

Interactive comment on “A channel transmission losses model for different dryland rivers” by A. C. Costa et al.

A. C. Costa et al.

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Dear Reviewer,

We appreciated very much your in-depth comments and suggestions. Please find our first response below:

1. I understand that the authors need to include the equations, but I found that I got more and more confused as I read this section and started to lose sight of what the model is trying to achieve. I did not find the information provided in Fig.1 very helpful, although Fig. 2 does help to clarify some parts of the model. One gets the impression of a very complex model with many parameters that might be expected to be very

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difficult to apply in data scarce areas.

Our intentions when developing this model was to include the governing processes – but not “all details” of water transmission (including transmission losses) in dryland rivers. We have summarised the governing processes and the hydrological compartments (aquifer, unsat zone, stream reach, sub-basin) involved in the introduction of the section 2 (page 8909). Figure 1 is intended to clarify the spatial structure and interlinkages of these compartments. As we think that it is appropriate that the model is described rather comprehensively, we have further presented the governing equations in the sub-sections 2.1 to 2.6, as you agreed. Readers more interesting in the model application rather than the equations may go directly to section 3. Anyway, we appreciate your suggestion to rephrase the text in order to improve tangibility and readability. We may also try to include an additional table which summarizes the required information to run the model (both input data and model parameters).

2. On page 8919 reference is made to accumulation in depressions followed by evaporation, but I am not clear how this would be handled inside the model, nor where the data to parameterise this would come from without a very detailed DEM.

Sorry, we understand that this needs to be expressed more clearly. In our model, we assume that in case the soil in the flood plains adjacent to the river stretches will be completely saturated, i.e. the “groundwater” in the flood plains will rise above the surface level, the excess water does not flow into to the river course, because it might be temporarily stored on the surface of the floodplains and then evaporate. We consider this assumption being appropriate because the flood plains are very wide and the depth of a possible surface excess water is very shallow (a few cm at most). Therefore, we did not model in detail this process, instead assume that this excess water will evaporate rather soon. We will rewrite L15-17 in that way into the revised version of our manuscript (RVM).

3. I am also a bit confused about how incremental flows along a river reach are ac-

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counted for in the model and the examples used.

We are not sure what you mean with incremental flow. But if you mean lateral flow from tributaries, it was not accounted for the examples used. In the model, please see on page 8912 (Lines 2-3) and Fig.1 (Basin and river systems). At the end of Lines 2-3 we will add up "(see Fig. 1)" into the RVM.

4. The abstract and the conclusions refer to reliable predictions, but I do not think that the various results presented confirm that the model can predict reliably. First of all there are some cases where the model clearly has not performed very well (e.g. substantial routing delay problems in Fig. 5c and Fig. 9) and there are not enough events and sites used in the study to reach a conclusion about reliability of the model. The authors also evaluate different forms of the model (Figs. 5a to 5c) and conclude that the more complex model is the best. While this may be the case, there are many problems with the best model compared to the observed data. I am therefore doubtful if the reliability of the model has been demonstrated sufficiently for it to be considered reliable and therefore applicable in an ungauged situation.

Please note that we focused on a reliable prediction of the stream flow volume and event peak. We consider routing uncertainties are more relevant for flood forecasting issue (see e.g. Sivapalan, 2003, pp. 861). We completely agree that it is desirable to apply the model to more events and sites in order to further test the model performance under different hydrological conditions and data. Even though we hope the reader may understand that observational data in such conditions are rather rare and difficult to collect (making a few events very valuable). We agree that test on more events can be considered as a pre-requisite before it can be recommended for an direct application in an ungauged situation, with no control data available (see, Andréassian et al. 2007, 2009, 2010; Refsgaard and Hansen, 2010). The applications presented here are meant, first, to demonstrate the general applicability of the model for water planning and management issues and, second, to distinguish and test the different model versions. Referring the second point, we have shown that with the available observa-

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tional data of the Jaguaribe river reach in NE Brazil, the evaluation of different model versions showed that both stream-aquifer water exchanges and groundwater flow in the underlying alluvium parallel to the river course are necessary to predict stream flow and channel transmission losses. In our case study, the former process was more relevant than the latter. We will include into the RVM a better explanation of these intentions for model application and elaborate on the potentials of modelling-based hypothesis testing by subsequent targeted field campaigns (as discussed by Dunn et al., 2008).

5. The model formulations are presented in a lot of detail, but the sensitivity results are not discussed in very much detail at all and the reader might be confused about how the model is likely to perform when there are no (or not enough) data to go through a parameter estimation exercise (i.e. calibration).

We will try to improve the presentation (more details) about the sensitivity results in the RVM.

6. My main comment is therefore that the discussion of the results and the conclusions should be more critical and a better reflection of the limited sample size as well as the limitations of the results.

See answer 4 and 5.

7. Detailed corrections: P8905: There is a great deal of repetitive referencing in the the introduction.(OKAY) P8906, L9: lose not loss. (OKAY) P8908, L10: replace 'from the first behaviour to the former one and vice-versa, too.' with 'from the former to the latter and vice-versa'. (OKAY) P8908, L15 (and elsewhere): replace 'controls a catchment area' with 'drains a catchment area'. (OKAY) Page8909, L2: 'influential for channel..' (OKAY) Page8910, L8: '.. flows are hydraulically..' (OKAY) Page8910, L20: remove 'in fact' (see other parts of the text where this unnecessary type of wording is used). (OKAY) Page8913, L9: '..head at the surface..' (OKAY) Page8920, L18: 'dominant' not 'dominated'. (OKAY) Page8922, L13: '..losses are certainly..' (OKAY) Page8922, L19-

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22: This sentence is rather clumsy and needs to be re-phrased. (OKAY) Page8923, L19 (and elsewhere): I am sure there is a better way of presenting 'laboratorial-experiments based tables' - why not just refer to 'empirical tables'? (OKAY) Page8926, L13-15: I could not understand this sentence at all? Just below this a triangular channel X-section is referred to - is this a reasonable assumption and would it make any difference to the results if a different channel shape was used? (WE WILL BE REWRITTEN IT) Page8927, L14-16: I assume there is something missing here as there is no reference to Figs 9 and 10.(YOU ARE RIGHT; WE WILL INCLUDE the references to the FIGS: 9 AND 10) Page8928, L1: Change to 'The sensitivity did not vary with changes of soil...'. (OKAY) Page8929, L8: I am not sure what the part of the sentence ' which preserves similar scale..' means? (WE WILL BE REWRITTEN IT) Page8929, L19: (and elsewhere): Re-phrase the 'saturated-part-based parameters' with something that is clearer. (WE WILL BE REWRITTEN IT) Page8929, L23: '..should take into..' (OKAY) Page8930, L15: Remove the unnecessary word 'actual'. (OKAY) Page8934: Spelling of Mitzow (see text).(OKAY)

8. All of the sensitivity diagrams would be a lot clearer if the axes labels were on the bottom and left axes rather than in the middle of the graph. (OKAY)

9. Fig 6a refers to the sensitivity of 3 factors (porosity, soil moisture at FC and initial soil moisture), but there is only one set of sensitivity graphs - I am very confused by this.

Please see L3-6 on page 8925 and note that the X axis is the factor which was multiplied with the original values of the parameter set (see e.g. Fig. 6a).

References

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