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On the impact of the resolution on the surface and subsurface Eastern Tropical Atlantic warm bias

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The tropical variability has a great importance for the climate of adjacent areas. Its sea surface temperature anomalies (SSTA) affect in particular the Brazilian Nordeste and the Sahelian region, as well as the tropical Pacific or the Euro-Atlantic sector. Nevertheless, the state-of the art climate models exhibits very large systematic errors in reproducing the seasonal cycle and inter-annual variability in the equatorial and coastal Africa upwelling zones (up to several °C for SST). Theses biases exist already, in smaller proportions though, in forced ocean models (several 1/10th of °C), and affect not only the mixed layer but also the whole thermocline.

Here, we present an analysis of the impact of horizontal and vertical resolution changes on these biases. Three different DRAKKAR NEMO OGCM simulations have been analysed, associated to the same forcing set (DFS4.4) with different grid resolutions: “REF” for reference (1/4°, 46 vertical levels), “HH” with a finer horizontal grid (1/12°, 46 v.l.) and “HV” with a finer vertical grid (1/4°, 75 v.l.). At the surface, a more realistic seasonal SST cycle is produced in HH in the three upwellings, where the warm bias decreases (by 10% - 20%) during boreal spring and summer. A notable result is that increasing vertical resolution in HV causes a shift (in advance) of the upwelling SST seasonal cycles. In order to better understand these results, we estimate the three upwelling subsurface temperature errors, using various in-situ datasets, and provide thus a three-dimensional view of the biases.