Hydrol. Earth Syst. Sci. Discuss., 10, C5032–C5036, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C5032/2013/

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Using hydrologic measurements to investigate free phase gas ebullition in a Maine Peatland, USA" *by* C. E. Bon et al.

Anonymous Referee #1

Received and published: 18 September 2013

This manuscript reports the water level data recorded in clusters of monitoring wells during ebullition events and discusses their relationship with atmospheric pressure change and the rising water table caused by precipitation events. In addition, it reports dissolved methane and carbon dioxide concentrations in the groundwater samples collected from the wells, and discusses their relation with ebullition processes. The data collected in this study are unique and could possibly contribute significantly to an improved understanding of ebullition processes in peatlands. Unfortunately, however, I feel that the present manuscript appears to have a few important problems that need to be resolved before it is considered for publication. These relates to the accuracy of

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

hydraulic head measurement and calculation, potential problem with groundwater sampling method, the characteristics of wells, and apparent discrepancy between observed data and explanation. Please see my specific comments below.

1. Mixed units are used throughout the manuscripts (e.g. meter and feet for length), which makes it difficult for the reader to understand quantitative relations between variables. I strongly recommend the use of consistent SI unit, including Pa or meter water equivalent for pressure.

2. In the introduction (page 9724, line 26), several mechanisms of ebullition are listed, but it is not clear how some of these can produce ebullition, for example how the rising water table causes ebullition, and what is meant by "forceful, hour long bubbling events". This needs to be more clearly explained.

3. Page 9725, line 7. Reduction of CO2 with H2 is listed as the source of methane. It seems to me that the presence of H2 would require an extremely low redox potential. Is it possible to have such a low redox potential in relatively shallow (several meters) peat deposits? Was the pe or Eh measured at the study site?

4. Page 9727, line 25-26. Please indicate Pushaw Lake and delineate the 2200 ha peatland in Figure 2.

5. Page 9728, line 1-5. Please annotate these features in Figure 2 so the reader can understand the site characteristics.

6. Page 9729, line 5. How were these wells installed?

7. Page 9729, line 7-10. It is difficult to understand the function of this wooden frame and how it works. Please present a more clear explanation.

8. Page 9729, line 17-18. From this sentence, I understand that a dual-frequency GPS unit was used in an autonomous mode, not differential GPS tied to a common base station. If that is the case, the accuracy of relative elevation cannot be much better than 20-30 cm. Please carefully discuss this issue, as it is critical to the interpretation

HESSD

10, C5032–C5036, 2013

of hydraulic head data.

9. Page 9730, line 25. What was the accuracy of this manual measurement? Please quantify.

10. Page 9731, line 2. Are these pressure transducers vented or non-vented? If the latter, how are the pressure data compensated for barometric pressure change.

11. Also, for such a high-frequency measurement of pressure, one needs to be mindful of the hydraulic response time of wells. Have these wells been subjected to slug tests? If so, what were the basic time lags? If the basic time lag is much longer than 2 minutes, barometric fluctuations may cause artificially introduced apparent water level changes in wells. This need to be considered and discussed.

12. Page 9731, line 15. Which direction is the University of Maine located?

13. Page 9731, line 25. Is "one inch diameter" same as the inside diameter of well casing? If so, how was the plastic tubing lowered to the well? Was there any space between the tubing and the casing?

14. Page 9732, line 1. What is the water filled baggy?

15. Page 9732, line 7. What kind of tubing was this?

16. Page 9732, line 11. I do not understand this sentence. Please explain.

17. Page 9732, line 18-20. Was the "hand pump" used for water sampling as well? I am guessing that this is a vacuum pump. If so, how does it affect the pressure of water sample and possible degassing during sampling? Also, how is the sample "transferred" from the flask to 10 mL glass vial? Was the sample exposed to the atmosphere during the transfer? If so, how does it introduce a chance of degassing? These are the critical issues that need to be very carefully addressed.

18. Page 9734, line 4. What does the "initial level" indicate?

HESSD

10, C5032–C5036, 2013

19. Page 9734, line 11. I am guessing that Figure 4 shows the data collected on both day 1 and 2. It will be useful to use different symbols in the figure to indicate the samples collected on different days.

20. In relation to my comment above, were the gas concentrations of the samples collected from the same well on day 1 and 2 similar or different? If different, what causes a major change in concentration in just two days?

21. Page 9734, line 22. This sentence contradicts with Figure 5, which shows highest concentrations at about 3 m.

22. Page 9735, line 1. What is the saturation concentration of CO2?

23. Page 9735, line 6-7. What is the basis of this statement? Does the water level decline starts soon after sunrise, when plants start photosynthesizing? Were the plants still active in mid October and radiation high enough to cause high evaporation during day time? This needs to be discussed carefully.

24. Page 9735, line11-13. This is a soft and loose statement. Since this is one of the most important results, more detailed analysis and explanation is warranted. For example, what is the frequency of high-low cycles (Fig. 6)? How long do these events last? Do they always occur at certain wells, and not others?

25. Page 9735, line 20-24. Please show the data in a graph.

26. Page 9736, line 1-9. A cross section showing the location of well screens will be very useful.

27. Page 9737, line 18. What is the actual size (width) of slots, and how does it compare with expected pore sizes in the peat?

28. In relation to my comment above, is it possible for gas to diffuse through the slot and start forming bubbles inside the slotted screen?

29. Page 9737, line 22. Is the concentration properly measured and calculated?

HESSD

10, C5032–C5036, 2013

Please see my comment on the water sampling method.

30. Page 9740, line 14. This explanation is inconsistent with Figure 8, which shows the 7-ft well fluctuating before 13- and 17-ft wells.

31. Figure 2. This map is not very informative due to its small size and poor color contrast. Please improve the quality of the figure and make it more informative. The GPR image is too small to be useful.

32. Figure 4 and 5. These are "Excel default" graphs copied and pasted without much thoughts and efforts. Please use journal-quality figures for manuscript submission.

33. Figure 6. Please include a more meaningful time axis. What does each line represent? The midnight of each day?

34. Figure 10. Instead of showing the satellite image, which has already be shown in Figure 2, please use a topographic map, so the reader can understand the relation between topographic gradient and hydraulic gradient. There is a "bull's eye" in the hydraulic head contours indicating a point sink. Where does the water go? It cannot flow through the esker, because it is a point sink.

35. Figure 11. The hydraulic head values shown in this cross section are not consistent with the values shown in Figure 10, even though the data are from the same date. Why are they different?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 9721, 2013.