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Evolution of the Atlantic Multidecadal Variability in a model with an improved North Atlantic Current

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The dynamics and temporal evolution of the Atlantic Multidecadal Variability (AMV) is investigated in a coupled climate model. The model contains a correction to the North Atlantic flow field to improve the path of the North Atlantic Current, thereby alleviating the surface cold bias, a common problem with climate models, and offering a unique opportunity to study the AMV in a model. Changes in greenhouse gas forcing or aerosol loading are not considered. A striking feature of our results is the contrast between the western and eastern sides of the subpolar gyre in the model. On the western side, heat supply from the ocean plays a major role, with most of this heat being given up to the atmosphere in the warm phase, largely symmetrically about the time of the AMV maximum. By contrast, on the eastern side, the ocean gains heat from the atmosphere, with relatively little role for ocean heat supply in the years before the AMV maximum. Thereafter, the balance changes with heat now being removed from the eastern side by the ocean leading to a reducing ocean heat content, behavior we associate with the establishment of an intergyre gyre at the time of the AMV maximum. In the warm phase, melting sea-ice leads to a freshening of surface waters northeast of Greenland which travel southward into the Irminger and Labrador Sea, shutting down convection and terminating the AMV warm phase.