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Hydrology and Earth System Sciences Discussions

Interactive comment on "The potential of observed soil moisture dynamics for predicting summer evapotranspiration in a successional chronosequence" *by* J. A. Breña Naranjo et al.

Anonymous Referee #2

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*** General comments

The manuscript analysis the results of two very simple numerical models regarding the actual evapotranspiraton (AET) of a forest chronosequence during summer. Both models are based on the budget equation of volumetric soil water content Theta. Model 1 includes the active root depth Z, rainfall P, percolation q and the AET. Model 2 is identical to model 1 but considers in addition the rain interception I in the forest canopy. Goal of the study is to estimate the AET from measured P, q, Theta, and estimated I and Z only.

If successful, the simple model approach would allow the determination of AET without expensive turbulent flux measurement sites, only using rain, percolation and soil water data, and would avoid expensive and data-intensive models that also rely on a lot of parameterisation. Thus the presented method would be helpful in situations where rain, percolation and soil-water data but no atmospheric turbulent flux measurement are available.

The models were applied to a forest chronosequence (three elements at three sites) in Canada for the summers from 2001 to 2008, i.e. seven cases. The simulated AET was compared to AET measured at three towers (one per site) using eddy covariance (i.e. turbulent latent heat flux).

The models were run using two simulation time steps: 30 min and 24 h. The model outputs were compared to measured AET using several temporal averaging approaches: mean diurnal cycles, 10-days averages and mean total sum of summer AET. Only for the total sum of summer AET fair agreement with measured data was found with absolute deviations between 6 and 24 per cent.

The manuscript is well written and the findings are worth to be published. The simple model approach gives a rough estimation for AET. But this is not bad regarding the simplicity of the model. 'You get what you paid for'. And the simple model is able to give a probably useful AET estimate for sites where no precise turbulent flux measurements are available. Only, the author's conclusions are quite bold and should be reduced with respect to the actual findings of the presented study. Thus, the manuscript should be accepted for publication after major revision.

*** Specific comments and questions:

a) How and where were P and q measured?

b) Latent heat flux measurement: The energy budget was not closed (17 to 11 per cent missing). What is the expected error of measured AET?

c) What are the expected errors of measured P, q and Theta?

d) How do the measurement errors affect the comparison of simulated and measured AET?

e) Why is the rain interception threshold introduced by Gash (1979) adequate for the presented study?

f) Why is an estimate of Z = 30 min adequate?

* Comments and corrections to the author's conclusions

1) Authors: the simple models are suited for predicting AET at least during the water-limited season (summer) – Referee: Actually the mean diurnal cycles and the 10-days averages did not agree well with measurements. Only the mean total sum of summer AET (Table 2) and the seasonal prediction (Fig. 2) show agreement with deviations between 6 and 24 per cent to the measurements. And why is the standard deviation of the simulated AET twice as large as for the measurements?

2) Authors: adequate simulation time step is essential, Delta t = 30 min is optimum – Referee: The authors only studied two time steps (30 min, 24 h) that are so far apart from each other that this conclusion is not valid. A parameter study for the simulation time steps like 30 min, 1 h, 2 h, 4 h would be necessary to make such a conclusion.

3) Authors: active root depth Z is essential, Z = 30 cm is optimum – Referee: This conclusion is not valid at all since no parameter study on Z was presented.

4) Authors: rainfall interception is not a crucial parameter in the budget / models – Referee: Only one threshold was tested. This is not enough for such conclusion.

5) Authors: mean summer AET increases with stand age in the forest chronosequence – Referee: ok

6) Authors: standard deviation of AET decreases with stand age in the forest chronosequence – Referee: for the measured data this is true at first sight, but not significant!

For the simulations this is not true at all!

*** Technical corrections:

* 'is' -> 'are' in 5303-15 and 5308-25

* Please add signs (+/-) to the absolute errors in Table 2!

* The diagrams 1a and 1b are way too small to see any details of the diurnal cycles

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 5301, 2011.