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TITLE:
Modulation of the Arctic Oscillation by Extreme Land Surface Snow Conditions over Siberia

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ABSTRACT:
The influence of land surface snow conditions on the winter Arctic Oscillation (AO) mode is investigated using large-ensemble (20) numerical GCM simulations. A control simulation with climatological surface (land and ocean) conditions indicates that the AO is an internal mode of the Northern Hemisphere winter-time atmosphere. Satellite observations of historical autumn-winter snow conditions are applied over Siberia as model boundary conditions for two snow-forced experiments, one using the highest observed autumn snow cover over Eurasia (1976), and another using the lowest (1988). The ensemble-mean difference between the two snow-forced experiments is computed to evaluate the climatic response to Siberian snow conditions. Experiment results suggest that Siberian snow conditions exert a modulating influence on the AO mode. Furthermore, an atmospheric teleconnection pathway is identified, involving well-known wave-mean flow interaction processes throughout the troposphere and stratosphere. Anomalously high Siberian snow increases local upward stationary wave flux activity in the late autumn/early winter, weakens the stratospheric polar vortex, and causes upper-tropospheric stationary waves to refract poleward. These related stationary wave and mean flow anomalies propagate down through the troposphere via a positive feedback, which results in a downward propagating negative AO anomaly during the winter season from the stratosphere to the surface. This pathway provides a physical explanation for how regional land surface snow anomalies can influence winter climate on a hemispheric scale. The results of this study may potentially lead to improved predictions of the winter AO mode, based on Siberian snow conditions the preceding autumn.

PRESENTATION PREFERENCE:
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