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Comment on hess-2022-125

Anonymous Referee #2

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-RC2, 2022

This paper analyzes the relationship between G and Rn at a continental scale with hundreds of flux site measurements. This work is interesting to RS energy balance ET model users. It concluded that the linear coefficient (LC) method and the methods embedded with the normalized difference vegetation index (NDVI) were able to accurately simulate a half-hourly G series at most sites. The methods using fractional vegetation coverage showed poor performance. The highest accuracy was exhibited during sunrise periods (6:00-7:00), followed by sunset periods (17:00-18:00). The lowest accuracy was observed at noon periods (10:00-15:30). These conclusions are important for RS ET simulation. From this point, this work deserves a publication on HESS. Meanwhile, it also has some shortages which needs more clarification. The following are some comments.

Two major comments:
G was taken as the residual of Rn-H-LE in this paper, without considering the energy balance issue. This method might work for some low canopies which has a relative homogeneous land surface. The measurement of H and LE might have problem for forest site, since H and LE sensor are not high enough to be out of the sub-roughness layer on the canopy top. Hereby, this paper needs some discussion on why the energy unbalance item can be all partitioned to G, or what kind of data quality controlling process can make him/her believe that H and LE measurement at the selected sites are accurate and they don`t need energy balance correction.

Eq.2-6, the author has optimized a, a1, a2, and b. However, they did not analyze the values of these optimized variable. Figure 8 only show optimized values for three methods, without show other two methods. a1 and a2 in eq. 5 has their definition or physical meaning in the original publication. Whether the optimized values for these two parameters still follow the range of their physical meaning? I suggest to do some statistical analysis of these optimized parameter values. This can help other users when using equation 2-5. Chen et al. 2019 AFM has optimized fc based G/Rn equation. Please make a comparison with this study. They have optimized a1, a2 with a classification of land covers and canopy types. Since these parameter values could varies due to canopy

covers, I suggest this paper also use canopy classification to analyze the NSE values in figure 6, KGE, RMSE, RE in figure 5, R^2 and slope in figure 3. Figure 1 can be also divided into different land covers. And, please also conclude which of the five methods is the best for which land covers or canopy classification. This result will be more useful for the RS ET model users. Figure 4, it would be interesting to analyze the linear fitting R^2 between G/Rn and NDVI for different canopy. The same problem with figure 7. Figure5, please also add Re, RMSE and KGE for other methods, not only show the LC method.

Some minor comments:

Figure 6. The NSE value is calculated after or before a, a1, a2, b were optimized? The figure description should include this information.

Figure 8, the label for y-axis is not accurate, please revise it.

Figure 1a shows that G and Rn has a time phase difference in their diurnal variation. However, this paper does not consider this effect. Please explain why not consider this effect in their using G/Rn equations.

These ET datasets include, but are not limited to, the Breathing Earth System Simulator (BESS) (Jiang and Ryu, 2016), Moderate Resolution Imaging Spectroradiometer (MODIS; MOD16A2) (Mu et al., 2011), GLEAM (Miralles et al., 2011), and Numerical Terradynamic Simulation Group (NTSG) (Zhang et al., 2010) products. There are more global ET products which is based on energy balance method, such as EB-ET (Chen et al. 2021), htt p://data.tpdc.ac.cn/zh-hans/data/df4005fb-9449-4760-8e8a-09727df9fe36/?q=energy%20balance
This ET product is based on energy balance method. The author may think that this study is more useful for energy balance based ET models.

The surface energy balance method provides an alternative solution for assessing the G simulation schemes (van der Tol et al., 2012). This method could avoid the inconsistent spatial scale of G with that of LE and H in field measurements. I don`t understand what`s the meaning of these two sentences, please rephrase them.

The slope and R2 of the linear fitting curve were -0.012 and 0.92, respectively. Are you sure the slope is negative value?

Change "use Rn to calculate G in the RS inversion of ET" to use Rn to calculate G in RS based energy balance ET models (Chen et al. 2019 AFM; Chen et al. 2021 JGR).

Some references about energy balance ET models should be cited:

Chen, X., et al. (2019). "Optimization of a remote sensing energy balance method over different canopy applied at global scale." Agricultural and Forest Meteorology 279: 107633.

Chen, X., et al. (2021). "Remote Sensing of Global Daily Evapotranspiration based on a Surface Energy Balance Method and Reanalysis Data." Journal of Geophysical Research: Atmospheres 126(16): e2020JD032873.

Chen, X., et al. (2014). "Development of a 10-year (2001–2010) 0.1° data set of land-surface energy balance for mainland China." Atmos. Chem. Phys. 14(23): 13097-13117