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Interactive comment on "Multi-molecular tracers of terrestrial carbon transfer across the pan-Arctic – Part 1: Comparison of hydrolysable components with plant wax lipids and lignin phenols" *by* X. Feng et al.

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In the study presented by Feng and co-authors, results from an analysis of hydrolysable organic matter in Arctic river-influenced sediments are discussed. The authors focus on the information contained within the molecular marker concentrations of terrigenous organic matter and interpret their results in context of transfer of terrestrial carbon to the Ocean in the Arctic.

The manuscript is well written, and the results are reported in great detail. The study is

mainly interesting because hydolizalbe OM is rarely investigated, and the information conainted within remains largely unexplored. The discussion consequently focuses on how the individual biomarker abundances and biomarker indices could relate to catchment characteristics and how they can inform about sources and pathways of transport. The study is based on only a few sediments, in most cases only one sample per river (except the Colville river, where 2 samples are analysed). Thus the data are likely no accurate characterization of the entire systems. The authors are careful not to deduce any far-reaching conclusions from this limited data set but focus rather on discussing the relative abundances of the individual biomarker groups between the samples, taking into account only some general water shed characteristics (wetland and forest coverage). Generally I thus think that this paper is an interesting contribution to Biogeosciences presenting some novel aspects of organic geochemical research in the Arctic.

However, there are some aspects that I think deserve more consideration and might require some revisions in the manuscript. The major issue I have is that sediments recovered off the mouths of Arctic rivers (Ob', Yenisey, Lena, Kolyma, Indigirka, Mackenzie, Kalix) likely in various water depths (please add this information to table 1) and at variable distances from the river mouths are compared with material collected from a river bank (Yukon) and directly from the ice covering the river during the spring flood (Colville). While the latter clearly cannot accurately be called sediments, and it is debatable for the Yukon material as well, the authors do not discuss how the differences in the materials might explain much of the variability. The samples from the ice and the river bank will most likely differ in grain-size, age, mineral content, not to mention marine organic matter and inorganic matter contributions, which will affect at least the biomarker concentrations (bulk and OM normalized). I think that it has to be made clear in several locations of the text that different types of material are discussed here. It is for example evident from Figure 2 and most clearly from the PCA (displayed in Figure 8) that the Colville and Yukon materials are different from the marine sediments. Part of the explanation for this discrepancy might be the lack of a marine influence (e.g.,

by leading to aggregation and flocculation of dissolved and colloidal terrigenous OM when salt water is encountered), which is not mentioned here at all. Overall, I think that the authors need to consider the individual sample settings more carefully before discussing differences between the samples. Besides, it might also be useful to point out that the few samples analysed here, albeit their general agreement with more extensive published data sets from the individual river mouth influences regions (Fig. 5), might not be ideal representatives of the catchment characteristics.

Detailed comments: P 4723, line 6-8: This sentence is not precisely describing the type of material analysed here: The samples analysed here are either marine surface sediment samples take off the mouths of the rivers, or a river bank sample, or material transported with the spring flood and deposited on the ice shortly before break-up. “surface sediments derived from rivers” is not clear. P. 4724, line 7: Please consider Hugelius et al., 2014 for an updated estimate of the carbon stocks. Line 19: Here and throughout the text: The paper by Winterfeld et al. is now published in Biogeosciences (12, 2261-2283; 2015). Page 4725, line 12/13: “Arctic” with a capital A. Pager 4726/4727: Paragraph 2.1: Here, the different samples are described. It has to made clear how the materials from the Yukon and Colville differ from the others (see general comments). Page 4730-4731: Paragraph discussing solvent-extractable lipids: Here, it will be necessary to mention that the Colville material and Yukon river bank sediment (purely terrestrial material) vs. the Mackenzie (with marine influence) are expected to differ between each other in terms of the LMW FA concentration. Same later in the discussion, e.g., page 4733, lines 2-3. Page 4733, line 10 and line 17: Use consistent expressions for C16-C28 FA. Page 4735-4736: discussion on the sources of suberin and cutin: Could the correlation observed between suberin and HMW FA and between cutin and lignin, respectively, perhaps also be caused by similar preservation potentials/similar chemical behaviour of the individual components? Page 4739, line 18: Delete “alternatively” Figure 2: Please extend the figure caption significantly describing what is displayed on the individual panels. Plaese also indicate which of the data are cited from prior publications and include the sources

Interactive comment on Biogeosciences Discuss., 12, 4721, 2015.