Towards a new understanding of carbon processing in freshwaters: methane emission hot spots and carbon burial

Von 2013-09-01 bis 2019-08-31, Abgeschlossenes Projekt

Ziel

In spite of their small areal extent, inland waters play a vital role in the carbon cycle of the continents, as they emit significant amounts of the greenhouse gases (GHG) carbon dioxide (CO2) and methane (CH4) to the atmosphere, and simultaneously bury more organic carbon (OC) in their sediments than the entire ocean. Particularly in tropical hydropower reservoirs, GHG emissions can be large, mainly owing to high CH4 emission. Moreover, the number of tropical hydropower reservoirs will continue to increase dramatically, due to an urgent need for economic growth and a vast unused hydropower potential in many tropical countries. However, the current understanding of the magnitude of GHG emission, and of the processes regulating it, is insufficient. Here I propose a research program on tropical reservoirs in Brazil that takes advantage of recent developments in both concepts and methodologies to provide unique evaluations of GHG emission and OC burial in tropical reservoirs. In particular, I will test the following hypotheses: 1) Current estimates of reservoir CH4 emission are at least one order of magnitude too low, since they have completely missed the recently discovered existence of gas bubble emission hot spots; 2) The burial of land-derived OC in reservoir sediments offsets a significant share of the GHG emissions; and 3) The sustained, long-term CH4 emission from reservoirs is to a large degree fuelled by primary production of new OC within the reservoir, and may therefore be reduced by management of nutrient supply. The new understanding and the cross-disciplinary methodological approach will constitute a major advance to aquatic science in general, and have strong impacts on the understanding of other aquatic systems at other latitudes as well. In addition, the results will be merged into an existing reservoir GHG risk assessment tool to improve planning, design, management and judgment of hydropower reservoirs.

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