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Changes in the Lena River discharge and net precipitation over the basin during 2005-2008

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River discharge from the Lena River in eastern Siberia is one of the large sources of freshwater in the Arctic Ocean, which plays important roles for sea ice formation and the ocean conveyor belt. It accounts for about 7% of the total freshwater inflow to the Arctic Ocean including total river discharge, net precipitation (P-E) over the ocean and ocean current. In the middle part of the Lena River basin, precipitation was high during 2005-2008 and associated several drastic changes in terrestrial water cycle were observed: extended flood, deepening of active layer and so on. On the other hand the Lena River discharge at the mouth and net precipitation over the basin were also high level during the same period. In this study, we attempt to reveal relationship between the local and basin-wide changes, and those causes associated with moisture transport and large-scale atmospheric circulation.

Annual mean river discharge and net precipitation of the Lena River show strong positive correlation during the past three decades, while they have a time lag of about three months. The discharge and precipitation over the basin also show strong positive correlation during the past seven decades. These results indicate that the interannual variation of the Lena River discharge is controlled by that of the precipitation, while effects of changes in evapotranspiration and land water storage are minor.

On the monthly time scale, net precipitation is positively correlated with precipitation and moisture flux convergence over the Lena River basin. In addition, the monthly mean precipitation shows strong positive correlation with number of days (NOD) in heavy precipitation category. During 2005-2008, the precipitation was high in several months that is consistent with observed results in/around Yakutsk. The NOD was lower in 2005 and 2006 and higher in 2007 compared to the other years. This suggests that the processes associated with the high precipitation were different in each year and in each month.

In August 2005 and August 2006, both of the precipitation and moisture flux convergence are high and heavy precipitation was frequent. However contributions of moisture flux components were different in the two periods. Stationary flux convergence dominates the total flux convergence in August 2005, while transient flux convergence contributes largely to the total flux convergence in August 2006. These results indicate that the moisture transport associated with cyclone activity affects the heavy precipitation in August 2005, while the moisture transport associated with the mean flow of large-scale atmospheric circulation affects the heavy precipitation in August 2006.

In the next step, we will analyze relationships among cyclone activity, heavy precipitation and transient moisture flux (convergence). In addition, the other events of high precipitation during 2005-2008 will be our future work.

Keywords: Easern Siberia, Recent Change, River Discharge, Net Precipitation, Cyclone Activity