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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 #1

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GENERAL COMMENTS

The authors propose an interesting and quite plausible argument, both through data and scaling analyses, for a small cooling effect on the surface temperature of a tropical lake due to heavy rainfall. In the lake under consideration a cooling of 0.3 K is proposed under heavy rainfall conditions, small but nevertheless likely climatologically significant. The manuscript is concise, thoughtful, and well written, but would benefit from a little more clarification on a few points as outlined below.

SPECIFIC COMMENTS

The authors propose four possible mechanisms for the observed cooling. The first – near surface evaporative cooling of raindrops – is noted as a purely atmospheric phe-

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Discussion paper

nomenon, and thus excluded from further discussion as the primary interest seems to be lake model parameterizations (Pg. 3, lines 18-19). This exclusion seems a bit hasty: there is no indication in the title emphasizing lake modelling, and the abstract explicitly states the importance for atmospheric models (Pg. 1, lines 10-12). A little more discussion of this mechanism is warranted or the target audience should be identified as lake modelers in order to remove this slight inconsistency.

The scaling analysis for mechanical mixing is interesting, but there is an underlying assumption that all of the incoming mechanical energy (i.e. the kinetic energy of the falling rain drops) is converted into TKE available for mixing. Is this process really 100% efficient? I expect some of the energy must go nearly instantaneously into heat through viscosity. A slightly more sophisticated scaling argument might be able to show that this fraction of energy is very small. At least the possibility should be mentioned.

Radiometers have been used for measuring lake surface temperatures for many years, but there may be slightly different systematic errors under different conditions (i.e. heavy rain vs dull day). Since the temperature effect is relatively small, this might be important and worth a mention. There may be literature on this subject. Any comparison of the radiometric temperatures measured at this site with actual in situ instruments would be helpful – but I gather there are no in situ data? Note that the authors have addressed random measurement errors but not the possibility of different systematic errors.

Fig. 9 shows that during daytime the net radiation from WET exceeds VMET by quite a lot, presumably due to more SW radiation reaching the surface. This is the justification for introducing the DWET category. Fig. 9 also shows that during the night (16 – 5 UTC) the net radiation (i.e. net LW) for VWET exceeds both that for WET and DWET (by 7 or 8 W/m2) – implying either a colder surface or increased downward LW for VWET. This period largely coincides with the period of greatest rainrates for VWET shown in Fig. 5. It seems to me this strengthens the authors' argument that heavy rainfall cools the surface, but they don't point this out. This may be worth mentioning. Fig. 11 also shows the strongest signal is during 16 – 24 UTC.

MINOR COMMENTS AND FIGURES

Page 3, line 31: This claim needs a reference.

Page 8, lines 16-18: Not clear why you have ruled out mechanism 1 (evaporative cooling)

Fig. 1: would benefit from a context map inset showing location of the lake within Africa

Fig. 2: what are the large boxes in the upper left-hand image?

Fig. 10: there seems to be a large jump between 23 UTC and 0 UTC. This does not seem physically possible, especially where the curves are changing smoothly. Is there a processing error?

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