Change of tropical ocean circulation in SODA and CMIP5

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Tropical Pacific sea surface temperature (SST) is of considerable significance to global climate, with impacts on global drought, tropical cyclone activity and biological productivity. However, observations and model results disagree about the magnitude, and even the sign, of tropical Pacific SST in response to global warming. In this study we rely on a new version of Simple Ocean Data Assimilation (SODA) that spans the period from 1871 through 2008 to investigate long-term trends of tropical Pacific SST, and possible mechanisms responsible for its variability. The ocean component of SODA is based on the Parallel Ocean Program (POP) software, and the resolution is 0.4 (longitude) x 0.25 (latitude) x 40-level (vertical) with 10m spacing near the surface. The surface forcing of the ocean model is provided from the atmospheric reanalysis 20CRv2. Results from SODA show that tropical Pacific SST cooled from 1900 to 2008, and the cooling trend is the result of an enhanced Subtropical-Tropical Meridional Overturning Circulation. The enhanced subsurface mass convergence from the subtropics to the tropics, mainly in the Southern Hemisphere, cools the eastern equatorial thermocline via increased equatorial upwelling. In order to investigate the robustness of the cooling trend of tropical Pacific SST and the possible mechanisms responsible for it, we analyze output of CMIP5 models, and compare with results from SODA. We present a comparison between SODA and CMIP5 historical integrations to identify similarities and differences and understand the differences in terms of ocean dynamics.

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