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# The Atmospheric Response to a Future Warming Deficit in North Atlantic SSTs

Melissa Gervais (1,3), Jeffrey Shaman (2), and Yochanan Kushnir (3)

(1) The Pennsylvania State University, State College, United States (mmg62@psu.edu), (2) Columbia University, New York, United States, (3) Lamont-Doherty Earth Observatory, Columbia University, New York, United States

In future climate simulations there is a pronounced region of reduced warming in the subpolar gyre of the North Atlantic Ocean known as the North Atlantic warming hole (NAWH). This study investigates the impact of the NAWH on atmospheric circulation and midlatitude jets within the Community Earth System model (CESM). A series of large-ensemble atmospheric model experiments with prescribed seas surface temperatures (SST) and sea ice are conducted, in which the warming hole is either filled or deepened. Two mechanisms through which the NAWH impacts the atmosphere are identified: a linear response characterized by a shallow atmospheric cooling and an increase in sea level pressure shifted slightly downstream of the SST changes; and an eddy-mean feedback response whereby the enhanced SST gradient produced by the NAWH leads to increased transient eddy activity that propagates vertically and enhances the midlatitude jet. The response to the NAWH is hemispheric in nature, impacting both the North Atlantic and North Pacific jets. The relative contributions of these two mechanisms and the details of the response are also strongly dependent on the season, time period, and warming hole strength. Furthermore, the local impacts of the NAWH on sea level pressure and the North Atlantic eddy driven jet are on the same order of magnitude as the full climate change response in the region, indicating the importance of this response. These results indicate that the NAWH plays an important role in midlatitude atmospheric circulation changes in CESM future climate simulations.