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The Impact of Tropical Atlantic SST Variability on the Tropical Atmosphere during Boreal Summer

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The interannual variability of boreal summer sea surface temperature (SST) in the tropical Atlantic displays two dominant modes, the Atlantic zonal mode highlighting SST variations in the equatorial–southern tropical Atlantic (ESTA) region and the northern tropical Atlantic (NTA) mode focusing on SST fluctuations in the NTA region except in the Gulf of Guinea. Observational evidence indicates that both the boreal summer ESTA and NTA warming are accompanied by a pair of anomalous low-level anticyclones over the western tropical Pacific, and the NTA-related anticyclone is more obvious than the ESTA-related one. Both atmosphere-only and partially coupled experiments conducted with the Community Earth System Model version 1.2 support the observed NTA–Pacific teleconnection. In contrast, the ESTA-induced atmospheric circulation response is negligible over the tropical Pacific in the atmosphere-only experiments, and although the response becomes stronger in the partially coupled experiments, obvious differences still exist between the simulations and observation. The ESTA-induced atmospheric circulation response features an anomalous low-level cyclone over the western tropical Pacific in the partially coupled experiments, opposite to its observed counterpart. It is found that the ESTA warming coincides with significantly La Niña-like SST anomalies in the central–eastern equatorial Pacific, the influence of which on the tropical atmospheric circulation is opposite to that of the ESTA warming, and therefore contributes to difference between the ESTA-related simulations and observation. Moreover, the cold climatological mean SST in the ESTA region is unfavorable to enhancing the ESTA–Pacific teleconnection during boreal summer