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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimating the effect of rainfall on the surface temperature of a tropical lake" *by* Gabriel Gerard Rooney et al.

Anonymous Referee #2

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The authors explore a unique long-term observational dataset on a tropical lake to evaluate the role of rainfall on lake surface temperature. In addition to the data analysis, the authors present several scale analysis regarding the direct heat flux and mechanical and convective mixing. The authors found a reduction of lake temperature of about 0.3k in days of heavy rainfall when compared with days with light-to-moderate rainfall, suggesting that further efforts in quantifying and representing this process is important in other regions as well as to be included in atmospheric models. The manuscript is well organized and written presenting an new diagnostic of a process that has not been much explored. Despite the novelty of the work and data used, I have some concerns regarding the potential influence of the radiative fluxes on the diagnostics. Furthermore, a modeling study complementing the observational analysis would strongly en-

rich the study. Therefore, I recommend the manuscript to be accepted after the authors have addressed some following comments:

Section 3, ln 15: The authors point 4 processes in which rainfall can affect lake surface temperature. Since the authors mention the evaporative cooling, the solar radiation shading during daytime associated with clouds could be also mentioned as a process which should be, in principle properly represented by the atmospheric model

Figure 4: Power spectrum of wind: There are several peaks on the sub-daily frequencies. Could the authors provide the frequencies of these and comment on their source (breeze effects?)

The authors filtered the effect of radiation by defining the DWET days as days with net radiation below 1.5x10**7 J m-2. The average different between DWET net radiation and VWET is about -2.3 W m-2. Visual inspection of T and LSWT mean diurnal cycles for VWET suggests a temperature difference between air and LSWT of about 22.5 (air) - 25 (LSWT) -2.5 (maximum difference), which would give an cooling heat flux of about -3 W m-2 (using the formula in section 3.1). Therefore, even on the mean, the radiation effect might still be relevant and comparable in this case with the direct heat flux. Furthermore, it is not shown the partition between SW and LW. While LW radiation affects only the surface water temperature, SW penetrates the water column. I believe it is important to further detail the potential radiation effects. Figure 10 could be extended with two extra panels including SWnet and LWnet complementing the information in figure 9 to clarify potential impact of radiation, in particular solar in the differences between DWET and VWET.

The authors suggest that rainfall temperature and rain-induced turbulence could be implemented into lake models as a way to represent the effects of rainfall in LSWT. However, they do not show if a lake model (or several) are not able to represent the LSWT differences seen in the observations. Considering the high quality and length of the observations, simulations with a lake model in stand-alone model would prove fundamental to support the authors suggestions. For example: does the model when forced with the observations also gives lake surface temperature differences comparable with the observations? This would strong support the efforts to represent missing processes. Another conclusion could be that other errors in the model have a higher impact and role of rainfall on LSWT is of secondary. I understand that this would require an extra and significant amount of work, and leave this decision to the editor in case the authors do not have the time and/or capacity to perform those simulations in a reasonable time window. If this is the case, I would encourage the authors to at least extend a bit more the conclusions suggesting model protocols to access this problem,

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