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Reply on RC3

Yutian Ke et al.

Author comment on "MOdern River archivEs of Particulate Organic Carbon: MOREPOC" by Yutian Ke et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-161-AC3, 2022

Dear Reviewer 3,

Thanks for your comments, which helped to improve the dataset. MOREPOC v1.1 is now available on Zenodo. This refined version of the database now includes 3,546 SPM data entries, among which 3,053 with POC content, 3,402 with stable carbon isotope ($\delta^{13}C$) values, 2,283 with radiocarbon activity ($\Delta^{14}C$) values, 1,936 with total nitrogen content. This represents a significant update compared to MOREPOC v1.0.

Our replies to your comments are as follows:

Line 26, Line 27: We rephrased this sentence in more appropriate terms: "Land plants, soils, aquatic organisms, and microbes can all contribute radiocarbon-active POC_{bio} to riverine POC, with ages ranging from modern to multi-millennial (Galy et al 2007; Blair et al., 2010; Hilton et al., 2011)".

Line 35: The sentence was rephrased: "The terrestrial POC_{bio} burial can be up to around 70 MtC/yr considering an average burial efficiency of 30% to an input of ~110-230 MtC/yr (Blair and Aller, 2012; Burdige, 2005; Galy et al, 2015), while the oxidation of POC_{petro} in sedimentary rocks can contribute ~40-100 MtC/yr to atmospheric CO_2 (Petsch, 2014; Hilton and West, 2020). These fluxes are comparable to those induced by silicate weathering, carbonate weathering by oxidation of sulfides and volcanism, demonstrating that POC could play an important role in the Earth's long term carbon cycle (Berner, 2003; Hilton et al., 2014; Petsch, 2014; Galy et al., 2007; Galy and Eglinton, 2011; Hilton and West, 2020)."

Introduction: we added the definition of POC to the text: "POC is the fraction of total organic carbon that remains on a filter of a given mesh size".

Line 84: We were referring to the coordinate system used when digitalizing MOREPOC data entries in a shapefile layer in ArcGIS 10.3, We rephrased this sentence: "The location of samples was digitalized if available, and an associate ArcGIS data layer in shapefile format (see MOREPOC_v1.1.rar) is provided with all points projected in a Geographic Coordinate System using the World Geodetic System 1984 (WGS1984)."

Section 2.4: This is definitely a good point that will need more work in the future. In such a wide compilation, sampling locations correspond to catchments of different scales, i.e.,

main channels vs. tributaries as well as sub-tributaries. However, it is challenging to summarize the information on whether samples were collected at a river mouth, along the flowing routing or the headwater. Nevertheless, we believe that by looking into the map of MOREPOC sampling points (such as the ArcGIS product provided with MOREPOC) the reader will be able to find that most sampling locations represent integrated signals of biogeochemical processes over a whole catchment.

Line 121: We changed to use mesh size.

Line 172: C3 plants make up over 95% of the global biomass, such that it would be hard to find significant C4 signals in global POC patterns. However we now explain in section 3.1: "However, it can also be observed that POC-rich riverine SPM can be relatively enriched in ^{13}C, with $\delta^{13}C$ values larger than -20‰ (Figure 2 and Figure 3). This pattern might indicate the presence of an additional pool of ^{14}C- and ^{13}C-rich POC in the terrestrial environment (Cerling et al., 1997), consisting of modern C4-plants in catchments dominated by grasslands or savannah (*e.g.,* Marwick et al., 2015)."

General 3.1: $\delta^{13}C$ values can be affected by the degradation of POC during fluvial transport, as shown by Mayorga et al. (2005), with the preferential degradation of young, labile biospheric OC resulting in an increase of $\delta^{13}C$ values. However, such effect typically does not result in $\delta^{13}C$ values outside the range of C3 plant OC. We added an explanation for the very ^{13}C-depleted signals in fluvial POC in Section 3.1. Actually, these samples are mostly from permafrost-draining rivers; and secondly, aquatic authigenic OC production can be an important mechanism contributing ^{13}C-depleted and ^{14}C-enriched POC (Longworth et al., 2007; Marwick et al., 2015; Wu et al., 2018).

Line 257: Al/Si was not introduced properly in the previous version of the manuscript. We now explain in section 2.7 why MOREPOC features Al/Si data: "Lastly, if available, the aluminum-to-silicon mass ratio (Al/Si) is also provided in MOREPOC v1.1. This elemental ratio is an efficient proxy for the particle size of riverine sediment, allowing to characterize the grain size effect of sediments on POC loading in fluvial load (Galy et al., 2008b; Bouchez et al., 2011; Hilton et al., 2015). The mineralogy and particle size of sediments are generally related, with coarse particles being quartz-rich (low Al/Si ratios) and fine particles being clay-rich (high Al/Si ratios) (Galy et al., 2008b). POC contents are usually positively related to the fraction of fine grains in the sediment (Mayer, 1994; Galy et al., 2008b; Bouchez et al., 2014).