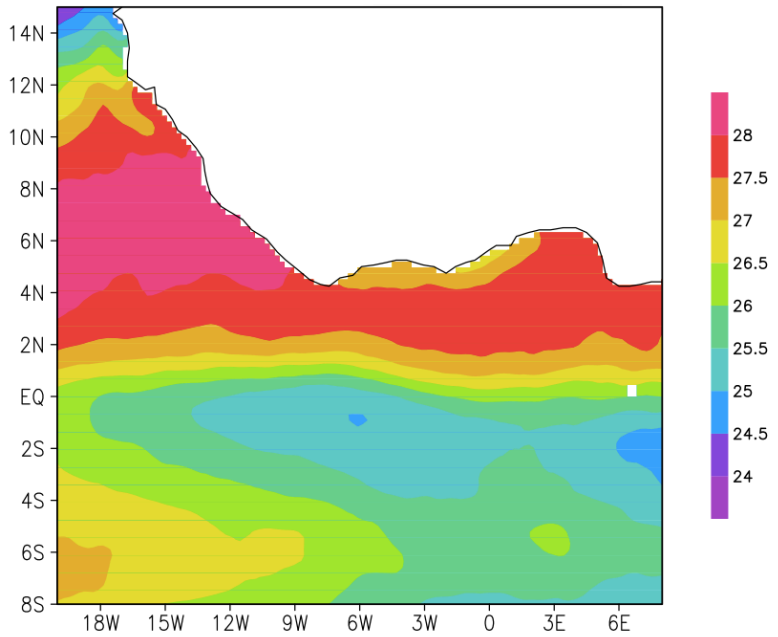
- **Case 3 *LB1_SST2* : LB (Case 1) with SST (Case 2)**
- **Case 4 *LB2_SST1* : LB (Case 2) with SST (Case 1)**

} Allow to validate the SST influence versus the external forcing influence

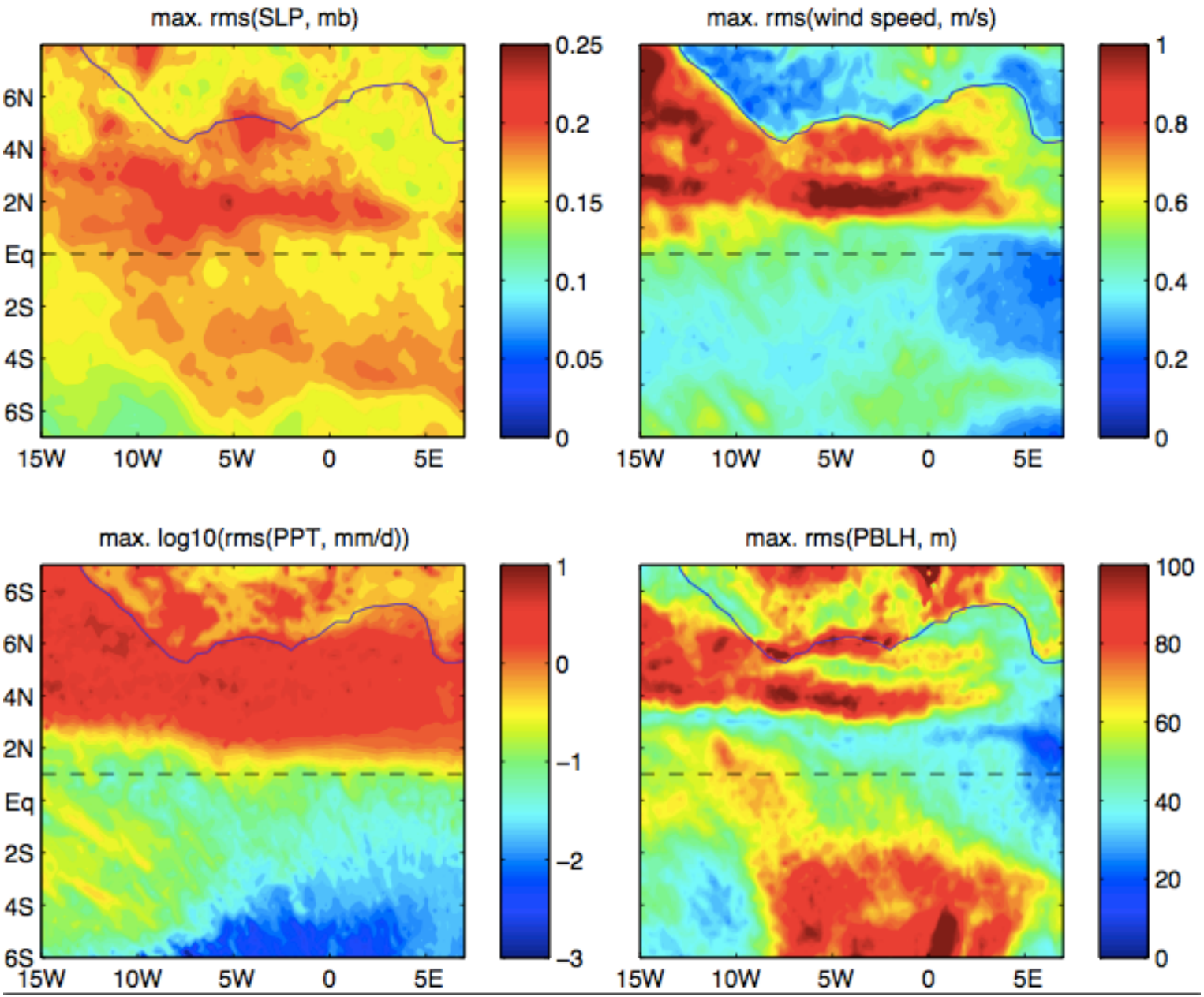
SST1 (Case 1)



