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Temperature correction of TDR determined soil water content values

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The objective of the study was to evaluate the influence of temperature on the bulk dielectric permittivity, ε_b, of soil and the water content measurement error by TDR method.

The dominant role of the analyzed effect play free water particles of the soil. It was confirmed that the other factor influencing the temperature effect of ε_b is the release of bound water particles from solids with the temperature increase.

It was found that there is a specific value of soil water content for each tested soil, named the equilibrium water content, θ_{eq}, where the temperature effect of the bulk dielectric permittivity is minimized. This means that the both opposite physical phenomena influencing the temperature change of the soil ε_b are balanced. For the soils with the water content below θ_{eq} the temperature effect of ε_b is positive, i.e. $\varepsilon_b$increases with the temperature increase, and for the soils with the water content above θ_{eq} the temperature effect of ε_b is negative, i.e. ε_b decreases with temperature increase. It is shown that the values of θ_{eq} depend on soil specific surface of the tested soils.

The proposed correction of the temperature effect is empirical and it incorporates the trend lines fitted to the TDR determined values of $\varepsilon_b(T)$. This correction takes into account the values of the equilibrium water content, θ_{eq}. The absolute measurement error of soil water content determination by reflectometric method, resulting from the temperature effect of ε_b, decreases almost three times after application of the empirical correction.