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Fluvial dissolved inorganic C dynamics in the Western Amazonian basin: where does this carbon come from?

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The Amazon river and tributaries constitute globally a significant freshwater body and thus a source of atmospheric carbon dioxide. Aquatic carbon dioxide may originate from biological or physicochemical reprocessing of allochthonous dissolved, particulate or inorganic C (ecosystem-derived C, EDC) or it may derive from groundwater inputs of dissolved inorganic C through lithological weathering by soil-derived organic acids or by the dissolution of atmospheric carbon dioxide (minerogenic-derived C, MDC). In addition to quantifying and scaling catchment source import and export terms, accurate budgeting requires additional source differentiation. The significance of MDC is not usually considered by those assessing carbon dioxide efflux, yet differentiating MDC from EDC is crucial. For example, MDC should be less directly affected than EDC by future climatic change, becoming proportionally more important to fluvial carbon dioxide efflux in drought episodes.

We are measuring the stable carbon isotopic ratio of dissolved inorganic C to determine the relative importance of MDC and EDC to total C loads in the Tambopata basin in Western Peru. This is an area little studied for C cycling, but important as the soils here are more nutrient rich than the remainder of the Amazon basin which is more studied. Our field station is in the Tambopata national park and since 2010 we have sampled four different river systems which vary in size and drainage characteristics: the Tambopata, (CA ∼14,000 km sq.; ∼30% of its in the Andes Mountains); La Torre (∼2000 km sq.), New Colpita and Main Trail (both < 2 km sq. forest drainage but Main Trail only active in the wet season). Additionally the pH, conductivity, dissolved oxygen, water temperature and stage height have been monitored in these drainage systems where possible by logging at 15 minute intervals.

Our data shows that there are statistically significant differences in carbon isotopic composition (ranging from -14 to -29 ‰ and [DIC] concentration (ranging from 0.1 to 0.7 mM) between rivers, which we interpret to represent differences in the MDC / EDC input. We will present this data and discuss in more detail local, seasonal and regional controls on composition, and its application in source contribution apportionment.

Whilst we are utilising this DIC isotope tracer to differentiate the source of DIC (and ultimately effluxed carbon dioxide) this study shows the potential of utilising the DIC-C isotopic composition as a tracer of groundwater-surface water interaction.