Geophysical Research Abstracts, Vol. 9, 08141, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08141

Temporal and spatial variation of Total Organic Carbon from a boreal catchment

S.J. Köhler(1), H. Laudon (2),I. Buffam(2) , K. Bishop(2)

(1) Institute of Applied Geosciences, TUGraz, Austria.

(2) Department of Forest Ecology

Swedish University of Agricultural Sciences

(3) Department of Environmental Assessment

Swedish University of Agricultural Sciences

The understanding the short term and long term dynamics of organic carbon in both soils and streams is important for the transport of metals , acidity, the dynamics of both iron and phosphorous, biological carbon turnover in boreal ecosystems and base cation export. Highly variable concentrations in organic carbon are responsible for most of the observed variations in pH and buffering capacity in pristine boreal streams. Changes in TOC concentrations in streams and surface waters due to climate change, land use or pollution may lead to important changes in surface water chemistry with sometimes long reaching profound consequences for biota. This paper investigates the patterns of total organic carbon (TOC) from forest and mire areas in a 50 ha boreal catchment during 11 years, together with potential drivers of those patterns. TOC averaged 20 mg L^{-1}, with an annual export of 7.9 $\pm$3.9 g m^{-2} $year^{-1}$. The mean TOC on the forested, 13 ha subcatchment with no mapped wetland was 15$\pm$2.6 mg L^{-1}, (5.9$\pm$3.9 g m^{-2} $year^{-1}$) while the mean from the 19 ha mire subcatchment with 50% mire was 33 $\pm$4.4 mg L^{-1}. The areal TOC export from the forested subcatchment (7.9$\pm$3.9 g m^{-2}) was 25% less per unit area than from the mire. During spring 3.2$\pm$1.3 g m^{-2} is exported. This is ca. half of the mean annual export, and exhibited less interannual variability than was seen in the spring and autumn.

The temporal variation in TOC (10-50 mg L^{-1}) at the outlet is a mixture of sources with contrasting relationships between TOC, flow and season. Variations in TOC dur-

ing winter are low at all sites and largest during the snow melt period when most TOC export occurs. During the snow free period (June-October) variations are better correlated to flow than during spring snowmelt. Mire TOC concentrations are more stable than in the other sub-catchments with wet summers stabilizing TOC concentrations and dry summers leading to larger variations. The opposite is true for the forested sub-catchment. This spatial variation of TOC response within the catchment explains the poor relationship between flow and/or temperature and TOC for the whole catchment. There was no trend in DOC concentrations over the study period, despite a significant decrease in both SO_4^{2-} deposition and runoff concentrations. Temperature variations are of minor importance for the annual TOC, but are correlated with average monthly TOC concentrations. There was a logarithmic relationship between TOC and flow in the forested catchment which is consistent with higher flows traversing more superficial, organic rich flowpaths.