Recent insights on Tropical Atlantic oceanic variability from the CCSM4 coupled climate model

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In this study we analyze important aspects of the tropical Atlantic Ocean from the new simulations of the 4th version of the NSF-DOE coupled climate model, the Community Climate System Model (CCSM4). The data used in this study is from several different simulations, among them a set of five simulations from 1980 to 2005 with different initial conditions, but similar radiative forcing. Among the features that we analyze are: the structure of the Atlantic Warm Pool in boreal summer; the main modes of sea surface temperature (SST) variability in the tropical South and North Atlantic; the density-dependent flow from the subtropics to the tropics; the variability of heat storage in the Benquela region; and the biases or differences between the model simulations and the observations in the tropical Atlantic. We observed that: the ensemble mean of the Atlantic Warm Pool in the CCSM4 is realistic when compared to observations for the period between 1980 and 2005; the ensemble mean of the Principal Component (PC) analysis shows strong agreement with the PCs from the observations; the subtropical waters in the coupled model reach the Equator mainly from the South Atlantic, whereas the ocean-only simulation also has contributions of water from the North Atlantic to the Equator; the heat budget in the Benguela region is dominated by vertical advection; and the biases in CCSM4 in the tropical Atlantic are recurrent with respect to the biases from previous versions of the CCSM, although the variability has improved.