Seasonal dynamics of carbon transport and CO_2 emissions in Alpine Rivers

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Rivers transport and process large amounts of carbon from terrestrial sources. The typical supersaturation of dissolved CO_2 in river water fuels considerable emissions to the atmosphere. A recent global analysis arrived at an estimate of 1.8 Pg yr^{-1} [1] and emphasized the important role of inland waters in the continental carbon cycle [2].

To improve such estimates a detailed analysis of factors governing the seasonality and spatial trends of aquatic CO_2 emissions is required. We analyzed by-weekly data collected over the last 40 years on major Swiss Rivers. The time-series allowed assessing the temporal and spatial variability of organic and inorganic carbon and the partial pressure carbon dioxide (pCO_2) in the upper Rhone and the Rhine River and some major tributaries. The regular seasonal oscillations in pCO_2 often spanned ranges from close to equilibrium to > 1000 ppm. Concentrations of dissolved CO_2 increased along the flow path. Monitoring stations along the main rivers allowed calculating C mass balances and C export from terrestrial systems. The different sub basins showed large contrasts in population density and land-use which facilitated the identification of environmental factors governing the transport of carbon and the emission of CO_2 in these river systems for the period 1974 to 2013.

[1] Raymond P.A. et al. (2013) *Nature*, **503**, 355-359 [2] Wehrli B. (2013) *Nature*, **503**, 346-347.