Tropical rivers as a sink of organic matter and source of methane

Henrique Oliveira Sawakuchi[1], Maria de Fátima Fernandes Lamy Rasera[1], Alex Vladimir Krusche[1], Maria Victoria Ramos Ballester[1], André Oliveira Sawakuchi[2]

1- Environmental Analysis and Geoprocessing Laboratory
Center of Nuclear Energy in Agriculture – University of São Paulo
2 - Institute of Geosciences - University of São Paulo

Inland water is already known as an important source of methane to atmosphere. Methane is produced in anaerobic environments usually find in lakes and floodplain bottom sediment. It is the main reason that almost all information regarding methane flux come from these environments. However, while floodplain dries during low water season reducing methanogenesis, river channels keep the capacity to emit methane throughout the year. Here we present preliminary results of CH_4 flux measurements done in 4 large tropical rivers within the Amazon basin, which are represented by the main channel of the Amazon River at its middle (Óbidos) and lower (Macapá) sectors, and by the lower portions of the Madeira, Tapajós and Xingu rivers. These rivers drain areas with different relief, vegetation and climate, which should influence the characteristics of the sediments regarding their methanogenesis potential. We measured 21 areas using floating chamber during dry (low water) season, between September and November of 2011. Measured fluxes of all rivers ranged from 59.3 to 2974.4 mmol m^{-2} yr^{-1} with the average from all measured places being 443.6 mmol m^{-2} yr^{-1}. The high heterogeneity among rivers and within each river can be attributed to differences in water flux dynamics and sediment characteristics. Geomorphologic structure of channels is one important factor to consider in the formation of anoxic zones in rivers due to formation of settings able to the deposition of organic rich sediments. Natural barred channels forming wide and relatively deep water bodies with significant fetch for wave action allow deposition of organic-rich muddy sediments in huge areas within the channel, similar to a lake or estuary. This kind of environment is different from common river channels, which are characterized by bypass of the suspended load rich in fine grained organic material. Thus, barred channels have a stronger potential of methane emission. Average values of our CH_4 flux measurements for these two river environments show that barred channel areas can have much higher fluxes than non-barred channels, with averages of 961.5 and 184.7 mmol m^{-2} yr^{-1}, respectively. Hence, CH_4 flux from these depositional zones is similar to some tropical floodplain lakes and reservoirs. It shows that tropical rivers can have a meaningful contribution in methane emission. Mapping the area and bottom sediments of these depositional river zones will give us a better idea of the controls and magnitude of methane flux from tropical rivers.

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