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Biogeochemical Controls of CO_2 Concentrations and Fluxes in an Amazon Floodplain Lake – a Multiscale Approach

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Seasonal variations in inundation and related environmental conditions in floodplains govern carbon dioxide dynamics. Variations in CO_2 concentrations and exchanges with the atmosphere were investigated over 24 hour periods from August 2014 to September 2016 in two different regions of Lake Janauacá, an Amazon floodplain lake (3o23' S 60o18' W). Meteorological, ancillary environmental measurements, and temperature and dissolved oxygen profiles were combined with pCO_2 in surface waters and chamber estimates of air-water gas exchange. pCO_2 values varied by four orders of magnitude (6 to 66289 μatm) and were greater during the night. CO_2 emissions varied by two orders of magnitude (- 5 to 119 mmol m-2 h-1) and, in general, were greater during the day. Wind protected sites, closer to vegetated areas, had higher pCO_2 values and lower CO_2 fluxes compared to sites with more wind exposure. Inter-annual differences were mainly related to changes in herbaceous plant coverage associated with exceptionally low water levels in one year , while diel changes were related to planktonic dynamics. pCO_2 values were positively correlated with water depth and pCO_2 measured in aquatic plant mats, but inversely related to chlorophyll. Our findings demonstrate how variations in inundation govern the different biogeochemical controls of CO_2 dynamics in floodplains, and how these environments can respond to exceptional conditions.