

Interactive comment on “On the validity of modeling concepts for (the simulation of) groundwater flow in lowland peat areas – case study at the Zegveld experimental field” by P. Trambauer et al.

Anonymous Referee #2

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The work by Trambauer et al. is focused on the possibility of reliably simulating the flow field in the Holocene peat layer that outcrops in a large portion of The Netherlands. This task is accomplished by both experimental and modeling activities. The objective is clearly very interesting from the scientific point of view as the hydrologic response of peats is well known to be very complex. The goal is also very important from an applicative point of view because this peat unit constitutes the seal for the underlying sandy aquifer.

The major problems concerning the work described in the ms are related to the modeling effort. In fact, if the research focus is on the flow field in the upper 6-m thick peat layer, why the model domain is extended down to 300 m depth (p. 2075)? As the experimental investigation revealed a significant lateral heterogeneity of the CCL also at the local scale (see Fig. 3), why and in which way the simulation domain is extended from the dimension of the test site (about 50 m long) to a 900 m long domain (p. 2076)? In my view, much more reliable results should be obtained by modeling only the Holocene unit in the experimental site with: - a much more refined grid able to represent accurately the peat heterogeneity, in both the horizontal and in the vertical directions to obtain much more accurate velocity fields and travel times; - using the pressure head in the first sandy aquifer as boundary condition on the domain bottom; the simulation of the confined aquifer system is absolutely useless; - using the water level in the 2 ditches limiting the experimental site as lateral boundary conditions. Only very qualitative information can be obtained with the present model set-up. This is the main reason why I don't support the publication of the present ms in HEES.

There are also other weaknesses with the paper: 1) the conclusion about the possibility of using Darcy's law in peat soil is quite ambiguous. What means "Based on this information one is inclined to believe that Darcy's law with constant K_h may not be valid ... but that its application in model computations is justified" (p. 2076)?

2) slug tests were carried out to characterize K_h in the peat layers (p. 2070). But the conductivities obtained by their interpretation are representative of which layers? It is strongly evidenced just above that the CCL is very heterogeneous. Moreover, Fig. 5 shows that during the slug tests the water level remains well above the original position (at time =500 s the water level displacement is still 50% of the initial value). Why?

3) data about the result of the monitoring activity (e.g., water level vs time at the different monitoring points) must be shown;

4) what are the "standard rules for model calibration" (p. 2075)? What are the "GxG

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maps" (p. 2078)? Are the resolution of these maps comparable with that of the investigation carried out to characterize the experimental site?

5) Section 5.1.3 is useless and can be deleted;

6) do the simulations account for the water flow in the shallowest unsaturated CCL? Or is the CCL completely saturated?

7) in p. 2078 it is written that the "transient model was initially built ... for the winter period 2009 to 2010" and then "extended ... to simulate 4 and 8 yr simulation periods". But in which way this task is carried out? What is the reliability of extending data recorded over a winter season to a 10 yr long period? Some discussion is needed;

8) it is a nonsense to compare the model sensitivity to hydraulic conductivity and groundwater recharge (p. 2079-2080). The former is a factor forcing the system, the latter an intrinsic property of the system;

9) model results in the heterogeneous simulations (Figs. 8, 10, and 12) need to be clarified. Due to the CCL heterogeneity (K_v in the 3rd layer is 3 to 4 order of magnitude less than in layers 2 and 4 - see Table 2) it should be expected a much longer travel time to cross unit 3 instead of the other layers (i.e., much more bullets within the 3rd FD layer). But this is not what the pictures show. Why?

10) Fig. 1: all the borehole locations and the modeling section must be shown in the aerial photograph;

11) Figs 8 to 13: add proper vertical and horizontal scales. Why the domain of Figs. 10-13 is different from that used in Figs. 8-9?

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