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Influence of the Preceding Arctic Sea Ice and Eurasian Snow Cover Anomalies on the Urals Blocking during Summer

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The influence of observation preceding external forcings on the Urals blocking activity during summer is investigated, and results revealed that an Atlantic-Eurasian wave train and a positive height anomaly over the Urals is linked with the preceding Arctic sea ice concentration anomalies (SICA) and North Atlantic tripole sea surface temperature anomalies (SSTA). The mechanisms for the response are diagnosed by observation and numerical simulations with version 3.1 of the Community Atmospheric Model (CAM3.1).
The Urals atmospheric response to SICA is triggered and maintained largely by SICA-induced heating through two mechanisms. First, SICA-induced heating anomaly and the interaction between associated transient eddy forcing and low frequency flow, could excite largescale Eurasian teleconnection and height anomaly over the Urals. Second, SICA-induced heating anomaly could trigger westerly jet anomaly at the upper troposphere during winter, and its configuration with Eurasian teleconnection could further excite Eurasia snow water equivalent melt anomalies (SWEMA) and soil moisture anomalies from spring to summer, which are ultimately responsible for the height anomaly over the Urals. While, the atmospheric response to the SSTA is also investigated, results show that the diabatic heating and the transient eddy forcing are responsible for the enhancement of height anomaly over the Urals. Two sets of runs are performed for the simulation, one control run and three sensitive runs with SICA, SSTA, and SICA+SWEMA+SSTA added to the prescribed values in CAM3.1. Comparing the model response to observations suggests that, the three simulations reproduce the feedback of the external forcings upon the atmospheric circulation, but also yield some inconsistency over the North Atlantic due to the deficiency in simulating low frequency flow. Moreover, the simulated combined response is characteristic by a similar wave train cross the North Atlantic and Eurasia regions. There, the results confirm that the Urals circulation anomaly is maintained and intensified by the combined impact of preceding external forcings through two mechanisms, and thus result in an intensified Urals blocking.