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Hydrology and Earth System Sciences Discussions

Interactive comment on "Parameterization and uncertainty in coupled ecohydrological models" *by* S. Arnold et al.

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We would like to thank the Anonymous Referee #1 for this review and the constructive comments. We have addressed his/her comments as follows:

Comment: Maybe the title should be "Complexity of Coupled Ecohydrological Models and uncertainty in simulation results" or in that way. The parameterization plays only a minor role in the article while the model complexity/structure of the models is of major concern.

Response: We see the point. We have changed the title as follows: "Uncertainty in parameterization and model structure affects simulation results in coupled ecohydrologic

models"

Comment: Looking at Fig. 1, with colours/structures in the northern part completely different to those in the southern part, it is hardly to imagine that the alluvial aquifer is embedded into impermeable granite (although the cross section given in Dahan et al. (2008) - Fig. 2 - shows such a geologic setting). Can the authors give further evidence that there is no rift/fault below the alluvial aquifer?

Response: Yes, there are additional hints. For example Morin et al. (2009) make the same assumption in a hydrological modelling study and could successfully reproduce flood routing and transmission losses. This increases our confidence that leakage from the bottom of the aquifer is negligible. The apparent change in structure, visible in Fig. 1, is due to the sand dunes overlying the bedrock. Further, Schmidt and Plöthner (1999) concluded that the floods contribute little to the ground water recharge of the dunes area. We included Morin et al. (2009) and Schmidt and Plöthner (1999) as a citation to the paper, to make this point more clear in the final manuscript.

Comment: Furthermore, Fig. 2 displays rather a cross section than the water balance (Otherwise the arrows should be labelled and further information given). What is the "intermediate zone" in Fig. 2 supposed to be (not mentioned in the text or the formulae)?

Response: True. We added notation to the arrows and also included a definition of the "intermediate zone" in the figure legend: "The intermediate zone denotes the layer where saturated and unsaturated conditions alternate frequently."

Comment: In line 7 (page 4163) the number of "2400 m3/d ha" is given as cited from Dahan et al. (2008). I could not find this number there - is it calculated from data therein?

Response: Yes, it is calculated from data therein. Dahan et al. (2008) give a time constant infiltration rate of QI(t) = 1 cm/h, which is 2400 m^3/d*ha. We included a note

in the Methods section to show this.

Comment: Formula (8) and line 7 (page 4164) "...ground water volume available to plant roots": the water available to plant roots will be depending considerably on the plants age and hence the root depths. This fact is not mentioned in the article, but will play a role regarding the transpiration, the depth to ground water, green and reserve biomass (2.4 Ecological model) and others.

Response: We agree that rooting depth depends on the plant age, and it would likely influence the model results. We could take this into account and remain the character of an aggregated population model by introducing an age structure in the reserve biomass. In a more detailed approach the dependency of the rooting depth on the plant age could be taken into account by modelling on the individual scale (Individual Based Model). In both cases the number of parameters would increase and lead to a more complex model structure than we proposed to develop. Therefore, we chose a simple model, where rooting depth stands for a representative maximum uptake depth of the entire population. However, we think taking into account the age dependent rooting depth is a good idea, and should be included in more complex model versions. We have included a comment regarding this fact to the Methods and Discussion section.

Comment: Line 1 (page 4165): "QIn" with partially dry or flooded river bed it is hardly to imagine that the gw-inflow from upstream is constant over the season - can you give any evidence?

Response: The middle part of the Kuiseb River, which is the area under study in this article, is divided into several compartments separated by exposed bedrock (Morin et al., 2009). To keep the model simple, we assumed the study site to be only one large compartment that is recharged by the flood and the ground water inflow from upstream. The real ground water inflow is unknown, thus we were forced to make an assumption. We chose constant inflow, because this relieves us from having to take into account yet another pattern (about which we have no real information).

Comment: Although the results show that for model "B" only 0.009% of the parameter sets are acceptable, the number of the parameter sets for models "A" and "C" also is very small. Therefore I think it is somewhat premature to exclude "B" from further analysis. Comment: Line 26 (page 4176) and line 8 (page 4177): "only two of the three models" and "only models A and C"; the number of parameter sets allowing for coexistence is larger for models "A" and "C", but the mentioned lines indicate that model "B" does not allow for coexistence at all. (Also in the Conclusion section, line 4, page 4181) Comment: What if the fewer parameter sets acceptable for model "B" give more robust results than those for models "A" and "C"?

Response: We see that we left this point unclear. In the final version, we have better motivated this decision at the beginning of the results section and corrected the other relevant sections. In fact, model B was not subject to further investigations because there were no parameter sets leading to elevated robustness of three species coexistence with P3>0.5.

Comment: Line 28 (page 4177): "...integrating more knowledge in a model does not automatically lead to more realistic modelling results"; here it should be mentioned, that "On the other hand, (simple) models can give satisfactory results, but for wrong reasons" (effects may be neglected which can play an important role under different management or climatic conditions)

Response: Yes, we agree. We added this statement in the Discussion section.

References

Morin, E., Grodek, T., Dahan, O., Benito, G., Kulls, C., Jacoby, Y., van Langenhove, G., Seely, M., and Enzel, Y.: Flood routing and alluvial aquifer recharge along the ephemeral arid Kuiseb River, Namibia, Journal of Hydrology, 368, 262-275, 2009.

Schmidt, G., and Plöthner, D.: Abschätzung der Grundwasservorräte im Fluß- und Dünengebiet des Unteren Kuiseb / Namibia, Zeitschrift für angewandte Gologie, 44,

1999.

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