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## ***Interactive comment on “Spatial variability of diploptene $\delta^{13}\text{C}$ values in thermokarst lakes: the potential to analyse the complexity of lacustrine methane cycling” by K. L. Davies et al.***

### **Anonymous Referee #2**

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Davies and co-authors present a study on spatial variability of diploptene  $\delta^{13}\text{C}$  measurements of the bacterial biomarker diploptene in thermokarst lakes together with methane monitoring, and that has the potential to assess past carbon cycling in northern high latitudes. However, I think the paper still needs some work before publication. The critical issue is that the authors showed totally 14 diploptene  $\delta^{13}\text{C}$  values within the same zone (TK zone or Centre section) from two lakes, but with big variations. Although the authors proposed several reasons for the large variability in the  $\delta^{13}\text{C}$  values of diploptene across small spatial distances, maybe more data would be useful.

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1. In the abstract, line 13: diplotene should be diploptene. The same as line 18. 2. In the abstract, line 21: (e.g., age and type of organic carbon) and. .... I think the authors just showed one age and it seems they didn't discuss anything about type of organic carbon in the paper. The authors should clarify this. 3. 3.2 Methane monitoring: the authors mentioned methane  $\delta^{13}\text{C}$  and  $\delta\text{D}$ , but didn't show/discuss them in the paper. 4. 3.5 Mass balance equation: "... $\delta^{13}\text{C}$  hetero\_hopane is the  $\delta^{13}\text{C}$  value of the hopanoids derived from heterotrophic bacteria. . .", So please specify which hopanoids in the paper because a lot of hopanoids are derived from bacteria. . . 5. Results section of Line 24-25(P12171): '.....Diploptene  $\delta^{13}\text{C}$  values in the thermokarst zone of Ace L. are similar to those of the lake centre at Smith,.....', I couldn't see they are similar. 6. Line 14 in the 5.2 section, it is fig3 or fig.4? 7. 5.2 section and Table 3: It is also not very clear that MOB biomass has large variations across the small distances. For example, at the TK zone of Ace Lake, sample a3 and a4 are close, but the difference of MOB biomass is around 30%. If it is because of microbial community, so give more evidence.

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**BGD**

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