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# *Interactive comment on* "Water Flow Controls the Spatial Variability of Methane Emissions in a Northern Valley Fen Ecosystem" *by* Hui Zhang et al.

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This manuscript examines the emission of methane from a small wetland during the summer over a three year period (though the upper parts of the wetland were sampled in only the third year) and provides environmental measurements to help explain the patterns that were observed. The methane emission rates are consistent with other peatland systems in this type of environment. The originality of the study is the focus on emissions in the central part of the wetland, a mesotrophic sedge fen, which show that methane emission rates are smallest at the upper, drier part of the wetland, increase in the middle section which is wetter and then decrease in the central



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part which is essentially a very wet riparian strip with slowly flowing water in a stream. Methane production, consumption and emission are complex processes in terms of a multitude of influencing factors and the authors attempted to identify properties which may be important in the creation of the emission patterns. These include dissolved oxygen, temperature, plant distribution and estimates of plant production (GPP), LAI and presence of arenchymous species. Through essentially correlative analysis, the authors demonstrate the importance of flowing water and dissolved oxygen is reducing methane emissions in the central part of the fen, the drier conditions producing small emissions at the margin, resulting in maximum emissions in the middle part of the upland-stream transect. The manuscript concludes with speculation on the effect of climate change in these types of wetlands, though no strong predictions were made, rather an identification of environmental changes' linkages to methane emission.

The authors have assembled a good data base on a complicated northern wetland (compared to bogs for example). It is unfortunate that the upper parts of the wetland were not sampled until the third year, which provides evidence of the peak methane emissions part way to the fluvial section, but it seems that the third year results could probably occur in the earlier two years. As with such a complex system, with counteracting properties influencing methane emission rates, it is difficult to tell how generally applicable these results will be. I think the paper would be strengthened by a greater consideration of the setting of the wetland within the overall watershed about which there is little mention. Climate change effects will be moderated by the other parts of the watershed, which seems to be forested from photographs and thus it would be useful to know the size of the wetland (which is about 1 km2) and the size, topography and soils/vegetation of the overall watershed. It would also be useful to know how common such mesotrophic sedge wetlands are in these landscapes and whether they are 'unique' so that application of the broad principles from this study may be inapplicable. Fens are more difficult to understand and model, than 'boring bogs'.

I have made some specific comments and suggestions on the pdf, which I hope will





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improve the utility of the manuscript.

Please also note the supplement to this comment:
https://bg.copernicus.org/preprints/bg-2020-268/bg-2020-268-RC1-supplement.pdf

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