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Re-evaluating the role of solar variability on Northern Hemisphere temperature trends since the 19th century

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ABSTRACT

Debate over what influence (if any) solar variability has had on surface air temperature trends since the 19th century has been controversial. In this paper, we consider two factors which may have contributed to this controversy:

1. Several different solar variability datasets exist. While each of these datasets is constructed on plausible grounds, they often imply contradictory estimates for the trends in solar activity since the 19th century.
2. Although attempts have been made to account for non-climatic biases in previous estimates of surface air temperature trends, recent research by two of the authors has shown that current estimates are likely still affected by non-climatic biases, particularly urbanization bias.

With these points in mind, we first review the debate over solar variability. We summarize the points of general agreement between most groups and the aspects which still remain controversial. We discuss possible future research which may help resolve the controversy of these aspects. Then, in order to account for the problem of urbanization bias, we compile a new estimate of Northern Hemisphere surface air temperature trends since 1881, using records from predominantly rural stations in the monthly Global Historical Climatology Network dataset. Like previous weather station-based estimates, our new estimate suggests that surface air temperatures warmed during the 1880s-1940s and 1980s-2000s. However, this new estimate suggests these two warming periods were separated by a pronounced cooling period during the 1950s-1970s and that the relative warmth of the mid-20th century warm period was comparable to the recent warm period.

We then compare our weather station-based temperature trend estimate to several other independent estimates. This new record is found to be consistent with estimates of Northern Hemisphere Sea Surface Temperature (SST) trends, as well as temperature proxy-based estimates derived from glacier length records and

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