



The impacts of inter-El Niño variability on the Tropical Atlantic and Northeast Brazil climate

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In this study, observations and numerical simulations are used to investigate how different El Niño events affect the development of SST anomalies in the Atlantic and how this relates to the Brazilian Northeast (NE) precipitation. Our results show that different types of El Niño have different impacts on the SST anomalies of the equatorial and tropical South Atlantic but similar SST response in the tropical North Atlantic. Strong and long (weak and short) El Niños with the main heating source located in the eastern (central) Pacific generate cold (warm) anomalies in the cold tongue and Benguela upwelling regions during boreal winter and spring. When the SST anomalies in the eastern equatorial and tropical South Atlantic are cold (warm), the meridional SST gradient across the equator is positive (negative) and the ITCZ is prevented (allowed) to move southward during the boreal spring; as a consequence, the precipitation is below (above) the average over the NE. Thus, strong and long (weak and short) El Niños are followed by dry (wet) conditions in the NE. During strong and long El Niños, changes in both the Walker circulation over the Atlantic and the Pacific-South Atlantic (PSA) wave train cause easterly wind anomalies in the western equatorial Atlantic, which in turn activate the Bjerknes mechanism establishing the cold tongue in boreal spring and summer. These easterly anomalies are also responsible for the Benguela upwelling. During short and weak El Niños, westerly wind anomalies are present in the western equatorial Atlantic accompanied by warm anomalies in the eastern equatorial and tropical South Atlantic; a positive phase of the South Atlantic dipole develops during boreal winter. Our simulations highlight the importance of ocean dynamics in establishing the correct slope of the equatorial thermocline and SST anomalies, which in turn determine the correct rainfall response over the NE.