EGU22-13393
https://doi.org/10.5194/egusphere-egu22-13393
EGU General Assembly 2022

Sourcing and Long-Range Bedload Transport of Fluvial Particulate Organic Matter: Rio Bermejo, Argentina

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The long-term burial flux of organic carbon is typically constrained based on the flux of suspended sediment; however, organic carbon can travel in the bedload of rivers as coarse particulate organic matter ($CPOM_{Bed}$, >1mm). Even so, we lack studies documenting the source of $CPOM_{Bed}$ in river networks, the fate of $CPOM_{Bed}$ during long distance fluvial transport, and the flux of $CPOM_{Bed}$ to ocean basins. Collectively, this lack of knowledge limits our ability to constrain the global carbon budget. Here, we present a first survey to investigate the sources of bedload CPOM transported over a 1000 km long stretch of the Rio Bermejo, Argentina, which has no tributary inputs. We sampled river bed material from six locations along the Rio Bermejo and its headwaters. To trace the source of the $CPOM_{Bed}$, we extracted leaf wax n-alkanes and measured stable hydrogen and carbon isotopes ratios (d^2H_{wax}, $d^{13}C_{wax}$). We compared bedload samples with samples from suspended sediment, soil and leaf litter from the floodplain, from the Rio Bermejo mainstem and the headwater catchment. The n-alkane carbon preference (CPI) index shows no difference between upstream and downstream sampling locations and remains relatively higher compared to the suspended sediment CPI. d^2H_{wax} ranges between 120 – 160 ‰ for all sampling sites and indicates a source elevation between 500 – 3500 m a.s.l. We suggest that downstream $CPOM_{Bed}$ is derived mostly from distal headwater sources of relatively fresh organic debris and largely preserved during long distance fluvial transit. Our initial results imply that headwater erosion of terrestrial plant debris contributes substantial amounts of bedload CPOM, which can be efficiently transported through lowland rivers for hundreds of kilometres. Our results are the first of their kind and pave the way for future work measuring the flux of $CPOM_{Bed}$ to ocean basins. Together, this work will allow us to quantify a currently unincorporated term in carbon budgets and improve our estimates of source to sink carbon cycling.