Geophysical Research Abstracts
Vol. 17, EGU2015-11535, 2015
EGU General Assembly 2015

Estimating gas exchange of CO_2 and CH_4 between headwater systems and the atmosphere in Southwest Sweden

Celia Somlai (1), Sivakiruthika Natchimuthu (2), David Bastviken (2), and Andreas Lorke (1)

(1) University Koblenz Landau, Institute for Environmental Sciences, Environmental Physics, Landau, Germany (somlai@uni-landau.de), (2) Linköping University, Department of Thematic Studies - Water and Environmental Studies, Sweden

Quantifying the role of inland water systems in terms of carbon sinks and sources and their connection to the terrestrial ecosystems and landscapes is fundamental for improving the balance approach of regional and global carbon budgets. Recent research showed that freshwater bodies emit significant amounts of CO_2 and CH_4 into the atmosphere. The extent of the emissions from small streams and headwaters, however, remains uncertain due to a limited availability of data. Studies have shown that headwater systems receive most of the terrestrial organic carbon, have the highest dissolved CO_2 concentration and the highest gas exchange velocities and cover the largest fractional surface area within fluvial networks.

The gas exchange between inland waters and the atmosphere is controlled by two factors: the difference between the dissolved gas concentration and its atmospheric equilibrium concentration, and the gas exchange velocity. The direct measurement of the dissolved gas concentration of greenhouse gases can be measured straightforwardly, for example, by gas chromatography from headspace extraction of water sample. In contrast, direct measurement of gas exchange velocity is more complex and time consuming, as simultaneous measurements with a volatile and nonvolatile inert tracer gas are needed.

Here we analyze measurements of gas exchange velocities, concentrations and fluxes of dissolved CO_2 and CH_4, as well as loads of total organic and inorganic carbon in 10 reaches in headwater streams in Southwest Sweden. We compare the gas exchange velocities measured directly through tracer injections with those estimated through various empirical approaches, which are based on modelled and measured current velocity, stream depth and slope. Furthermore, we estimate the resulting uncertainties of the flux estimates. We also present different time series of dissolved CO_2, CH_4 and O_2 concentration, water temperature, barometric pressure, electro conductivity, and pH values measured during the period of tracer injection.