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Measured soil water content data and water balance for ESAs method improvement

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In the present work, the "Environmentally Sensitive Areas to Desertification" model (ESAs) developed for the detection of the areas prone to desertification, was applied on data of the experimental field of the Agricultural Faculty of the University of Turin. One of the factors that represents the climatic component in the ESAs model, is the Aridity Index. The aim of this work is to test the reliability of a new method to calculate the Aridity Index based on the number of days of water stress in a year, predicted with a simple soil water balance model. To test the validity of this approach, a comparison was made between soil moisture values at five different depths (0.15, 0.3, 0.6, 1.0 and 2.0 meters) measured by the automatic TDR station installed in the experimental field and the soil moisture predicted by the two soil water balance models, i.e., the simplified FAO method and that developed by Reed et al. (1997). The study was carried out over the period from 2003 to 2007. Required daily meteorological datasets were provided by the automatic station installed in the experimental field with a uniform grass cover. The influence of the reference evapotranspiration (ETo) used as input parameter in the two water balance models, was tested with a sensitivity analysis applied in five different ways of calculation; that is to say, the methods of Hargreaves-Samani (1982), FAO-56 Penman-Monteith (1998), Jensen-Haise (1963), Caprio (1974) and Priestley-Taylor (1972). A statistical analysis using different error indexes and efficiency criteria showed that the two water balance models lead to similar results. While both models tended to slightly overestimate the actual soil water content, the model performances were globally better at shallow depths. Below 30 cm depth, the errors between observed and predicted values quickly increase; however,

the efficiency indexes are little affected and some of them are even improving. For all simulations, the best results were achieved during the summer months (June to August). Considering the few input data and soil parameters required, the overall model performances were good proving the validity of the new method for calculating the Aridity Index. This kind of simulation could easily be implemented in a GIS, giving a spatialized hydrological simulation of the water content fluctuations over an area of interest.