Atlantic Sea Surface Temperatures and Winter Snowfall Along the Southern Margin of the Eastern United States Snowbelt

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ABSTRACT

A previous study identified significant correlations between winter sea surface temperature anomalies (SSTAs) off the northeast coast of the United States and winter snowfall in southern and coastal New England. A follow-up study of wider geographic scope has identified a similar snowfall-SSTA association for a region covering parts of Virginia, North Carolina, and Tennessee. The association in this region is much stronger, despite its location far inland and distant from the area of the Atlantic Ocean in question.

Furthermore, there are significant lag associations between winter snowfall and fall SSTAs, which, at some locations, are of greater significance than the contemporaneous associations.

Following falls with warm SSTs in the index region, the winter 700 mb height anomaly pattern suggests zonal flow and a more northerly storm track across the eastern U.S., while cold SST falls tend to precede winters with a more meridional flow pattern and more southerly storm track. From this study alone, it is not possible to determine to what extent, if at all, the fall SSTAs actually influence the subsequent winter atmospheric circulation. But it is possible that the coupled atmosphere–ocean system may have modes of fall–winter transition that are characterized by distinct patterns of SSTAs in the western Atlantic Ocean that are already evident in the fall.

Just how useful this lag association may be for seasonal snowfall forecasts is not clear though. At Roanoke, Virginia, the fall SSTA lag association explains roughly 25% of winter snowfall variance from 1951–1992. However, the snowiest winters of this period occurred in the 1960s, which was a decade of unusually cold conditions off the east coast of the USA, and this may have biased the result. An examination of winters since 1992 suggests that fall SSTAs in themselves may not always be a reliable predictor of winter snowfall conditions.

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