Geophysical Research Abstracts
Vol. 19, EGU2017-13553, 2017
EGU General Assembly 2017

Diurnal variability of CO_2 and CH4 emissions from tropical reservoirs

Annika Linkhorst (1), José Reinaldo Paranaíba (2), Nathan Barros (2), Tonya DelSontro (3), Anastasija Isidorova (1), Raquel Mendonça (1,2), and Sebastian Sobek (1)

(1) Limnology, Department of Ecology and Genetics, Uppsala University, Uppsala, Sweden, (2) Department of Biology, Institute of Biological Sciences, Federal University of Juiz de Fora, Juiz de Fora, Brazil, (3) Department of Biological Sciences, University of Quebec at Montreal, Montreal, Canada

Reservoirs are important atmospheric sources of carbon dioxide (CO_2) and methane (CH4) with CH4 being a greenhouse gas (GHG) at least 28 times more potent than CO_2. Reservoir GHG emissions tend to be heterogeneous, however, and thus current emission estimates are likely conservative since they often overlook emission hot spots and hot moments, especially for CH4 ebullition. For CO_2, diffusion is the dominant flux pathway, and diurnal patterns in CO_2 emissions can largely be linked to photosynthesis. In contrast, ebullition, the release of gases through bubbles that are formed in the sediments and travel through the water column, is a major emission pathway for CH4 in shallow waters. We visually observed a change in quantity and size of bubbles at different times of the day, and therefore conducted a diurnal study in four different Brazilian reservoirs of different size, age, climatic and geographic characteristics. We hypothesized that sub-daily trends in CH4 ebullition occur in Brazilian reservoirs as bubble release depends on physical factors such as turbulence and hydrostatic pressure, which can exhibit sub-daily patterns in large, managed reservoirs. In each reservoir, we performed measurements of CO_2 and CH4 fluxes at one location over 24 hours. CH4 ebullition was tracked continuously by an echosounder, and 13 anchored bubble traps per reservoir were sampled every three hours. Further, a custom-built equilibrator monitored dissolved CH4 and CO_2 concentrations, and diffusive and total fluxes of CO_2 and CH4 were measured using floating chambers in triplicates every 30 minutes during the same period. We observed that CH4 ebullition as well as CH4 and CO_2 diffusion peaked during the day, with peak fluxes being up to four times higher than low fluxes. However, the exact timing and magnitude varied for the different sampling events, and could in part be linked to biological and physical properties of the respective reservoir. This study combined different state-of-the-art techniques to show, for the first time, short-scale temporal variability for both diffusion and ebullition of CO_2 and CH4 in different tropical reservoirs. It shows substantial and non-negligable diurnal variability in GHG emission from tropical reservoirs. Further studies are needed to find out if the pattern of low flux during night needs to be accounted for in estimations of GHG emission from reservoirs.