

Interactive comment on “V2Karst V1.0: A parsimonious large-scale integrated vegetation-recharge model to simulate the impact of climate and land cover change in karst regions” by Fanny Sarrazin et al.

Anonymous Referee #1

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The manuscript presents a modified version of the large-scale karst recharge model VarKarst. The here presented model (V2Karst V1.0) replaces the simplified evapotranspiration (ET) component (empirical Priestley-Taylor equation) by the physical based Penman-Monteith equation (for potential evapotranspiration). The authors also include a separate calculation of the different evaporation processes in order to use the model for climate and land cover change impact studies. The model extension increases the number of parameters. The general functioning as well as the influence of the new parameters are tested by applying the new model to four study sites, different in cli-

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mate and vegetation. The manuscript is a novel extension of previous work published by the research group. The conceptual description and the numerical adaptation of the processes are sound. The results of the model application on the four test sites prove the general functioning of the new model. However, the manuscript also has weak points, which are mainly related to the presentation of the method and the results. The manuscript can easily be shortened by 10-20% without losing important information. The presentation of the results needs to be improved, especially since it is difficult to distinguish between observed values and modeled results. My detailed comments are listed below.

Main Comments

The purpose of V2Karst V1.0 is to predict recharge in karst regions. The authors mention that “a large part of the groundwater recharge occurs as concentrated and fast flow in large apertures and the other part as diffuse and slow flow in the matrix (Hartmann and Baker, 2017).” Especially concentrated recharge, e.g. fast infiltration into sinkholes, can be considered as a short-term process and is entirely uncoupled from soil and/or vegetation properties (overland flow -> percolation). I assume that your model, calculating the water balance, underestimates the recharge in karst regions dominated by concentrated recharge. Do you think your model is able to equally represent both recharge processes?

I am aware of the fact that the manuscript is focused on the implementation and the testing of the new evapotranspiration component. Since soil layers in karst regions can be thin or even totally absent the authors should consider this fact in the interpretation of the results. The manuscript lacks a description/characterization of the four karst regions (e.g. by describing dominant karst features or by the interpretation of spring hydrographs). In general, a differentiation between different karst systems and therefore the wide variety of hydraulic properties dominating the recharge pattern (see above) is missing here.

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As already mentioned, the current manuscript is too long and needs to be shortened: - (Almost) every section starts with a short introduction on the section. Most of them are redundant. - The authors use wordy descriptions instead of clear words for describing their work. Is a “virtual experiment with synthetic data to assess the sensitivity” (Page 1, Line 19) not simply a “sensitivity analysis”? - Discussion chapter: Consists of sentences/paragraphs, which can be defined as general knowledge (e.g. Page 26. Line 16; Page 26, Line 24) or which should be familiar by the readers of the journal (e.g. Page 28, Line 12).

Secondary Comments

- Page 1, Line 21: “. . . and they suggest that simulated recharge is sensitive to both precipitation (overall amount and temporal distribution) and land cover.” Is this one of the main results of your work and is it really a new finding? - Page 2, Line 30: The sentence is difficult to understand. - Page 4, Line 17: Please, rephrase the long sentence (and consider deleting the first part of the sentence). - Page 6, Line 12: Could you please add a bit more information on how diffuse and concentrated recharge is considered by the model. - Page 12, Line 12/13/14: Please, consider using SI-Units. - Page 13 Seasonality of vegetation: Are you using the same seasonality on every study site irrespective of the local climate and vegetation type? - Page 15, Line 4: Please consider splitting the sentence. - Equation 17/18: Please remove the units from the equation and mention both parameters in the text, e.g. “1. Eact,bow [mmmonth-1], a corrected value that assumes that latent heat ($\delta\dot{Q}_{\text{lat}}$ [MJ.m-2.month-1]) and sensible heat ($\delta\dot{Q}_{\text{sen}}$ [MJ.m-2.month-1]) have similar errors (referred to as Bowen ratio estimate): - Page 17, Line 29: Please, rephrase the sentence. - Page 24, Line 4: Please, rephrase the sentence. - Figure 4: The Figure presents the results in a confusing way and some of the values exceed the constrained parameter ranges according to Table 3.

Minor comments and typographical errors

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- Please, use a consistent citation style. - Please, use a consistent style for figure references. Two different versions exist: Fig. and Figure - Units -> Replace the dots by multiplication sign or even better delete them. - Page 2, Line 2: . . .world. . . - Page 2, Line 2: For instance, . . . - Page 5, Line 4: . . . (Hartmann et al., 2015). This . . . (space missing) - Page 5, Line 33: . . . to represent. . . - Page 7, Line 13: . . . the following formulas . . . - Page 12, Line 13: . . . is the psychrometric constant, . . . - Page 15, Line 18: . . . data processing are reported . . . - Page 20, Line 18: red lines -> the a priori information are indicated by black lines in Figure 4! - Page 29, Line 14: We, therefore, . . . - Figure 5, Line 4: . . . percentage of Eact . . . - Figure 6: Line 5: Blue . . . - Figure 9: Line 4: remove the open bracket

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