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The tropical Atlantic Ocean receives an important freshwater supply from river runoff and from precipitation in the intertropical convergence zone. It results in a strong salinity stratification that may influence vertical mixing, and thus sea surface temperature (SST) and air-sea fluxes. The aim of this study is to assess the impact of salinity stratification on the tropical Atlantic surface variables. This is achieved through comparison among regional 1/4° coupled ocean-atmosphere simulations for which the contribution of salinity stratification in the vertical mixing scheme is included or discarded. The analysis reveals that the strong salinity stratification in the northwestern tropical Atlantic induces a significant increase of SST (0.2°C-0.5°C) and rainfall (+19%) in summer, hereby intensifying the ocean-atmosphere water cycle, despite a negative atmospheric feedback. Indeed, the atmosphere dampens the oceanic response through an increase in latent heat loss and a reduction of shortwave radiation reaching
the ocean surface. In winter, the impacts of salinity stratification are much weaker, most probably because of a deeper mixed layer at this time. In the equatorial region, we found that salinity stratification induces a year-round shoaling of the thermocline, reinforcing the cold tongue cool anomaly in summer. The concept of barrier layer has not been identified as relevant to explain the SST response to salinity stratification in our region of interest.
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