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A Prototype Two-Decade Fully-Coupled Fine-Resolution CCSM Simulation

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A fully coupled global simulation using the Community Climate System Model (CCSM) was configured using grid resolutions of 0.1° for the ocean and ice, and 0.25° for the atmospheric and land components and was run for 20 years. The component models are the Los Alamos Parallel Ocean Program 2.0 (POP2.0) and CICE4.0, and the Community Atmospheric Model 3.5 (CAM3.5) and the Community Land Model 3 (CLM3). As such, this coupled simulation represents one of the first efforts to simulate the planetary system at such high horizontal resolution, spontaneously generating much of the ocean mesoscale variability and category 4 tropical cyclones in the atmosphere. The finite volume dynamical core is used in CAM3.5. First we compare the climatology of the lower circulation of the atmosphere and the upper ocean with data to identify biases. The sea surface temperature (SST) in the North Atlantic is too cold; this basis is due to excessively strong subpolar westerly winds that advect too much cold water into the subtropical gyres via the eastern boundary currents. In the North Atlantic the anomalously low SST leads to a dearth of hurricanes, while too high SSTs in the eastern Pacific result in too many tropical systems forming in the North Pacific. The oceanic response under the track of one tropical cyclone event will be discussed in detail. Sea surface height (SSH) variability associated with Agulhas eddies indicates that the bias seen in an equivalent forced stand-alone ocean simulation where eddies follow the same too northwesterly path across the entire South Atlantic basin is alleviated. Feature tracking of these eddies using SSH anomalies from altimetry and CCSM indicate that the simulated eddy pathways in the coupled model are indeed more realistic both in terms of their more westerly direction and their mid-basin dissipation.