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Discussions

Interactive comment on "An interdisciplinary swat ecohydrological model to define catchment-scale hydrologic partitioning" by C. L. Shope et al.

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General comments:

The authors present a SWAT application to a small watershed in South Korea, which is characterized by large differences in elevation and very steep slopes. Generally, I think that this is a very interesting topic as SWAT was not explicitly developed for steeply sloping watersheds and still has some major shortcomings in representing hydrological processes in mountainous areas. Often, studies in such areas are hampered by a lack of field data to validate model results and identify the most important problems. In this study, a relatively good database is available with regard to climatic and discharge data as well as soil and land use/management information. The authors developed a new

algorithm to improve the representation of spatial rainfall variability in the model using their extensive measurement data. I am absolutely sure that the SWAT modeling was done very thoroughly and scientifically sound. However, in my opinion, this manuscript needs major revision. Firstly, it is very long and contains a lot of information (which would probably be enough for two or three papers), so I recommend to shorten it and stay focussed on the main objectives. Secondly, in the Results & Discussion you give a lot of information that actually belongs in the Introduction or in the Materials & Methods chapter. Please structure the paper more clearly and make sure that in the Materials & Methods you give all relevant information that is necessary for the reader to be able to follow your analyses and explanations in the Results & Discussion.

Specific comments:

Page 7238, lines 2-25: In the first paragraph of the introduction, you talk about ecosystem services and land use change, both of which are not really focussed on later on in the manuscript. I recommend to lay a stronger focus on the challenges involved in applying SWAT to the Haean watershed and how you used the available data and methods to improve the model setup and parameterization.

Page 7241, lines 4-8: Do you have any information about where the irrigation water in the Haean watershed actually comes from?

Page 7241, line 27 - page 7242, line 5: Please make sure that your objectives match what you present in the results and discussion section. With regard to objective (2) I think you would have to compare your results to results obtained without the spatiotemporal interpolation of precipitation in order to actually assess the potential of the new algorithm you developed.

Page 7243, lines 11-14: If you add this here, I would recommend to name the chapter "Haean climate and hydrology".

Page 7245, lines 8-19: Here you mix the general model description and the description

of which algorithms you used in your model for the Haean watershed. This is a little confusing, so I recommend to describe this separately. s

Page 7245, lines 10-11: In a study we did in a mountainous watershed in China, we found out that when calculating the daily CN values based on the soil water content, surface runoff decreased with increasing slope. This happened because lateral flow increased strongly with increasing slope, which led to a decrease of soil moisture. Have you analyzed the dependency of simulated surface runoff on slope in the Haean watershed?

Page 7246, lines 8-15: Not all variables are explained here. How were the weighting factors w1, w2, and w3 determined? What does "+ ..." at the end of the first two lines of the equation mean? The observation point aspect is denoted differently in the explanation than in the equation. Have you applied this algorithm for all climate variables or for precipitation only?

Page 7246, lines 10-21: This paragraph does not really describe evapotranspiration measurements as indicated in the title of the chapter.

Page 7248, line 15: Add "(RDA)" after "Rural Development Administration" to introduce the abbreviation used in line 17.

Page 7250, lines 26-27: What is PIXGRO?

Page 7251, lines 19-22: Quite frankly, I don't really understand what you did here. Can you explain this a little better?

Page 7253, lines 3-5: You should have mentioned this in the Materials & Methods chapter. Why did you only mention IDW there?

Chapter 4.2.1: In my opinion, you mix information that should be part of the introduction or materials & methods with results here.

Page 7255, lines 1-4: How do you explain these spatial patterns of flow components?

Land use, soil types, slope? Please discuss your results in more detail here.

Chapter 4.2.2: I'm not sure if this section is necessary. The statistics have been presented in a large number of papers already and since your manuscript is very long, this might be a good opportunity to shorten it a little. If you want to keep this chapter I recommend to move it to the materials & methods chapter.

Page 7257, line 3 - page 7259, line 7: This should be part of the materials & methods chapter. Also, I recommend to shorten this section. For example, in my opinion a detailed description of SUFI-2 is not necessary here.

Page 7257, lines 3-8: To me, this is a little confusing: did you use calendar years or hydrologic years? What do you mean by "a combination of 2003, 2004 and 2009 discharge estimates"? Why didn't you use the data for 2011?

Page 7257, lines 12-15: Please explain the selection of monitoring locations for analysis in the materials & methods.

Page 7257, lines 17-19: What about the impact of aspect?

Page 7259, lines 8-9: Please mention the hydrograph analysis in the materials & methods chapter. Which technique did you use?

Page 7259, line 18: Do you mean "by maximizing the NSE"?

Page 7259, lines 18-24: First you state the the NSE increased when using Muskingum routing instead of variable storage routing, but then you state that the change was negligible. This doesn't really make sense to me.

Page 7260, lines 22-28: Which technique did you use? Please explain this in materials & methods.

Page 7261, lines 1-2: What do you mean by this? Please explain this a little better.

Page 7262, lines 8-9: Make sure that numbers and units match here.

Page 7262, lines 10-12: If you refer to Figure 5 here, I would expect the 95% confidence interval to be shown in that figure.

Page 7262, line 13: Wasn't 2010 the calibration period?

Page 7263, line 17: Do all crops growing in the Haean watershed have a base temperature of 0.0°C?

Page 7264, lines 10-25: In my opinion, this is not really relevant to the objectives of this paper. Have you thought about publishing a separate paper on land use change and crop productivity in the Haean watershed?

Page 7264, lines 19-21: But then this might also be the case for all the other plots. Are they more representative of the average production in the watershed?

Chapter 4.5: How did you implement this in SWAT? Were the culverts and roads integrated as part of the stream network? Did you change the subbasin delineation for the new model setups? You have to explain this better. Maybe this might even be an interesting topic for a separate paper. What was the impact on the remaining monitoring locations?

Page 7267, lines 1-3: How do you explain this?

Chapter 5: You give some new information in the conclusion, which I think should be part of the discussion instead.

Page 7269, line 3-5: You did not present any results on subdaily simulations in this paper, though.

Table 3: What is JD? Julian day? How can you determine a specific Julian day when you based your management schedules on heat units as stated on page 7250?

Table 5: In this table, you list data for 6 monitoring locations, in the next for 10, and in Figures 4 and 5 you show data for 5 locations. This is a little confusing. Generally, the selection of monitoring locations you present and discuss results for seems a little

random throughout the whole manuscript.

Figure 6: The value 129 in the equation does not really seem to match the order of magnitude of the y axis. Also, I'm not sure if you can really identify a trend from that data. It seems to me that the heat sum is pretty similar for all years except 2003, 2008, and 2009. Maybe 2008 and 2009 were extreme years just like 2003. If you excluded the last two years from analysis, the heat sums would probably indicate an increasing trend.

Figure 7: Why did you use a different color for cabbage than for the remaining crops? If I'm not mistaken, the standard abbreviation for tons is t.

Technical corrections:

Page 7240, line 6: Remove the comma after "where"

Page 7240, line 15: Replace "decreased" with "decrease"

Page 7247, line 8: Remove brackets

Page 7247, line 19: "Priestley-Taylor" instead of "Priestly-Taylor"

Page 7249, line 11: Do you mean "forest encroachment"?

Page 7249, line 20: Do you mean "Agriculture"?

Page 7250, line 9: Replace "were" with "was"

Page 7260, line 12: Replace "Melese" with "Melesse"

Page 7260, line 28: Do you mean S4 here?

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