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The two contrasting carbon cycles of the Amazon River system: Rapid turnover of most organic matter versus transport of refractory remains

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The Amazon River system exports 10-15 times more carbon directly to the atmosphere as carbon dioxide gas evasion than is discharged to the sea as dissolved and particulate organic carbon (DOC & POC) or dissolved inorganic carbon (DIC) (Richey *et al*. 2002, *Nature* 416, p 617). These CO_2 fluxes suggest that humid tropical rivers play a substantially more important role in regional and global carbon cycles than previously appreciated. To investigate the sources of this vast flux, we surveyed the stable and radio carbon isotope composition of DIC, DOC, fine POC and coarse POC in Amazonian rivers ranging from mountain and lowland streams to the mainstem. Our data shows that these CO_2 fluxes are driven by respiration of organic carbon that cycles from atmosphere to terrestrial vegetation to river and back to atmosphere in five years or less (Mayorga *et al*. 2005, *Nature* 436, p 538). Furthermore, this fast cycling OC pool has a substantially enriched stable isotope signature and younger radiocarbon signature relative to the bulk of organic carbon in transport by the river.

The implication of these earlier studies is that there is a very fast riverine carbon cycle that is largely "invisible" from observations of bulk organic matter properties. We will present a simple model of organic matter sources and processing that attempts to reconcile observations of CO_2 evasion fluxes and isotopic composition that suggest a fast cycle with observations of bulk DOC and POC properties suggesting a slower

cycle.