Role of the remote and local wind stress forcing in the development of the warm SST errors in the South-Eastern Tropical Atlantic in a coupled high-resolution seasonal hindcast

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This study is a part of the EU-FP7 PREFACE project, which aims, among other objectives, at better understanding physical mechanisms responsible for the development of the systematic warm SST biases in the Tropical South-Eastern Atlantic (SETA) region in climate models. Here, we analyse processes involved in the setting of the SETA bias in a high resolution version of the CNRM-CM coupled model, based on full-field initialized seasonal hindcasts starting on 1\textsuperscript{st} February over the period 2000-2009.

The SETA bias starts to grow from the first days of the hindcast, reaches its maximum in April-May and decay in June-July. Whereas the initial SST growth is likely associated with local atmospheric forcing, its further development is due to remote oceanic processes. Indeed, a mixed layer heat budget analysis in the SETA indicates a spurious warm ocean horizontal advection, observed as far as south of 25\textdegree S, that peaks at the begging of May. This is related to propagations of coastal-trapped Kelvin waves induced at the equator by anomalous westerly wind bursts associated with the equatorial bias of the atmospheric model. A sensitivity experiment with the wind stress corrected over the equatorial region suggests that the equatorial wind error explain more than 50\% of the SETA SST bias. Correcting the equatorial wind stress also allows a significant improvement of the mixed-layer heat budget locally and, consistently, a reduction of the SST bias in the ATL3 region by 45\%.

Comparison with a lower resolution version of the model suggests that increasing the resolution does not allow to significantly improve the SST biases in the Equatorial Atlantic and SETA region. However, a strong reduction of the bias in the high-resolution version is observed locally over the near-coastal Southern Benguela region and is due to better representation of fine-scale atmospheric and oceanic processes controlling the coastal upwelling.