



Use of physically-based models and Soil Taxonomy to identify soil moisture classes: Problems and proposals

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Soil classification according to Soil Taxonomy include, as fundamental feature, the estimation of soil moisture regime.

The term soil moisture regime refers to the “presence or absence either of ground water or of water held at a tension of less than 1500 kPa in the soil or in specific horizons during periods of the year”.

In the classification procedure, defining of the soil moisture control section is the primary step in order to obtain the soil moisture regimes classification.

Currently, the estimation of soil moisture regimes is carried out through simple calculation schemes, such as Newhall and Billaux models, and only in few cases some authors suggest the use of different more complex models (i.e., EPIC)

In fact, in the Soil Taxonomy, the definition of the soil moisture control section is based on the wetting front position in two different conditions: the upper boundary is the depth to which a dry soil will be moistened by 2.5 cm of water within 24 hours and the lower boundary is the depth to which a dry soil will be moistened by 7.5 cm of water within 48 hours.

Newhall, Billaux and EPIC models don't use physical laws to describe soil water flows, but they use a simple bucket-like scheme where the soil is divided into several compartments and water moves, instantly, only downward when the field capacity is achieved.

On the other side, a large number of one-dimensional hydrological simulation models (SWAP, Cropsyst, Hydrus, MACRO, etc..) are available, tested and successfully used. The flow is simulated according to pressure head gradients through the numerical solution of the Richard's equation. These simulation models can be fruitful used to improve the study of soil moisture regimes.

The aims of this work are: (i) analysis of the soil moisture control section concept by a physically based model (SWAP); (ii) comparison of the classification obtained in five different Italian pedoclimatic conditions (Mantova and Lodi in northern Italy; Salerno, Benevento and Caserta in southern Italy) applying the classical models (Newhall e Billaux) and the physically-based models (CropSyst e SWAP),

The results have shown that the Soil Taxonomy scheme for the definition of the soil moisture regime is unrealistic for the considered Mediterranean soil hydrological conditions. In fact, the same classifications arise irrespective of the soil type. In this respect some suggestions on how modified the section control boundaries were formulated.

Keywords: Soil moisture regimes, Newhall, Swap, Soil Taxonomy