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Snow-(N)AO teleconnection and its modulation by the Quasi-Biennal Oscillation

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In this study we explore the wintertime extratropical atmospheric response to fall Siberian snow anomalies, and especially the response of the North Atlantic Oscillation (NAO), using observations and two distinct atmospheric general circulation models. The role of the Quasi-Biennal Oscillation (QBO) in modulating this response is discussed by differentiating easterly and westerly QBO years. The influence of Siberian snow anomalies on the polar stratosphere is compared to the so-called "Holton-Tan" effect of the QBO in both models. In particular, we want to verify whether the easterly phase of the QBO promote a larger response to increased Siberian snow by preconditioning the state of the polar stratosphere, since such snow and QBO anomalies have coincided in recent decades when the snow-(N)AO teleconnection is statistically significant. Our simulations suggest that the response of the polar stratosphere to the QBO is of larger amplitude than the response to increased Siberian snow. Moreover, when the two forcings are included they do not interfere constructively, i.e. it does not result in a larger response than the effect of QBO alone. Our work adds to a growing body of evidence suggesting that climate models do not capture a robust and stationary snow-(N)AO relationship. The teleconnection might therefore appear as a stochastic artifact rather than a genuine atmospheric response to snow cover variability, although model biases in capturing the teleconnection moderate this interpretation.