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Atlantic Meridional Overturning Circulation: Its variability in the Community Climate System Model version 4

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An analysis of the Atlantic Meridional Overturning Circulation (AMOC) variability from the 1300-year, pre-industrial control simulation of the Community Climate System Model version 4 (CCSM4) is presented. The CCSM4 was recently released to the user community, and it contains many physical and numerical improvements in all its component models in comparison with its previous version CCSM3. In its standard configuration, all components use nominal 1 degree horizontal resolution. In general, the CCSM4 control simulation shows much less AMOC variance than was found in CCSM3. An overflow parameterization for the Denmark Strait and Faroe Bank Channel overflows contributes to this reduction in variance by maintaining stratification in the Labrador Sea Basin. In stark contrast with the 20-year - sometimes oscillatory - AMOC peak variability in CCSM3, CCSM4 AMOC has only weak spectral peaks exceeding red noise at timescales longer than 50 years. Overall, the correlations of AMOC index time series with other time series for surface temperature, boundary layer depth, etc. are mostly weaker than in CCSM3. Furthermore, our results indicate that previously proposed mechanisms for AMOC variability in CCSM3 are not applicable to the new control simulation.