Earth Syst. Dynam. Discuss., 5, C102–C106, 2014
www.earth-syst-dynam-discuss.net/5/C102/2014/

Earth System Dynamics Discussions
Open Access

ESDD
5, C102–C106, 2014

Interactive Comment

Interactive comment on "Contrasting roles of interception and transpiration in the hydrological cycle – Part 2: Moisture recycling" *by* R. J. van der Ent et al.

Anonymous Referee #3

Received and published: 25 April 2014

In the submitted paper *Contrasting roles of interception and transpiration in the hydrological cycle – Part 2: Moisture recycling*, R. J. van der Ent and his co-authors present new metrics which allow a more detailed analysis of the different partitions of evapotranspiration. The authors thereby use estimates from the STEAM model (which was described in their companion paper) and ERA Interim reanalysis data to present a revised image of the global water cycle. This is achieved by partitioning total evapotranspiration into direct (→ interception) and delayed (→ transpiration) evaporation. By that, it is stated that interception and transpiration have different atmospheric residence times and length scales. The authors thereby conclude that land-use changes (which can change the partitioning between interception and

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

transpiration significantly) can influence moisture recycling patterns and thus lead to a redistribution of water.

The paper is very well written and contains a lot of meaningful information which might be useful for many different subjects. The results are presented in a clear and comprehensible way which made it easy to follow the author's findings. However, there are (amongst others) some issues which typically arise from such single-model analyses (→ general comments). These should be adressed before the paper is published. I would therefore recommend a publication after **minor revisions**.

General comments:

- All results in the paper are based on a single model. Therefore, it would be interesting how "reliable" these numers are. In section 4, the authors conclude that 60% (56%) of intercepted (transpirated) evaporation returns to the land surface. When we take into account all the uncertainties from the moisture tracking model, STEAM, and ERA Interim, I wonder if e.g. the difference of 4% between intercepted and transpirated evaporation is "realistic" or simply due to errors or simplifications in the model and driving data. It would be very interesting to see some "ensemble" analyses and how the results change if e.g. the driving data is slightly modified (→ stability). I know that this would go far beyond the scope of the paper but the authors might consider this for future investigations.
- In advance, as the authors provide absolute numbers of the different partitions of evapotranspiration (and other water cycle quantities), I think it is absolutely necessary to give at least some rough uncertainty estimates of these values.
- In section 2.2, the authors present some new metrics which allow a much more detailed analysis of moisture recycling. It could help the reader a lot if the authors summarize these metrics (together with a short description) in a table.

ESDD

5, C102–C106, 2014

- Section 3.6: I somehow have the feeling that this section is a bit "out of topic". It further does not add a lot to the author's main findings.

- That being said, it would make more sense if the authors remove the West Africa section completely and add a more detailed analysis on the seasonality of their results. It would be very interesting to see e.g. how their recycling metrics change over time.

Specific comments:

- Page 283, line 25: Could you give a short explanation what you mean by "recycled" evapotranspiration?

- Page 285, line 27: *We aim at ...* I think this is a bit too far reaching. You're not presenting a completely new image, but a more detailed look at the global water cylce.

- Section 2.1: The terminology in the formulas is a bit mis-leading. It is common practice to call evapotranspiration ET (or even ET_a for actual evapotranspiration). Here, you're using the term E_t for transpiration only.

- Page 287, line 5: Using oceanic precipitation and evaporation estimates from reanalyses is dangerous!!! We know that the analysis increments in reanalysis models can significantly distort the water budgets. This can be observed especially over the oceans. As you directly use oceanic values from ERA Interim in your analysis, it might be necessary to comment on the reliablity of these estimaes (e.g. use GPCP, HOAPS, TRMM, ...).

- Page 287, lines 10 – 11: Why don't you use the full resolution product ($0.75° \times 0.75°$)?

ESDD

5, C102–C106, 2014

Interactive Comment

- Page 289, Equations 12, 13, 14: What exactly do you mean by $N\,(P_c \leftarrow E_c)$? In the current version, this incicates that N is a function of $(P_c \leftarrow E_c)$. As you do not use $(P_c \leftarrow E_c)$ in the following, I think these formulas can be easily changed.

- Page 289, line 25 *The lifetime of continental ...* The authors explain that $\tau_{\rho,c}$ is the "average age" of a water particle. I don't know if I might miss the point here but what does this imply if precipitation in a pixel is a combination of recycled (from the pixel itself, short lifetime) and advected (from a remote location, long lifetime) moisture? As $\tau_{\rho,c}$ is an *average*, it could be that this value does not even occur in reality. Can you comment on this?

- Pages 291 – 292: Think about re-arranging the formulas. It might be more convenient to start with λ_ρ, .. and then explain what ρ_{x_1}, .. is.

- Page 294, Section 3.1: Are these numbers on ERA Interim (ocean) and STEAM (land)?

- Page 294, Lines 297 – 298: How do you compute Q? Is this an output from the STEAM model? Do you somehow account for trends in the continental water storage?

- Page 294, Line 10: A portion of this land evaporation (E_o) is advected to the oceans ...

- Page 294, From line 12: I think you should add some comments about the reliability of these numbers (see second general comment).

- Page 295, Lines 16 – 19: How does this explain the location of the "hot spot" of interception?

- Page 296, Lines 10 – 15: Even if this sounds like a reasonable explanation, the difference between interception and transpiration is only about 5% in these

ESDD

5, C102–C106, 2014

Interactive Comment

regions! I fear that such differences can also be explained with errors in the model or driving data... In that sense, a different model might give totally different numbers (see first general comment).

- Figure 1: This figure needs much more detailed explanation. Especially, $\sum F_{in}$ and $\sum F_{out}$ are not explicitly mentioned in the text. This makes it rather difficult to understand what is going on.
- Figure 2: Consider using equal color bars (at least for 2b and 2c).
- Global Maps (Fig. 2 – 6, A1, A2) Consider using only a single colorbar for maps which share the same color map. This gives you more space for the figure.

Interactive comment on Earth Syst. Dynam. Discuss., 5, 281, 2014.