Geophysical Research Abstracts
Vol. 17, EGU2015-10236, 2015
EGU General Assembly 2015

Dynamics in storage-discharge relations on annual and seasonal scale in a large sub-Arctic catchment.

Stefan Ploum (1), Ype van der Velde (2), Ryan Teuling (1), and Steve Lyon (3)

(1) Hydrology and Quantitative Water Management Group, Wageningen University, Netherlands, (2) Soil, Geography and Landscape Group, Wageningen University, Netherlands, (3) Physical Geography and Quaternary Geology Department, Stockholm University, Sweden

Warming of the Arctic and sub-Arctic environment can affect the global carbon budget because tundra systems have the potential to develop from a carbon sink into a major carbon source. The transport of carbon on catchment scale is tightly related to hydrology: stream water DOC (dissolved organic carbon) and DIC (dissolved inorganic carbon) concentrations are affected by water flow paths and travel times, and these are again sensitive to shifts in temperature. In this study we investigate the effects of soil temperature and snow levels on streamflow recessions in Abiskojokken, a large sub-Arctic catchment in northern Sweden (566 km2). During a large part of the year the storage depends on the presence of soil frost and snow accumulation, which both vary annually. This means that combining hydrological groundwater theory and temperature records could learn us how sensitive storage-discharge relations are to temperature change. Because a large part of the yearly discharge occurs in spring and summer, we focused on the comparison of recessions during these seasons. We expected that soil frost early in the spring generates surface runoff and thus causes a fast catchment response. However, our results indicate that recessions in spring melt are slower than recessions in the summer. We did a second analysis on years which experienced extremities in winter duration, soil temperatures or snow level. Under certain conditions (long winters, low soil temperatures and both high and low snow levels), the recession behaviour in the spring again becomes similar to summer recessions. These results indicate recession behaviour in spring is influenced by winter conditions and that the storage-discharge relation in a sub-Arctic setting are dynamic on seasonal and annual scale. We conclude that the spatial elapse of snowmelt over the large catchment and the soil frost state are important for this dynamic storage-discharge relation. For accurate carbon export rates, it is of interest to further investigate the possibilities to estimate carbon transport from streamflow and temperature records.