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Earth System Dynamics
Discussions

Interactive comment on "Contrasting roles of interception and transpiration in the hydrological cycle – Part 1: Simple Terrestrial Evaporation to Atmosphere Model" *by* L. Wang-Erlandsson et al.

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We thank the referee for taking the time to make constructive and detailed comments. We addressed the general comments of Referee #1 in an earlier response and would here like to respond to his/her specific comments. The referee's comments are in italics, and our responses are in upright font. Unless otherwise stated, sections and equations referred to are those of the manuscript.

1) Section 3.2 contains a critical assumption of the model with no justification

beyond that it is 'logical'. I suspect that this assumption (of the order that water is evaporated from the different surfaces) determines a large part of the partitioning of water. This must be clarified and justified. Ideally, sensitivity experiments should be performed to show to what extent these assumptions affect the overall results.

In the real world, evaporations from different stocks occur in parallel. To take parallel evaporation into account, bare soil fraction (or vegetation cover) is sometimes assumed based on satellite measurement or prescribed parameters (e.g., Barlage and Zeng, 2004; van den Hurk, 2003; van den Hurk et al., 2000; Oyama and Nobre, 2004). Reduction of net radiation available for soil evaporation can also be done based on a Beer's law relationship with assumed extinction coefficient (Bastiaanssen et al., 2012; Zhou et al., 2006).

We opted for the serial evaporation approach because we think it is an adequate assumption and because we did not want to make yet another assumption on vegetation cover or extinction coefficient, nor use satellite data (due to our need for a simple and flexible model, see also our explanation of the rationale of STEAM in our response to referee #1's general comments). We acknowledge that the serial evaporation sequence is a simplification, but consider our evaporation sequence (see Eq. 7-10) logical because:

1. Vegetation interception occurs on the leaf surfaces, to some extent inhibiting transpiration. The aerodynamic resistance is lower and evaporation occurs most easily.
2. Transpiration occur in reality also before leafs are completely dry, but we think that some of this effect is implicitly compensated for since interception storage is limited and thus allow transpiration to occur within the same time step.
3. Floor interception evaporation occurs below vegetation, is reached by less radi-

ation and has no inhibitory effect on transpiration. In case of sparse vegetation types (e.g., savanna), leaf area index is less than for forest. In this case, vegetation interception and transpiration are also reduced, allowing more energy to reach the floor interception stock. This implicitly compensates for our choice to not use bare soil fraction or extinction coefficient (see also p.222, L16-20).

4. Soil moisture evaporation should occur after floor interception by definition.

We think that a sensitivity experiment with another evaporation sequence would not be very useful, because any other sequence is simply against our better knowledge of how nature operates. However, we will analyse the sensitivity of the interception storage assumption on the evaporation partitioning.

2) There is a lot of awkward phrasing, with mixing up of tenses and pronouns and some typos. While I fully appreciate that writing in a second language is difficult, the paper needs to be fully proof read by a fluent/native speaker to make sure that points are being made clearly and as the authors intended.

We will let a native speaker proof read the revised manuscript.

Similarly, some of the expression is rather casual and imprecise for a journal article. Some examples:
a. Section 4.3. Page 220. Line 17: 'considered to be on the high side'. Rephrasing the expression with referenced evidence within the same sentence would aid comprehension.

We will rephrase to "higher than several other satellite and/or gauge-based precipitation datasets". Following this sentence, we provide examples of global precipitation of

other satellite and/or gauge-based precipitataion datasets.

b. When reference is made to Supplementary material, (not appendices as is used here throughout the text) it is useful for the reader if the reference is as specific as possible: point readers to a particular section of SM, a table, a figure etc. Such directions are usually put in brackets. E.g. The blah is blah (see supplementary information figure x).

In the revision, we will reference to specific figures in Supplementary materials when appropriate.

c. Page 222, line6. This comes across as a normative and vague statement, especially in the phrasing that "criticism shows" it to be wrong and "unlikely". Please specify why you disagree. It would also be considerate to note Jasechko's reply, as well as other recent critiques of isotope estimates. There are several other instances where the authors might want to consider whether it absolutely necessary to dismiss the work of others when presenting their own model.

We will extend the discussion and include Jasechko's reply and recent critiques of isotope estimates (i.e., Schlaepfer et al., (2014); Sutanto et al., (2014) which were not available when we submitted our manuscript).

