B15B-1427 - The importance of inland water CO_2, CH_4, N_2O to summertime greenhouse gas exchange with the atmosphere in Arctic tundra lowlands

Withdrawn

Monday, 13 December 2021

23:00 - 01:00

Convention Center - Poster Hall, D-F

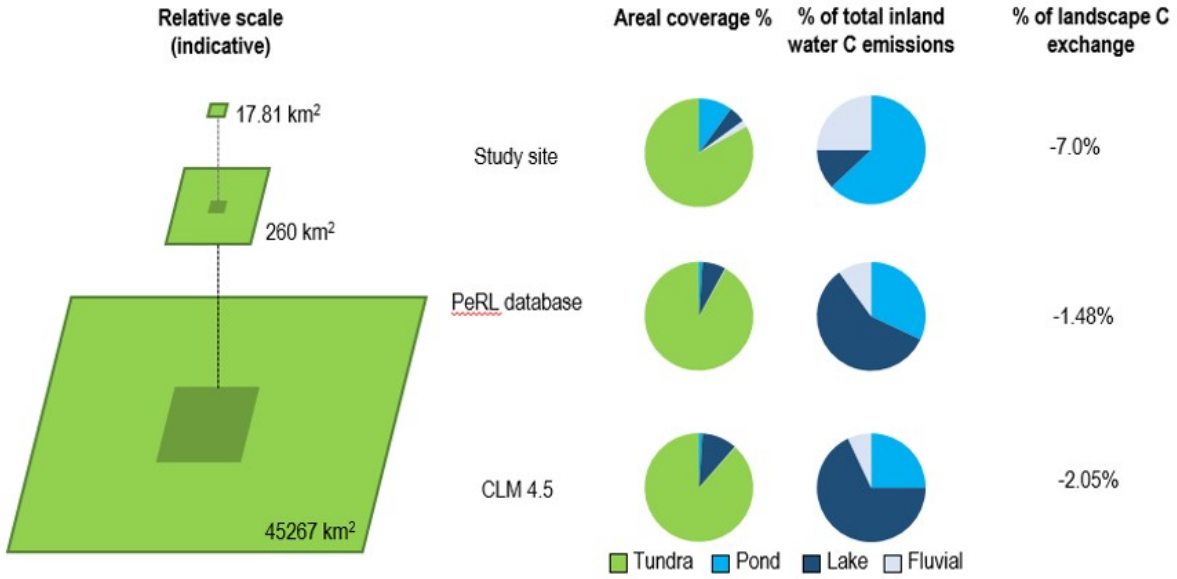
Abstract

Inland waters in Arctic landscapes have carbon and nutrient cycles that are closely coupled to terrestrial processes. These waters act as conduits of terrestrial material by transporting, actively storing and processing it, subsequently emitting greenhouse gases (GHG) carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) to the atmosphere. To quantify the role inland waters play in Arctic GHG budgets, it is necessary to quantify the importance of GHG emissions from all types of inland waters relative to the terrestrial sink capacity at the landscape scale.

Here, we present simultaneous measurements of dissolved CO_2, CH_4 and N_2O from lake, pond and low order fluvial systems across three summers in the Indigirka River lowlands, northeast Siberia (2015-2017). During May-July 2017, the region experienced a large flood of which we captured the tail end. Using remote sensing information to up-scale inland water emissions, we calculated combined carbon (C) emissions, CO_2-C and diffusive CH_4-C, that ranged from 2.6 to 2.8 Mg C d^{-1} (95% CI) during a non-flood scenario (e.g 2015-2016), and ranged from 3.6 to 3.9 Mg C d^{-1} (95% CI) during a flood scenario (e.g 2017), when an estimated 7% of the study area was flooded. Integrating these values into the landscape C exchange of the study area offset the landscape C sink during summer by 22-32%. Inland water N_2O emissions were negligible in comparison to CO_2 and CH_4 emissions, in terms of their radiative forcing, accounting for < 0.005% of landscape GHG exchange in CO_2-equivalents.

Upscaling our landscape-scale results to larger areas indicates that in the northeast Siberian Arctic tundra, inland water CO_2 and CH_4 emissions are an important component of regional carbon budgets. For example, at the scale of the output resolution of land surface models such as CLM 4.5 (~45267 km^2), our

estimate of inland water C emissions offset the landscape carbon sink by ~2%. This may warrant undertaking the complicated task of including inland water carbon processes into these large land models.



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