Impact of Gulf Stream SST biases on the global atmospheric circulation

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The UK Met Office Unified Model in the Global Coupled 2 (GC2) configuration has a warm bias of up to almost 7 K, which is associated with surface heat flux biases and potentially related to biases in the atmospheric circulation. The role of this SST bias is examined with a focus on the tropospheric response by performing three sensitivity experiments. The SST biases are imposed on the atmosphere-only configuration of the model over a small and medium section of the Gulf Stream, and also the wider North Atlantic.

We show (Lee et al., 2018) that the dynamical response to this anomalous Gulf Stream heating (and associated shifting and changing SST gradients) is to enhance vertical motion in the transient eddies over the Gulf Stream, rather than balance the heating with a linear dynamical meridional wind or meridional eddy heat transport. Together with the imposed Gulf Stream heating bias, the response affects the troposphere not only locally but also in remote regions of the Northern Hemisphere via a planetary Rossby wave response. The sensitivity experiments partially reproduce some of the differences in the coupled configuration of the model relative to the atmosphere-only configuration and to the ERA-Interim reanalysis.

These biases may have implications for the ability of the model to respond correctly to variability or changes in the Gulf Stream. Better global prediction therefore requires particular focus on reducing any large western boundary current SST biases in these regions of high ocean-atmosphere interaction.

Key words: HadGEM3-CG2, sensitivity experiments, western boundary currents, vertical motion, planetary waves

References

Lee, R. W., and Coauthors, 2018: *Climate Dynamics*, doi: https://doi.org/10.1007/s00382-018-4083-9