

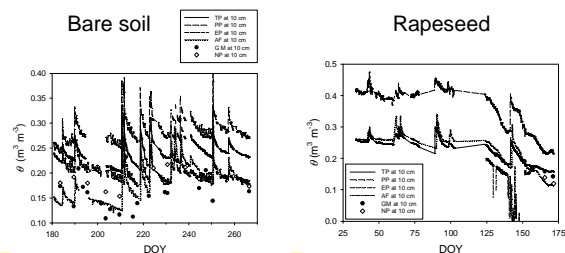
Magda El-Bishti, Anne Verhoef and Bruce Main
 Department of Soil Science, School of Human and Environmental Sciences, University of Reading, UK
 asr02me@rdg.ac.uk

Background

Reliable estimates of evaporation are important for agricultural and horticultural applications, but also for hydro-meteorological studies. The soil water balance method (SWB) is a cheap alternative to the eddy covariance (EC) method, but only if reliable sub-daily soil moisture (θ) data are available.

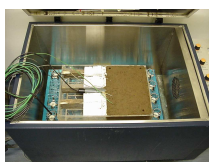
Materials and methods

Diurnal estimates of evaporation, E , were obtained from the SWB method, combined with the zero-flux-plane approach, using θ profiles obtained with various types of capacitance sensors installed in a bare soil, a rapeseed plot and a maize field. These sensors comprised Theta probes (TP), Profiles probes (PP), ECH₂O probes (EP) and Aquaflex sensors (AF). The output of the sensors contained significant perturbations due to noise and was affected by temperature. Smoothing and temperature-correction procedures were required to obtain reliable θ and E .

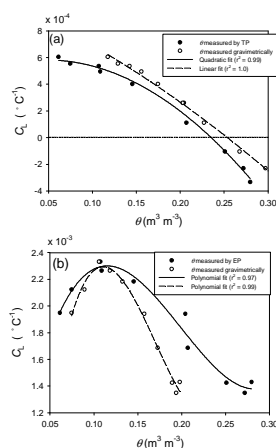


Temperature-correction

It was found that a considerable difference existed between field- and laboratory-based temperature correction factors (C_F and C_L , respectively) and that they strongly depended on θ . Using C_L to correct field θ profiles for temperature led to unsatisfactory estimates of E , as shown below.

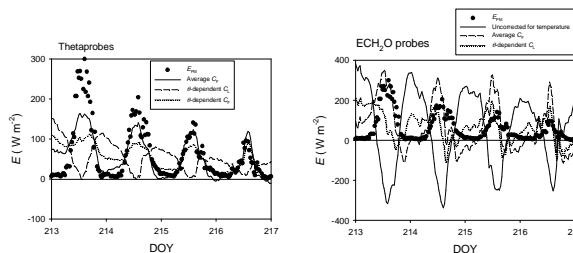


The relationship between the laboratory-based temperature-correction coefficient, C_L , and θ (as measured gravimetrically and with the TP or EP) for the TP (a) and EP (b), respectively.



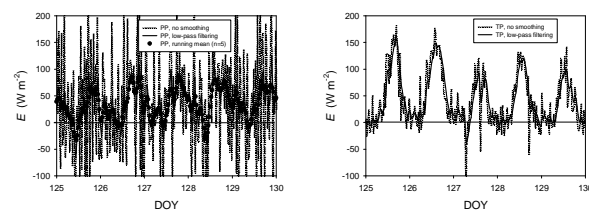
$$\theta_c = \theta_m - C_{L/F} (T_s - 20)$$

Acknowledgements: We would like to thank the Secretariat of Higher Education in Libya for the financial support, William Macphee for his assistance, and the staff at the Crops Research Unit (UoR).

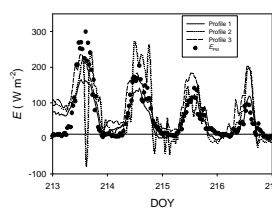


Smoothing

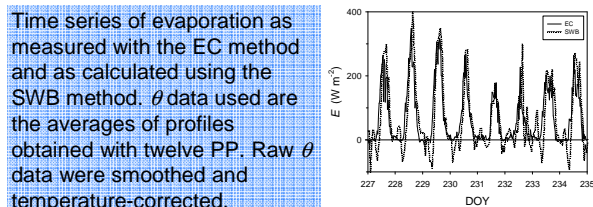
Smoothing is required for all sensor types and both running mean and low-pass filtering procedures are generally appropriate. Some sensors (e.g. PP) are much more affected by noise than others (e.g. TP), as shown below.



Spatial variability



Bare soil E values (θ smoothed and temperature-corrected) for three different TP profiles. Estimates obtained with the Penman-Monteith equation are also shown.



Conclusions

➤ Realistic diurnal values of evaporation can only be obtained if the soil moisture profiles measured with dielectric sensors are first smoothed and corrected for temperature.

➤ A multiple of θ profiles needs to be used to obtain reliable estimates of evaporation.