

Reviewer's report: hess-2016-198

Reviewer #1:

The manuscript "Daily Landsat-scale evapotranspiration estimation over a forested landscape in North Carolina, USA using multi-satellite data fusion" addresses the lack of spatial and temporal resolution when using satellite imagery to estimate ET over heterogeneous landscapes. The authors overcome this problem by the application of multi-sensor data fusion combined with the STARF model. Additionally, the authors introduce a new method, based on STARFM, to fill gaps in primary data sets caused, for example, by cloud cover. Their method is validated with empirical data from two eddy covariance flux towers. The study is novel and innovative, and well structured and written. Figures and tables are widely appropriate. I only have minor suggestions and comments to improve the manuscript's readability and consistency.

We are greatly thankful to the reviewer for this thorough and thoughtful review.

Specific comments:

P2L14: ET also varies with different development stages, as actually demonstrated by the authors' own study.

Great point. We now added development stages in the sentence as one of the parameters that affect ET.

P3L11-12: "plant status" ... please be more specific, do you refer to the development stage?

We changed "plant status" to "plant growth rate".

P3L18: Add von Bertalanffy (1968), "General Systems Theory" to the lists of references as he was one of the first addressing the equifinality problem.

Thanks for providing the citation, we added it in.

P4L18: What methodological challenges do the described differences between forest land cover and shorter crops cover imply for this study?

We added this statement: "This presents a modeling challenge in terms of accurately defining turbulent exchange coefficients, as well as describing radiation transport through the canopy."

P4L25-27: "We also present a new method, ..., for filling gaps ..." Sounds nearly redundant but is one of the primary novelty of the paper as far as I understand. Shouldn't it be more upfront then?

We agree that we should put this new gap-filling method more upfront. We have rephrased this with a stronger statement. We prefer to maintain the distinction between science objectives and this methodological advancement, however.

“Additionally, we present a novel methodological advancement, based on data fusion, for filling gaps in Landsat-based ET retrievals due to partial cloud cover as well as the scan-line corrector (SLC) failure in Landsat 7. This technique facilitates more complete use of the existing Landsat archive for investigating water use dynamics at the landscape scale. “

Equations in general: Please add the units to the description of each parameter.

We added the units to the description of model parameters and variables.

Equation 2: It’s not clear to me what the purpose is of presenting the general equation first and then the two equations specifically referring to canopy and soil. If redundant, remove the general version and tag the other two as (a) and (b).

The three equations have been retained to signify that the model solves for both the component and system fluxes. However, we rearranged terms in the first equation to make the 3 more parallel.

P5L22-23: Did you mean "... T is the air temperature measured at height Z_T ..."?

Z_T is a parameter in equation (3). This is now clarified within the text.

P10L26: Replace "3" with "three"

We removed “3” in this sentence, as it seemed redundant.

P12L9: Same as above. "... including one Landsat 7 scene and seven from Landsat 8 ..."

We replaced “1” with “one” and “7” with “seven”.

P13L13-21: I think this paragraph goes beyond the classic presentation of results and should be moved to the discussion section.

We agree with the reviewer that this material did not belong in results. The contrast with previous attempts to gap-fill Landsat 7 imagery is now made within the methods section.

P13L27: Put "ET" in brackets.

Reference to ET was removed here, because Table 2 refers only to energy fluxes.

P14L2: "... 3 site ..." Typo?

The typo was removed.

P15L1-2: Inconsistency. "... ET was 3% of the total observed flux at NC2 and -4% at NC3" In Fig. 9, at both sites the modelled ET is below the observed ET.

We checked the data and fixed the typo.

P15L7-9: "[Note:]" Please use a footnote instead.

It is now inserted as the footnote.

P19L18: Add "(Australia)" after "Victoria".

Australia was added.

Fig. 1, caption: For consistency, replace "vegetation" with "canopy".

We replaced "vegetation" with "canopy".

Fig. 7, caption: Repetitive. Condense.

We modified the caption to condense it.

Fig. 7, legends: "1:1 line", "LE" should be " λE ".

Legends were fixed.

Figs. 13 and 14: Merge. The information is the same apart from the standard deviations in Fig. 14.

While there is some overlap in information, we believe there is visual value in retaining the bar chart with the standard deviations to more clearly visualize differences in the total seasonal water use, as well as the variability across the scene. The cumulative curves provide temporal information, and would become too cluttered if the range in variation was superimposed.

Fig. 15, legend:

Typo ... "Young Plantation"

Typo was fixed.