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Tropical Interannual Variability Changes from a Substantial Weakening of the Atlantic Meridional Overturning Circulation

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Multidecadal fluctuation of the Thermohaline Circulation (THC) is thought to be an important driver of the observed multidecadal variability of Sea Surface Temperature (SST) in Atlantic over the 20th century as well as a modulator of El Nino-Southern Oscillation (ENSO) interannual variability. Observations have revealed that together with the multidecadal Atlantic SST change since the later 1960s is an intensified tropical Atlantic-tropical Pacific teleconnection. Nevertheless, the processes that are responsible for this multidecadal change of Atlantic-tropical Pacific connection are not fully understood. The aim of this study is to understand the tropical Atlantic interannual variability in a coupled GCM simulation and to investigate the impact of a substantial weakening of the THC on the tropical Atlantic interannual variability and its teleconnection with the Pacific basin. To this end, we analyse the Atlantic interannual variability in the coupled GCM control simulation and in a parallel "water hosing" experiment in which the THC is substantially weakened by applying anomalous external freshwater to the North Atlantic. Results suggest that in response to a weakening of the THC, there is an enhancement of ENSO variability. Significant changes in the interannual variability are also found over the equatorial Atlantic; a significant increase of variance in late spring-early summer and a significant decrease of variance in autumn-early spring. The increase of variability in spring is a consequence of a change in ENSO which affects the tropical Atlantic and the decrease of variance in autumn is due to a deeper mean thermocline which reduces upwelling and thus eliminates Bjerknes feedback. Finally, the tropical Atlantic-Pacific connection is enhanced suggesting the THC highly modulates tropical teleconnections.