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Hydrology and Earth System Sciences Discussions

Interactive comment on "Shallow soil moisture – ground thaw interactions and controls – Part 2: Influences of water and energy fluxes" *by* X. J. Guan et al.

Anonymous Referee #2

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This paper describes the differences in the water and energy fluxes of a peatland, valley, and wetland site in order to explain the observed differences in ground thaw depths and soil moisture. The spatial patterns in ground thaw and soil moisture and the correlations between the two are described in the accompanying paper. The main result of this paper is that the different interactions between ground thaw and soil moisture for the three sites were due to differences in the presence of surface water. Another key result is that the transfer of latent heat that accompanied lateral surface runoff caused the wet areas in the peatland and wetland sites to be the locations of deepest thaw. This paper provides enough new and addition information and is structured in such a way that it does deserve to be a stand-alone paper. The methods, the modified peclet

number, and results are described very well. Unfortunately, there are no uncertainty estimates for many of the water balance components so that it is not clear what the uncertainties of the calculated fluxes and peclet numbers are and how these uncertainties compare to the differences for the three sites. Therefore it is not clear how these uncertainties affect the results. This is my main concern about this paper (see also specific comment 1 below). There are a few minor typos in the text but overall the paper is very well written. Due to the large number of equations for the water and energy balance components, the large number of symbols and subscripts is sometimes a bit confusing. This would be alleviated by including a list of symbols in an appendix at the end of the paper.

Specific comments:

1) Methods: for the first water balance components (e.g. snow survey and melt) uncertainty estimates are given. These estimates are missing for the other components and should be included so that the reader has some idea of the uncertainties and can interpret the results accordingly. If there is no information of this error/uncertainty for a certain water balance component, then the authors should give a best estimate. These uncertainties should be mentioned when the different water and energy balance components for the different sites are compared and should also be used in the calculations of the modified peclet numbers. That way the readers will have some sense of how these uncertainties compare to the observed differences for the three sites and what the uncertainty of these modified peclet numbers is.

2) P73L8: could this "missing flux" term not just be an error term as well? And isn't this term set to zero when the difference in storage is used to calculate "Qs"? If you mean "Qs" with the "missing flux term", then rewrite or expand this section so that it is clearer what is meant here.

3) P76L15: the wording of the piezometer pipes is a bit awkward/confusing. Until line 17 it is not clear what the C-pipes are. It would be easier to understand if they were

just called ‘shallow (0.20 m), deep (0.50m)’ in L14 and ‘very deep piezometers’ or ‘extra deep piezometers’ in L15 instead of ‘A, B, C pipes’.

4) P77L15: How many days were there with missing or suspect data and how big was the difference between the discharge calculated from the water balance residual and the actual measured discharge?

5) P80L1: At what depth were the Ech2o-te sensors installed? At multiple depths or just one depth? Where were they installed? Please provide more information about these measurements.

6) P80L12: Give information on how the specific yields were determined.

7) P85L18: How do the observed changes in storage or the storage changes calculated with Eq 12 compare with those calculated with Eq1? This would give the reader a better sense of the uncertainties (see also comment 1).

8) P88L10: I think that this section should be expanded and especially this statement should be clarified as it is not totally clear what is meant here if the reader only reads this paper (and not the accompanying paper).

9) Figure 1: When this figure is printed in black and white, it is hard to see the contour lines. Make them a bit darker (and maybe the contour labels a bit lighter).

10) Figure 4: I found this figure hard to read when it is printed in black and white as there were so many lines. It would be easier if some of the line types were shown different in the legend or if more distinct line types (or thicknesses) were used. For example ET seems to be almost a solid line in the legend but it is not in the figure. It would also be better if surface inflow and outflow were just plotted on a different (2nd y-axis) rather than scaled on the same figure.

11) Figure 5: what day was taken as zero cumulative surface water input? Why do the lines not start at zero? It would be interesting if there was an error bar or error band that highlighted the uncertainty in these sums.

Minor technical comments:

*) P80L24: replace “Ech20” by “Ech20-TE”

*) P81L16: replace “netlands” by “wetlands”

*) P86L6: remove “at” at the end of het sentence

*) P86L13: remove “The peatland. . .during snowmelt”. This sentence seems a bit out of place here.

*) P87L8: replace “considerate” by “considered”

*) P87L20: remove “at 1.1.”. It seems out of place and it is not clear what is meant with that.

*) P90L7: replace “Qgs” by “Qps”?

*) P90L20: replace the first “patterns” by “correlations” and the second “patterns” by “differences”? That way it would be clearer that this paper mainly aims to explain the differences between the 3 sites rather than the detailed soil moisture or ground thaw patterns at each site.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 67, 2010.