1. Introduction

Strong ocean-atmosphere coupling in the western tropical Atlantic Ocean:

- Due to the presence of warm waters (over 28°C)
- Development of deep-convection
- Heaty precipitations below the Inter-Tropical Convergence Zone (ITCZ)

To study this coupling: implementation of a high resolution (~25 km) ocean-atmosphere coupled configuration of the tropical Atlantic basin (15°S to 25°N)

Models: NEMO 4.0 for ocean, WRF 3.7.1 for atmosphere, OASIS3-MCT 3.0 as coupler (NOW model, Samson et al., 2014). Grid: Mercator projection.

Here, we present a sensitivity testing of WRF parameterizations and a comparison of the simulations with observations.

2. Method

Simulations between 2000 and 2003 (spin-up: 1 year)
Tests conducted only on the atmospheric model (the oceanic model parameters remained the same).

Three main parameters were tested:
- the longwave (LW) and shortwave (SW) radiation schemes, and the Planetary Boundary Layer (PBL) scheme. The microphysics and convection schemes remained identical; we chose WSM6 for microphysics and Betts-Miller-Janjic for convection schemes (Meynadier et al., 2014).

The table below summarizes the different tests:

<table>
<thead>
<tr>
<th>Run</th>
<th>LW</th>
<th>SW</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Yonsei University</td>
<td>New Goddard</td>
</tr>
<tr>
<td>2</td>
<td>Yonsei University</td>
<td>RRTMG</td>
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<tr>
<td>3</td>
<td>Yonsei University</td>
<td>RRTM</td>
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<tr>
<td>4</td>
<td>Asymmetric Convective Model 2</td>
<td>New Goddard</td>
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<tr>
<td>5</td>
<td>Asymmetric Convective Model 2</td>
<td>RRTMG</td>
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<tr>
<td>6</td>
<td>Asymmetric Convective Model 2</td>
<td>RRTM</td>
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</tbody>
</table>

Table 1: Description of the tested parameterizations

3. Results

Comparison of the different simulations for several variables (zonal and meridional sections):

Fig. 2: South-North sections, mean between 20°W and 40°W of a) Sea Surface Temperature, b) Sea Surface Salinity, c) Precipitation, d) Net Shortwave Radiation, e) Downward Longwave Radiation, and f) Latent Heat Flux.

Fig. 3: West-East sections, mean between 0°N and 20°N of a) Mixed Layer Depth and b) Barrier Layer Thickness.

4. Conclusion

Sensitivity testing of WRF parameterizations and comparison with observations show us:

- Good spatial representation of SST, SSS and precipitation, but heat fluxes not well represented (especially shortwave and latent heat fluxes)
- High sensitivity to the PBL and radiative schemes
- Need for further testing: consideration of parameterized clouds in the radiative scheme (test of a new WRF version)

Next step: use of this configuration to investigate the influence of salinity stratification on the air-sea interactions. Indeed, ITCZ + Amazon plume induce a very strong salinity stratification, with possible feedback on the SST, convection and precipitation (Krishnamohan et al., 2010). This feedback loop has the potential to alter the climate of the whole Atlantic sector (Jähfer et al., 2017).

References