Geophysical Research Abstracts,
Vol. 11, EGU2009-7926, 2009
EGU General Assembly 2009

Modelling seasonal and long-term patterns in stream dissolved organic carbon concentration in mire and forest dominated landscape elements at Svartberget, Sweden using INCA-C

M. Futter (1), S.J. Koehler (2), and K.H. Bishop (3)

(1) Macaulay Institute, Catchment Management, Aberdeen, United Kingdom (m.futter@macaulay.ac.uk), (2) Graz University of Technology, Dept. of Applied Geosciences, Graz, Austria (koehler@tugraz.at), (3) Swedish University of Agricultural Sciences, Aquatic Science and Assessment, Uppsala, Sweden (kevin.bishop@vatten.slu.se)

We present an application of the INCA-C (Integrated Catchments model for Carbon) to the Svartberget catchment in central Sweden. The INCA-C model is a catchment-scale, semi-distributed, process-based model of dissolved organic carbon (DOC) that has been used previously to simulate intra- and inter-annual patterns in surface water DOC concentration and flux in boreal and temperate forested catchments (Futter et al. 2007).
The 50 ha Svartberget catchment provides an ideal location for evaluating the performance of INCA-C as it contains two mire and upland landscape elements, where the output from each element has been monitored separately for a decade. Previous work has shown that these two landscape elements have markedly different intra-annual patterns of DOC concentration and export as well as the importance of the riparian zone in controlling surface water DOC concentration from the forested sub-catchment (Köhler et al. 2008). The 19 ha mire sub-catchment is dominated by bog communities with Scots pine in the upland areas. The 13 ha forested sub-catchment stream joins the main stem of the stream just above the confluence. It is dominated by Scots pine and Norway spruce. A third sub-catchment between the mire and the catchment outflow has a similar vegetation cover to that of the forested sub-catchment.

INCA is designed to model different landscape elements, and combine them to simulate downstream locations. Like most complex, process-based models, however, INCA-C is over-determined. Insufficient data are available to constrain all processes and pool-sizes. As a result, similar in-stream DOC concentrations may be obtained by varying either aquatic or terrestrial rate parameters. The Svartberget catchment provides an opportunity to constrain the model parameter space for the entire catchment as there is information for the two major constituent elements, forest and mire. Additionally soil solution data from the riparian zone in the forest area together with a large set of physical parameters such as water content and soil temperature allow to constrain the range of the major driving variables and quantify the riparian zone effect on DOC mobilisation.

The INCA-C model was able to capture the seasonal patterns in DOC concentration at the three sub-catchments. Using parameter sets derived from the forested sub-catchment, it was possible to constrain the simulations for the catchment outflow. The approach presented can be used in other modelling applications where data are available for multiple sub-catchments and extended to the lower lying higher order catchments. Further work is required to incorporate riparian zone dynamics into INCA-C.

M.N. Futter, D. Butterfield, B.J. Cosby, P.J. Dillon, A.J. Wade and P.G. Whitehead. 2007. Modelling the mechanisms that control in-stream dissolved organic carbon dynamics in upland and forested catchments. Water Resources Research 43, W02424, doi:10.1029/2006WR004960

S.J. Köhler, I. Buffam, H. Laudon and K.H. Bishop 2008. Climate's control of intra-annual and interannual variability of total organic carbon concentration and flux in two contrasting boreal landscape elements. Journal of Geophysical Research 113, G03012, doi:10.1029/2007JG000629.