Review Comment

"How is particulate organic carbon transported through the river-fed Congo Submarine Canyon to the deep-sea?"

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Submitted to Biogeosciences

General Comments :

This manuscript describes a study on transport mechanisms of organic carbon throughout the Congo River Canyon towards the deep sea. It combines geophysical (turbidity flow measurements) with geochemical (organic carbon properties) methods to understand processes and organic carbon properties important to understand the fate of terrestrial organic carbon entering the coastal and deep ocean. Understanding transport mechanisms and fate of organic carbon is crucial to estimate its potential for degradation and burial with regards to effects on the global climate. While a lot of studies focus solely on seabed surface sediment samples, this study also examines the suspended sediments collected through a sediment trap, making it an important contribution in the field of organic carbon transport and suitable for publication in *Biogeosciences*. The manuscript has a clearly indicated motivation, well described methodology and logical discussion. Despite minor comments outlined below, I suggest accepting it for publication in *Biogeosciences.*

One of the main points I noticed is the use of particulate organic carbon and total organic carbon being in some sections a bit confusing/inconsistent and used synonymously. While the introduction mentions particulate organic carbon, the results and major part of the discussion does not and suddenly section 5.3 does talk about particulate organic carbon again. It might be good to find a balance between particulate and total organic carbon (where applicable) throughout the whole text to avoid confusion for the reader.

Specific Comments:

Line 66 ff:
A question from someone not working with submarine canyons: "This lack of understanding…" – does that make canyons the "perfect" analogue to study and understand these processes? If so, it might be worth mentioning it.

Line 70 ff:

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Reading about particulate organic carbon made me right away wonder if you also compared the data to seabed sediment data, which you did, so it might be worth to consider mentioning this important comparison here already.

Line 73:
"… the Congo River ranks fifth in terms of global particulate organic carbon" – are those the same 7% of organic carbon mentioned in the abstract?

Line 109:
The mentioned number of average annual discharge of 40,000 m³/s for the years 1903-1995, are those the most recent numbers available?

Line 165 ff:
The fourteen mentioned turbidity profiles are they all from M9 mooring?

Line 169:
"…the 14th January event." sound really specific. While it is mentioned in the intro as the strongest event where cables were destroyed, here this is not mentioned again and one might wonder if the expression should be known. Can you either elaborate on that with half a sentence or leave it out?

Section 3:
Grain size analysis description is missing from the method section; "grain size using a Mastersizer laser particle size analyser" (l. 211 f.) is not sufficient as a method description. This becomes even more clear, when looking at the data, divided into D90 and D50, which I have to confess, despite having worked with grain size data before, I do not know what this entails. It might be good to provide this additional piece of information for the reader (including any sample preparation for the grain size measerments).

Line 409:
"…turbidity currents carry organic carbon at a much higher transit flux…". While this makes perfect sense to me in theory, I am wondering how in figure 8 the highest amounts of TOC only match the velocity peak of turbidity current 1, while in the 2-5 interval TOC is elevated during the velocity peak, but the highest TOC values are coinciding with low velocities and a similar pattern can be observed for the 6-8 interval. Can you discuss this a bit further?

Line 415:
"…did not allow sands transported at the base of turbidity currents to be collected." According to your results (p. 42, l. 348), you have sandy samples. Are those the exceptions of small amounts of sands transported above 30 m or is this inconsistent?

Line 423 f:

"…assuming that tides and turbidity currents have the same sediment concentrations." Does this assumption make sense at all? You are proving it wrong below, but it seems striking from the beginning.

Line 431ff:
The paragraph about TOC appears a bit sudden in this section. Maybe consider moving it into the carbon section (5.2)?

Line 452:
"…(at least to the naked eye)." indicates that you did not do any X-ray for those cores, while you did so for the sediment trap. Is there a possibility to still add this data?

Line 457:
Here you state that you estimate the transit flux of organic carbon transported by turbidity currents ten times higher than for tides, while in l. 409 (page before) it says two to three times. Is this a different context and therefore reason for the different numbers?

Line 512:
What does the part "… in the laboratory," mean in this context? Generally, marine organic matter degrades faster than terrestrial organic matter, in the water column, not in the laboratory.

Line 569 f:
"…remove efficiently particulate organic carbon from the terrestrial biosphere to the deep-sea." – What is meant here, is terrestrial originating organic carbon, right? The sentence reads a bit as if the canyon removes it directly from land. I suggest adding a few words for clarification, such as "… and export it to the deep-sea."

