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The Cryosphere Discussions
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Interactive comment on "Carbonaceous material export from Siberian permafrost tracked across the Arctic Shelf using Raman spectroscopy" *by* Robert B. Sparkes et al.

Anonymous Referee #2

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General comments:

This paper applied Raman Spectroscopy to track carbonaceous material export from Siberian permafrost region. This is the first application of Raman Spectroscopy on sedimentary CM in the Arctic which showed very interesting findings. In this study, samples were mostly marine surface sediments from nearshore to distal shelf of three major Arctic rivers in East Siberia and few terrestrial permafrost samples. Samples was classified into four class based on Raman peak areas and widths. After statistical analysis of all the data, they found that highly graphitized CM was higher in the distal slope of than the rest of the shelf which is more likely a result of winnowing effect. In addition,

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Discussion paper

they found that there is longitudinal variation of sources of CM to the deeper shelf from riverine inputs and coastal erosion. This information highlighted the importance of CM in carbon cycling in the Arctic, especially for predicting future climate, since this recalcitrant part of total OC may not have effect on atmospheric CO2 levels. In addition, their work introduced another technique for tracking permafrost mobilization in long distance in the Arctic, apart from bulk and biomarker which experience severe degradation during transport. The content of this paper is about CM export from permafrost to the Arctic Ocean, so it is under the general scope of the Cryosphere. This paper is well-organized and clearly stated. Large sample size, wide distribution and multi-sampling of each sample were sufficient to support their interpretations and conclusions. The experiment and concepts are well described. The author properly cited related paper and showed the specialty of this study. As a result, I recommend the publication of this paper in The Cyrosphere. There are still some minor issues as list under specific comments.

Specific comments:

Page 5 line 5. What is the reference for "over decadal to millennial timescales. . .into account.

Page 5 line 21-22. "Three terrestrial location . . .catchment" This sentence needs to be modified because the three sites can not represent what is coming from the catchment. Even though this is clarified later, it should be stated here as well.

Page 5 line 23-25. Each terrestrial location has three samples analyzed. How different are they on those parameter? Only averages are shown in the supplementary data. Vertical difference could be very significant in permafrost cores.

Page 6 Figure 1. It would be nice to have ICD distribution on this map.

Page 8 Table 1. In the table statement, Tmin and Tmax were not mentioned. Even though T is related to R2 and RA2 ratio, it is still better to keep consistence in statement

and table content.

Page 9 section 3.2. List of grouping is not in the sample order as the figure 2. It would make more sense to keep the same order.

Page 11. Table 2. I think it would be better to put the three terrestrial sites separately so that it would be easier to compare with individual river outflow.

Page 16 line 19-20. “are mostly sourced from coastal erosion”. This may be true. But can you give some grain-size evidence to better support this? What is the difference between coastal inputs and riverine inputs? Which one has higher amount of fine particles?

Line 21. “noticeable that YS-102. . .distal ESASsamples”. Please highlight those dots if you want to talk about them. I did not see three dots that are distinguishingly different from others.

Technical corretions: Page 2, line5. Period is missing prior to Deepening. Page 3, line 25. Superscipt for -1 Line 29. Delete “and” after power. Page 5 line 5. Add “than” after “This is a much larger system”. Figure 5 b: The two colors are too hard to distinguish.

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