

Interactive comment on “On inclusion of water resource management in Earth System models – Part 1: Problem definition and representation of water demand” by A. Nazemi and H. S. Wheater

Anonymous Referee #2

Received and published: 27 August 2014

This is a very interesting, comprehensive and detailed review on approaches to simulate freshwater demand by using large scale models. Certainly it fits very well to the scope of the journal and I'm sure that it will find a broad readership. I highly recommend to publish it in HESS but have a few comments that the authors may consider in a revised version of the manuscript:

1) I agree with the anonymous referee #1 that it would be nice to have some more explanation with regard to the basic structure of the review (maybe even a schematic illustration). It should describe the classification of models into Land-Surface-Schemes (LSS) versus Global Hydrological Models (GHM), irrigative versus non-irrigative de-

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mand, top-down versus bottom-up approaches, online representation versus offline representation. In addition to the explanation of terms it could be described why exactly these distinctions are useful. This would fit nicely to the end of section 1 (page 8247).

2) I miss some discussion related to environmental water demand. The authors describe nicely all the anthropogenic impacts on the world's freshwater system and the structures like reservoirs or dams controlling amount and dynamics of the discharge in many rivers or (over)use of groundwater. Shouldn't it also be part of water resources management to ensure basic environmental water requirements when considering that most of the freshwater bodies are controlled or at least impacted by human activities? Or in other words: do we need to manage these requirements actively instead of just constraining human water extractions? Should we account for environmental water demand at the demand side (this paper) or at the supply side (the companion paper in HESSD)? It seems that the topic becomes more and more relevant while the implementation in large scale models remains very weak and simplified. At least in the discussion section I would therefore expect some sentences related to this issue.

Specific comments: Page 8240, lines 23-25: “We argue that current limitations in simulating various human demands and their impact on the Earth System are mainly due to the uncertainties in data support, demand algorithms and large-scale models.” => It seems that this is obvious. I don't know any other reason that may contribute to the limitations . . .

Page 8244, lines 23-26: “Although human water use still accounts for a small proportion of total water on and below the surface (see Oki and Kanae, 2006), it currently includes around 26% of terrestrial evaporation and 54% of surface runoff that is geographically and temporally available (Postel et al., 1996).” => 54% of global surface runoff seems to be a lot! Does this include instream uses (e.g. for water power)?

Page 8248, line 13: I miss the reference to Wada et al., 2010 in the list of references.

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The same for Siebert et al., 2010 in line 15. Please check the list of references for completeness.

Page 8264, lines 26-30: "Uncertainty in current data support . . .". I think, another major constraint in data support are inconsistencies across model input data. The models described in this paper require information for many different input variables. Typically, these input data sets are developed independently from each other with different methods resulting in inconsistencies, in particular at pixel level (e.g. soil properties do not fit to land use, humidity does not fit to precipitation, irrigated land in forest areas . . .). Typically, modelers fix these inconsistencies by applying simple rules or assumptions. The impact may be small for global mean values but can be high at the local or regional scale.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 8239, 2014.

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