Editorial Comments:

Line 30:
"Remarkably" appears to me a bit odd to start the sentence. Is it that remarkably?

Line 137 f:
"Piston cores were recently retrieved…" – when is recent? Could you add a year to it?

Line 203 & 211:
It might be more useful to mention the number of multi-cores collected (l. 203), rather than all 91 samples (l. 211).

Line 219:
Where was the first set of samples measured? You mention locations for the latter two sets of samples, but not the first.

Line 221:
"(ULiege, Belgium)" for consistency.

Line 226 ff:
Consider adjusting the sentences "Knowing the TOC of each sample, we weighed adequate masses [into silver capsules] […]. Samples were acidified with 1M hydrologic acid to remove inorganic carbon." Otherwise, it sounds a bit like the silver capsules are needed for organic carbon removal.

Line 229 ff:
The sentence mentions measurements in triplicates measured at two different locations. Which is the third or where were they measured twice?

Line 241:
Is there a concentration of the hydrochloric acid to be mentioned?

Line 347:
"1.8 and 4.6 %[,] respectively …" is missing a comma.

Line 349:
"TOC [measured] at the base"? "found" does not seem to be the correct word.

Line 426:
"… and far most sediment" should be "far MORE sediment".

Line 428:
"km3" is missing the 3 in superscript.

Line 541:
"…compared to THE Congo RIVER"?

Line 554:
"…rapid erosion rateS"

Figure 1:
- Line 145: "A. Map of THE Congo River…"
- Line 347: Where "cores" are mentioned, are those the piston cores, mentioned in the text? Writing multi-cores and cores, makes one wonder what kind of cores they are.
- A: "RDC" is not explained in the figure caption.
- A: "JC187 Multi-core" looks like the number of a single multi-core, but there are multiple ones listed with different numbers, unless the reason for this number is explained in the caption, I suggest to simply write "multi-core" in the legend.

- A: The superscript number 1 is hard to find in the figure caption, maybe consider writing "(this study)" behind the multi-core and "(Baudin et al., 2017)" behind the lob core and trap, also "Trap" is capitalized, while "core" is not.
- B: Add number "C" into the image next to the profile.

Figure 2:
- Line 189: should Congo Submarine Canyon be capitalized? For consistency.

Figure 3:
- Line 290: the mentioned yellow line is not yellow.
- C: The highlighted frequency of "12.5 h" should be mentioned in the caption. Also, shouldn't it be "Hz" as indicated at the x-axis? cf. l. 303 where it says the same.

Figure 4:
- Can the figure be improved by changing it into three rows? That way (B) will be better visible and comparable to (C).

Figure 5:
- Is there a reason for the bathymetry in the background? To me it seems rather confusing than helpful as it looks like the data continues into the sediment. The first time I looked at the data I was looking for a legend explaining the "additional" data to me, until I realized, it was the bathymetry. If there is not a practical reason for it, maybe consider removing it to avoid confusion or mention it in the caption.

Figure 6:
- What are the blue lines and the highlighted intervals? Information is missing in the caption.
- C: What are the two different types of data?
- E: Is there a reason for the missing lines connecting the black data points?
- Line 340, 341 & 343: l. 340 mentions "trap succession" while both following lines mention "trapped succession", is that correct?

Figure 7:
- Description for panel (B) is missing, (C) is labelled (B) and (D) is missing as a letter before of the description.
- As for fig. 1, it might be helpful to add the references into the figure legend to make it more clear which data is from this study, and which is not.

Figure 8:
- Line 400: "multi-sensor-core-logging" used to be capitalized on page 18 in the text. Adapt for consistency.
- Why are certain turbidity currents grouped? Could you add one explanatory line to the figure caption, including the reason for the highlighted intervals they represent?

Figure 9:
- Line 466: "…with data river data…", one "data" too many.
- B: mentions negative and positive values in the idealized velocity profile. I do not see any values. I am also not sure, I understand what those profiles are showing. Why is the height (water depth?) so different and why does the mooring appear to be at different depths? They might need a bit more explanation.

Table 1:

- It might be clear from the sample code, but I suggest adding some info about sample type into the table (which are the sediment trap and which the seabed samples).
- Is there a reason why the very last four samples in the table do not have TN values?