Geophysical Research Abstracts
Vol. 18, EGU2016-14061-2, 2016
EGU General Assembly 2016

A new empirical method to predict carbon dioxide evasion from boreal lakes

Adam Hastie (1), Ronny Lauerwald (1), Gesa Weyhenmeyer (2), Sebastian Sobek (2), and Pierre Regnier (1)
(1) Belgium (Adam.Hastie@ulb.ac.be), (2) Sweden (Gesa.Weyhenmeyer@ebc.uu.se)

Carbon dioxide evasion from lakes ($F\mathrm{CO_2}$) is an important component of the global carbon budget. In this study, empirical models have been developed to predict $\mathrm{CO_2}$ partial pressure ($p\mathrm{CO_2}$) in boreal lakes at the 0.5˚ grid scale, with the aim of producing the first map of $F\mathrm{CO_2}$ from these high latitude aquatic systems. Approximately 57,000 samples of lake $p\mathrm{CO_2}$ from Sweden and Finland were used to train the models. Significant seasonality in $p\mathrm{CO_2}$ was identified and thus data were split into two categories based on water temperature; 0-4.5˚C and >4.5˚C. The lake $p\mathrm{CO_2}$ data and various globally available, environmental parameters such as elevation, terrestrial net primary production (NPP) and climate (temperature T, rainfall R) were spatially aggregated to a 0.5˚ resolution. Preliminary results from multiple regression analyses suggest that a significant proportion of the variability in boreal lake $p\mathrm{CO_2}$ can be explained using these globally available parameters. For water temperatures above 4.5˚C, the explained proportion of the variability in lake $p\mathrm{CO_2}$ is particularly high (r^2= 0.7). Following further refinement and validation, a map of estimated lake $p\mathrm{CO_2}$ for the entire boreal region will be established. This map will then be combined with lake surface area data from the GLObal WAter BOdies database (GLOWABO, Verpoorter et al., 2014), and a calculation of gas exchange velocity k to produce the first map of boreal lake $F\mathrm{CO_2}$. Finally, IPCC projections of the selected environmental predictors (T, NPP, and R) will be used to estimate future $F\mathrm{CO_2}$ from boreal lakes and their sensitivity to climate change.