Geophysical Research Abstracts
Vol. 19, EGU2017-13592, 2017
EGU General Assembly 2017

Spatio-temporal dynamics of evapotranspiration from forested, ephemeral wetlands and its implication for hydrologic connectivity in the Western Boreal Plain in Alberta, Canada

Alexander Hurley (1), Nicholas Kettridge (1), Kevin Devito (2), Kelly Hokanson (2), Rhoswen Leonard (1), Stefan Krause (1), and James Michael Waddington (3)

(1) University of Birmingham, School of Geography, Earth and Environmental Science, United Kingdom (agh514@bham.ac.uk), (2) Department of Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9, Canada, (3) School of Geography and Earth Sciences, McMaster University, Hamilton, ON, L8S 4K1, Canada

In catchments where hydrologic connectivity is predominantly controlled by storage-threshold dynamics, landscape units promoting water transmission can be crucial for overall ecohydrological functioning. In Canada's Western Boreal Plain, ephemeral wetlands surrounded by upland forests on deep and coarse, glacial deposits are examples of such units. In the sub-humid climate, their importance is exacerbated due to regional, multi-year water deficits, resulting from high evapotranspirative (ET) demand coinciding with most of the annual precipitation and its variability between years. Yet, these ephemeral wetlands frequently saturate during small rain events; hence, they likely play a key role in supplying water to adjacent and downstream systems in both dry and wet periods.

We assess factors controlling water losses from these wetlands to the atmosphere (via the soil surface and vegetation), how they change over time (i.e. throughout the growing season), and the extent to which they vary in space. Our goal is to generate process-based understanding of ET dynamics and to determine potential feedbacks that reduce ET losses, maximizing the magnitude and period over which these landscape units may act as water sources. We hypothesize that the following mechanisms enhance the ascribed water transmitting function: (1) external and internal shading reduces incident radiation and therefore available energy to drive ET; this effect increases with leaf area, but is counter-acted by interception. (2) Vegetation structure reduces turbulent exchange with air masses above the canopy, thereby decreasing humidity gradients driving ET. (3) High, near-surface soil tensions during periods of drying limit rates of evaporation. We applied a combined measurement approach to assess spatial and temporal dynamics of ET in the 2016 growing season (May - August) and gathered additional data to assess abiotic and biotic controls on ET rates. We continuously measured ET from the wetland's surface via automated, closed-dynamic chambers (CDC) and whole-tree transpiration (sap flow) of individuals within and adjacent to the wetland, and determined spatial variability with a manual CDC system across the wetland mid-season. Ultimately, this work will generate process-based understanding of ephemeral wetlands as water transmitting features. It will thereby contribute to the growing knowledge base on storage-threshold and connectivity dynamics in Western Boreal Plain catchments.