Geophysical Research Abstracts
Vol. 21, EGU2019-13967, 2019
EGU General Assembly 2019

The coupling between the ocean and the atmosphere in the equatorial Atlantic seasonal cycle

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We investigate the relevance of the ocean-atmosphere interactions in driving the seasonal cycle in the tropical Atlantic basin. We build a hybrid coupled offline model with the atmosphere and ocean components of the Norwegian Earth System model (NorESM). The atmospheric component is forced with two different observed sea surface temperature (SST): (1) global daily-climatological SST and (2) annual-mean SST in the equatorial Atlantic and daily-climatological SST elsewhere. The output of these two simulations is then used to force the ocean component and produce two new simulations (ocn_climSST and ocn_eqmeanSST, respectively) to assess the role of active ocean-atmosphere interaction in the seasonal cycle. The comparison between the two atmospheric model runs show that seasonal variations in SST strongly influence the seasonal evolution of the West African Monsoon and the ITCZ over the equatorial Atlantic Ocean. Forcing the model with equatorial annual mean SST considerably reduces the seasonal variance in the atmosphere, specially in the zonal winds in the western equatorial Atlantic. Contrastingly, the impact on the zonal winds in the central and eastern equatorial Atlantic is rather small. The ocean component captures the seasonality and amplitude of the SST for the ocn_climSST simulation. In the ocn_eqmeanSST simulation the phasing of the SST is reproduced but the variance is reduced by about 80% (50%) for the maximum (minimum) of the SST in the eastern equatorial Atlantic during boreal spring (summer). In the western equatorial Atlantic the amplitude of the SST is drastically reduced throughout the year for ocn_eqmeanSST simulation. We conclude that the coupling between ocean and atmosphere is stronger in the western than in the eastern equatorial Atlantic. We are now computing a seasonal mixed layer heat budget to identify the main drivers of the seasonal cycle of the SST with a special focus on quantifying the role of the coupling between the ocean and the atmosphere.