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FAO-56 Dual approach combined to multi-sensor remote sensing for estimating evapotranspiration in semiarid-region

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In semiarid regions, and northern Africa in particular, the absence of rainfall, together with the occurrence of long periods of drought, represent one of the main environmental factors having a negative effect on agricultural productivity. The evaluation of vegetation cover and the monitoring of hydric stress are indispensable in these regions, particularly in areas with pluvial agriculture. The second challenge is to estimate evapotranspiration precisely in order to quantify the reserve of water stock in soil. A variety of surface physical models have been proposed at regional and global scales in the last years (Noilhan et Planton, 1989 ; Braud et al. 1995 ; Mahfouf et al. 1995 ; Olioso et al. 1999a ; Calvet et al. 1998 ; Coudert et al. 2006). The aim of this study is to propose a simple tool, combined to remote sensing, for a regional estimation of evapotranspiration, without making use of complex physical surface models which need a large number of inputs. Concerning remote sensing, in the last two decades, considerable efforts have been made to develop remote sensing techniques for the characterization of the spatial and temporal variability of soil parameters at regional and global scales (vegetation characteristics and soil moisture).
The most common and practical approach used for estimating crop water requirement and evapotranspiration at local scales is the FAO-56 model (Allen, 1998). It is simply estimated through the combination of a reference evapotranspiration (ET0) and crop coefficients. The dual FAO56 approach uses two coefficients to separate the respective contribution of plant transpiration (Kcb) and soil evaporation.

In that context, we propose the use of a modified FAO.56 dual approach for a regional estimation of evapotranspiration. The proposed approach is combined with remote sensing. Two vegetation classes are considered in evapotranspiration estimation. For cereals, crop coefficients and cover fraction, are estimated through relationships established with Normalized Difference Vegetation Index (NDVI) retrieved from SPOT-VGT data. For soil, a relationship is established between retrieved soil moistures, from ERS/WSC Vienna university products and evaporation. The application is in a semi-arid region, in central Tunisia, in North Africa. The proposed approach is validated using physical SVAT ISBA-A-gs model (Calvet et al., 1998) simulated during the period (1991-2007). Soil moisture outputs of ISBA are firstly validated with satellite ERS/WSC products. Finally, a comparison is realized between ISBA and FAO approach over the studied site.