

Review of "A high resolution global scale groundwater model" By I. De Graaf et al.

Scientific Significance:

Does the manuscript represent a substantial contribution to scientific progress within the scope of Hydrology and Earth System Sciences (substantial new concepts, ideas, methods, or data)?

The paper addresses a very interesting topic which is definitely suitable for the journal. I believe it is important to have a better consideration of groundwater at the global scale: this will help understanding and refining the results of the global hydrological model and it is definitely justified by the increase amount of data (also geological data) that are becoming available at the global scale. We are all aware of the limitations of the global set of data, but this should not prevent us from using these data for global scale models just clearly showing all the potential drawbacks.

The paper is definitely within the scope of HESS.

Scientific Quality:

Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)?

The applied methods that are applied are valid, but the general description of the approach is a little confused and mainly the discussion is not complete. For example, regarding the description of the methods, I found confused the explanation of the aquifer properties presented in chapter 2.2: I would suggest some rewording there.

Regarding the discussion, I think it needs to be more focused on the very important and critical points. Just as an example, many times it is noted that there are problems because of the perched water tables in the mountains but it is not clear what is the actual impact of these observations (there is a figure that should show that, Figure 6, but it is impossible to understand that). Instead of concentrating on that I would find very interesting a discussion regarding the general overestimation of the results. What the authors think as the more reasonable explanation for that? I find it more interesting potentially with a higher impact on the future work than the problem with the perched GW table.

Presentation Quality:

Are the scientific results and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables, appropriate use of English language)?

I will provide here a more detailed list of suggestions:

p. 5220 l. 10: the sentence is not clear

p. 5223 l. 25: transmissivity should be in m^2/d so I do not understand why in the parenthesis k is correctly multiply by the thickness D but the units are m/d .

p. 5224 l. 20: I do not understand the difference between surface and floodplain elevation. Aren't they both obtained with Hydrosheds? And what happens when the aquifer thickness is zero?

p. 5227 l. 10-15: this should be better explained

p. 5229 l. 3-5: am I right that this implies that smaller rivers will not lose water?

p. 5229 l. 10-20: it is not clear which is the use of this in the MODFLOW model.

p. 5230 l. 3-10: I am not sure that changing together conductivity and recharge can provide useful results: usually they are strongly correlated

p. 5230 paragraph 2.5: how have transient data been used

p. 5230 l. 26: put the figure number where these results are presented

p. 5231 l. 14: figure number is missing

p. 5232 l. 8-9: not clear

p. 5232 paragraph 3.2: did I understand correctly that the observations have been used as they are?

p. 5233 l. 13: I do not understand why the blue dots are still in the figure and also regarding the same figure (figure 6) the difference between the two versions is not clear and I would suggest to present only one of them

p. 5233-5234: the last paragraph of 3.2 is very confusing

p. 5235: the conclusion needs to be restructured: the problem with the perched groundwater tables is repeated again, but I think that a discussion on the potential reason for the residuals being always negative should be included

Figure 5: it is really hard to distinguish and I suggest a better explanation in the caption

Figure 7: in this figure, what is presented in the three maps is hardly readable and I suggest to keep just the histograms