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Weakened impact of the Atlantic Niño on the future Guinean coast rainfall

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Much of the rainfall variability in the Guinean coast area during the boreal summer is driven by the sea surface temperature (SST) variations in the eastern equatorial Atlantic, amplified by land-atmosphere interactions. This oceanic region corresponds to the center of action of the Atlantic Equatorial mode, also termed Atlantic Niño (ATL3), which is the leading SST mode of variability in the tropical Atlantic basin. In years of positive ATL3, above normal SST conditions in the ATL3 area weaken the sea level pressure gradient between the West African lands and the ocean, which in turn reduces the monsoon flow penetration into Sahel. Subsequently, the rainfall increases over the Guinean coast area. According to observations and climate models, the relation between the Atlantic Niño and the rainfall in coastal Guinea is stationary over the 20th century. While this relation remains unchanged over the 21st century in climate model projections, the strength of the teleconnection is reduced in a warmer climate. The weakened ATL3 effect on the rainfall over the tropical Atlantic (in years of positive ATL3) has been attributed to the stabilization of the atmosphere column above the tropical Atlantic. Analysis of historical and high anthropogenic emission scenario (the Shared Socioeconomic Pathways 5-8.5) simulations from 31 models participating in the sixth phase of the Coupled Model Intercomparison Project suggests an additional role of the Bjerkness feedback. A weakened SST amplitude related to ATL3 positive phases reduces the anomalous westerlies, which in turn increases the upwelling cooling effect on the sea surface. Both the Guinean coast region and the equatorial Atlantic experiment the projected rainfall reduction associated with ATL3, with a higher confidence over the ocean than over the coastal lands.