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# North Atlantic sea surface temperatures and the structure of the atmospheric storm track

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Understanding changes in the North Atlantic atmospheric circulation, whether for climate change or seasonal-to-decadal predictions, is a challenging problem. This is due, in part, to the unique characteristics of the North Atlantic storm track which are sensitive to a complex range of forcings including land-sea contrast, orography and sea-surface temperatures (SSTs).

The impact of North Atlantic SST patterns on the storm track is investigated using a hierarchy of HadAM3 GCM simulations featuring idealized (aquaplanet) and "semi-realistic" boundary conditions. This builds on earlier work by Brayshaw et al (2009) who used this framework to examine the effects of the topography of North America. The framework allows the physical mechanisms determining the tropospheric response to North Atlantic SST patterns to be examined, both in isolation and in combination with continental-scale land-masses and orography.

In isolation, a Gulf Stream SST pattern strengthens the downstream storm track while a North Atlantic Drift warm SST anomaly weakens it. These changes are consistent with modifications to the extratropical SST gradient and near-surface baroclinicity and each storm track response is associated with a consistent change in the tropospheric jet structure. Near-surface horizontal wind convergence is locally enhanced over the warm side of strengthened SST gradients associated with ascending air and increased precipitation, consistent with previous observational studies (e.g., Minobe et al 2008). Intriguingly, however, the results suggest that relatively small changes in subtropical SST associated with much larger extratropical SST anomalies can have a significant effect on the extratropical response: the physical mechanisms for this are discussed.

When the combined SST pattern is introduced into the full semi-realistic framework (including a North American continent and the Rocky Mountains), the results suggest that the topographically generated southwest-northeast tilt in the North Atlantic storm track is enhanced. In particular, the Gulf Stream shifts the storm track south in the western Atlantic whereas the strong high-latitude SST gradients in the North East Atlantic appear to enhances the storm track in the area around Iceland.