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Interactive comment on "Spatial variability of diploptene δ^{13}C values in thermokarst lakes: the potential to analyse the complexity of lacustrine methane cycling" *by* K. L. Davies et al.

Anonymous Referee #3

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This manuscript looks at diploptene δ13C in two thermokarst lakes, uses these values to estimate methane oxidation activity and discusses the potential to uses this method to reconstruct past methane dynamics. What the data shows is that diploptene δ13C is highly variable, both within and between lakes, and that there is no clear relationship between diploptene δ13C and thermokarst activity or methane ebullition. While this finding is useful and potentially publishable, the manuscript, particularly the abstract implies that the findings are much closer to the proposed goal of using diploptene δ13C to reconstruct past methane ebullition. While the authors offer explanations for this variability in the discussion, the manuscript needs to do a better job of addressing the limitations of drawing broader conclusions from such a small and highly variable

dataset.

Specific Comments: 1. In the abstract diploptene is misspelled twice. 2. Page 12163 Line 4, What is a "bight" 3. Page 12164 Line 2-4, "potential confounding factor. . ." this seems potential pretty important, what impact could this have on your results 4. Introduction, it is not clear exactly what patterns you would you expect to see in diploptene δ13C under the scenarios discussed. Be more explicit about what specific diploptene δ13C patterns would tell you about methane dynamics. 5. Page 12168, Line 5, Any particular reason for using the 1-2cm sediment slice 6. Page 12167, Line 25, Don't include the δD analytical error if you don't include any δD data. 7. Page 12170 Line 11, You give a potential range of 0-30‰ what value did you use, is this the 10‰ you discuss earlier, please clarify 8. Overall the calculation of diploptene δ13C seems pretty vague with a lot of estimates, this is ok, isotopes can be messy, but the discussion of these choices and the variation/uncertainty they introduce could be more clearly discussed, especially give the high variability and inconsistency of your results and the claims that this method could be used to do historical reconstructions. 9. Line 12171 Line 6, How many bubbles were sampled for δ13C, there are no error values listed, which seems to suggest only a single sample was analyzed at each site. If that is the case, there is not much you can infer from this one number; especially considering how your diploptene δ13C data shows just how spatially variable δ13C is in this system. 10. Methods: Sample size, replication, sampling location information needs to be clearly covered in the methods section. This information needs to be included for all analyses, not just diploptene δ13C, although I couldn't even find sample size information for diploptene δ13C in the methods section (it is mentioned later in te manuscript). 11. It looks like Ace lake was only sampled in the TK zone whereas Smith Lake was also sampled away from the TK zone. This is unfortunate, since it really limits the ability to distinguish potential impacts of thermokarst activity from other spatial differences within/between lakes. 12. The Figures & Results sections make it difficult to fully assess the variability of the diploptene δ13C data, in the text only the min/max values for each site is listed (no average +/- std dev so you can't tell if there is juts a few outliers

or the data is evenly spread out) and then the figures just show 10‰ increments.

Interactive comment on Biogeosciences Discuss., 12, 12157, 2015.