

Study of interannual variability of the atmospheric water cycle in the Arctic circumpolar region

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The thawing depth (active layer depth) in late summer drastically deepened and the soil moisture increased from 2005 to 2008 in the middle of the Lena River Basin. This was partly due to the high rainfall in late summer, as well as the high snowfall in winter. Subsequently, permafrost-forest degradations and waterlogging has been detected in the region. To clarify whether high precipitation occurred in the past in this region, we investigate the atmospheric water cycle and water budget using archived precipitation (PREC/L) and atmospheric re-analysis data (JRA-25, JRA-55). Previous studies revealed a negative correlation in the summer atmospheric circulation pattern between the Lena and Ob River Basins. However, little is known about the atmospheric water cycles in the Arctic circumpolar region, including the Mackenzie River Basin. Hence we analyzed the interannual variability of the atmospheric water cycle in the Arctic circumpolar region, comparing the three large North Eurasian river basins (Lena, Yenisei, and Ob) and the Mackenzie river basin. The analyzed results are as follows.

1) In the highest five-year summer net precipitation in the Lena River basin during the period 1958 to 2012, significant cyclonic deviation was present from the Barents Sea towards the region across from the Yenisei and Lena. The deviation distribution of the height field and the water vapor flux from the west to the Lena river basin were significantly increased, so as to form a positive deviation of net precipitation.

2) A significant enhancement of cyclonic circulation was detected from 2005 to 2008 on the Eurasian side of the Arctic Ocean. However, anticyclones appeared over Mongolia. These probably increased the atmospheric moisture convergence over the Lena River Basin in this period.

3) A significant positive trend in the summer precipitation and the summer net precipitation appeared after 1995 between the Lena and Yenisei River Basins. On the contrary, the negative trends between the Lena and the Ob River Basins became unclear from 1993.

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