

## ***Interactive comment on “Temporal variation in depth to water table and hydrochemistry in three raised bogs and their laggs in coastal British Columbia, Canada” by S. A. Howie and H. J. van Meerveld***

### **Anonymous Referee #1**

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This paper focuses on hydrological and geochemical characteristics of an important transitional environment at the edge of bog peatlands. There is surprisingly sparse detailed hydrological information on this transitional zone, especially given its ecological significance as a series of ecotones, and its potential role in the health of the bog system it surrounds. Consequently, any contribution of sound data has value. Unfortunately, this research has several fatal flaws, which in my opinion cannot be rectified by rewriting, and seriously compromises most of the interpretations made. Firstly, the

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hydrological analysis is based on water table characteristics at representative sites along multiple transects. However, the instrument used to measure “water table” was a piezometer, 1.5 m long with slots at the bottom 40 cm. This is a piezometer, not a well, and is thus giving pressure (expressed as total head) at 1.1 – 1.5 m depth (i.e centred at 1.25 m), and not water table. It is quite probable the lagg is a zone of groundwater discharge, in which the total head measured in the piezometer there would be higher than the local water table. Bogs are typically recharge features (albeit weak), in which the water table would be higher than measured in the piezometer. Thus all the water table values reported are wrong – not water table. One could, I suppose, report water pressure at 1.25 m, and make an analysis – but this would be arbitrary.

Secondly, the water chemistry data are highly suspect, because of serious improper protocols for sample collection. Most samples were collected several weeks after the piezometer was pumped – thus water sat in them for several weeks – one cannot leave water samples exposed to air for 2 weeks and expect the pH not to change. Moreover, EC and pH were measured in the top 10-15 cm of the water column (that sat for 2 weeks). Water seriously stratifies in a piezometer, and must be mixed thoroughly. Finally, there is no mention of caps on the piezometers, so rain and dust may enter them. Since the paper is about hydrology and water chemistry, and these were measured improperly, all that follows in the manuscript, is in my opinion, of little value. This is a great shame given the effort and expense. Because of the flaws, the rest of my critique is perhaps pointless. The introduction is too long and poorly organized. It took several pages to get to the point of the paper- which is about lags. We do not need a lesson in bog hydrology or how bog distribution is related to precipitation dynamics – we want to know about lags (or bog margins). Indeed there is not a great deal known about them; the author(s) wrote some of the most recent (and valuable) publications. This paper should start with a description or definition of lags (or margins), why they are important, and why they need to be further examined. This will set the context for the paper (and especially for the introduction, which should be focused on lags). There is also a tendency to cite review papers to support statements (e.g Wheeler and Shaw),

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who did not do the work and make the conclusions cited.

While the objectives are clearly stated, they do not follow well from what preceded; we do not really know why it is important that we improve our knowledge of them. Also, the second objective asks if a single period measurement is adequate to characterize bog and lagg hydrochemistry. This came as a surprise as it was not discussed at all in the preceding introduction – and it is a topic (i.e. sampling frequency), which has been addressed in the literature, albeit perhaps not for bogs and lags. I do not have much more to say about the writing in the Study Area and Methods sections (except in the detailed points below). In general I found the Results section to be rather wordy, trying to describe in words what is better shown in the Figures. I found it frustrating that the Results were more about the derived data (variability) than the data themselves (i.e. rather than describe the value of the measurement at a given site or transect, the presentation went more into how they varied by listing the difference in values, and not the values themselves. In places the Results slipped into Discussion with interpretations and literature. The Discussion never looked back at the Figures. I don't have much issue with the interpretations in the Discussion, notwithstanding my opinion that the data are flawed. However, it would be useful to discuss the strength of hydrological and geochemical interactions between sites on the transects, as a way of explaining the patterns observed.

### Specific Comments

14066:16 The article cited presumably refers to Irish/European bogs. In the Western Boreal Plain (Alberta and Saskatchewan) precipitation is not evenly distributed, and it is less than PE 14066:18 This sentence about precipitation is circular. Furthermore, I don't recall seeing anything about precipitation intensity affecting bog distribution; and the statement about precipitation distribution is not clear – distribution in time or space; and how is this a factor? There is an excellent article that discusses this, at least in the context of Eastern Canada (Damman 1979 paper "GEOGRAPHIC PATTERNS IN PEATLAND DEVELOPMENT IN EASTERN NORTH AMERICA). 14068:17 This paper

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is primarily about lags – but this is the first mention. It should be first and foremost in the introduction to set the topic. 14072:14 If surface lowering has reached the centre of the bog then probably there is no area “undisturbed”. Perhaps “relatively pristine”? 14072:19/20 It is not clear what the parenthesized expressions are. For example, how can a lag be an upland? 14073:1 Can you represent water chemistry of a 3000 ha bog with one piezometer nest? 14073:13 What is an “upland lag”? 14073:15 Suggest this paragraph be replaced with a table 14073:25 “Bog margin” and “lag margin” are more descriptive than trans1 and trans2. Names with earnings are easier to follow. 14074:9 Is there a need to differentiate between the two lags in one transect – e.g. lagg1 and lagg2? 14074:15 To what level of accuracy? 14074:18 Piezometers cannot be used to determine water table. For this a well is required – slotted over its entire length. 14074:22 This is an unusually long time to precede sampling. Water chemistry can change while water sits in a pipe. Did the piezometer have a cap to keep out rainwater and litter? 14075:6 Water sitting in piezometers becomes strongly stratified, so EC measurements of the top 10-15 cm of the water column will not represent the condition of the water in the pipe. 14077:1-15 The only convincing evidence of a rise in water table is that which occurs in lagg1 immediately after the clearcut. It is not fair to conclude the water table rise in 2011 is due to logging, through a comparison of 2010 and 2011, when 2011 was a wetter year, judging by the precip shown in Fig. 4. Also in Fig 4 (not affected by logging, the lowest measured water table (the metric you use) in 2011 was higher than in 2010. You need to focus the comparison on what happened at different sites in 2011, when the climate difference can be ignored. 14077:21 Not sure why the focus is so much on the variability rather than the values, but anyway I don’t see enough data at Campbell River to deduce a trend in variability. 14078:1 Again such a focus on variability, and it is not that helpful to know 28% of the sites had a certain variability – it is more important to know it by site type. 14070:18 The results section at this point has strayed from results to discussion, with interpretations and referencing. Better to keep the results separate, as was done above. 14080:13 In my opinion it would make more sense to have described these spatial patterns of pH, EC etc. at

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the different sites first (i.e. before discussing temporal variability). You need to report what the characteristic values are at different locations, then go on to discuss temporal variation. 14086:7 When I look at Sherwood trans1 and trans 2, and even Sherwood bog, I see the water table in 2011 being LOWER than 2010, except at the logged sites (which simply stated is more convincing than the more convoluted argument put forth earlier. 14086: 20 – end of paragraph. I found this section confusing.

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