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# *Interactive comment on* "Imprints of evaporation and vegetation type in diurnal temperature variations" *by* Annu Panwar et al.

**Anonymous Referee #1**

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The study by Panwar proposed a metric "warming rate" to quantify the diurnal variation in surface and air temperature, and investigated the sensitivity of the warming rate to evaporative fraction and aerodynamic conductance in different land cover conditions. The authors concluded that the surface warming rate is sensitivity to the evaporative fraction over the short vegetation, but no imprint of evaporation is found in the diurnal surface/air temperature. This is an interesting study, and it is on a topic of relevance and general interest to the readers of this journal. However, some parts of the manuscript are hard to follow, and need some improvements and better discussions.

My major concerns are:

1. What is the purpose of calculating the temperature warming rate to evaporative fraction? Previous studies suggest that aerodynamic resistance (or conductance) plays



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Discussion paper

a major role in land use-induced temperature change (Zhao et al. 2014; Chen and Dirmeyer 2016; Winckler et al. 2019). The surface warming rate can be mainly associated with aerodynamic conductance. The consistency between the distribution of the warming rate in Figure 3 and the distribution of aerodynamic conductance in Figure 5 may support this idea - higher conductance corresponds to a lower warming rate. How is the distribution of the evaporative fraction? And why not calculate the sensitivity of "the sensitivity" to aerodynamic resistance, but only use aerodynamic conductance as a secondary factor?

2. One of the main conclusions of this study is that the warming rates do not carry imprints of evaporation in the forest. What is the physical mechanism of this absent imprints? Why does the high aerodynamic conductance of the forest result in no imprint of evaporation in diurnal temperature variations? Does this necessarily mean ET of the forest has little impact on temperature? The authors need to provide more explanations of the physical processes and more discussions on the implications of the warming rate sensitivity.

3. Throughout the manuscript, “evaporation (or ET)” and “evaporative fraction” are used as interchangeable terms. However, the evaporative fraction also carries information about the sensible heat flux. I am wondering what the sensitivity of the warming rate to ET based on the observational analysis.

4. A similar issue to my 3rd point - the authors should note that aerodynamic conductance and evaporative fraction are not independent (Rigden and Li 2017). However, in their analysis, aerodynamic conductance and evaporative fraction were treated as two independent factors that govern the diurnal variations of surface temperature. For instance, “model reveals a strong sensitivity of the warming rates to evaporative fraction and aerodynamic conductance”; “the diurnal variations in temperatures are mainly governed by their aerodynamic properties resulting in no imprint of evaporation in diurnal temperature variations.” If considering the dependency of aerodynamic conductance and evaporative fraction, will their conclusions be the same?

Specific comments:

1. L28-29: Why use diurnal temperature variations to predict evaporation? And this conclusion seems opposite to the conclusion in L567-568.

2. L95: Define surface temperature. Skin temperature? I noted it is explained in the later section, but it would be better to explain it here.

3. Section 2 should be a subsection of section 3 or at least after section 3. It should be a consistent order with the structure of the result section.

4. L166: How to get the reference temperature Tref?

5. L187-188: Which two equations?

6. L208-211: Why are these two filters used? Can the authors provide more explanations for the first filter?

7. L220: The FLUXNET site also provides information about the vegetation type. Is the reported land cover type consistent with the 1km IGBP land cover product?

8. L277-278: The difference should be attributed to the low aerodynamic conductance? For the short vegetation, the conductance is low, which means the heat transfer from the surface to the lower atmosphere is less efficient.

9. L292-293: Where is the consistency in Figure A2?

10. L293-295: It is very confusing here. First, this sentence does not explain anything from the previous sentence. Second, Figure 4 only shows the sensitivity of the warming rate. Is the actual range of the evaporative fraction 0∼1 from dry to wet days? In methodology (L167), the range is defined as 0.1∼0.9?

11. Figure 4: The label of the color bar is not correct.

12. L369: Figure 6a?

13. L373: same issue as above.

14. L390-391: What does each dot stand for in Figure 6b?

15. L406-407: “the response of the surface temperature warming rate to evaporative fraction is predominantly governed by the aerodynamic conductance” - Can you explain how to get this conclusion from Figure 6?

16. L436-437: “enhanced aerodynamic conductance plays a small, but noticeable role in weakening the response of the warming rate to evaporative fraction.” - This conclusion is contradictory to the conclusion in L406-407.

Reference:

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