SST2 (Case 2)



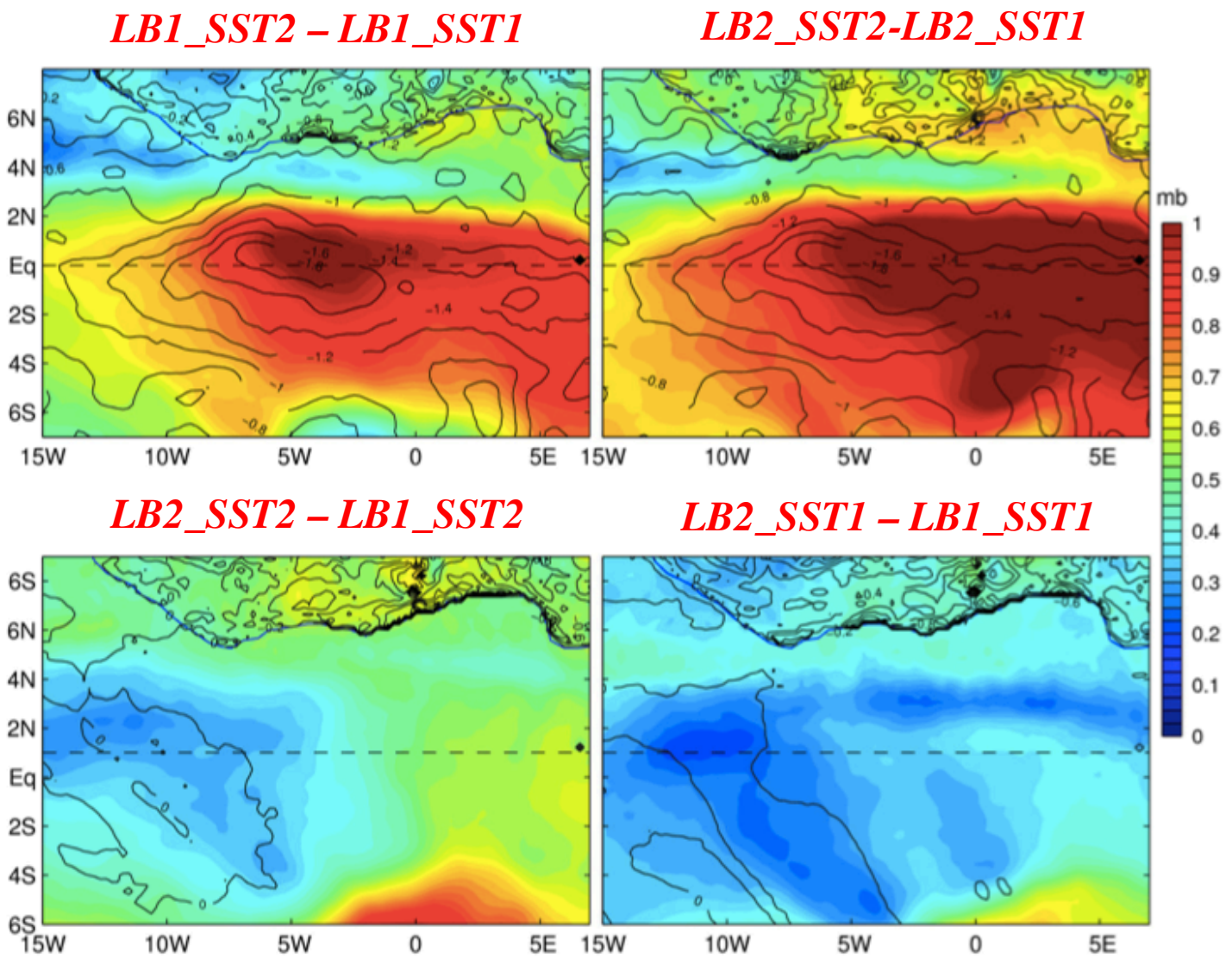
Noise level in the model



SST influence versus the external forcing : impact on SLP patterns

SST influence

