Geophysical Research Abstracts
Vol. 20, EGU2018-17346, 2018
EGU General Assembly 2018

Controls of organic carbon turnover and microbial growth in oligotrophic groundwater ecosystems – results from sediment flow-through microcosm experiments

Roland Hofmann (1), Jenny Uhl (2), Mehdi Gharasoo (1), Norbert Hertkorn (2), Philippe Schmitt-Kopplin (2), and Christian Griebler (1)

(1) Helmholtz Zentrum München GmbH, Institute of Groundwater Ecology, Neuherberg, Germany (christian.griebler@helmholtz-muenchen.de), (2) Helmholtz Zentrum München GmbH, Research Unit Biogeochemistry, Neuherberg, Germany

Groundwater ecosystems are low in productivity (oligotrophic), characterized by low microbial cell numbers and extremely low community growth rates. On the other hand, groundwater rarely contains less than 1-2 mg/L DOC with a small fraction always being readily biodegradable (BDOC, AOC). To uncover controls of organic carbon turnover and microbial growth and productivity, we conducted well controlled experiments in sediment flow-through microcosm fed by groundwater that was amended at various extents with DOM from soil extracts. Sorption and biodegradation of DOM was evaluated using FTICR-MS and DOC analysis. Flow cytometry and 3H-leucine incorporation was applied to follow bacterial biomass production. From DOC and bacterial biomass data bacterial growth efficiencies (BGE) were calculated and a reactive modelling of bacterial growth was conducted. Our study revealed solid evidence that oligotrophic groundwater is poor in easy degradable organic carbon and it is mainly the (poly)phenolic compounds that are slowly biodegraded. Fresh soil extract, on the other hand, contained significant amounts of carbohydrates and highly oxygenated aromatic compounds that are potentially introduced into shallow aquifers only with heavy rain events. These compounds were readily degraded and led, with a delay of days to weeks, to pronounced bacterial growth. Surprisingly, BGE were higher in experiments with the more refractory DOM compared to the fresh soil extract fed communities. As expected, microbial biomass and growth was mainly with the sediment associated communities. In conclusion, microbial growth in oligotrophic groundwater ecosystems is limited by ready available organic carbon and BGE is comparably low. Periodic input of easy degradable DOM is hardly converted into new biomass. Future studies need to focus on the interactive use of freely dissolved and adsorbed DOM, a yet ignored pool of organic carbon.