Pattern of Atlantic Multidecadal SST Variability in CMIP3 and CMIP5 models, link to AMOC, and related global impacts

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Atlantic Multi-decadal Variability (AMV), also known as the Atlantic Multi-decadal Oscillation (AMO), is characterized by a sharp rise and fall of the North Atlantic basin-wide sea surface temperatures (SST) on multi-decadal time scales. Widespread consequences of these rapid temperature swings were noted in many previous studies. Among these are the drying of Sahel in the 1960-70s and change in the frequency and intensity of Atlantic hurricanes on multi-decadal time scales. Given the short instrumental data records (about century long) the central question is whether these climate fluctuations are robustly linked with the AMV and to what extent are these connections subject to changes in a changing (warming) climate. Here we address this issue by using the CMIP3 and CMIP5 simulations for the 20th, 21st, and pre-industrial eras with IPCC models. While models tend to produce AMV of shorter periods (20-30 years) than suggested by the observations, the spatial structures of the SST anomaly patterns and their association with worldwide precipitation are surprisingly similar between models (with differing external forcing) and observations. Our results confirm the strong link between AMV and Sahel rainfall and suggest a clear physical mechanism for the linkage (meridional shifts of the Atlantic ITCZ). The results also help to clarify influences that may not be robust, such as the impacts over North America, India, and Australia.