We thank Reviewer 2 for helpful comments. Reviewer 2's comments are in black, and our response is in red:

Reviewer 2

This manuscript comparatively tests four hypotheses of the Priestley-Tyalor wet-surface evaporation and calculated the corresponding parameters. It is an interesting work for the research on evaporation, from both the theoretical and application perspetives. I think it is worth for publishing after addressing several comments below.

Major comments:

1. The criterion of LEref>0.9LEp for wet surface conditions requires acurate wind function f(u) for LEp. The actual wind function may vary with the aerodynamic conditions, the boundary layer characteristics, or even the magnitude of wind speed. The wind function (3) with the fixed canopy height used in this study may derivate from the actual one (Han et al., 2021), especially with the growth of the vegetation. Let's write Ep with fixed wind function (3) as Ep'. E=alpha*Ee is equivalent to E/Ep'= alpha*Ee/Ep'. Then, E/Ep' may be substantially less than 0.9 by using wind function (3) with fixed canopy height, and substantial data which should be taken as under wet surface conditions may be excluded. Under this conditions, the RH may be limited to large values artificially to make sure that Ee/Ep'>0.9. So, an evaluation on the result of the chosen for near wet surface conditions is needed, against other methods, or on the real wet surfaces, such as wetlands. What is the proportion of data left for a permanent wetlands by this criterion with the fixed wind function?

The criterion LE_{ref}>(some fraction of LE_{p}) seems to us to be the most straightforward way of expressing the wet surface condition. For a wet surface, the equation for the actual evaporation is literally the same as the equation for LE_{p}, so if LE is approximately LE_{p}, the surface should be wet. We agree that the wind function can play a role, and that there is some uncertainty in the values of z_0 used, where z_0 is given by $h/8$ and h is the canopy height.

To address this issue, we plan to add the following at the end of section 5:

> Different data points might be assumed to represent wet surface conditions depending on the threshold value of T as illustrated in Figure 1. But different points could also result for a given T value for different values of z_0 used in the wind function (3). Han et al. (2021) noted that different assumptions regarding the proper wind function parameters (e.g., z_0) can produce disparate results in wet surface evaporation studies. The data presented here have used the Wang et al. (2020) z_0 and d_0 formulations as described above. But eddy covariance measurements of friction velocity u^* ($\mathrm{m\ s^{-1}}$) are available for most of the sites and measurement periods. This means the logarithmic wind profile $\underline{u}=(u_*/k)\log[(z_u-d_0)/z_0]$ (Brutsaert, 2005) can be solved for z_0 for each measurement period for which u_* is available. This value of z_0 is specific to a particular site and a particular month or day, so it accounts for roughness variations with season and wind direction.

> With these data, the values of z_0 calculated in this way are somewhat smaller than those found with the Wang et al. (2020) formulation, which causes LE_p values to be smaller. Nevertheless, a figure similar to Figure 1 but using these new z_0 values (not shown) suggests that T=0.9 is still appropriate. This method results in root mean square errors comparable to those in Tables 1 and 2 (see Supplement, Tables S.2.1 and S.2.2). The number of data points differ because not all time periods had u^* measurements and because different z_0 values resulted in different data points qualifying as wet surface values. However, the key findings remain unchanged. Results from the Wang et al. (2020) version of z_0 and d_0 are shown because they represent the way the roughness of land surfaces is usually estimated.

Finding the fraction of permanent wetlands that meet our criterion is a good idea. However, the "permanent wetland" classification is the only wetland category used by IGBP, and some seasonal wetlands are placed in this category. For example, the Fogg Dam (AU-Fog) description at https://www.ozflux.org.au/monitoringsites/foggdam/foggdam_description.html says, "the flux tower site was classified as a seasonally flooded wetland." Thus, not all evaporation from these sites should be expected to be wet surface values. Of the 323 months of data from "WET" sites, 105 months were classified as wet surface evaporation. We believe our threshold value is a more reliable way of identifying wet surfaces.

2. The result of the third hypothesis with large values of RH near the unity (Table 2 and 3) may be affected by above data chosen method, as Ee/Ep'>0.9 requires large RH.

The criterion is actually LE_{ref}/LE_p>0.9. All the methods are susceptible to bias if errors are made in determining which measurements represent wet surfaces. That is why various thresholds of T and different estimates of z_0 (see response 1 above) have been considered.

3. For the hypothesis 4. Are the days of months with negative Href were excluded? Then, the data outside the range of Eq. (6) were excluded. The results may be influenced by this.

Yes, averaging periods with negative R_n, R_n-G, H, or LE were all excluded. This was done Following Andreas et all. (2014) who placed wet surface evaporation scenarios into several categories. The case where H and LE are both positive is the one of interest in this study. See also Priestley and Taylor (1972).

4. Table 2 and 3 only supply the optimized parameter of the other three hypotheses. How the calculated alpha varies? Are the mean or median values related with ac?

The paper is intended to test whether a_A, RH, and m are more fundamental than alpha. While the resulting average values of alpha from all these methods will be similar, Figure 3 shows that the different methods produce different individual values of alpha; these individual values are our interest here.

5. Line 397: The Priestley-Taylor coefficient was not regarded a constant in Han and Tian (2018), but with seasonal variations, to the best of my knowledge. Please refer to Han et al., (2021).

Thank you. We have included Han et al. (2021) in the literature review now, and Han and Tian (2018, 2020) were removed from the sentence on line 397.

6. Lines 400-410. The performance with constant ac is good by considering all the data. But bias exist under the conditions with small values or large values of LEref, as shown in Figure 3. Is it possible to give some discussion?

The point of writing this paper is that the constant-α model needs to be re-considered. So, we are not surprised to find the bias pointed out by the reviewer. In a way, this makes sense, because for a wet surface, we expect $LE = LE_p = \alpha LE_e$ (Brutsaert, 2005). But LE_p from (1) has two terms, LE_e (4) and the second term, which we will call LE_{aero} (e.g., Han and Tian, 2018), where LE_{aero} depends mostly on the vapor pressure deficit and the wind function. This gives:

$$LE_e + LE_{aero} = \alpha LE_e$$

Or

$$\alpha = 1 + LE_{aero}/LE_e$$

Supposing LE_{aero} varies somewhat independently of LE_e, small values of LE_e would tend to result in large values of α and vice versa (see Han et al. 2021).

Other comments:

1. Page 16 and 17, Typo for Table 2 and 3. Tables will be corrected with the latest computed values

2. Table 2. The intercept of RH with optimized LE is 15.54, but 15.52 in Figure 4. Table will be corrected with the latest computed values.

3. Line 342: four hypotheses? Yes, thank you, we will correct it.

Reference:

Han, S., Tian, F., Wang, W., & Wang, L. (2021). Sigmoid generalized complementary equation for evaporation over wet surfaces: A nonlinear modification of the Priestley–Taylor equation. Water Resources Research, 57(9), e2020WR028737. doi:10.1029/2020wr028737