Poster Presentation
Theme 3.1: Biogeochemical Processes - Processes Understanding and Human Impacts
Keywords: coupled Earth system, inland waters, dissolved organic carbon, carbon dioxide, mesocosm

Moderate effect of allochthonous organic carbon input on CO2 production in a well-buffered mesotrophic lake

Nydahl, Anna C*; Wallin, Marcus B; Tranvik, Lars J; Weyhenmeyer, Gesa A
Uppsala University, Sweden

Inland waters are important sources of carbon dioxide (CO_2) to the atmosphere due to outgassing of imported dissolved inorganic carbon (DIC) as well as mineralization of imported organic carbon. In eutrophic and mesotrophic lakes these sources may however be outweighed by fixation of CO_2 by primary production, making them net CO_2 sinks. Nonetheless, these lakes are often neglected in research on carbon processing in inland waters. Allochthonous dissolved organic carbon (DOC) input has increased in many inland waters and the effects of enhanced DOC are two-fold. Firstly, allochthonous DOC may function as a carbon source to heterotrophs, stimulating CO_2 production. Secondly, DOC contributes to water color, hence increasing light attenuation and potentially hampering CO_2 consumption by primary producers. Here we used two crossed full factorial design mesocosm experiments in Lake Erken, Sweden to test the effect of allochthonous DOC input and increased light attenuation via shading on CO_2 dynamics in mesotrophic lake water. We found that DOC input from two sources (a reverse osmosis concentrate from a headwater humic stream and HuminFeed®, an extract from Leonardite) as well as shading promoted CO_2 production. Although the DOC enrichments stimulated heterotrophic processes, we found that the regulatory effects of DOC on primary production via shading dominated the DOC effect on DIC. Furthermore, alkaline (pH ~8.3) lake water resulted in the DIC pool largely buffering variations in CO_2 from metabolism of allochthonous DOC. Despite substantial input of allochthonous DOC (5-10 mg/L) and subsequent mineralization, the relative effect on the CO_2 production was moderate and by the end of the second experiment water CO_2 concentrations were undersaturated with respect to the atmosphere in all treatments. Regardless of future increase in allochthonous DOC, we expect the CO_2 production in productive well-buffered lakes to continue to be driven mainly by autochthonous primary production dynamics. Consequently, our results could have important implications for assessments of future carbon budgets.

Poster Session (see poster session schedule)