The fate of water vapor over the Atlantic and variations in the AMOC

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Coupled relationships between the interannual variability in Atlantic meridional overturning circulation (AMOC) and the atmospheric water cycle are examined in the Community Earth System Model version 1.2 (CESM1.2) simulation using water tracers in the atmosphere. We examine connections between the strength of the AMOC and: i) the origins of waters that fall on the north and south Atlantic, ii) cross-equatorial moisture transport in Atlantic-basin, and iii) the hydrologic cycle in the Pacific basin. We utilize the water-tagging capability in CAM5.3, the atmosphere component of CESM1.2, to trace the path of all aspects of the atmospheric water cycle. This capability is implemented in a CESM1.2 1850's 30-year control simulation. Water is tagged in 10 degree latitude bands in each ocean basin. Water originating over land is tagged by the continent of origin. We regress the AMOC index against fluxes of precipitation over the regions of interest on inter-annual time scales. This study offers a first look at the origin of precipitation that falls on the Atlantic Ocean in a coupled atmosphere-ocean climate model and the relationship between moisture transport and the AMOC. We show statistically-significant, linear relationships between a stronger AMOC and greater water vapor transport out of the Atlantic and into the Pacific. We quantify the reduction in water flux out of the Atlantic when the AMOC is weaker.
Our research contributes to our understanding of the feedbacks between the atmospheric hydrologic cycle and the AMOC, cross-equatorial moisture transport, and of teleconnections between the Pacific and Atlantic basins.

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