

Interactive comment on “Uncertainty analysis of a spatially-explicit annual water-balance model: case study of the Cape Fear catchment, NC” by P. Hamel and A. J. Guswa

Anonymous Referee #3

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I found the paper very interesting. Tools such as InVEST are more and more frequently used, and a work which highlights uncertainty of model outputs and provides guidelines to implement sensitivity analyses in the modeling approach is of high interest.

The research question addressed in the introduction seems to focus on whether the Budyko curve can be applied in a spatially explicit context as it is in InVEST, as opposed to the traditional application in lumped models. The work of the authors is put in the context of recent studies which tested for uncertainties of predictions of the InVEST tool in the introduction. I would suggest to extend this paragraph to highlight in more detail how the presented approach adds to prior findings. The motivation stated in the

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abstract does not link to the main text. I would suggest to add a small paragraph to the introduction about what constitutes the mentioned increasing demand for assessments of water provisioning services and how e.g. ecosystem service assessments can benefit from valid spatially-explicit models (as opposed to lumped models), and how the presented work relates to this.

Overall, the paper is well written. A main flaw in the writing style, however, is a lack of consistency in the terms used, which involves an introduction of ‘jargon’ at some points: For example, you alternate between “water yield” and “yield”, “water withdrawal” and “groundwater withdrawal”, “crop coefficient” and “crop factor”, “distributed” and “spatially explicit” model, “Zhang model” and “lumped model”, etc. Additionally, you use the terms basin, catchment, watershed, subcatchment and subwatershed interchangeably throughout the paper. I would suggest using one term consistently throughout the paper to facilitate the reading process. The description of the analyses performed in the paper are well documented. The Budyko formula and relevant parameters are well explained and necessary background information is provided in the method section.

At some points in this paper, the overall aim of this paper could be emphasized. This could be done by highlighting a set of research questions in the introduction, and use a parallel writing style/structure across the method, results and discussion sections. This could involve restructuring some of the subsections or even merge them, for example: In the methodology, first, introduce the study area; second, introduce the InVEST model and Budyko equation; third, selection of the Z parameter; forth, the overviews on the sensitivity analyses. In the result section, I would suggest to maintain this structure, which means that you would have to either merge section 2.5.2 with section 2.3 or split section 3.1 and move the section about sensitivity to climate to 3.3.3 in the result section, to make the paper structure more reader-friendly and consistent. The same goes for the naming of the headings: In the result and method sections, you refer to “Performance of the InVEST model”, while you call it “Model performance” in the Discussion (Same goes for “spatially explicit” in the header of sections 3.2 and 4.2

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and “distributed” in section 2.4). I would suggest to aim for a parallel structure and to streamline the chosen terms. In section 4.1, again, you only address sensitivity to Kc and Z, not to climate, even though these findings are also mentioned in the paragraph.

I.12 p.11013: This part is a bit non-informative (some more than others,...). I would suggest to refer to the maximum observed variability or another more quantitative way to make the statement more meaningful. I.1 p.11016: withdrawal (spelling error)

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