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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Modelling canopy and litter interception in commercial forest plantations in South Africa" *by* H. H. Bulcock and G. P. W. Jewitt

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Review on Modelling canopy and litter interception in commercial forest plantations in South Africa by H.H. Bulcock and G.P.W. Jewitt

General comments

The paper by Bulcock and Jewitt is a very interesting paper that describes the application of a developed Variable Storage Gash (VSG) model for three vegetation species in South Africa. A variable storage component that considers rainfall intensity is added to the original and revised Gash model to model canopy interception. To

model litter interception empirically derived drying curves are used. The model results from the VSG-model and the litter interception model are very good. However, this might not be surprising because extra parameters are added, so more parameters of freedom are available for calibration. It is only not clear from the manuscript if and how many extra parameters are added. This should be clarified in the manuscript as also mentioned in the specific comments.

Furthermore, the paper is not showing if their developed VSG-model preforms better than the original and revised Gash model. Hence, is the VSG really an improvement? Although the model results are really good, the added VSG-component is also highly empirical. The same holds for the litter interception model. This is a limitation of the study (as correctly mentioned by the authors in the conclusions), but could be more emphasized (e.g. in the abstract). Furthermore, the used parameters of the Gash model are not presented. It would also be interesting to compare the used parameters with the derived storage capacities found in Bulcock and Jewitt, 2012.

In general, the paper is well written and structured, however sometimes units/dimensions are missing or are not correct, and some equations from the Gash model are not correctly presented. See the specific comments for these corrections.

Specific comments

P8293: Maybe change title to emphasis that a new Gash model is developed.

P8294 L21: Change reference Gerrits et al, 2008 into the more appropriate reference Gerrits et al., 2010

P8295 L5: I_l is not defined as 'interception loss [L]

P8295 L7-9: Add dimensions (or units) of E [L/T], S_c [L], and t [T]

P8295 L18-P8296 L2: Add dimensions or units for the parameters and variables.

Eq3: Since Sf is a flux also here the integral over time should be taken ($\int S_f \mathrm{d}t$). Furthermore S_f should be written in italic with 'f' as a subscript, and there is no explanation what P and E are. It is also not clear from the text what the difference between P and R is ($R = P_{average}$?).

P8296 L1: Sf should be written in italic.

P8296 L23-25: Add dimensions or units for R and E.

P8299 L1-2: It is not true that in the previous versions of the Gash model S_c is constant. As mentioned by the authors S_f =f(LAI).

P8301 L9: The VSG-model uses 'only' 5+7 parameters. How many parameters has the original and revised Gash model? Maybe add this information in Table 1.

Eq5: Change $P'g$ into P'_g in the entire manuscript.

P8301 L15-17 and Eq5: This equation is from the original Gash model. The revised (sparse) model uses another equation. Please change text accordingly.

P8301 L24 and Eq6: Change $P't$ into P'_t.

Eq7-11: These equations are from the original Gash model. The revised (sparse) model uses other equations. Please change text accordingly.

Eq7-11: These equations are not correct or incomplete. Summations over the number of storms is missing (m, n, and q). Please check with the original Gash model.

P8303 L1: Please change stemflow, F, into S_f to be consistent throughout the manuscript.

Eq12-13: Please make use of subscripts.

Fig1: Redundant figure.

P8304 L24: '. . . less than 0.36 mm/h and the LAI.' Please correct this sentence.

P8305 L6: Add unit q.

Eq16: Units of this equation are not correct. $[L] \neq [L^3] * [-]$

P8305 L20: Parameters a and b have a dimension. Please add them.

P8305 L21: Correct the sentence '.. particular vegetation type requires values..'.

P8307 L17-18: It is not clear if the drying curves are derived from lab experiments or also from field measurements. According to Figure 2 only from the lab. Please clarify.

P8307 L21-22: The thickness of the litter layer is also important for litter interception. Please add.

P8309 L6-7: Please refer to Bulcock and Jewitt, 2012.

P8310 L1-2: What part of the time series is used for calibration and what part for validation. This is not completely clear from the text in my view. Please clarify.

P8312 L20-22: The authors claim that looking at the drained soil water is a good independent measure to verify the model performance. However, if I am not mistaken observed litter interception in is calculated as the difference between throughfall and drainable water. Hence the observations are not independent of the drainable water, right?

P8314 L9: I do not understand that the VSG-model has fewer parameters than the original and revised Gash model. Even if one is making use of empirical relations (Eq 18-19) these are parameters.

Fig 2: If I am correct the presented drying curves are the average of several (lab?) experiments in three years. If this is the case, please clarify this in the caption. Furthermore, what was the potential evaporation during the lab experiment? Is this in

the same order of magnitude with the model period?

Used references

Bulcock, H. H. and Jewitt, G. P. W.: Field data collection and analysis of canopy and litter interception in commercial forest plantations in the KwaZulu-Natal Midlands, South Africa, Hydrol. Earth Syst. Sci. Discuss., 9, 8257-8292, doi:10.5194/hessd-9-8257-2012, 2012

Gerrits, A.M.J., Pfister, L., Savenije, H.H.G. (2010): Spatial and temporal variability of canopy and forest floor interception in a beech forest, Hydrological Processes, Vol 24, 3011–3025

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