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Hydrology and Earth System Sciences
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Discussions

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 #1

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General comment

This paper comprehensively reviews how the current generation of global (hydrological) models consider and parameterize freshwater demand and its interactions with other components of the earth system. In so doing, it provides a great overview of the existing model suite and the uncertainties related to global-scale water demand assessments. There is little to add to it, but nonetheless here follow some recommendations of what research areas could be further discussed (and where the paper could be more focused).

Major (moderate) comments

Title and models: Your definition of Earth System Models is unclear. On the one hand you talk about GHMs and on the other hand about LSSs, while DGVMs also come into play. Please consider a thorough definition of model types (and a change of the title if applicable). Also, the title mentions “water resource management” while your focus is rather water demand (indeed, how models do water management is explicitly left out as stated on p. 8249 lines 2f – or do you mean effects on climate here?).

Section 3.2. and 3.3: I’m afraid I haven’t understood the difference between “bottom-up” and “top-down” approaches. Are these appropriate terms? And aren’t the problems discussed in 3.3 (e.g. the PET method) also inherent to approaches discussed in 3.2? P. 8251 first paragraph: Models with fully dynamic crop growth and dynamic irrigation may also misrepresent irrigation demands if they do not correctly represent the seasonality. In contrast, models with fixed crop calendars may not respond well to yearly weather conditions. I think Portmann et al. (2010) have a discussion on these effects, which should be considered here.

Some further aspects could be briefly discussed, i.e. the following: How do models treat demand from groundwater (fossil, renewable)? How do water demand and its parameterization feed back to runoff/discharge and eventually sea level rise (could be part of section 5.1)? What can be said about how models treat tradeoffs among different demands (irrigation, industry, municipal) – which I think is a major topic? Do/can models rigorously consider water limitations in their demand calculations – which is another very important topic in my view? Whether models consider seawater desalination and “green” water demands could also be mentioned.

Minor and technical comments

The Abstract should mention a focus on how water limits energy, agriculture, etc., in case you’ll consider this in your revision.

HESSD

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The text on hydrologic improvements of models in terms of water supply (p. 8242 lines 17ff) is rather long given the focus of this paper; isn't this the focus of the companion paper? P. 8243 lines 7-12 could also be left out. P. 8245 lines 8-19: This paragraph could be shortened and moved to the related discussion on the preceding page.

Section 3 starts rather suddenly with irrigation, please introduce the section in a better way.

P. 8257 lines 19-22: I have the impression that non-irrigative demands are usually treated less interactively with other components than irrigation demands, can you say something about that?

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