

Role of the AMOC in ocean heat storage and transient climate change

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Abstract:

We consider here the role of the Atlantic meridional overturning circulation (AMOC) in setting the effective heat capacity of the global ocean and, consequently, the pace of transient climate change. The depth and strength of AMOC are shown to each be correlated with the depth of heat storage across a suite of state-of-the-art general circulation models (GCMs). In those models with a deeper and stronger AMOC, a smaller portion of the heat anomaly remains in the ocean mixed layer and thus the surface temperature response is delayed. Representations of AMOC differ vastly across the GCMs, providing a major source of intermodel spread in the sea surface temperature (SST) response. An energy balance ocean model fit to the GCMs is used to demonstrate that the intermodel spread in SSTs due to variations in the ocean's effective heat capacity is significant but smaller than the spread due to climate feedbacks. We further consider the extent to which the penetration of heat into the ocean interior can be thought of as passive advection via climatological currents, and to what extent changes in AMOC modify deep ocean heat storage under global warming.