AMOC in CMIP5 models: Historical and RCP simulations

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Atlantic Meridional Overturning Circulation (AMOC) from CMIP5 models are examined in this study. Following the practice used in IPCC AR4 report, we define the AMOC index as the maximum volume transport streamfunction at 30N. The multi-model ensemble mean AMOC index (averaged over 10 models, 41 realizations) shows a weak decrease of AMOC from year 1861 to 2005. Superimposed on the weak downward trend is a multi-decadal variation of the AMOC, which is anti-correlated with the modeled as well as observed AMO (Atlantic Multidecadal Oscillation) index. This anti-correlation, combined with the time history of the modeled AMOC index, suggest that surface aerosol forcing is a common factor driving changes in both the AMOC and AMO, but AMOC strengthens under increased aerosol load while AMO cools down, or vice versa. Models available by now indicate a convergence of the simulated mean AMOC in the 20th century towards the observational estimates of 12-22 Sv; whether this converge holds true when more model data becomes available remains to be seen. Under "representative concentration pathways" RCP2.6 and RCP4.5 forcing scenarios, all models show a decrease of AMOC in the first half of the 21st century, but the majority of the models also indicate a rebound of AMOC around 2060. This recovery is more robust under RCP2.6 forcing than under RCP4.5 forcing, and the recovery rate is faster in the weaker forcing case. All available models show a continuous decrease of AMOC throughout the 21st century under RCP6.0 and RCP8.5 forcings.