

Interactive comment on “Divergence of reference evapotranspiration observations with windy tropical conditions” by R. G. Anderson et al.

Anonymous Referee #1

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Manuscript Title: Divergence of reference evapotranspiration observations with windy tropical conditions”

Authors: R. G. Anderson et al.

General:

This is an interesting paper on the evapotranspiration (ET) of sugarcane under tropical conditions. The authors used an Eddy Covariance (EC) system to measure ET and the ASCE method to calculate a reference ET for both a short (grass) and a tall (alfalfa) crop. Also, they calculated ET with the Priestley-Taylor method. The results show that the calculated reference ET, at the windy site, exceeded the measured ET by 854 mm during a 267-day period, i.e., 3.2 mm/d. Indeed this is a large discrepancy and it points

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that either the measured ET with the EC was underestimated and/or the calculated ET was overestimated. The main problems with this work are summarized as follows:

1. Authors do not have an independent measurement of sugarcane ET to disprove or to confirm the measured ET with the EC system.
2. They do not have a water balance data (input and output) to at least confirm the seasonal sugarcane ET. For this purpose they need a record of the input (rain and irrigation) and a measurement of the water content in the soil profile.
3. It is well known that EC measurements tend to underestimate ET and thus the calculation of bulk canopy resistance by inverting the Penman-Monteith equation is irrelevant given the large discrepancy of measured and calculated ET.

Because of the above problems this paper cannot be accepted for publication and my recommendation is to release it to the authors. The authors have made the assumption that the measured ET with the Eddy Covariance system is correct and thus cannot support the results presented. Further, based on the results of the calculated ET using the ASCE method, it appears that perhaps the authors have made a mistake in their calculations as some of the values given in Fig. 4 of 10 – 12 mm/d of ET are too high for the environmental conditions of their site. I suggest that the authors revisit these calculations and make sure that the correct input is used, particularly for global shortwave irradiance [MJ/m² d].

As an example, I calculated the daily reference ET using the ASCE method (15 July)

Site ET_{grass} [mm/d] ET_{alfalfa} [mm/d] Lee 4.3 4.8 Windy 4.8 6.1

Input values used were taken from Table 1, except for irradiance, dewpoint and pressure, for the Lee site for the middle of July:

Latitude: 20.784664 Longitude: 156.403869 Elevation: 203 m T_{max}, air: 27.3 °C T_{min}, air: 17.8 °C Average daily dewpoint temperature: 19.4 °C (from NOAA) Average daily rh: 65 Average daily wind speed: 2.0 m/s Average daily barometric pressure: 100 kPa

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(from NOAA)

This paper deals with ET of sugarcane and as such the authors include information that is not relevant to the topic. For example, the data plotted in Fig. 2 is not relevant and should be deleted. The data of measured soil water content (Fig. 3d) is of no importance for this work. The authors should have at least measured profile soil water content and the beginning and at the end of the experiment to provide an estimate of seasonal ET based on a simple water balance equation.

Specific comments

1. It would be helpful if the authors used the same symbols for terms as given by the ASCE for reference ET. This is one of the reasons the ASCE introduced a “standard” equation and symbols to avoid confusion.
2. Page 6475 line 25. The ASCE and FAO-56 are essentially same calculation.
3. Page 6476 line 18. All irrigation is supplemental.
4. Page 6477 line 15. Essentially they only have one objective. The objectives read as an afterthought, i.e., the measured and calculated ET differed and therefore we need another objective. Objectives 2 and 3 are not objectives.
5. Page 6477 line 25. A common mistake is to refer to the measured value of “radiation” with a pyranometer as solar radiation. This is incorrect it is solar irradiance, a property of the receiver. Radiation is a property of the source.
6. Page 6479 line 8. This does not mean that the values obtained with the EC system are correct. The authors have made the implicit assumption that because all instruments were factory calibrated the results must be correct. An instrument can be calibrated but still give the wrong value for the parameter being measured.
7. Page 6479. Was shortwave global irradiance measured?
8. Page 6479 line 10. What is the purpose of measuring soil water content at one depth?
9. Page 6482 – section 2.4. This section is irrelevant to the topic of this paper.
10. Page 6483. The measurement of leaf stomatal resistance with the Decagon SC-1 instrument has been shown to have problems under field conditions.
11. Figures. In some of the figures it is difficult to discern what values are plotted and what corresponds to what site.

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Recommendation

My recommendation is to release the manuscript. The authors do not have the data to support conclusions or to confirm or disprove if the EC measurements are correct. This is important given the large discrepancy between measured and calculated values of ET. Upon inspection of the calculated values of reference ET it seems that some of the values reported are too high. Values of reference ET of 10 mm/d seem too large for the experimental site. Values of reference ET > 10 mm/d are normally associated with high air temperature (> 30 °C), low air humidity (< 10 °C Tdew), large daily shortwave irradiance (> 30 MJ/m² d), and windy conditions (> 5 m/s). These are conditions of the semiarid High Plains of US in the middle of the summer. These are not the conditions at the experimental site. Tropical environments, because of proximity to equator and a 12-hour day usually have daily ET values in the 4–8 mm/d range. It is unfortunate that the authors did not recognize the problems with the EC and attempted to validate these measurements with an independent measure of seasonal ET. The assumption that the EC measurements are correct cannot be supported and thus the results presented are inconclusive.

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