

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3 https://doi.org/10.5194/hess-2022-125-RC3, 2022 © Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.

Comment on hess-2022-125

Anonymous Referee #3

Referee comment on "Accuracy of five ground heat flux empirical simulation methods in the surface-energy-balance-based remote-sensing evapotranspiration models" by Zhaofei Liu, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-125-RC3, 2022

The main target of this paper is to test several empirical formulations of the ratio between the soil heat flux G and the net radiation Rn, which is a key issue for estimating evapotranspiration through surface energy budget models forced by instantaneous remote sensing surface temperature data.

Main issues with the paper are:

- The evaluation dataset is based on the sole estimate of G as a residual of the energy budget from flux tower measurements; G being usually small compared to the turbulent fluxes, the total uncertainty is high, and a more robust method would have been to do, as classically done, a correction of the subsurface sol heat flux plates measurements, with potentially a further correction with the residual G estimate, bearing in mind that turbulent fluxes are generally underestimated. Furthermore, the FLUXNET dataset is not representative of the agro- eco-types where remotely sensed ET estimates are required; especially, crops in Mediterranean and semi-arid climates are largely underrepresented. This limits the study's impact.
- The number of empirical equations under study is limited, esp. regarding previous works (Sun et al., 2013*, Bonsoms and Boulet 2022**)
- I am concerned with Figure 1a: H and Rn are equal ! Also, why are the flux values so low for half hourly flux estimates ? Some explanation is required here; if G is the residual, the energy budget is closed, the SEB average of all sites should also be closed for each half hourly value, i.e Rn-G=H+LE. Also, G' seems to be an uncorrected G measurement at a few cm depth (please confirm, G' is actually not defined properly in the paper), the corrected G' at the surface should be shown and analysed for all sites compared to G, esp. since the normalized (G) and (G') looks similar (1e versus 1f).

Detailed comments:

- Line 7: what is the difference between "intra-day" and "diurnal" ?
- Line 9: add that G is required for RD ET models based on the SEB forced by radiative surface temperature (it is of no importance for other models).
- Line 9: add "empirical", i.e. "G empirical estimation methods"
- Line 13: "the two methods ... ": revise the sentence ; I find a bit contradictory that calibrated G/Rn based on NDVI and fractional cover have contrasted performances.
- L65 to 77: all models based on forcing SEB with land surface temperature need an estimate of G/Rn, no need to review them all, better provide an updated review of all G/Rn equations
- Line 140: we can't use only calibrated parameters for operational applications (i.e. satellite products) so it is important to also test the default (published) parameter values (comment also made by other reviewers).
- Line 370: NO, Santanello and Friedl (2003) do NOT need LST
- Line 420: I don't understand this sentence

* Sun, Z., Gebremichael, M., and Wang, Q.: Evaluation of Empirical Remote Sensing-Based Equations for Estimating Soil Heat Flux, Journal of the Meteorological Society of Japan, 91, 627-638, 10.2151/jmsj.2013-505, 2013.

** Bonsoms, J., and Boulet, G.: Ensemble Machine Learning Outperforms Empirical Equations for the Ground Heat Flux Estimation with Remote Sensing Data, Remote Sensing, 14, 1788, 10.3390/rs14081788, 2022.