

Interactive comment on “Landscape analysis of soil methane flux across complex terrain” by Kendra E. Kaiser et al.

Anonymous Referee #2

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The manuscript presents an interesting work about landscape analysis of soil CH₄ flux across a range of landscape positions (riparian and upland). This study aims to identify how topographic metrics-mediated environmental variables influenced watershed scale CH₄ fluxes during the growing season. The authors found that riparian sites had near zero CH₄ flux, while upland had significant CH₄ uptake, which significantly correlated with topographic metrics. This study demonstrates the importance of spatial heterogeneity and the lateral redistribution of water on watershed net CH₄ flux. It also points out the need of estimating CH₄ fluxes across complex terrain through modeling the spatial variability of landscapes.

The objectives are clear and the methodological approaches are sufficient to answer the questions posed in the introduction and to justify the conclusions. The manuscript

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is clear and easy to follow, with clear results and streamlined interpretation. The topic is well in line with the scope of the journal and the overall quality is also good.

Please find below specific comments:

Page 1, Lines 18-20 It is better to point out the time period that this finding was observed. Since the temperature and other parameters may change with time and thus the associated uptake/emission point (38

Page 2, Lines 10-12 Restructure the sentence to make it clear.

Page 2, Line 15 Better to rewrite this sentence.

Page 3, Line 25 Here, it is better to see the range of the gentle to steep gradient slopes.

Page 6, Lines 10-12 In the Eq.1, you described “slope= $\cos\theta$ ”, and then “. . .where . . . θ is slope” “ θ is local slop”. I am confusing about the definition of θ whether θ or $\cos\theta$ is slope? I would like to know if θ means the angle of the surface to the horizontal. If it is, doesn't slope equal to $\tan\theta$?

Page 7, Line 4 I do not understand why $n=32$, since you have 32 sampling sites and three soil sampling layers.

Page 9 How sensitive is the method for fCH₄ calculation? There is a big variation in effective soil diffusivity as the VWC lower than 10

Page 10, Line 8 “CH₄ fluxes” instead of “fCH₄ fluxes”.

Page 10, Line 9 “fCH₄ and environmental variables” instead of “fCH₄ measurements and environmental variables”

Page 12, Line 15 Change “Fig.4” to “Fig.4a”

Page 14, Lines 2-4 Change “Fig.4” to “Fig.4b”

Page 18 Lines 1-2 Place the definition of DFC to where it occurs the first time.

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Page 18, Line 12 Should be Fig. A4

Page 18, Line 18 Should be Table 4

Page 19, Figure 9 In the legend, please check the panel letters to make sure they indicate the right figures.

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