

Interactive comment on “On the effect of the uncertainty in soil properties on the simulated hydrological state and fluxes at different spatio-temporal scales” by Gabriele Baroni et al.

Anonymous Referee #1

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Review of Baroni et al. 2016, STOTEN

General comments

The study analyses uncertainty in soil properties (sand%, clay% and bulk density) using 3 different perturbation methods. The perturbed soil properties are run through the hydrological model mHM in order to evaluate the effect of uncertainty on the soil properties on the simulated hydrological states and fluxes. The uncertainty on the simulated model outputs are afterwards analysed at different spatial and temporal scales. This is an interesting paper and a novel contribution. The paper is technical strong, written in good English and has a good structure. I recommend publishing the paper after minor revision

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Specific comments

Novelty: I think you should state more clearly that your study is a novel contribution in respect to both the ways of introducing uncertainty on soil properties (if I understand correctly, this is done more simple in other studies?) and that you take the temporal resolution into account in your analysis (which is not considered in Refsgaard et al. (2016), Hansen et al. (2014), He et al. (2015))

Title: I suggest changing the title to "Effects of uncertainty in soil properties on simulated hydrological state and fluxes at different spatio-temporal scales"

Figure 1 and Page 3, line 22: When first seeing figure 1 and reading the text, I was a bit confused about the transect depicted in the figure. After reading the rest of the article I now understand that it is a horizontal transect through a catchment and not a vertical transect (showing how the sand% change with depth). Could you maybe make this more clear in the text and also in figure1?

Page 3, line 4: I suggest adding some extra text to this sentence, which tells the reader that you are using more sophisticated methods to describe the uncertainty, compared to the studies you mention on page 2 that use more simple assumptions. In this way you clearly indicate that your work is novel.

Page 5, line 11: I do not understand what you mean by "the vertical soil horizons are aggregated to the total soil depth of 2 m"?

Page 5, line 12: How do you define the 29 soil units? Could you show the units on the maps of figure 3?

Page 6, line 21: How is the upscaling done? Is it just taking an area-weighted average of the parameters?

Page 8, line 8 + Figure 2: So are the gauging stations shown on figure 2 "artificial stations" you put in to define the subcatchments you use in analysis #3? If so, could you call them something else on figure 2 that indicates that these are not real gauging

stations with actual measurements

Page 10, line 32 + page 11, line 1: Are these average CV values across the catchment (15% for Q, 11% for GWR, 3% for SM and 1% for AET) for all the perturbation methods all together (that is how I read the first part of the text) or for the RE method only i.e. the results in figure 6 left (this is how I understand the parenthesis on line 1, p.11)? Please make this more clear in the text.

Page 11, line 14-15 + figure 7: So you calculated correlations coefficients for each of the 3 perturbation methods and then afterwards the average and standard deviation of these R2 (which is plotted on figure 7)? Please specify this in the text and in the figure text.

Page 11, line 20: It looks to me as the pattern in soil moisture uncertainty is very similar to the patterns in clay%? When I visual compare the CV SM map in figure 6 (left) and clay% maps in figure 4.

Page 11, last section: When reading this I was wondering why the AET is not correlation to soil moisture. But you give the explanation on page 12 line 17-18, that AET is close to PET most of the time, and I guess that is why they are not correlated? Maybe you could also mention this explanation on page 11?

Page 12 line 29 + Page 16 line 6: I do not understand what you mean by threshold behaviour/condition?

Page 13, line 18-26 + point 5 in conclusions: You conclude that stream flow, which is an integrated flux, is only sensitive to large spatial structures, whereas the local states and fluxes (i.e. soil moisture, AET, GWR) are sensitive to small scale variations. This makes sense to me. But I would like some more explanation (on page 13) on how you see this from the graphs in figure 9, since that is not clear to me.

Page 14, line 7-26: I found this sections difficult to understand, please consider to rephrase so it is easier to read. Since you are talking about “representative scale” in

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the section, I suggest that you present the RES concept already here (you only mention it in the conclusion).

Page 16, line 24-25: I think you should make it more clear, that you have done something new compared to the other studies using the RES approach. I suggest starting the sentence with something like “This study proposes two extensions to the RES approach. . .”

Technical corrections

Page 1, line 12: Delete “the” in front of “uncertainties”

Page 1, line 12: Change “The methods are applied at the soil map. . .” to “The methods are applied on the soil map. . .”

Page 1, line 21: Change to “. . .(or is not). . .”

