

How AMOC variations affect climate: the North Atlantic versus an interhemispheric seesaw

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The effect of AMOC variations on SST, and climate in general, is a subject of intense studies. One important aspect of this connection is whether the AMOC impacts are localized in the Northern hemisphere or extend to the Southern hemisphere as well. In particular, the Atlantic SST dipole index, designed to reflect interhemispheric seesaw changes in sea surface temperatures, has been proposed to approximate AMOC variations over the duration of the instrumental temperature record. Using control and historical simulations of the CMIP5 dataset, here we investigate whether this index provides a good proxy for AMOC variability on decadal to centennial timescales and whether in fact the SST response on these timescales is interhemispheric in nature or centered more on the North Atlantic. We find that indeed the power spectra of AMOC variations and the Atlantic dipole index share common spectral peaks in many models, and the two indices typically correlate with coefficients ranging from 0.2 to 0.8 with a few year lead. However, even for the models with the highest correspondence between the AMOC and the Atlantic dipole, the correlation between the two is mainly controlled by SST variations in the North Atlantic. Taking into consideration the South Atlantic SST does not improve this correlation, and in many cases makes it significantly worse. We conclude that on decadal to centennial timescales AMOC variations mainly affects the North Atlantic, with the SST sensitivity of the North Atlantic SST given by the CMIP5 multi-model average of about 0.3°C per 1Sv of AMOC change.

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