Influence of Low-frequency Solar Forcing on the East Asian Winter Monsoon Based on HadCM3 and Observations

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In this study, we investigate the influence of low-frequency solar forcing on the East Asian winter monsoon (EAWM) by analyzing a four-member ensemble of 600-year simulations (Schurer et al., 2014) performed with HadCM3 (Hadley Centre Coupled Model, version 3). We find that the EAWM is strengthened when total solar irradiance (TSI) increases on the multidecadal time scale. The model results indicate that positive TSI anomalies can result in the weakening of Atlantic meridional overturning circulation, causing negative sea surface temperature (SST) anomalies in the North Atlantic. Especially for the subtropical North Atlantic, the negative SST anomalies can excite an anomalous Rossby wave train that moves from the subtropical North Atlantic to the Greenland Sea and finally to Siberia. In this process, the positive sea-ice feedback over the Greenland Sea further enhances the Rossby wave. The wave train can reach the Siberian region, and strengthen the Siberian high. As a result, low-level East Asian winter circulation is strengthened and the surface air temperature in East Asia decreases. Overall, when solar forcing is stronger on the multidecadal time scale, the EAWM is typically stronger than normal. Finally, a similar linkage can be observed between the EAWM and solar forcing during the period 1850–1970.

Key words: solar forcing, East Asian winter monsoon, Atlantic sea surface temperature, Rossby wave train

References

Schurer, A. P., and Coauthors, 2014: *Nature Geoscience*, **7**, 104-108.