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Biogeosciences Discussions

Interactive comment on "A simple ecohydrological model captures essentials of seasonal leaf dynamics in semi-arid tropical grasslands" *by* P. Choler et al.

Anonymous Referee #1

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General comments:

In this modeling study of leaf phenology, Choler et al. proposed a nonlinear modeling approach considering the feedback of vegetation on soil moisture. They first calibrated the model using semi-arid perennial tropic grasslands, and compared it with a linear model. The green vegetation fractions (cover) from 2001 to 2008 at 400 sites in the grasslands were derived from NDVI data and used in model parameterization and validation together with climatic variables. They found that the mean absolute error of linear and nonlinear models did not markedly differ, but the nonlinear regression model reduced the systematic error and performed better at the driest sites and during the

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seasonal transitions.

The rationale behind this study is solid, as all would agree that leaf phenology and soil moisture (perhaps soil temperature) are coupled in certain ways. But I have a few concerns regarding to the model improvement and the estimation method. First, it seems to me that using a relative complex nonlinear modeling does not improve much in term of modeling leaf phenology and dynamics as indicated by statistics in Table 2, and Table 1. Since the nonlinear modeling includes more model parameters, it is more difficult to fit and the model outputs are actually more sensitivity to the parameter changes (Fig. 3). The proposed model is basically a statistical model, similar to the linear models. Second, I understand that there are many different ways to define the objective function. But the current objective function (Eq. 4) might not be an effective one, as the median function is less sensitive compared to other common used functions. While the authors argued that MAE or CVMAE is a better statistic than MSE in parameter estimation, however, MSE (or CVMSE), r2 and other statistics were calculated and shown as goodness-of-fit indicators (Table 2). I would suggest that the authors use the commonly used objective function for parameter estimation. Third, it's a pity that no measured soil water content data were available. Otherwise, these data could provide an independent validation of the model. I'm also not clear how the evapotransition data were used in the models. It seems to me that the potential evapotranspiration data (Et) were derived (P8667, line 4) and Et consisted evaporation plus plant transpiration (p8668, L5), as used in model M1. However, model M2 separated Et into bare soil evaporation and plant transpiration. Was Et in model M2 the same as Et in model M1? If not, how was evapotranspiration in model M2 calculated? The authors may need to clarify these issues before the manuscript can be accepted for publication. The followings are some minor comments and suggestions.

Specific comments: Line 19. "because these models attempt to capture fundamental ecohydrological processes, they should be favoured approach for prognostic models of phenology". I do not agree with this statement. It seems to me that both models M1

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and M2 are basically statistical model with very simplified ecophysiological processes involved. Those models will help us understand and predict leaf phenology, but may provide very limited knowledge on the plant ecohydological processes and leaf growth. P8662, line 24: LAI: I think LAI is more commonly used for leaf phenology. Is there any relationship between V estimated in this study and LAI? P8668, M1, Eq. 2: any references for this linear model? (iv): Vmin: minimum V? K is the carrying capacity. How to determine Vmin and K? Would the Vmin and K influence the parameter estimations? P8668, line 12: "... according to a one (M1A) or a two (M1B) parameter ramp function": I don't understand this sentence. It seems that M1B assume alpha3=0. Please clarify. P8670, line 16: why should $\beta 2$ and $\beta 4$ be less than one? P8670, lines 16-25: One disadvantage of using MAE instead of MSE is that there is no direct way to calculate the standard error of model parameters. Perhaps that's the reason that 30 different calibrations were made (P8671 line 8-9). Eq. 4, objective function. F is not sensitive, as median does not use all quantitative information contain in the data. P8675, line 13-18: I would like to see a simple regression analysis of V and climatic variables, such as P, E, and We, Wcap and some combination of variables. If there is any significant relationship, the results can be used to compare with the outputs of proposed model in this study. P8676, line 9: leaf phenology. Is it possible to derive quantitative criteria for the timing of leaf onset, growth and offset based on the proposed model? Table 2. "... are the means of 30 x 300 estimates". For each run, 300 sites should be used to get one estimate. Therefore, the mean values should be calculated from 30 estimates. Fig. 1. Were precipitation data from these 8 weather stations used in models calculated?

Interactive comment on Biogeosciences Discuss., 6, 8661, 2009.