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Geoscientific Model Development Discussions

Interactive comment on "Simulation of groundwater and surface water over the continental US using a hyperresolution, integrated hydrologic model" *by* R. M. Maxwell et al.

Anonymous Referee #1

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This manuscript by Maxwell et al. seeks to address one of the grand challenges in the field of hydrology by simulation of surface-subsurface flow across a very large area of North America at high spatial resolution. The simulation results demonstrate an ability to capture the general features of the surface and subsurface system as compared to the observed streamflow and head data. Whilst the results are expected, a quantitative demonstration of such with a mechanistic model is quite powerful. This model of a large part of the US is a nice advancement from the proof of concept for ParFlow at very large cell numbers (Kollet et al 2010). This paper is a good fit for GMD and I have only some minor comments on the manuscript, which should be addressed before publication.

Pg 7320 Ln 11: "scale" should be "scales".

Pg 7320 Ln 23: delete superfluous "6,300,000 or"

Pg 7321 Ln 21: Is this sentence saying that ParFlow can simulate variable density and viscosity, but you have chosen not too? This assumption is fine, it is just a little unclear.

Pg 7323 Ln 6: These well-known mechanisms of infiltration excess and saturation excess should have a reference to aid the reader if they would like to know more, e.g. Dunne 1983 .

Pg 7323 Ln 21: Please give details for the robust numerical solvers or provide a reference here.

Pg 7326 Ln 27: I am not sure "novelly" is appropriate here, or at least needs further qualifying. ParFlow and other models such as HGS have demonstrated this already. Is the novel aspect the very large scale model using such an approach to naturally generate streams? If so then this could be specified.

Pg 7325 Ln 15: Rather than "good" can the authors be quantitative here.

Pg 7327 Ln 12-15: This is important because I assume all of the observational data is post-development. This requires more discussion, e.g. How does this play into to the goodness of fit for the model? Given that Parflow has the capability for all of these anthropogenic stresses, is it likely that they will be added? This is most likely future work that could be eluded to in the conclusions.

Pg 7327 Ln 24: " the goodness of fit may be obscured" Why is this?

Pg 7327 Ln 27: " and may be due", change to "are likely"?

Pg 7329 Ln 1: Delete "the" before Colorado

Pg 7329 Ln 24: I don't think this is counter intuitive at all, I would expect that in areas with larger K that recharge would be greater and stream density would decrease due

to decreased runoff.

Pg 7329 Ln 26: Insert “is” after “This” . . . => “This is more clearly “

Pg 7330 Ln 15-29: Figure 10 is being referenced where it should be Figure 11.

Refs

Dunne, T., 1983. Relation of field studies and modeling in the prediction of storm runoff. In: I. Rodr∼guez-Iturbe and V.K. Gupta (Guest-Editors), Scale Problems in Hydrology. J. Hydrol., 65: 25–48.

1. Does the paper address relevant scientific modelling questions within the scope of GMD? Does the paper present a model, advances in modelling science or a modelling protocol that is suitable for addressing relevant scientific questions within the scope of EGU? YES, YES

2. Does the paper present novel concepts, ideas, tools, or data? YES

3. Does the paper represent a sufficiently substantial advance in modelling science? YES

4. Are the methods and assumptions valid and clearly outlined? YES

5. Are the results sufficient to support the interpretations and conclusions? MAINLY YES

6. Is the description sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? In the case of model description papers, it should in theory be possible for an independent scientist to construct a model that, while not necessarily numerically identical, will produce scientifically equivalent results. Model development papers should be similarly reproducible. For MIP and benchmarking papers it should be possible for the protocol to be precisely reproduced for an independent model. Descriptions of numerical advances should be precisely reproducible. YES

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? YES

8. Does the title clearly reflect the contents of the paper? The model name and number should be included in papers that deal with only one model. YES

9. Does the abstract provide a concise and complete summary? YES

10. Is the overall presentation well structured and clear? YES

11. Is the language fluent and precise? MOSTLY

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Figure 7 and 8 are quite small and hard to read. I would suggest enlarging these so that the font sizes are at least 8pt (but 10pt would be better).

14. Are the number and quality of references appropriate? YES

15. Is the amount and quality of supplementary material appropriate? For model description papers, authors are strongly encouraged to submit supplementary material containing the model code and a user manual. For development, technical and benchmarking papers, the submission of code to perform calculations described in the text is strongly encouraged. The source code and manual appear available online.

Interactive comment on Geosci. Model Dev. Discuss., 7, 7317, 2014.