Geophysical Research Abstracts,
Vol. 11, EGU2009-8610, 2009
EGU General Assembly 2009


# Controls on the flux of Dissolved Organic Carbon (DOC) from small, shallow heathland catchments, S. Norway in summer and autumn

J. Mulder (1) and S. Haaland (2)

(1) Norwegian University of Life Sciences, Plant and Environmental Sciences, Aas, Norway (jan.mulder@umb.no), (2) Norwegian Institute for Agric. and Environ. Res., Bioforsk, Fr. A. Dahlsvei 20, NO-1432 Ås, Norway

Controls on the flux of Dissolved Organic Carbon (DOC) from small, shallow heathland catchments, S. Norway in summer and autumn

Jan Mulder1 (jan.mulder@umb.no) and Ståle Haaland1,2
1Norwegian University of Life Sciences, Dept Plant- and Environ. Sciences, Box 5003, NO-1432 Ås, Norway
2Norwegian Institute for Agric. and Environ. Res., Bioforsk, Fr. A. Dahlsvei 20, NO-1432 Ås, Norway

Abstract

Leaching of dissolved organic carbon (DOC) from soils may contribute significantly to the terrestrial carbon balance. Metabolic transformation of organic matter to DOC, and further to CO2, as well as DOC leaching depends on climatic parameters, including temperature and precipitation. Produced DOC may be stored temporarily in the soil, due to adsorption to the soil matrix. Adsorption buffers the concentration of DOC in soil water and in catchment runoff. Unfortunately, stores of adsorbed DOC are difficult to quantify by direct measurement and little is known about the dynamics of the in-situ pool size of adsorbed DOC, and its depletion and replenishment rates. The main objective of this presentation is to assess the in situ pool size of adsorbed DOC, based on DOC leaching characteristics. In addition, variations in DOC leaching and replenishment rates are assessed throughout the growing season.

The study was conducted in relatively simple systems, viz. relatively small (about 100 m2) heathland catchments at Storgama, southern Norway, altitude 450 - 600 m. About 30% of the catchment surface area is bare rock (granite), the remainder being covered by shallow organic-rich soils (Folic Histosols and Dystric or Lithic Leptosols; average soil depth 10 – 34 cm). Vegetation is dominated by heather (Calluna vulgaris L.) and by moorgrass (Molina coerulea L.) and peat moss (Sphagnum sp.) in depressions. Mean annual (1961-1990) temperature and precipitation volumes at the nearest official meteorological station (Tveitsund) are 5.7 [U+F0B0] C and 993 mm, respectively. Concentrations of DOC in runoff range between 2-5 mg l-1 after snowmelt and 10-15 mg l-1 in the growing season.

These natural catchments provide unique opportunities to conduct full scale in situ manipulation experiments involving DOC leaching in response to increased precipitation in summer and autumn. Due the thin soils, variations in water flow paths are not expected to be of major concern.

The effect of increased weekly precipitation (10 mm/week) on the accumulated flux of leached DOC was studied in two catchments between July 1 and October 15 during 2004, 2005 and 2006. Precipitation was added at night at about 4.0 mm hr-1, using a sprinkler system. Five other catchments, receiving natural precipitation only, were used as reference. Episodic studies were conducted in three catchments (75 m2, 78 m2 and 98 m2, respectively) in summer and autumn of 2005 and 2006. In autumn 2005 and summer 2006, short artificial precipitation episodes (6-10 hrs; intensity 4-7 mm/hour) were repeated with one to three weeks intervals. In autumn 2006, prolonged episodes (2 days) were conducted.

Results suggest that leaching of about 1.2 g DOC m-2 is required to cause a 50% reduction in DOC concentration

in runoff. This implies that large events are required before considerable reduction in DOC concentration in surface soils can be observed. Our data also suggest that the pool size of adsorbed DOC in the shallow soils at any time may be as little as 2-3 g m-2. This may be compared to the much larger pool sizes of soil organic carbon of about 10,000 g m-2 in these catchments. The replenishment rate of adsorbed DOC is fast and the DOC pool could be fully restored probably within days during summer. In autumn, where temperatures may get close to 0oC, more time is required, but a few weeks seem sufficient. Both pool size and replenishment rate are seasonally dependent and the adsorbed DOC pool is smallest after snowmelt in spring. During the growing season the pool of adsorbed DOC is at its maximum. Our data also suggest that under non-leaching conditions the pool size of adsorbed DOC does not increase steadily, but levels off, possibly due to conversion of DOC to less reversibly bound forms, or to further decomposition to CO2.