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Interactive Comment

Interactive comment on "Mapping evapotranspiration with high resolution aircraft imagery over vineyards using one and two source modeling schemes" *by* T. Xia et al.

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The paper presents an example of terrestrial evaporation (ET) estimation over 2 vineyard fields by 2 thermal-based methodologies. One is a relatively new and very simple one-source algorithm with a very complex name (DATTUTDUT, I'll shorten it as DAUT hereinafter) that only requires land surface radiometric temperature; the second one is a more established methodology (TSEBS) that requires also multi-spectra imagery at different bands and its algorithm is more complex to apply.

The paper is a good contribution to the field of deriving ET at the few meters resolution for agriculture and water management applications, illustrate our current capability to use thermal imagery to estimate ET over these type of fields, and discuss some of the remaining challenges. The paper is well written with the adequate level of detail, and the work carried out is easy to follow.

Some general comments about the paper are:

(1) It is expected that the more complex algorithm (TSEBS) will out perform the simpler DAUT, so I was wondering about the motivation of this comparison for a large part of the article. The idea that they could be used together in an operational scheme with TSEBS only run when DAUT fails came later in the paper. It should perhaps be presented already in the introduction (and not at the end in the conclusions) to help understanding the motivation of the paper.

(2) Although the spacecraft multispectral imagery is at sub-meter resolution, most of the data is spatially downgraded to a few meters resolution. This is required to allow TSEBS to operate, but my understanding of DAUT makes me think that it can operate at the sub-meter resolution. It would have been vey interesting to have DAUT at sub-meter resolution, aggregate to meter-resolution, and compare with the TSEBS meter-resolution ET estimates. We could think that the one-source models are more adequate to deal with less "complex" pixels (in terms of soil canopy composition), so running DAUT at sub-meter resolution is likely to result in a larger number of "simpler" pixels (i.e., full canopy or full soil coverage) and a better performance. In the context of precision agriculture applications commented in the introduction that would have been interesting to see. (3) Thinking about real applications of these methods, the estimation of daily ET based on the ratio of instantaneous to daytime available energy at the tower seems a bit counterintuitive in the sense that in real life the tower will probably not be there. The ET methodology can still use the EF constant assumption, but it would require an estimation of the available energy not only at the instantaneous step but also integrated over the day. This could be perhaps discussed in the text. (4) The section about water consumption is just a comparison of TSEBS and DAUT field integrated ET with field integrated tower ET assuming that the tower ET fetch is representative of the

whole field. It is of interest as it shows the variability that can exist at the field scale and the need of ET methodologies that could capture that variability. I imagine that for other type of crops growing in irrigated fields (i.e., water availability is not an issue) the variation would be smaller and micrometeorological methods still van be of utility. For this concrete example, based on the paper findings the variability seems related to a large extent to changes in LAI across the field. What about water availability, may it play a role here? The vineyards are drip irrigated, does this imply that water availability is constant through the field and ET response does not reflect water stress? I imagine that in practical applications there can be challenges in separating ET variability caused by water availability or biomass variability, and how this can be used to infer water stress and condition irrigation management.

Some more specific comments:

P11911.L10. I thought DAUT only required thermal images, no shortwave imagery as the downwelling radiation is based on astronomical calculations and the albedo scaled based on the thermal information.

P11913.L10. Given the importance of Rn for the ET estimation, it may be good to detail a bit how TSEBS operated here (as it is detailed for DAUT later in the text). My understanding is that it requires the downward SW and LW components (but these inputs are not listed in P11920.L8 as key inputs to TSEBS).

P11917.L18. A map of LAI for one of the DOYs discussed my help illustrate the difference between both vineyards, and being useful also for the water consumption discussion later in the paper where ET variability within the field is linked to LAI variability.

P11920.L1. See previous comment about imposing the scale where TSEBS can operate (few-meters) to DAUT.

P11920.L17. Ground-based reflectance was not collected for all the flights, but could the existing ground-based data have been used for a local (and possibly more accurate)

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calibration of the DN values? Was the existing ground-based data limited in terms of sampling the reflectance space? The airborne sub-meter and 30 meter LandSat resolutions are quite different.

P11921.L5. If we consider the 3 bands separately, the agreement to the ground based reflectance does not look that good, especially for the NIR. Any reason for the aircraft NIR being in worse agreement with the ground based NIR (if my impression of the NIR being worst than the others from looking at Figure 2 is correct)?

P11922.L10. It may be of interest to give some details about the flux footprint model.

P11923.L1. Wondering if bias and RMSD were similar for the estimates of Ts and Tc.

P11923.L15. Some percentage figures may be nice to help judging the RMSD (e.g., the fraction of the expected instantaneous fluxes corresponding to the reported RMSD).

P11924.L10. I would argue that the very simplistic determination of the Rn-G in DAUT is also key here, independent of the one-two source differences in how the fluxes are treated and the implications of the contextual scaling approach by DAUT. It would be curious to see how TSEBS and DAUT would score if their radiative inputs were exchanged (i.e., TSEBS using the downward SW and LW from DAUT, and DAUT using TSEBS available energy, if this makes any sense).

P11926.L25. For someone that works in evaluating satellite TR, this 3K bias is a relevant figure. Any ideas about the reasons suspected to be behind this bias? Out of curiosity, how are the ground-based TR measurements collected? TIR cameras?

P11927.L10. This is a nice exercise showing the relatively large sensitivity to the TR errors form thermal methods that depends on the absolute value of TR. I would argue that a more realistic determination of the TR uncertainties from available instruments is needed so this uncertainty can be properly propagated into the ET estimations errors.

P11928. L4. As discussed in this paragraph, perhaps a slightly more “complicated” but effective way of selecting the end members of the TR distribution could greatly improve

DAUT estimates.

P11931.L14. This section looks to me more just the “Conclusions” (the previous section was already labeled “Results and Discussions”).

P11934. I imagine that the UAV technology is targeting the sub-meter resolution. Given the limitation of TSEBS to work beyond the plot/micrometeorological scale, any thoughts about possible candidates to complement DAUT for high precision agriculture (i.e., another thermal based ET methodology able to work at the sub-meter scale, operationally more demanding but able to deal with the cases where DAUT fails to provide decent ET estimates)?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 11905, 2015.