B24C-07: Carbon Dioxide Evasion from Boreal Lakes: Drivers, Variability and Revised Global Estimate

Tuesday, 13 December 2016
17:30 - 17:45
📍 *Moscone West - 2008*

Carbon dioxide evasion (FCO$_2$) from lakes and reservoirs is established as an important component of the global carbon (C) cycle, a fact reflected by the inclusion of these waterbodies in the most recent IPCC assessment report. In this study we developed a statistical model driven by environmental geodata, to predict CO$_2$ partial pressure (pCO$_2$) in boreal lakes, and to create the first high resolution map (0.5°) of boreal (50°- 70°) lake pCO$_2$. The resulting map of pCO$_2$ was combined with lake area (lakes >0.01km^2) from the recently developed GLOWABO database (*Verpoorter et al.*, 2014) and estimates of gas transfer velocity k, to produce the first high resolution map of boreal lake FCO$_2$. Before training our model, the geodata as well as approximately 27,000 samples of 'open water' (excluding periods of ice cover) pCO$_2$ from the boreal region, were gridded at 0.5° resolution and log transformed where necessary. A multilinear regression was used to derive a prediction equation for $\log_{10} p$CO$_2$ as a function of $\log_{10}$ lake area, net primary productivity (NPP), precipitation, wind speed and soil pH (r^2= 0.66), and then applied in ArcGIS to build the map of pCO$_2$. After validation, the map of boreal lake pCO$_2$ was used to derive a map of boreal lake FCO$_2$. For the boreal region we estimate an average, lake area weighted, pCO$_2$ of 930 µatm and FCO$_2$ of 170 (121-243) Tg C yr^{-1}. Our estimate of FCO$_2$ will soon be updated with the incorporation of the smallest lakes (<0.01km^2). Despite the current exclusion of the smallest lakes, our estimate is higher than the highest previous estimate of approximately 110 Tg C yr^{-1} (*Aufdenkampe et al*, 2011). Moreover, our empirical approach driven by environmental geodata can be used as the basis for estimating future FCO$_2$ from boreal lakes, and their sensitivity to climate change.

Authors

Adam Todd Hastie *
Université Libre de Bruxelles

Ronny Lauerwald
University of Exeter

Université Libre de Bruxelles

Gesa A. Weyhenmeyer
Uppsala University

Sebastian Sobek
Uppsala University

Charles Verpoorter
Université du Littoral Côte d'Opale

Pierre A. G. Regnier
Université Libre de Bruxelles

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