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Footprint of the AMOC in future temperature change as simulated by CMIP3 and CMIP5 model ensembles.

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Performing a regression of surface air temperature on global mean temperature reveals the temperature pattern associated with climate change. This pattern can be obtained from observations by use of datasets from GISS, HCMO/CRU and NOAA. A similar pattern can be obtained from model estimates, combining historical runs and future scenario runs. Here, we compare runs from the CMIP3 ensemble, where the historical runs are extended with the A1B scenario, and from the CMIP5 ensemble where the historical runs are extended with the RCP8.5 scenario. The footprints of temperature change associated with global temperature rise thus obtained show broad similarities, but also marked model biases. Here, we investigate whether part of the model bias may be attributed to the response of the AMOC to global temperature rise. This response features a large model spread, and as a result, large uncertainty in its projection on the global temperature field. To this end a bivariate regression of surface temperature to both global mean temperature and an AMOC index has been performed for the CMIP3 and CMIP5 model ensembles. The footprint of global mean temperature rise is now separated in a more purely radiative-forced pattern, void of the cold spot in the North Atlantic, and an AMOC-associated footprint, not unlike the AMO pattern. Assuming that this pattern is realistically simulated by the model ensembles allows for an inverse estimate of the AMOC-decline projected on the observed pattern of surface temperature change. This provides us with a powerful metric to validate the AMOC response in coupled climate models.