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Hydrology and Earth System Sciences Discussions

Interactive comment on "Quantifying the impact of groundwater depth on evapotranspiration in a semi-arid grassland region" *by* M. E. Soylu et al.

Anonymous Referee #2

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Comments on " Quantifying The Impact Of Groundwater Depth On Evapotranspiration In A Semi-Arid Grassland Region" By Mehmet Evren Soylu, Erkan Istanbulluoglu, John D. Lenters, Tiejun Wang, Hess-2010-262-Manuscript-Version2

General comments

The paper tried to estimate the advantage of the modified G-E model in dealing with the interaction between groundwater depth and surface evapotranspiration, for areas where the water table is shallow. Although the topic is quite interesting, the author did not organize the information in an understandable way. Most of the manuscript is fragmented, unclear and inconsistent.

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It takes a lot of efforts to check the different equations in several relevant references to understand the consistency that the manuscript should have, which actually is absent at this stage. For example, in Line 18 Page 5, the authors stated that the potential water extraction was often taken as the potential rate of transpiration. However, referring to the same literature the authors cited, the potential water extraction was actually expressed as the ratio of the potential transpiration to the root zone depth. Even in the introduction, inconsistency existed. For example, in Line 24 Page 4, the authors stated that two modified forms of G-E model were used. However, in Line 18 Page 9, the authors stated that the original G-E model and a modified version of it were used.

Some specific comments are given below. 1 COMMENTS FOR SECTION 2.2 1.1 What is the model used for soil water retention and unsaturated hydraulic conductivity? It should be stated clear, considering three different simulators are used. 1.2 What is the expression or concept for the water uptake fraction and the potential transpiration? It is important to understand the concept of the water uptake fraction and the potential transpiration in IBIS, considering that the study focuses on the relationship between the groundwater depth and the ratio of actually evapotranspiration to potential evapotranspiration. 1.3 How are the parameters in Equation (7) determined? Although most of the details could be checked when referred to the relevant literature, it is important to point them out directly, because they are fundamental for this simulation study. The same reason applies also for the above two points listed. 1.4 Line 17 Page 7 The authors stated that "IBIS originally has 11 soil layers with varying thicknesses from 5 cm to 50cm. It means that the thickness of soil column could reach at least 5.5m. Why 2.5m was used for the thickness? And, if 2.5m is used, what is the note spacing in IBIS? 1.5 Line 20 Page 7 The author stated that "in our model simulations, the water table is positioned by saturating the soil layers below the specified water table depth. . .. . ." Is this for all three simulators? It is always necessary to state more specifically for readers.

2 COMMENTS FOR SECTION 2.3 2.1 Line 21-23 Page 9 What is the model used for soil water retention? 2.2 From equation (10) to (15), the same symbol, n, is used to

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express soil index and porosity at the same time. Clarify it. There is another symbol, s, which is used in equation (7) as the heat/vapor transfer coefficient between canopy and air, but also is used to express saturation degree in equation (15). Change the symbol. 2.3 How is the ETp in equation (18) determined? 2.4 Why grass is used as the prescribed plant parameters? What is the parameterization scheme for grass as the plant? 2.5 Is there any reason, literature or mathematical derivation for the assumption in Line 5 Page 11? 3 COMMENTS FOR SECTION 3.2 3.1 Line 11-15 Page 12 The direct comparison between the measurement and the simulation by HYDRUS1D and IBIS should be conducted for validating model. As for the G-E model, it is acceptable to use averaged value, but not for the model that can provide outputs at observed depths. 3.2 Line 24 Page 12 Instead of pre-defined soil type, the real test of the soil physical parameters in lab or in situ is required for validating a model. 3.3 Line 26-27 Page 12 Why were the parameters in models adjusted? What was the mechanism behind? 3.4 Line 28 Page 12 In figure 1, only daily data was shown, how were the hourly input data generated? 3.5 Line 11 Page 13 In the first paragraph of section 3.2, the averaged value of soil moisture content (by the way, the original word "soil moisture value" should be revised as soil moisture content) is used in IBIS and HYDRUS 1D. Then, the explanation here for the strong response to precipitation is not correct.

4 COMMENTS FOR SECTION 3.3 In the third paragraph of this section, the author stated that ETp is calculated using the Priestley-Taylor method. However, in the last sentence of the fifth paragraph, the ETp in HYDRUS 1D is taken from Eta in IBIS with all soil layers saturated. It confused readers. Is this the reason for the difference in ratios of Eta/ETp in Table 3? 4.1 Line 20 Page 14 How is water table increased from 2m to the surface? 4.2 Note spacing effect should be checked with a higher resolution, in order to show the trend of the effect more convincingly. 5 COMMENTS FOR SECTION 4.1 Different soil physical parameters will definitely influence the calculation results, so does different node spacing. There is nothing innovative in this section, in terms of sensitivity analysis.

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What is the concept of “critical zone”? Does it have anything to do with rooting depth of the vegetation? 6 COMMENTS FOR SECTION 4.2 6.1 Line 16-17 Page 17 Of course, they will converge when the water table gets closer to the surface, because the same ETp is used for both IBIS and HYDRUS 1D according to Line 1-2 Page 15.

As long as the potential evapotranspiration is calculated with the same scheme, when the soil is saturated, the ETa/ETp should equal to one unless the calculation scheme is not correct. 6.2 Line 15-18 Page 18 Considering that the equations for unsaturated hydraulic conductivity are not the same in these two simulators, the discrepancies between HYDRUS and G-E model can be explained in more details. The different schemes for calculating actual evaporation in these two simulators could also contribute to the difference in figure 6.

In Fig. 1, what is the representativeness of the meteorological station some 150 km away?

In Figs 4-6, what does measurement say?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6887, 2010.