Geophysical Research Abstracts
Vol. 18, EGU2016-5508, 2016
EGU General Assembly 2016

Continuous In-Stream Assimilatory Nitrate Uptake from High Frequency Sensor Measurements

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Recently developed in situ sensors provide new opportunities to measure changes in stream concentration at high temporal frequencies that historical have not been feasible. In this study we used multi-parameter sensor measurements to relate assimilatory uptake to metabolic rates and calculate continually uptake rates for two stream reaches and a whole stream network. Two years of continues 15 min data from a forest and agricultural stream reach of the Selke river ($463 km^2$) revealed strong correlation between assimilatory uptake and GPP for the forest (r^2=0.72) and agricultural (r^2=0.56) stream reach. The slopes of these regressions were in good agreement with predicted assimilatory N-uptake based on additional metabolism data. Mean yearly assimilatory uptake rates were 6.4 times higher in the agricultural stream (mean 68.5 $mgNm^{-2}d^{-1}$, max 270 $mgNm^{-2}d^{-1}$) than in the forest stream (mean 10.7 $mgNm^{-2}d^{-1}$, max 97.5 $mgNm^{-2}d^{-1}$). Percentage daily assimilatory uptake amounted up to 47.4 % in the whole mainly agricultural watershed, whereas the total yearly assimilatory in-stream uptake was 9.0% of total nitrogen load of the watershed. This value was lower in the forest dominated upstream watershed (4.8%) and higher in the lower agriculture dominated watershed (13.4%). High frequency measurements offer exploring continues nutrient uptake metrics for streams with strongly deviating site characteristics.