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Hydrology and Earth System Sciences Discussions

Interactive comment on "Potential groundwater contribution to Amazon evapotranspiration" *by* Y. Fan and G. Miguez-Macho

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We thank Dr. Teuling for raising the valid and constructive criticisms on the calculation of potential capillary flux from the simulated equilibrium water table. Indeed it is difficult to infer dry season soil water dynamics from calculations based on hydrologic equilibrium. We are fully aware of this, but our motivation was to provide a first-order estimate of the "potential" (as prominently shown in the title) or "maximum" influence such a water table depth may have on land surface flux, albeit tentative and crude. This extra step was taken because we are naturally curious what this water table might do. However, in doing so, many assumptions are made, some of which may not be valid as Dr. Teuling has correctly pointed out. Whether such a crude estimate of potential

capillary flux is an over- or under-estimate can be argued in both ways, because the natural system is far more complex, and depending on what feedbacks are considered and at what temporal scales, one's conclusions vary. The diverse environment within the Amazon also warns against a generalization that such an estimate is on the high or low end. We fully understand Dr. Teuling's concerns and have had some of the same concerns ourselves. But we had hoped that by showing this "potential" influence, we may stimulate discussions and motivate further investigations.

The best way to address Dr. Teuling's concerns is to conduct a fully dynamic model simulation of the coupled vegetation-soil-groundwater system at fine temporal scales to resolve diurnal, event, seasonal, and inter-annual dynamics. The presence of a shallow water table also impedes drainage during the wet season, in addition to sending upward capillary force in the dry season. These interactions can only be captured by dynamically coupling the soil water and groundwater reservoirs. This is the centerpiece of our current effort, and multiple simulations are being conducted as we write. The equilibrium water table presented here serves as the initial water table condition, from which the coupled vegetation, soil, and groundwater system evolve in response to diurnal, event, seasonal, and inter-annual climate forcing, over multiple years. A manuscript is planned for submission to HESS in the near future.

Regarding the present paper, one option is to remove the section on potential capillary flux calculations and only present the water table observations, the high resolution simulation of the equilibrium water table depth, and the discussion of climatic, terrain, and sea level controls on the water table. The work presented here has not been submitted to elsewhere, and as suggested by Dr. Teuling, this portion of the work could merit publication in itself. Removing the capillary flux calculation will also allow space to include details and citations of water table observations that we compiled from the literature; a large table containing the references, location of observations, and method of compilation had been left out because of space limitations. In addition, including more details on the groundwater model, for example, the calibration of parameters,

may also benefit the readers who wish to reproduce our model results or experiment with different climate forcings. We would like to hear Dr. Teuling's thoughts on this, as well as suggestions by the editor and other referees.

We will also include the omitted literature in future revisions. We thank Dr. Teuling again for his careful reading of the manuscript and his thoughtful reviews.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 5131, 2010.