external forcing influence

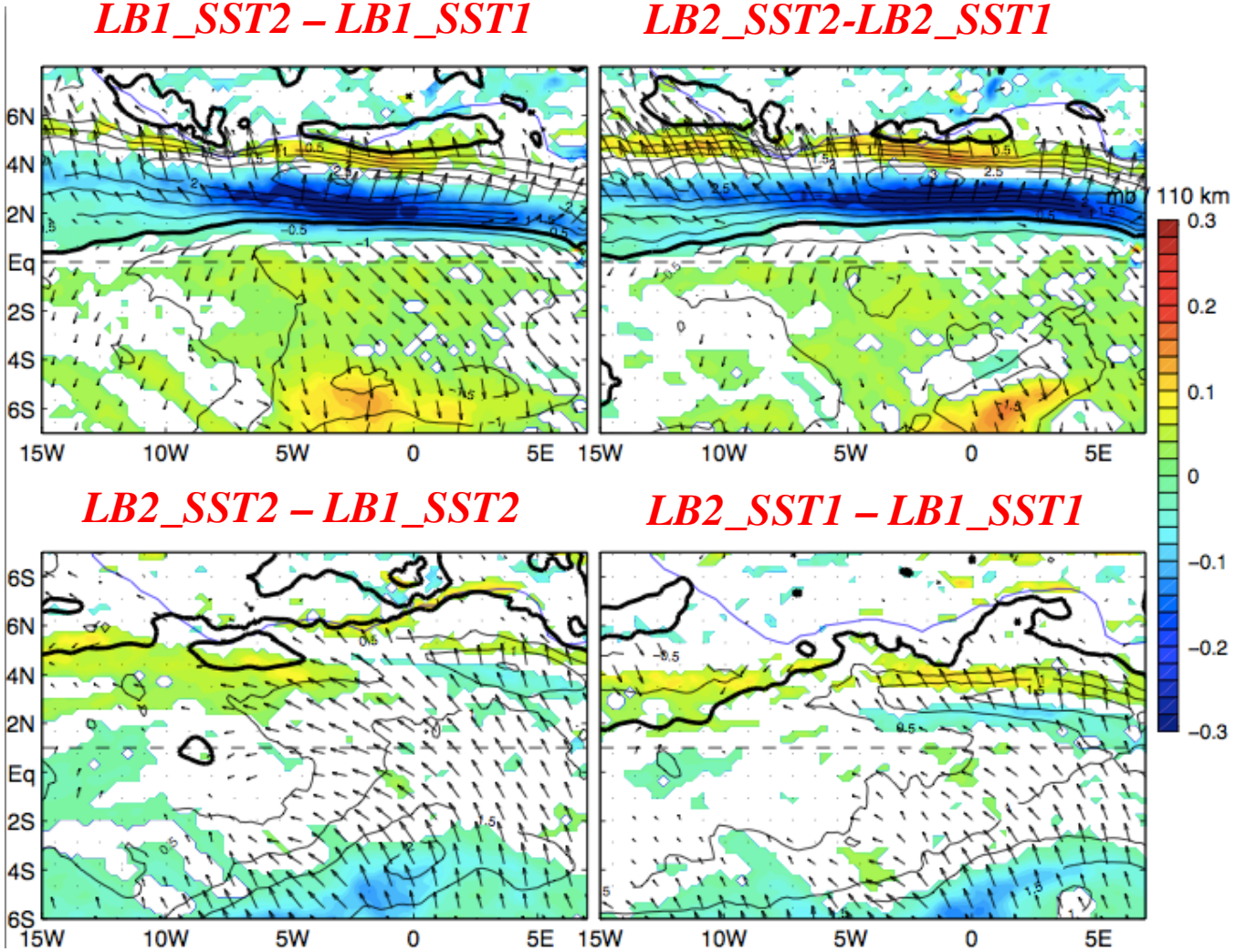


SLP (mb) shaded, SST(K) contour

SST influence versus the external forcing : impact on SLP gradients & surface wind

