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Soil Water Retention as Indicator for Soil Physical Quality - Examples from Two SoilTrEC European Critical Zone Observatories

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Soil water retention is of primary importance for majority of soil functions. The characteristics derived from Soil Water Retention Curve (SWRC) are directly related to soil structure and soil water regime and can be used as indicators for soil physical quality. The aim of this study is to present some parameters and relationships based on the SWRC data from the soil profiles characterising the European SoilTrEC Critical Zone Observatories Fuchsenbigl and Koiliaris.

The studied soils are representative for highly productive soils managed as arable land in the frame of soil formation chronosequence at “Marchfeld” (Fuchsenbigl CZO), Austria and heavily impacted soils during centuries through intensive grazing and farming, under severe risk of desertification in context of climatic and lithological gradient at Koiliaris, Crete, Greece. Soil water retention at pF $\leq$ 2.52 was determined using the undisturbed soil cores (100 cm3 and 50 cm3) by a suction plate method. Water retention at pF = 4.2 was determined by a membrane press method and at pF $\geq$ 5.6 – by adsorption of water vapour at controlled relative humidity, both using ground soil samples. The soil physical quality parameter (S-parameter) was defined as the slope of the water retention curve at its inflection point (Dexter, 2006), determined with the obtained parameters of van Genuhten (1980) water retention equation. The S-parameter values were categorised to assess soil physical quality as follows: S < 0.020 very poor, 0.020 $\leq$ S < 0.035 poor, 0.035 $\leq$ S < 0.050 good, S $\geq$ 0.050 very good (Dexter, 2004).

The results showed that most of the studied topsoil horizons have good physical quality according to both the S-parameter and the Plant-Available Water content (PAW), with the exception of the soils from croplands at CZO Fuxenbigl (F4, F5) which are with poor soil structure. The link between the S-parameter and the indicator of soil structure stability (water stable soil aggregates with size 1-3 mm) is not well defined. The scattering is due to high values of S in subsoil, which does not always coincide with favourable physical properties, as it can be seen from the relationship with the PAW content. It was found that values of S $\geq$ 0.05 correspond to PAW > 20 % vol. in the topsoil horizons. The high values of S in subsoil horizons are due to the low PAW and restrict the application of the S categories in these cases. Well defined links are found between the PAW content and the S-parameter when the data from the topsoil horizons are grouped in 2 groups according to the ratio between air-filled pores (at pF 2.52) and plant available water: <2 and $\geq$ 2.

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