Hydrol. Earth Syst. Sci. Discuss., 12, C5658–C5660, 2015
www.hydrol-earth-syst-sci-discuss.net/12/C5658/2015/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Stem-root flow effect on soil–atmosphere interactions and uncertainty assessments" *by* T.-H. Kuo et al.

Anonymous Referee #1

Received and published: 17 December 2015

The authors developed a stemflow model based on the SSiB model and run it at two sites with contrasting climates to study the impact of stemflow on soil water dynamics and consequent effect on surface energy fluxes. Though stemflow is insignificant in terms of volume, it is hydrologically and ecologically important for the forest and agriculture ecosystems due to its fast penetration through soil, localized and concentrated enhancement of soil water, the efficient transportation of nutrients along with the water, etc. Yet it is missing or taken account of as a component of throughfall in many modeling practices. This paper is valuable to demonstrate the importance of stemflow in a modeling aspect and I think the topic matches well with HESS. The work is of value is also because it is one of few modeling studies and for the first time to my knowledge develops a detailed parameterization. Also the paper is nicely written with clear logics

and structure. My comments and questions would be: 1. More modeling researches could be cited in the introduction paragraph, like Liang et al. (2009) proposed a 3D model in Journal of Hydrology. Also, a more recent review than the 2003 one is now available to cite, which is Levia and Germer (2015) in Reviews of Geophysics. 2. The authors proposed a new parameterization scheme describing the stemflow generation and its interaction with soil water, which is a very complex process and thus limitations and assumptions of the simple model should be stated or discussed. For example, the rainfall threshold for stemflow initialization is not taken into account and the variation of SLR is not considered. 3. Equations (3) and (4) indicate that the amount of root, in terms of root surface and root length, determines vertical and lateral flows. I am wondering if the vertical profile of root distribution taken into account or if a constant value is used. Since the two sites have different vegetation types, the difference in root profiles may also be an explanation to the contrast of stemflow magnitude in addition to the precipitation intensity mentioned in the manuscript. 4. The sentence "In Eq.(3), …. And horizontal root flow" (lines 5∼7 on page 11788) is not precise since the equation does not show that hi is determined by the horizontal root flow. This sentence and the following one implies that equation (6) is derived from equation (3), which is not the case. It is from the conservation of mass instead. 5. In Lines 14∼16 on page 11790, the authors mentioned that the soil moisture of the second soil layer responds faster to precipitation and fluctuates more pronouncedly than that of the first layer. But it seems to me that Figure 2 does not show the difference in the response speed between different soil layers. (If you look at one precipitation event at the end of August, SM2 even did not respond to it.) Regarding the magnitude of fluctuation, it seems that SM2 fluctuates more pronouncedly during the dry season or the seasons with lower precipitation, while in the rainy season (June to September) SM1 shows stronger fluctuations. I think one of the explanations is that SM2 and SM3 are almost saturated in the rainy season. 6. In Figure 4, the overestimation of soil moisture in SM1 and the underestimation in SM3 in spring, can be explained by the missing of other mechanisms like hydraulic redistribution which provides a bypass of soil water through the

inside of the root rather than the exterior surface of the root as in the case of stemflow transport. 7. The shading area in Figure 5b seems strange to me. I expect that the 50% curve should be enclosed by the shading area since the shading area shows a range from 0 to 100%. Is the shading area plotted by filling the areas between 0% and 100% curves? Or is it produced by a spectra of SLR values? It seems that latter is the case since it is mentioned in Lines 18∼19 on page 11788 that the authors "conducted a series of sensitivity test with systematically varying ratio. . .". Some minor revisions: In Table 1, the units of soil tension and hydraulic conductivity are not given. Also, the annual rainfall at LHC in the table is slightly different from what is given in the text. Units in Table 2 and 3 are also missing. Though they are m2/m2 and m3/m3, would be better to show them.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 11783, 2015.