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Hydrological Connectivity: A key to improve predictions of surface water chemistry

Thomas Grabs (1), Reinert Karlsen (1), José Ledesma (2), Hjalmar Laudon (3), Jan Seibert (4), Claudia Teutschbein (1), and Kevin Bishop (2)

(1) Department of Earth Sciences, Uppsala University, Uppsala, Sweden (thomas.grabs@geo.uu.se), (2) Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden, (3) Department of Forest Ecology and Management, Swedish University of Agricultural Sciences, Umeå, Sweden, (4) Department of Geography, University of Zurich, Zurich, Switzerland

Much of the effort to understand and manage human impact on water quality is based on the view that the influence of catchment properties on water is relatively static over time and space. One way to widen this view is to define what part of the landscape is being reflected in the water at different temporal scales. This is a way of looking at terrestrial-aquatic interactions by using the concept of hydrological connectivity. Connectivity has proven itself a versatile basis for conceptualizing controls on runoff generation and water quality. We established a Riparian Observatory, which was utilized to predict the spatial and temporal variability of surface water chemistry at the landscape scale based on vertical riparian zone connectivity (1-dimensional). This representation of how different soil layers in the riparian (near-stream) zone connect to the stream as the water table fluctuates in the vertical dimension has proven useful in not only explaining, but even predicting a significant degree of variability for a variety of chemical parameters in glacial till catchments. But given that observations indicate a considerable variability of riparian-zone properties and stream network extent, we now hypothesize that all three dimensions, i.e. (1) vertical, (2) lateral and (3) longitudinal connectivity, are identifiable controls on stream water chemistry. To test this hypothesis, we expanded the Riparian Observatory longitudinally into ephemeral channels and laterally upslope to measure variations in longitudinal and lateral connectivity as well as water chemistry. We used catchment topography to advance the representation of hydrological connectivity from one to three dimensions in the Riparian Flow Integration Model (RIM). We here present evaluation results from testing the improved RIM model based on the commensurate measurements in the expanded Riparian Observatory.