Title: Spatial and Temporal Variations in the Partial Pressure and Emission of CO_2 and CH_4 in and Amazon Floodplain Lake

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Abstract

The Amazon floodplain contains a variety of wetland environments which contribute CO2 and CH4 to the regional and global atmospheres. The partial pressure and emission of these greenhouse gases (GHGs) varies: 1) between habitats, 2) seasonally, as the characteristics these habitats changes and 3) diurnally, in response to diurnal stratification. In this study, we investigated the combined influence of these factors on the partial pressure and emission of GHGs in Lago Janauacá, a central Amazon floodplain lake (3o23' S; 60o18' O). All measurements were made between August of 2014 and April of 2015 at two different sites and in three distinct habitats: open water, flooded forest, flooded macrophytes. Concentrations of CO2 and CH4 in air were measured continuously with a cavity enhanced absorption spectrometer, Los Gatos Research´s Ultraportable Greenhouse Gas Analyzer (UGGA). Vertical profiles o pCO2 and pCH4 were measured using the UGGA connected to an electric pump and equilibrator. Diffusive surface emissions were estimated with the UGGA connected to a static floating chamber. To investigate the influence of vertical stratification and mixing on GHG partial pressure and emissions, a meteorological station and submersible sensor chain were deployed at each site. Meteorological sensors included wind speed and direction. The submersible chains included thermistors and oxygen sensors. Depth profiles of partial pressure and diffusive emissions for both CO2 and CH4 varied diurnally, seasonally and between habitats. Both pCO2 and pCH4 were consistently higher in bottom than surface waters with the largest differences occurring at high water when thermal stratification was most stable. Methane emissions and partial pressures were highest at low water while pCO2 and CO2 fluxes were highest during high water periods, with 35% of CO2 fluxes at low water being negative. The highest average surface value of pCO2 (5491 µatm), encountered during rising water, was ~3 times higher than that encountered at low water (1708 µatm). Partial pressures and emissions of both CO2 and CH4 were greatest in open water habitats and consistently higher at night. These patterns reflected the higher levels of wind driven mixing and turbulence in open water environments and higher convective mixing at night which promoted diffusive emission.

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