
Study on the long term trend of Arctic Oscillation and its driver

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Abstract

The most dominant atmospheric variability over the mid-to-high latitudes Northern Hemisphere during the boreal winter is the Arctic Oscillation (AO). It affects surface climate including surface temperature and precipitation in many industrialized and popularized regions such as East Asia and North America. Although the AO has a downward trend in the recent two decades, it has been still debated that how the AO changes under global warming. In this study, we investigate a linear trend of AO in a relatively long-term period, from the late 1950s to the recent period, using reanalysis data sets as well as atmospheric general circulation model (AGCM) experiments. As a result, it is found that the AO has a statistically significant upward trend for 1958/59-2017/18. It is also found that AGCM simulations, in which global historical sea surface temperature (SST) is prescribed, also show the same upward trend of AO. This result implies that the SST plays an important role in driving the upward trend of AO. We also conduct idealized experiments in which SSTs over different tropical regions, the Indian Ocean, western Pacific, eastern Pacific, and Atlantic, are prescribed, respectively, to investigate the role of each tropical ocean basin. As a result, it is found that the only SST forcing over the tropical Indian Ocean can drive the upward trend of AO. We further explore a physical process on how tropical Indian Ocean SST forces the upward trend of AO.

Keywords: Arctic Oscillation, Indian Ocean warming, Long term trend

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