Comment on hess-2022-125
Anonymous Referee #3


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 $R_n$, 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 $R_n$ 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. $R_n-G=H+LE$. 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