SST influence

external forcing influence

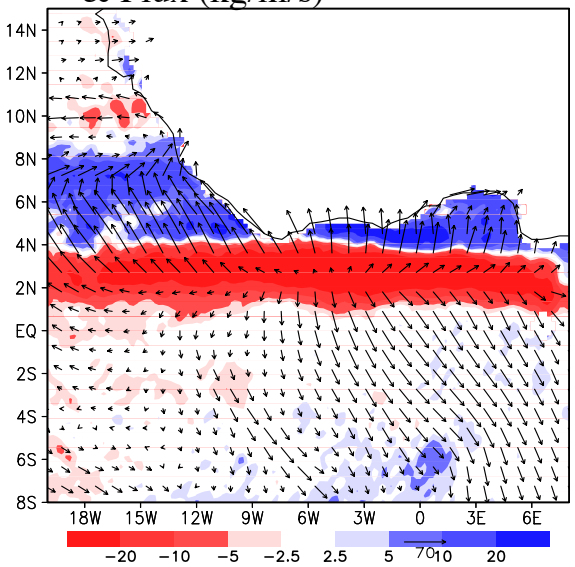


SLP meridional gradient (mb/km) *shaded*, surface wind speed (m/s) *contour*

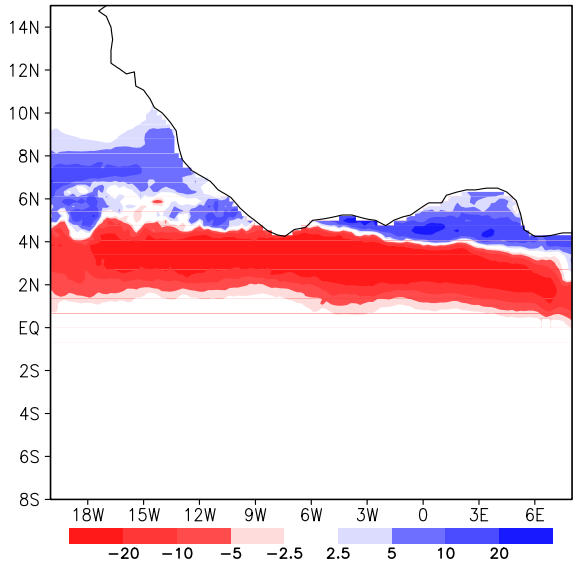
SST seasonal influence : impact on water cycle

LB2_SST2-LB2_SST1

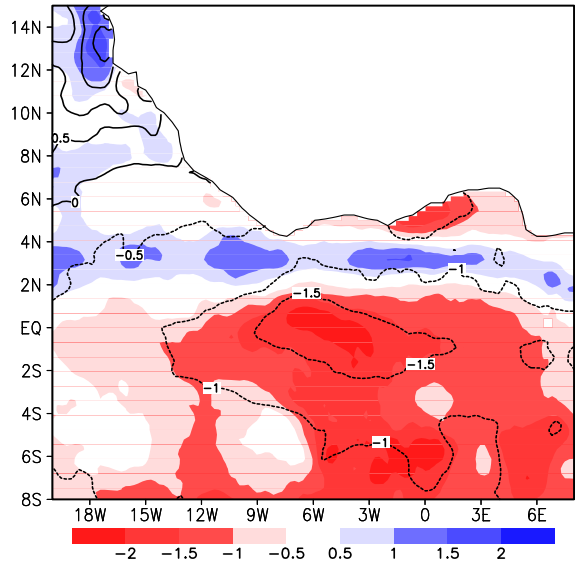
Moisture Flux Convergence (mm/dy)
& Flux (kg/m/s)



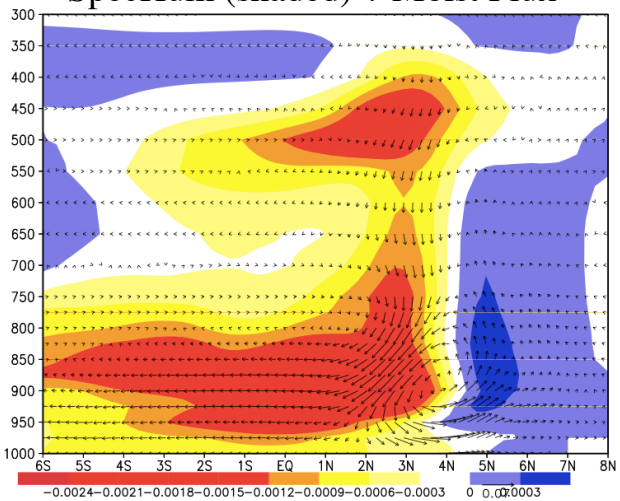
Precipitation (mm/dy)