Page 1, line 24: Delete “the” in front of “uncertainties” and add s on “soil map”

Page 1, line 13: Change “. . .propagated based on. . .” to “. . .propagated through. . .”

Page 3, line2: Please add “soil” in front of “map” and change “map” to “maps”

Page 3, line 4: Change to “In the present study, we investigate impacts of uncertainty of soil properties on hydrological states and fluxes”

Page 3, line 4-5: change to “Uncertainty in soil properties is. . .”

Page 3, line 5: Add comma before but

Page 3, line 9-10: Change to “The extent of the impact is expected to decrease with increasing the aggregation area and to disappear at a specific domain size.”

Page 3-4, line 31/1: change to “. . .smaller soil units that have not been detected. . .”

Page 4, line 27: Change “. . .can be also.” to “. . . can also be.”

Page 5, line 1: Change “field” to “fields”

Page 5, line 12: Please rephrase "...reveals a soil prevalently clay loam..."

Page 5, line 32: Change "...i.e., area smaller than..." to "...i.e., patterns smaller than..."

Page 6, line 11: Change "...and its packages" to "...using add-on packages". Maybe you should write which packages you use?

Page 6, line 23: Please rephrase the sentence. I suggest to change it to "...into 3 layers; the first layer is 5 cm, the second layer is 20 cm and the third has a variable thickness."

Page 6, line 30: I suggest changing ", which covers around 16430 grid cells" to "resulting in 16432 grid cells"

Page 7, line 7: Delete "in" after "yield"

Page 7, line 25: Delete "the" in front of "analysis #1"

Page 8, line 3: Delete "the" in front of "analysis #2"

Page 8, line 5: Add a reference to figure 2 where the location of the grid point are seen

Page 8, line 7-8: Change "In particular, for the analysis #3" to "For use in analysis #3"

Page 8, line 16: Change "cell" to "cells"

Page 8, line 18: Delete "the" in front of "analysis #4"

Page 8, line 18: Change "showed" to "shown"

Page 9, line 9: Change "down row" to "bottom row"

Page 9, line 17: Change to "...highly identifiable and the sharp changes between the units are still preserved."

Page 9, line 22-23: Please rephrase sentence (starting with however), it is difficult to understand.

Page 10, line 5: Change “detailed” to “described”

Page 10, line 8: Add a comma in after magnitude

Page 10, line 10: Change to (i.e., standard deviation > 0 for the resolution of 60 x 60 km²). Maybe the same sentence in line 13 can be shortened?

Page 10, line 11: Delete “the” in front of “spatial scale”.

Page 10, line 14: Add a comma in after domain

Page 10, line 29: Change to “. . .are shown for the transect..”

Page 10, line 32: Change “. . .over the catchment..” to “. . .across the catchment..”

Page 11, line 5: Change “affected on” to “affected in”

Page 12, line 23: Change “the first grid cell” to “grid cell A” and “the second grid cell” to “grid cell B”

Page 12, line 25: Delete “the” in front of “grid cell”

Page 14, line 11: Please rephrase “it is notable a certain spread..”

Page 14, line 12: Add s on “catchment”

Page 14, line 23: Change “with reducing the” to “with decreasing”

Page 14, line 25: Change “increasing” to “increasingly”

Page 15, line 3: Change “. . .across the all number of grid cells. . .” to “. . .across all the grid cells. . .”

Page 15, line 16: Change “emphasises” to “emphasises”

Page 15, line 18: Add d on compensate

Page 15, line 21: Add s on subcatchment

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Page 15, line 25: Please add u in “groundwater”

Page 15, line 29: Delete “the” before “soil properties”

Page 15, line 31: Put a “ : ” after “follow”

Page 16, line 1: Delete “the” in front of uncertainty

Page 16, line 15: Change “different” to “other” (end of line)

Page 16, line 18: Delete “the” in front of “spatial and temporal resolution”

Page 16, line 20: Change “This resolution is referred as. . .” to “This resolution is referred to as the. . .”

Page 16, line 33: Please rephrase “. . .with physical sound. . .”

Page 17, line 1: Change “soil map” to “ a soil map”

Page 17, line 7: Please change last part of line to “. . . are shown not to be..”

Page 17, line 9: Please add “on stream flow” after “model performance”

Page 17, line 12: Change “input factor” to “input parameters”

Page 17, line 13: Change “soil map” to “ a soil map”

Page 17, line 17: change to “. . .(or is not). . .”

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