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Organic carbon burial efficiency in a large tropical hydroelectric reservoir

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Because hydroelectric reservoirs receive relatively high inputs of sediments when compared to lakes and oceans, these systems are important sites for organic carbon (OC) accumulation. Nevertheless, the actual magnitude of carbon accumulating in reservoirs is poorly known due to a lack of whole-system studies of carbon burial. Hydroelectric reservoirs are also particularly heterogeneous systems in terms of organic carbon sources and sedimentation rates. Such heterogeneity leads to strong variations on carbon fluxes, even though the effect on OC burial has not yet been discussed. The aim of this paper was to determine the OC burial rate and efficiency in a large tropical reservoir and evaluate the importance of spatial heterogeneity affecting OC burial. Burial rates were determined through a novel approach which combines sediment sample analyses and a seismic survey. Our results confirm the major effect of sedimentation heterogeneity on OC burial efficiency which varied from 9 to 89% in the reservoir. In addition to the river-dam gradient of sedimentation, our data reinforce the importance of basin morphometry in determining the patterns of sediment deposition and carbon accumulation. No carbon accumulation occurred along the margins of the reservoir and irregular bottom morphology leaded to irregular carbon deposition. An integrative analysis, including the reservoir's heterogeneity, indicated that the whole system accumulates 42.2 g C m-2 yr-1 and that roughly 67% of the total OC load to the sediments is actually buried. The data also suggest that the sediment of the reservoir is mainly composed of terrestrial OC and that the heterogeneity in OC sources plays a minor role determining OC burial efficiency, which was strongly determined by sediment accumulation rate. Finally, our results in combination with literature data suggest that the high sedimentation rates cause hydroelectric reservoirs to accumulate carbon more efficiently than lakes, regardless of temperature. Among hydroelectric reservoirs, OC burial efficiency will probably be higher in more eutrophic and in colder systems and lower in warm systems receiving relatively low terrestrial OC inputs.