Can measurements of actual evapo-transpirationand large-area soil moisture deficit improve irrigation scheduling to reduce water use?

Evans, JG, Ragab, R, et al.

Abstract

In the context of increased pressure on water resources for crop production, where globally some are already in water crisis, it is necessary to maximise crop yield and quality for a given water resource. For irrigated crops, this means not only more efficient application of water, but also an improved understanding and modelling of crop water requirement. Highly instrumented plot studies may be used to test models of irrigation scheduling versus crop water requirement. There are two key aspects to this work: a) testing of crop evapotranspiration (ET) models by comparing with measurements of actual evaporation made by the eddy covariance (EC)technique and derived from larger scale scintillometer measurements; and b) having knowledge of the soil moisture deficit (SMD) in the crop rooting zone. Traditional point soil moisture sensors have significant drawbacks of invasive measurements, which interfere with farming operations, and small sensing volume that may only be representative of the micro-scale, often requiring many inconvenient and costly replications; however, the application of recent technology of COsmic-ray Soil MOisture Sensing (COSMOS) offers advantages of vastly increased spatial sensitivity, with a measurement radius of several hundred meters, whilst being non-invasive, sensing soil moisture from an above-ground location (easily removed for farming operations). Nevertheless, the challenge remains to bring these techniques together to inform irrigation decision support systems. Measurements are presented for ET and SMD using EC, scintillometer and COSMOS, and their potential for making improvements in decision support systems is discussed.