**Hydrology and
Earth System
Sciences**

Discussions

Open Access

HESSD

Interactive
comment

Interactive comment on "Adapting the thermal-based two-source energy balance model to estimate energy fluxes in a complex tree-grass ecosystem" *by* Vicente Burchard-Levine et al.

Anonymous Referee #2

Received and published: 22 November 2019

This paper applies various combinations of parameterizations of the TSEB model over a tree-grass ecosystem in Spain for 3 sites and 3 years: 2 wind profiles, 2 end-member representations of the system (trees and grass). It also performs a sensitivity analysis of the initial model. It shows that the most sensitive parameters are the vegetation height and the green and total vegetation fractions, that both profiles have similar performances, and that only the model made of a succession of endmembers is able to provide satisfying (o(50 W/m2)) H and LE RMSD values. This is an important contribution in the field of retrieving ET, E and T from RS data in orchard-like eco- and agro-systems (isolated trees with herbaceous understorey).

Main comments:

The introduction and discussion sections should position this work with respect with similar work by Andreu et al., (2018) using TSEB on the same dataset, ref. P 32 L 671.

I don't understand what is meant exactly by "default model configuration" (P13 L293-300): why is fc constant (and not varying according to LAI) ?

Is the "effective" roughness (following Raupach 1994) used in all model configurations ? It seems later that this only applies to when hc=8 m. This needs to be clarified.

It is not clear why the default model do not work properly, and only the endmembers do. An explanation/analysis should be more thoroughly presented in the paper.

The abstract is not clear enough (esp., assertion Line 25 is too vague) about the various versions of the models that are evaluated.

The Goudriaan and Massman equations for the aerodynamic resistances should be mentioned in Appendix, so that one understand for example the impact of Hmax, Xi,soil and Cd on the turbulent transfers.

One could easily shorten the model presentation (Eq. 1 unnecessary) in order to provide more insight on the measurement protocol (number of soil heat flux plates, representativity of the CNR4 FOV etc).

Also, the way the tree and grass LAI and the resulting fg and fc contributions are partitioned in the various model versions is not clear enough from 2.3.2: one does not understand when one refer to an effective (total) fg for the TGE? The grass fraction, or the tree fraction.

I don't understand why the endmembers in TSEB_2S are not weighted by a scaling factor depending on the development of the grass layer (instead of changing the model version abruptly from one season to the other).

Why didn't you look at the partitioning with the default model configuration ?

It would be interesting also (since the maximum PT parameter is not very sensitive) to show the time evolution of the reduced PT coefficient as simulated by the various model versions.

Minor comment:

P3 Line 63: missing verb

P3 L67 to 68: the topic changes abruptly, one needs a transition

P4 L74: a model is overparameterized only if there is not enough constraint on its outputs, it is not an effect of its sole complexity (in Beven's paper this refers to Discharge as the sole constraint on parameter calibration)

P4 L75 and 76: it is not clear what is meant by "main effect" end what is "total parameter contribution"

P8 L175: permits > allows ?

P9 L 209: "local LAI" : do you mean "clump LAI" ?

P10 L249 / P11 L250: thi sis a bit radical, usually this correction is only used when there is a closure of less than 80%, is that the case (provide numbers)

P11 L260: CNR4 is not a fully hemispherical measurement; what about the FOV of each instrument and its representativity for the Tree-Grass mix ? How many heat flux plates were used ?

Eq. 13: 0.94 is a very low figure for bare soil emissivity, and is somehow a model parameter itself; did you perform a sensitivity of this as well ?

Table 2: the range of values for the parameters that are measured in the field (e.g. fg, fc and hmax) seems unrealistically large, I understand that through this range one addresses the uncertainty of the tree+grass mix "effective" parameters linked with transpiration and turbulent transfer, but maybe this should be explained before presenting

this Table.

Table 3: when hc=0.5, I guess that roughness is no longer computed from Raupach 1994. This should be clarified.

Table 4: it is identical to Table 3, except for *, is this Table useful ? One understands that TSEB-2S is TSEBgrass for one season and TSEBTree for the other, is that correct ?

P26 L515: this is ofetn the case in TSEB, since a moderatly stressed vegetation with a soil that is still moist is interpreted in the model as a fully transpiring vegetation and a completely dry soil.