Hydrol. Earth Syst. Sci. Discuss., 11, C722–C726, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C722/2014/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "HESS Opinions: A perspective on different approaches to determine the contribution of transpiration to the surface moisture fluxes" *by* S. J. Sutanto et al.

Anonymous Referee #1

Received and published: 31 March 2014

Note to the editor: we lack the expertise to thoroughly review the isotope theory discussed in section 2.2 and connected potential discrepancies in section 4. The value of the paper will in large part depend on the novelty and accuracy of the suggestions to improve isotope transpiration estimates in section 4.

Comments:

1. The objective of the paper is unclear: a. The title seems to indicate that the objective of the paper is to look at different ways to determine transpiration relative to surface moisture fluxes. The manuscript however focuses on isotope techniques, and the fact

that they underestimate transpiration fluxes when compared to hydrometric measurements and land-surface models. Also, the term 'surface moisture flux' is somewhat misleading as one may expect it to include irrigation, precipitation, percolation etc. Isn't it clearer and more precise to replace 'surface moisture fluxes' with evapotranspiration? b. The abstract seems to indicate that the objective of the paper is to compare transpiration determined using isotopes versus using other techniques and possible discrepancies. This is more in line with the discussion and conclusion of the manuscript. c. The introduction however, states (L2587:10): "we provide a perspective on different approaches for disentangling the different fluxes contributing to the total evaporation." This seems to indicate all fluxes contributing to total evaporation are being investigated. But the rest of the introduction is focused only on transpiration.

2. L2586:5 "Transpiration is the largest contributor to the water flux from continental areas." Replace 'water flux' with evapotranspiration. The way this sentence is currently formulated could also include, e.g., water flowing in rivers to the oceans.

3. Assuming that the objective is to determine transpiration as a fraction of total ET, the fact that you can determine soil evaporation as the difference between total ET and transpiration (Line 2586:19) seems to come out of the blue. If evaporation from the soil is of interest, then why not mention interception from the canopy as well, as both of these components are mentioned in L2586:1? Alternatively this sentence could be omitted.

4. L2588:8-11: similar to comment #3. The heading of section 2 reads: "Methods to derive the transpiration fraction of total evaporation." A discussion of soil evaporation seems out of place, unless it is used to compute transpiration. That does not seem to be the case here.

5. L2588:23, 2590:7, 2596:10: here and elsewhere, 'evaporation' is sometimes used to describe all evaporation fluxes from a surface, at other times it describes the process. Sometimes continental or total evaporation is used. Please define the terminology

used.

6. L2589:4: Most lysimeters don't have a percolation meter; the 'losses' can be observed by weighing drainage water.

7. L2590, equation 4; if the main objective is to quantify transpiration, perhaps the equation for soil evaporation is not necessary.

8. Section 2.2, Isotope-based method. This section describes how transpiration can be estimated as a fraction of total evaporation. While section 2.3 describes the effect of canopy evaporation on total evaporation, this is not part of the discussion in the isotope section. Perhaps the reason isotope studies tend to overestimate transpiration is that they fail to correct for water lost through canopy evaporation?

9. L2594:8-9 "Global land models estimate the transpiration fraction to be less than 50%". This statement does not seem to concur with results shown in figure 1; where two studies are below 50%, one is about 50% and one is 80%. A fifth study, which may or may not be included in the term 'Global land model' is about 65%. It is unclear if 'Global land models' refer to the land-surface models that have global averages or to all the land-surface models. The figure describes land-surface models where some represent global averages whereas the text refers to global land models where some models represent global annual averages.

10. Section 3. This section is supposed to show that the transpiration fraction of total evaporation determined by isotope studies is high compared to studies using other methods (based on the introduction to section 4: "What can explain these systematic discrepancies between the isotope and non-isotope methods?"). This could be done in a more convincing manner. a. While distinction is made between global averaged and non-global averaged studies, there seems to be a huge difference in scale between studies, which is not really discussed. This may affect comparison between studies. b. L2595:16-2596:9 describe how "Different plant types exhibit a different transpiration fraction under similar climatic conditions." The following paragraph (L2595:22-27)

is confusing to me: "In China during summer, the maximum transpiration fractions of oaks and wheat are 96 and 80 %, respectively (Xu et al., 2008; Zhang et al.,2011). Hydrometric methods result in much lower transpiration fractions in Arizona US. A study from Cavanaugh et al. (2011) during summer in Shrubland area partitions transpiration fraction of 42–47 %. This is very low compared to an isotope-based study (85 %) in the same region although different plant types are examined." It appears that the fact that a shrub land area in Arizona has lower transpiration fractions compared to oaks and wheat in China is ascribed to the use of hydrometric versus isotopic measurements. Is that what the authors are trying to say? Especially considering that the Arizona data is over a whole season and the data from China is for transpiration at its peak? The comparison to an isotope based study without a reference does not seem very convincing either. c. L2596:5-9. Comparison between hydrometric and isotopic measurements. The difference is 4% for transpiration (why mention evaporation?) – What is the direction of the difference? Does it support the idea that isotopic measurements give higher transpiration than hydrometric measurements; or do the authors mean to say that the difference is quite small? d. L2596:15 the paper of Schlesinger and Jasechko 2014 shows that isotope studies tend to yield higher values for transpiration fraction compared to studies using other methods and models. They might be used as a reference. e. L2596:16 Coenders-Gerrits et al 2014 show that Jasechko et al 2013 was overestimated; but they do it by using the same isotope data. This means that isotope data can be interpreted differently but is not necessarily overestimating transpiration. This is an important limitation and must be discussed. f. L2596:25 "This systematic difference between isotope-based estimates and models. . ." The only obvious overestimation in transpiration fraction in isotope partitioning studies so far, seems to be the paper by Jasechko et al 2013. g. The study by Sutanto et al 2012 is the only study where the ability of HYDRUS-1D to estimate evaporation fluxes was tested, see Kool et al. 2014. To decide that isotope studies tend to overestimate transpiration based on a model that was not tested in any other way, seems a bad idea.

11. L2597:7-10 Why do we need hydraulic conductivity calculations? There is no error

in saturated soil. Saturated soil at the bottom of the lysimeter results in conditions that are different from field conditions.

12. The conclusion is clearly written and represents the discussion in the article well. The conclusion states the fact that “a few studies that compare estimates of evaporation at the same location and conditions using the isotope-based and hydrometric methods show that the results are in fairly good agreement.” (L2600:13-16). Perhaps the article could expand more on the fact that, while there is good agreement between isotope studies and hydrometric studies- there is a general trend of overestimation of transpiration fraction of total evaporation when using the isotope method. Currently the supporting material is unconvincing.

Miscellaneous: o L2588:10 “bellow” should be ‘below’ o L2596:9 “soil transpiration”; should be evaporation? o L2596:19 ‘far too’ can be omitted? o L2600:18-20 ‘challenge’ is used twice in one sentence, slightly confusing

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2583, 2014.