We are not sure which instances the referee refers to. As a general comment, we do not mean to dismiss the work of others in order to present our model, but only to discuss uncertainties in the field we think are relevant to mention. In the revision, we will consider reformulation if/where we can identify our current formulation to be unnecessarily dismissive.

3) There are numerous instances (mainly in the results section) of a figure being only very briefly referred to, without any clear attempt to explain why it is being shown or link it to the conclusions or the overall argument. This makes the paper feel very disjointed. Information is given, but without the guidance through the information from the authors, pointing out why it is interesting and important, that the reader would like. There are also many more tables, figures and appendices than are really needed or justified. To give one just one example, tables 1 and 3 could easily be combined.

We will combine table 1 and 3.

In the revision, we are considering reorganising the paper around two clearly defined topics: 1) model evaluation and 2) characterisation of the terrestrial time scales of the different evaporation fluxes. Reframing the manuscript in this way will make the manuscript feel more coherent, and some figures that are not needed will be removed in the revision process. We will make sure to better guide the reader using the figures and tables.

4) Many of the sections would benefit from being revised and reordered to make them shorter and clearer. Some examples:
a. The results and discussion is quite disjointed and not focused on the results of the model, with lengthy diversions criticizing data. This section doesn't give a clear indication of what the original results are. Many of the results are given with little analysis or discussion. The introduction is a rather long stream of information that is presented without a clear reason for why it is absolutely pertinent to the question in hand. This needs to be revised, clarified and shortened.

We will reorganise the manuscript and revise for it to be clearer and more to the point.

b. Section 2 and 3 would be more logical to a reader if they were the other way around. I.e. The model first, then the data used in this particular simulation (as presumably the model could be used with other datasets).

We will present the data after the model description.

c. The beginning of section 3 (p.210) could be substantially reduced in length if it were presented in a table with only the salient points clarified.

The information is already presented in Fig. 1 and Table 2, and the explanation in the text is given for clarity. We think presenting this information in a table will confuse the reader, and intend to retain the descriptive text.

d. Section 4 gives three analysis methods which were used. However, it is then very difficult to find what the results of these analyses were. It would probably be easier to read if the results of the analyses directly proceeded the description of the analysis technique, given that they are quite brief.

We appreciated the referee's feedback, but do not intend to change the structure as it is conventional to let methods precede results. Some readers might be confused if results were directly preceding the description of the analysis technique. In the revision, we will instead refer to the corresponding result section to facilitate navigation.

5) Some of the terminology used is not as clear as it could be. For instance: a. The terminology used to describe the separate parts of evapotranspiration is not particularly helpful. Using biophysical/physical for transpiration and all evaporation is not (so far as I know) a common terminology. Moreover, for ESD, it is potentially confusing for readers from a land surface or earth system modeling background who are familiar with the terms biophysical/biogeophysical in reference to all the surface changes (albedo, evapotranspiration, surface roughness etc.). Neither is this terminology consistent with the 'part 2' paper, which simply uses evaporation and transpiration. I would recommend that the authors follow this example.

We will skip the terms "biophysical/physical" for defining different types of evaporation fluxes. However, the partitioning of total evaporation into transpiration, vegetation interception, etc. is consistent with Part 2 (Van der Ent et al., 2014).

b. The words 'floor' and 'ground' seem to be used interchangeably. It would be easier for the reader if one was chosen, clearly defined, and then used consistently thereon.

Floor and ground should not be used interchangeably. We will clearly define and stick to the term "floor" to refer to the ground surface including litter. "Ground" will only be used in the fixed expression "ground heat flux", and when litter is not relevant (e.g., "leaf area index is defined as unit leaf area per unit ground area).

6) The color schemes used in the maps are not very accessible to those who are color blind, etc. Please consider using a color blind friendly color scheme (see for

instance Light and Bartlein (2004), for further information on this subject).
Light and Bartlein (2004) The End of the Rainbow? Color Schemes for Improved Data Graphics. Eos, Vol. 85, No. 40. Available from: http://geography.uoregon.edu/datagraphics/EOS/Light-and-Bartlein_EOS2004.pdf

We thank the referee for this suggestion. We will use a color blind friendly color scheme in the revision.

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