Hydrol. Earth Syst. Sci. Discuss., 8, C1573–C1581, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C1573/2011/

Hydrology and Earth System Sciences Discussions

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 #1

Received and published: 19 May 2011

Contents of the paper:

The manuscript addresses issues concerning the applicability of Darcy's law and the validity of modelling approaches for the characterization of water flow and transport processes in peat. A case study, applying subsurface investigation methods and modelling tools, is performed at an experimental field site. Results are discussed in order to draw conclusions about applicability of the employed methods and tools at the test site.

Specific comments:

2068:

Is the CCL a phreatic aquifer here?

2069:

parcel? → better "plot"

Water levels = ? Please indicate some values!

Is the CCL saturated, is it confined?

2070:

How deep were the drillings, which diameter was used?

How were the slug tests performed, what was the excitation procedure, how were the measurements performed (measuring equipment), what was the time scale of responses

At what depths were the samples obtained?

What is the groundwater level; the levels are described first at page 2078!

2072:

explain how the parameters A and F are obtained

2073:

KGS results are shown and discussed, so the KGS formula should be shown and discussed, and it should be shown how the results are obtained

The r_c and L are geo-metrical factors, and the D(α) is a variable also containing time t.

The D(α) includes a term for the storativity S of the soil which represents the capacity

for elastic storage depending on the compressibility of the material (Hinsby, 1992). The

S can be obtained using the Cooper method when the unconfined aquifer is showing a

delayed yield response. → it should be shown how r_c and L are obtained, D(α) should be explained (equation), explain more detailed how S is obtained

2074:

Why were not all slug tests evaluated with a transient method, which seems to be superior?

What is the reason for using the steady state method if the transient method is superior?

Why not using KGS if Dax has problems with estimating S

2075:

Based on this information one is inclined to believe that Darcy's law with a constant K_h may not be entirely valid to describe groundwater flow in peaty environments, but that its application in analytical and numerical model computations is justified. → ??? what is the aim of this statement, please explain why is the application of Darcy's law for modelling justified if it is not entirely valid. Please provide a clear justified statement!

Is the model confined or unconfined?

How is the situation within the peat, saturated or unsaturated, to what degree?

2076:

How was the capillary rise considered in the model?

At the research area the flow through the CCL is downward which means that the Q_{up}

can be neglected. A thorough analysis of phreatic groundwater levels in the CCL and

piezometric levels for the sandy aquifer indicated this flow direction. → please ex-

plain more detailed how this finding was obtained, were there filter screens at different depths, what is the vertical gradient, show the filter screen locations etc.

2077:

How was Modflow used within the peat? If the peat is unconfined, were confined/unconfined model cells used?

If the peat is unsaturated, how was the unsaturated zone considered?

Which PMWIN-Modflow version was used, especially which MODFLOW-Version was used, and which packages were implemented?

elevations of the land surface which varied between -1.9

up to 2.7m below sea level. → -2.7 m

The bottom of the CCL varies between -8.4m and 9.1m below sea level. → -9.1 m

Slug test experiments carried out during the fieldwork, permeameter laboratory tests

completed by the Wageningen University and Research Centre, different literatures that

discuss the permeability of the CCL (e.g. Weerts, 1996), and pumping tests carried out

20 in nearby pumping stations for domestic water supply were considered in providing

the data to set up the hydraulic conductivities and storage parameters for the different

model layers. → show and compare also the other non-proprietary values

To satisfy anisotropic conditions, ratios between the horizontal and vertical

hydraulic conductivities, varying from 1 to 5, were adopted for the peaty and clayey

model layers in the CCL. → explain the selection of these values

2078:

For the peaty layers with a phreatic response in the CCL the

levels, ranging from -2.3 to 2.9m below sea level, were obtained from so called GxG

maps. → -2.9 m, how was the phreatic behaviour justified, what does GxG mean, reference?

The levels covered the range from -2.9 to 3.9m

below sea level. → -3.9 m

An unsaturated model for the root zone supplied the input data for groundwater

recharge from precipitation. → which model, was the outcome used as recharge for Modflow, or how was the unsaturated zone considered in the model?

Is the capillary uprise considered here in the unsaturated zone model?

2079:

The open water levels at the river and

ditches in the model area are controlled by HDSR and maintained at a fixed position

for winter and summer conditions. → please provide some numbers

The analysis showed that increases or decreases of 50% in the values for the hydraulic conductivity of the CCL and the groundwater recharge resulted in phreatic groundwater level changes of less than 0.1m and piezometric groundwater level changes were even below 0.01 m. → what are piezometric groundwater level changes? All water levels are measured in piezometers, please change the formulation, as this wording is not correct; the authors most probably refer to heads in the CCL and in the sandy aquifer below, please indicate the vertical position of the head measuring level

The hydraulic conductivity is a bit less sensitive than the recharge. The transient mod-

els

require the input of storage parameters like the specific yield and this parameter is also

sensitive. From a general point of view, however, the sensitivity of model parameters

20 is not that large which could be attributed to the control which the open water levels at

the ditches exert on the groundwater levels. → this is a little bit imprecise, please provide numbers

2080:

For the transient model computed phreatic and piezometric groundwater levels could be compared with groundwater levels measured during the fieldwork in the upper peaty layers of the CCL and in the sandy first aquifer. → see above, → what are piezometric groundwater level changes? All water levels are measured in piezometers, please change the formulation, see above!

Please provide a calibration plot (measured versus simulated heads)!

The equivalent value for the horizontal conductivity was obtained from the total horizontal

transmissivity of the CCL and was calculated as K_h = $0.1md - 1.Theequivalent$

vertical conductivity was elaborated from the total resistance across the CCL. → please describe the averaging approaches in detail, what does total resistance mean?

2081:

Additional hypothetical models have been prepared to study the path lines

and travel times for typical upward flow through the CCL. → please provide more information on this, references etc.

2082:

Transient hypothetical models have been used to generate pathline patterns and compute

travel times for upward flow through the CCL. → please provide more information on these models (setup, boundary and initial conditions etc., what is hypothetical, . . .)

For comparative reasons, the absolute differences in phreatic and piezometric groundwater levels for the models were similar than for the models simulating downward flow. → All water levels are measured in piezometers, please change the formulation, see above!

2083:

Uncertainties in modeling arising from the heterogeneity in peat soils and

the applicability of Darcy's law could be eliminated through a proper model set up. → please remove this sentence, as the authors mention the Darcy's law issue is not clear yet etc.

2085:

The conclusion is that groundwater models that are based on the representation

of the CCL with one homogeneous model layer are less suitable for assessments on groundwater transport where travel times play an important role. In particular when

they are considered for the simulation of contaminant transport, models with a homogeneous

CCL should not be used.

→ Comment: These findings are somehow trivial. It is not surprising that a more detailed representation of reality will provide better results!

→ additional text is recommended here!

2087, 2089 and 2090:

the borehole locations should be indicated in Figure 1!

2091:

please provide water levels

2092:

location of the profile should be indicated in Figure 1

Fig. 4a needs more explanation. What is shown in Fig. 4a?

2093:

where is borehole N5? Please provide location in Figure 1.

N5 is not mentioned in Tab.1

2094:

please provide water levels

2095:

what is the meaning of "Model" in the arrow box?

what is GMO?

fresh/saline interface → please add water twice

indicate water levels

2096-2101:

explain the blue arrows and the blue boxes (ditches) in the figure captions

provide lengths in all figures, indicate water levels at least for the steady state scenarios

Concluding remarks:

The paper is not acceptable in the present form for HESS. **Moderate-major revision is suggested**, addressing the specific comments.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 2065, 2011.