Interactive comment on “High-Resolution Virtual Catchment Simulations of the Subsurface-Land Surface-Atmosphere System” by Bernd Schalge et al.

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Please find my comments in the attached pdf.

Best regards,

Erwin Zehe

Please also note the supplement to this comment:

General comments and evaluation: This manuscript introduces a coupled, cross compartment simulation of the water and energy cycles using the Neckar basin as case study. I very much agree with the authors that coupled simulations of water and energy cycles are a key to achieving our fundamental understanding of environmental system dynamics and b) to identify and verify deficiencies in data assimilation schemes. For the scope of the manuscript is better suited for the audience of HESS and I think that the proposed coupled simulation has a large scientific potential.

Unfortunately, the implementation of the coupled model study and its scientific presentation in the manuscript are far below the quality standard required for a publication in HESS. For present form the paper has no clear scientific objectives. Page 1 of the introduction reads very much a letter proposal which lists all possible advantages of virtual reality — yet the manuscript does not address a single of those possible scientific objectives. This is a major opportunity wasted for authors provide sound arguments, that plausibility of virtual simulations results is sufficient to use the virtual reality for scientific learning. I think this is a) wrong (see major point below) and b) applies that the manuscript is not comparable, simply because plausibility of model results is nothing that can be falsified based on the provided model evidence if the authors have a different system, they need to evaluate how to measure plausibility in an objective sense. In consequence the manuscript does not support a coupling scientific learning process because the final results may provide those results is correct but it is in accordance with the mental setting of the author.

Given the high potential of the coupled model strongly encourage the authors to re-evaluate a much more focused study, particularly with clear scientific objectives. I hope that the points listed below will be helpful for this. I have doubts whether this can be achieved within the period usually granted for major revisions, particularly also because the revision requires additional similarity tests with the model system.

Major points

1. In contrary to the authors’ statement, I think that virtual reality is only suitable for scientific learning, if they properly understand system dynamics and are familiar to the limitations of virtual simulation approach. It is not helpful to compare virtual results with real-world results and conclude that virtual results are realistic. Therefore plausibility studies need to be treated along with standard evaluation scores and acceptance thresholds, thereby avoiding the misapplication. In general when we find what we want to find, data assimilation procedures, which work well in an error-prone virtual reality, might not necessarily do a good job in reality, particularly if the model is biased. In reported study would have been on the question whether the proposed model system performs already good enough in an virtual reality. Therefore employing related-model extensions, even if this will be not the case yet, the study would be extremely interesting and valuable. Computational expense is not really a barrier here but, as there are available methods to assess completeness of data of computational expensive results within less than 50 runs further possible objective could be to quantify which limits in water-balance simulations stems from the fact that we usually drive the PDSI part of hydrological cycles, with element simulation data of air temperature and air humidity. In the coupled model does the expectation to the level of perfect predictions 47 and as favorable as the reference team.

2. The referencing is absolutely inappropriate. The authors should acknowledge past work of competing groups in the area of coupled, cross compartment modelling, of water in energy cycles.

Fig. 1.