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An assessment of marine biogeochemical processes in the tropical Atlantic in NorESMs

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Most state-of-the-art earth system model still exhibit large biases in the tropical Atlantic. This study aims to investigate how the physical bias influences the marine biogeochemical processes in the tropical Atlantic using Norwegian Earth System Model (NorESM). We assess four different configurations of NorESM: NorESM version 1 is taken as benchmark (NorESM-CTL), a version of this model with a physical bias correction using anomaly coupling (NorESM-AC), and NorESM version 2 with low and medium atmospheric resolution (NorESM-LM/NorESM-MM) is also utilized.

With respect to NorESM-CTL, the annual-mean sea surface temperature (SST) bias is improved largely in NorESM-AC and NorESM-MM in the equatorial Atlantic and southeast Atlantic. On the other hand, the improvement of seasonal cycle of SST can be seen in NorESM-AC and the two versions of NorESM2; development of Atlantic Cold Tongue (ACT) is realistic in terms of location and timing. Corresponding to the ACT seasonal cycle, the primary production in the equatorial Atlantic is also improved and in particular, the Atlantic summer bloom is well represented in NorESM-AC and NorESM-MM even though the amount of production is still much smaller than satellite observations. This realistic summer bloom can be related to the well-represented shallow thermocline and associated nitrate supply from the subsurface ocean at the equator.