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Discussions

Interactive comment on "Technical Note: On the Matt–Shuttleworth approach to estimate crop water requirements" *by* J. P. Lhomme et al.

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It is clear from Lhomme et al (2014) that aspects of the explanation of the Matt-Shuttleworth approach can generate confusion. Presumably this is because the description in Shuttleworth (2006) was not sufficiently explicit and simple. I welcome the opportunity to redress this and I am grateful to Lhomme et al (2014) for bringing this need to my attention. I have submitted a technical note separately to HESS entitled Comments on "On the Matt-Shuttleworth approach to estimate crop water requirements" which explains the logic behind the Matt-Shuttleworth approach clearly, simply and concisely. However, pending publication of that technical note I am concerned that, if left unchallenged, Lhomme et al (2014) might compound confusion and

compromise the progress that has been made in this field over the last decade. For this reason I am copying selected text of my technical note below.

In the Matt-Shuttleworth approach rsc is a crop-dependent, “effective” value for each day during the crop growth cycle. It may be calculated from the tabulated value of Kc on a particular day in the seasonal cycle, but NOT using weather variables on that day. In fact it is the effective value of (alpha-sub“a”.alpha-sub”s”) in Equation (7) of Lhomme et al (2014) on a particular day which should be calculated from rsc and weather data on that day. The surface resistances calculated from equation (10) shown in Figures 2 and 3 of Lhomme et al (2014) exhibit meteorological dependence only because the dependence that is actually present in (alpha-sub“a”.alpha-sub”s”) is wrongly ascribed to surface resistance when Equation (7) is inverted to Equation (10). Moreover, the values of surface resistance labelled M-S in Figures 2 and 3 are NOT the crop-dependent, effective values given by the Matt-Shuttleworth approach because they are calculated under the authors’ mistaken belief that on each day the Matt-Shuttleworth approach assumes reference crop evapotranspiration is equal to the value given by the Priestley-Taylor equation (Priestley and Taylor, 1972). Readers should be aware that the Conclusions section of Lhomme et al (2014) is based on calculations illustrated in these two problematic figures.

To facilitate the application of the Matt-Shuttleworth approach I provide two Excel spreadsheets at http://www.hwr.arizona.edu/∼shuttle/Terrestrial_Hydrometeorology/ which are ancillary to this paper. The first spreadsheet duplicates the calculations of rsc in Table 23.5 of Shuttleworth (2012): it can be modified to make calculations for other combinations of Kc and hc. The second spreadsheet is edited from that used to calculate Table 23.6 of Shuttleworth (2012) and makes example calculations of ETc using the Matt-Shuttleworth approach and also using the traditional FAO method for several example crops (hypothetically) growing at three example sites (Oxford, Tucson, and Manaus) on three example days. It can be modified to make (or test) such calculations with alternative data from alternative sites. It would be interesting if the authors

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of Lhomme et al (2014) were to make a numerical exploration for a broad range of atmospheric conditions which compares the calculated values of ETc using the FAO method and the (correct) Matt-Shuttleworth approach. Based on previous studies of this type (e.g., Shuttleworth and Wallace, 2009) it is likely that the two estimates of ETc will often be similar but they may differ significantly for taller crops growing in windy conditions and a dry atmosphere.

References

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