Geophysical Research Abstracts
Vol. 16, EGU2014-14128, 2014
EGU General Assembly 2014

River ice changes in a warming Arctic and its interaction with winter streamflow

Alexander Shiklomanov (1,2) and Richard Lammers (1)

(1) University of New Hampshire, Earth Systems Research Center, Durham, United States (alex.shiklomanov@unh.edu), (2) Arctic and Antarctic Research Institute, St. Petersburg, Russia

This work looks at the response of river ice to recent warming in the Arctic at downstream gauges on large Russian rivers flowing to the Arctic Ocean. For the Severnaya Dvina, Ob, Yenisey, Lena, Yana and Kolyma rivers we determine how river ice has changed in recent years and we try to understand the underlying causes of those changes. Long-term variability and trends in beginning and ending dates of ice events, duration of ice conditions, and maximum ice thickness were analyzed over 1955-2012. Significant changes in timing of ice events and a decrease in ice thickness were found for the five Siberian rivers. Duration of ice conditions decreased from 7 days for the Severnaya Dvina, Lena and Yenisey to almost 20 days for the Ob at Salekhard. The change in timing of ice events are consistent with changes in regional air temperature, which has significantly increased at each of these river gauges except Lena-Kusur. The primary cause of the considerable increase in maximum ice thickness was not identified. Variation of mean winter air temperature and river discharge do not correlate well with maximum ice thickness and it is assumed the influence of specific local conditions can play a more important role in ice formation at these locations.

In some regions of the Russian pan-Arctic winter river flow has increased over 40% when compared to multi-year means. We assume that the possible cause of increased winter river runoff is the reduction of barriers between subsurface water reservoirs and surface runoff due to improved drainage pathways. We hypothesize this is related to increasing winter air temperature and decreasing river ice. Using new data for river ice and discharge for small and medium size rivers in Russian pan-Arctic we have been trying to understand the interactions between winter streamflow, river ice and air temperature. Preliminary analysis has shown that with increasing of air temperature and decreasing river ice the exchange between ground and surface waters improves leading to higher runoff rates.