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Surface water chemistry - the key to assessing carbon cycle parameters in terrestrial ecosystems

Mikhail Semenov and Ekaterina Zimnik
Limnological Institute of Siberian Branch of Russian Academy of Sciences, Irkutsk, Russia (smu@mail.ru)

In areas unpolluted with mineral acids, the amount of cations released due to weathering is equivalent to the amount of hydrogen atoms incorporated into acidic groups of carbonic and carboxylic acids and, consequently, to the amount of carbon in these groups. The amount of cations derived from organic matter mineralization can serve as the basis for evaluating the CO2 emission from soil using carbon/base cations ratio in organic matter. The sum of carbon emitted as CO2 from the soil and the carbon incorporated into acid functional groups put together the total rate of organic matter oxidation. In this sudy the amounts of cations from both mineral and organic origin were estimated using only riverine water chemistry data. Estimations were based on a comparison of acid neutralising capacity (ANC) and dissolved organic carbon (DOC) ratios measured for the ice-covered and the ice-free periods. Since the groundwater contains mostly weathering products, weathering contribution to ANC in any period was assumed to be proportional to the measure of similarity of surface water chemistry in this period to groundwater/base flow chemistry. The winter base flow (the water sampled in winter from under the ice) was used as the groundwater. Groundwater is characterised by the maximum-possible ANC/DOC value or, conversely, the minimum possible DOC/ANC value among the other flows, thus the measure of riverine water and groundwater chemistry similarity can be expressed as (ANC/DOC)ice-free/(ANC/DOC)ice-covered, or (DOC/ANC)ice-covered/(DOC/ANC)ice-free. The rest of ANC is due to oganics mineralization. The highest amount of cations of organic origin was observed during mid-summer, when the maximum precipitation causing maximum lateral flow coincides with maximum temperature, which favours organic decomposition. Organic matter contribution decreases from spring to autumn, contrary to the increase in weathering contribution. In the first half of the ice-free period, this is conditioned by the optimisation of soil conditions favourable to weathering, and in the second half it is mostly due to the decrease in precipitation and, consequently, in lateral flow.