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A factor controlling long-term variations of the Siberian water cycles during the past two centuries

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Among all the rivers flowing into the Arctic Ocean, the three great Siberian rivers; Lena, Yenisei and Ob, are the three largest in terms of discharge (*R*), and are sources of freshwater, organic matter and heat into the ocean. While long-term variation and trend of the *R*s have been examined in a lot of previous studies, causes of the *R* variations are still unclear. A previous study indicated the negative correlation between the Lena and Ob *R*s during the 1980s to mid-1990s and it was affected by an east-west seesaw pattern of atmospheric circulation over Siberia. Our analysis indicated that 15-year running correlations between observed *R*s of the Lena and Ob becomes weak after the mid-1990s and it was positive in mid-1950s to 1960s. The similar relationships were seen in precipitation (*P*) over the two basins. As in the observed *R*s, more long-term record of reconstructed *R*s of the Lena and Ob based on the tree-ring showed positive, negative and weak correlations in each of the epochs during the past two centuries. Interestingly, the correlations of the reconstructed *R*s tend to be distributed on the negative side. These negative correlations were associated with the east-west seesaw pattern, as in the previous study. In addition, the correlations of *P*s over eastern and western Siberia in an atmospheric general circulation model (AGCM) control simulation were distributed on more negative side compared to those in the CMIP3 multi-coupled models' simulations. The results of the AGCM and CMIP3 models reveal that the seesaw pattern frequently appears as an atmospheric internal variability over Siberia. Therefore, our results indicated that the east-west seesaw pattern as an atmospheric internal variability is a key factor controlling the long-term variation of water cycles in Siberia region.