On the influence of GCM biases on seasonal prediction skill in the tropical Atlantic

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The link between mean state biases and the ability of models to reproduce surface wind and precipitation anomalies in the tropical Atlantic is examined using customized sensitivity tests with the SINTEX-F general circulation model (GCM) and atmosphere-only experiments from the Coupled Model Intercomparison Project Phase 5 (CMIP5). The control experiment (CTRL) for the SINTEX-F sensitivity test is a run in which SSTs are strongly restored to the optimally interpolated (OI) sea-surface temperature (SST) for the period 1982-2014. In the sensitivity experiment, called “Atl_bias”, the OI SST climatology is replaced with that of a 500-year free running control simulation with SINTEX-F. Thus the anomalies are the same as in OI SST but the climatology is that of the free-running coupled SINTEX-F model. Despite the substantial warm SST bias in Atl_bias the anomaly correlation coefficients (ACCs) of equatorial surface zonal wind and precipitation deteriorate only moderately, with some months even seeing an increase in ACC. Comparison of spatial patterns in CTRL and Atl_bias suggests that the ACC of surface zonal wind tends to increase where climatological precipitation does, regardless of whether the precipitation increase improves the bias or not. Atmosphere-only runs from the CMIP5 archive with prescribed SST warming patterns of about 4 K confirm that ACC is relatively robust to mean state SST changes. The results suggest that, in the context of atmosphere-only simulations, improving SST and precipitation biases does not necessarily improve the ACC of surface wind and precipitation. The root mean square error (RMSE), on the other hand, deteriorates significantly as warmer SST in the eastern tropical Atlantic engenders more vigorous convection and unrealistically high variability.

Keywords: GCM biases, tropical Atlantic, prediction skill