Evaporation (mm/dy)
& SST (K) (contour)

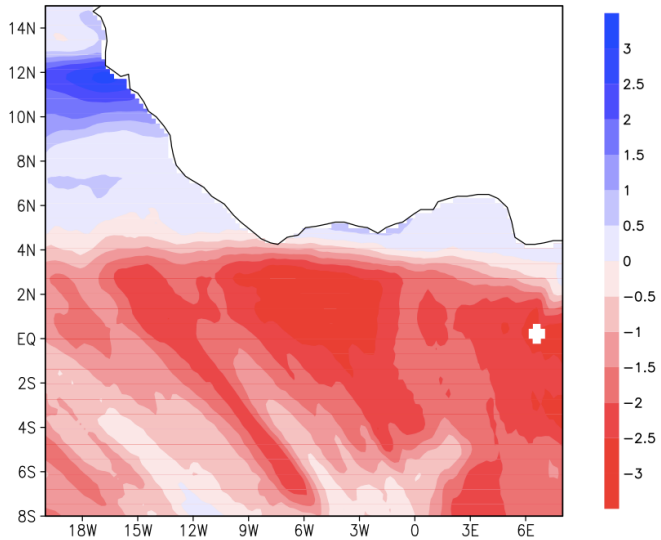


SpecHum (shaded) + Moist Flux



Cross section 10W-5E averaged

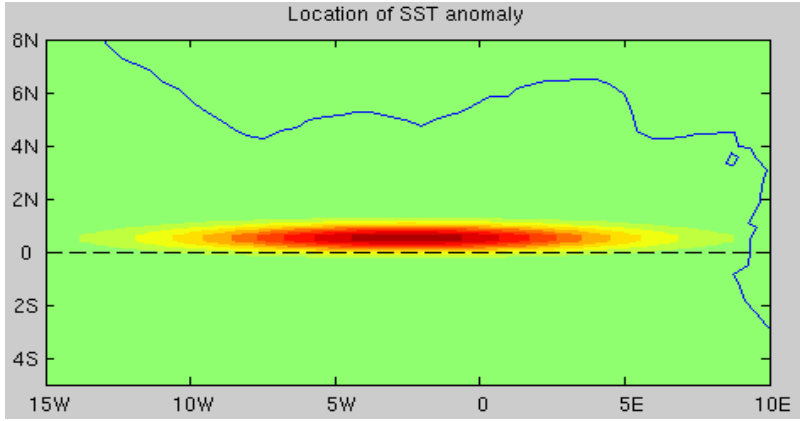
Precipitable water (kg/m2)

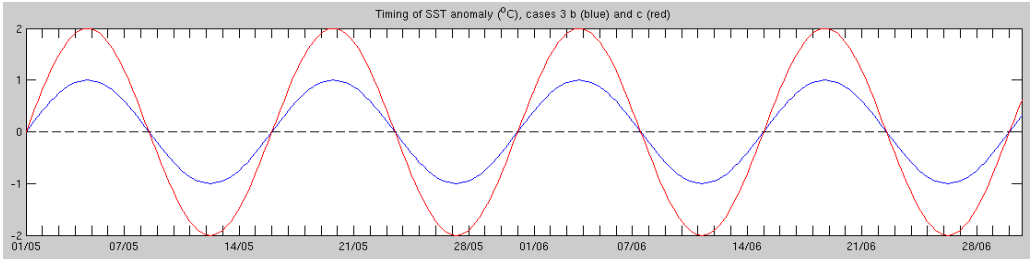


Conclusion & Perspectives

- WRF regional model useful and accurate tool to estimate atmospheric response to SST front in Gulf of Guinea
- Cross-simulations show that the seasonal SST influence on the low-level dynamics is very important way more than the external forcings.
- Impact is especially strong on surface wind speed and direction through changed SLP gradients
- It then has a strong impact on low-level moisture fluxes and surface evaporation changing moisture convergence and THEN precipitation patterns

To fully explain the underlying mechanisms we plan to do WRF simulations where :





WRF parameterizations set-up:

- Cumulus : **Betts Miller Janjic**
- PBL : **Yonsei University YSU**
- Radiation : **RRTMG**
- Microphysics : **WSM 6-class**
- Surface Layer : **Monin Obukhov**
  Eta scheme