

***Interactive comment on* “The impact of in-canopy wind profile formulations on heat flux estimation using the remote sensing-based two-source model for an open orchard canopy in southern Italy” by C. Cammalleri et al.**

Anonymous Referee #1

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General comments:

This manuscript is well written and well structured with a solid scientific approach. It presents a sensitivity study of the TSEB model, using 3 different algorithms to simulate the in canopy wind profile, applied to olive orchards in Sicily. The impact of the use of the 3 algorithms evaluated (Goudrian, Massman, and Lalic models) and analyzed from the surface fluxes measured on 2 fields. Airborne data acquired at fine resolution provided the main inputs to TSEB. Aggregation methods were used on airborne images

(this point is not enough described, see below specific comments) and average values computed for each landuse classe. It misses sometimes the standard error related to the averaged values. Accurate ground measurements were used to calibrate the model. It's the main reproach that we can do for this study. Indeed, it seems that the authors use specific coefficients derived from ground measurements or observations and consequently not easy to extrapolate to other conditions, it would be interesting to add a table with the main parameters used for each algorithm (hc, z_0, α, \dots) and their possible modifications according to the landuse, the time. . . A little bit more information would also be welcome for the ground measurement protocol for LAI and Ts (how many measurements per field?). See below my specific comments that may be useful to the authors, to improve some points not clear enough. After these minor revisions, I would therefore recommend this paper for publication.

Specific comments:

Title a little bit too long

Introduction p4692 lines 5-10: 'flux observations. . . are used to evaluate three different in canopy wind profile algorithms. . .' In fact, the flux observations were used to validated the surface fluxes simulated by 3 different TSEB versions, varying only by the in canopy wind profile representation. There are no measurements allowing to really test what in canopy wind profile model is better for the study case.

P4693 line 3 eq 3 , why there is no ground heat flux for vegetation (G_c)? Justification

Eq 3,4 it would be better to give a review of all parameters used in the equations with their value used in this study (maybe in annex)

P4694

line 3 'modelled by the approach proposed by Brutsaert (1982)' have you test other approach? This formula can be arguable for some situations

Line 4: emissivity varies according to soil moisture. . . have you kept these values

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constant for all surfaces?

Line 10: eq 7 coefficients defined for specific conditions or low crops? Application to sparse crops or to orchards problematic?

P4695 eq 10 means that you must know the mean row spacing. Is it possible everywhere for a regional application? What is the variability of this parameter?

P4696 eq 14: coef $c = 0.0025$, defined for maize. the cultivated crops can comprise a lot of very different crops. Have you test the sensitivity of c on r_s ?

P4696 You describe r_s but not r_a and r_x , why? (give some information in annex)

P4697 eq 15-16 what parameters are measured or fixed constant (add a table with 3 columns (Goudriaan, Massman, Lalic) sensitivity of these parameters (calibration performed more than validation)

P4698 eq 18 coef C_d can vary

P4701 give more information about the ground measurements LAI, T_s , canopy height: how many point measurement par field?

P4702: line 10: 3 soil heat plates used, is it enough to take into account the spatial variability at field scale? Accuracy?

P4703 line 5 'EC flux closure was enforced by assigning energy residuals to latent heat flux' It can be a problem if your G estimations are wrong (soil heat flux measurements are often problematic particularly for sparse crops and if you have heterogeneous soils)

Table 1 what comments on the high values for RE % for G? add in caption (values computed for all day long?) it would be more interesting to see mean values for the 7 studied dates.

P4703 line 26 what is the spectral range for the FLIR thermal camera?

P4704 figure 1 the information of wind speed for the 7 studied dates is also important.

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Maybe you can add mean values in adjacent table or on the figure 1

P4704. Why do you not use radiosoundings to other models to correct the images from atmospheric effects?

P4704 Why have you chosen the Clevers method to estimate LAI? There are other robust methods which can be applied to your data.

Line 25 'the canopy heights have been retrieved by means of local calibrated LAI based polynomial empirical relationship as suggested by Anderson' Could you give more information on this method (initially suitable for soybean or corn), please. This point is important. What is the variability obtained? Give values or a table for example.

P4705 line 11 how are aggregated thermal data?

Line 13: On the Table 3, it seems that some dates present standard deviations higher than 2, that is not negligible! Have you test the impact of this variability on your main outputs?

P4707 line 24 figure 7 only displays the mean values. These values were computed for areas comprising numerous pixels. It would be interesting to add the variability observed for the 3 simulations on the figure 8 (idem for fig 8-10)

Add standard errors in table 4 and fig 8

P4708 line 18 you have not mentioned before that α_q can change for the same field during the year. How have you defined this variation for your study case? Give the values in a table

P4709 lines 13-23. The comments must be more nuanced because there are no measurements on these crops (vineyards and citrus fields). A table with the main parameters chosen for these crops can be given here.

P4711 line 2 'the analysis suggests... ' the main results were obtained for olive orchards so the conclusion must be reviewed.

Line 16 the role of wind direction. Could you develop more this point (and add arrows on fig 2 to show this point)

Discussion on the application to other sites, data availability, accuracy?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4687, 2010.

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