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Stream-network scale patterns of CO_2 evasion

S Hengsberger (1), GA Singer (1), E Enrico (2), A Rinaldo (2), and TJ Battin (1)

(1) University of Vienna, Department of Limnology, Vienna, Austria , (2) Ecole Polytechnique Federale, Lausanne, Switzerland

The relevance of inland waters for global carbon fluxes is becoming increasingly recognized. While data on local CO_2 evasion from individual lakes and streams are now becoming available at fast pace, we still lack methods to upscale these local fluxes to the landscape and eventually to entire fluvial networks. We measured and predicted CO_2 evasion in a pre-alpine fluvial network (Ybbs River, Austria) draining a 6th-order catchment (ca 400 km2). Measurements of pCO_2 in more than 100 streams showed, not unexpectedly, CO_2 supersaturation throughout the entire network and distinct diurnal patterns. Furthermore, using whole-stream propane injections, we assessed KCO_2, the CO_2 transfer coefficient, along with various hydrogeomorphological parameters in 20 streams. We found a significant negative correlation between KCO_2 values and stream discharge, which was used to predict KCO_2 for all study streams. In combination with a digital network model, these data serve to extrapolate reach-scale estimates of CO_2 evasion to the entire fluvial network. Furthermore, we used a suite of optical parameters that describe dissolved organic carbon properties to explain the spatial variation in pCO_2 in the fluvial network.