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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Thank you for the valuable comments.

General Comments

The paper is not showing if their developed VSG-model performs better than the original Gash model. Hence, is the VSG really an improvement?

Response: A comparison between the original Gash model and the variable storage Gash model has been added in the results and discussion section.

The limitations of the VSG-model and litter interception model being reliant on empirical relationships (as correctly mentioned by the authors in the conclusions) could be more emphasized (e.g. in the abstract)

Response: The limitations of the models have been emphasized in the abstract as suggested by the referee.

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.

Response: number of parameters added Table 1.

It would also be interesting to compare the used parameters with the derived storage capacities found in Bulcock and Jewitt, 2012.

Response: The storage capacities derived from the Klaasens et al. (1998) mean method in Bulcock and Jewitt (2012) were used to model using canopy interception with the Original Gash (1979) model.

Specific comments

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

Corrected: "Modelling canopy and litter interception in commercial forest plantations in South Africa using the Variable Storage Gash Model and Idealised Drying Curves"

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

Corrected: Gerrits et al., 2010

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

Corrected

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

Corrected: units added

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 (RSfdt).Furthermore Sf should be written in italic with 'f' as a subscript, and there is noexplanation what P and E are. It is also not clear from the text what the differencebetween P and R is (R = Paverage?).

Corrected: Units added Sf changed to flux (i.e. Sfdt) Sf changed to S_f. "P" was a mistake in the formula and has been corrected to "R"

P8296 L1: Sf should be written in italic.

Corrected.

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

Corrected. Units added

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

Response: This has been clarified. What is meant is that the previous versions of the Gash model do not change the canopy storage capacity depending on the rainfall intensity of each storm like the VS Gash model does..

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.

Corrected: The VSG model has 16 parameters if the empirical parameters are included. This information has been added to Table 1.

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

Corrected

P8301 L15-17 and Eq5: This equation is from the original Gash model. The re-

vised(sparse) model uses another equation. Please change text accordingly.

Corrected: Reference to the original (Gash, 1979) model has been added.

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

Corrected

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

Corrected.

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.

Corrected

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

Corrected

Eq12-13: Please make use of subscripts.

Corrected

Fig1: Redundant figure.

Corrected: Figure removed

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

Corrected: removed "and the LAI".

P8305 L6: Add unit q.

Corrected: (mm-2)

Eq16: Units of this equation are not correct. [L] $\neq$ [L3] *[L]

Corrected

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

Response: "... where a = 0.124, b = 0.63, and are unitless parameters of a power function to scale mm.h-1 to mm3 (Hall, 2003)".

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

Corrected

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.

Corrected: the drying curves were derived from a combination of both lab and field measurements. The Fig 2 caption has been corrected.

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

Corrected: thickness added.

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

Corrected

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.

Corrected: The parameters were calibrated during the period April 2008 to April 2009 to account for both summer and winter rainfall. The parameters used in validating the models during the study period from April 2009 to March 2011 were kept constant, with only the rainfall and evaporation data changing when modelling from September 1998 to March 2011.

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 mistakenobserved litter interception in is calculated as the difference between throughfall and drainable water. Hence the observations are not independent of the drainable water,right?

Not corrected. The referee is correct that litter interception is measured as the throughfall and drainable water. However, the section in question is related to the "water that drains to the soil" which is measured completely independently. Therefore, after the canopy and litter interception has been modelled, the "drainable water" is the difference between gross precipitation and the modelled canopy and litter interception. Hence, if the "modelled drainable water" correlates well with the "measured drainable water", then this is a good indicator of the performance of the canopy and litter models as a whole/system.

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 (Eq18-19) these are parameters.

Corrected: This is a good point made by the referee. If the parameters from the empirical relationships are included, then the VSG model does in fact have more parameters than the original Gash model. This statement has been removed.

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.

Corrected 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?

Response: Unfortunately the potential evaporation was not measured so I cannot comment on this. However, the drying curves were derived from a combination of both the

data collected in a lab as well as in a covered outdoor area and the drying curves were almost identical, so presumably the potential evaporation were of similar order of magnitude.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8293, 2012.