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Impact of the North Atlantic Warming Hole on Sensible Weather

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In future climate projections there is a notable lack of warming in the North Atlantic subpolar gyre, known as the North Atlantic warming hole (NAWH). The NAWH has been previously shown to contribute to a poleward shift and eastward elongation of the North Atlantic jet that constitutes an additional important driver of future changes in the North Atlantic jet using a set of large-ensemble atmosphere simulations with the Community Earth System model. The current study investigates the impact of the warming hole on sensible weather, particularly over Europe using the same simulations. North Atlantic jet regimes are classified within the model simulations by applying self-organizing maps to winter daily wind speeds on the dynamic tropopause. The NAWH is found to increase the prevalence of jet regimes with stronger and more poleward jets. A previously identified transient eddy-mean response to the NAWH that leads to downstream enhancements of wind speeds is found to be dependent on the jet regimes. These localized regime-specific changes vary by latitude and strength, combining to form the broad increase in seasonal mean wind speeds over Eurasia. Impacts on surface temperature and precipitation within the various North Atlantic jet regimes are also investigated. A large decrease in surface temperature over Eurasia is found to be associated with the NAWH in regimes where air masses are advected over the subpolar gyre. Precipitation is found to be locally suppressed over the warming hole region and increased directly downstream. The impact of this downstream response on coastal European precipitation is dependent on the strength of the NAWH.