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THERMAL PROPERTIES OF CLAY SOILS WITH DIFFERENT HUMUS CONTENT FROM SOFIA FIELD

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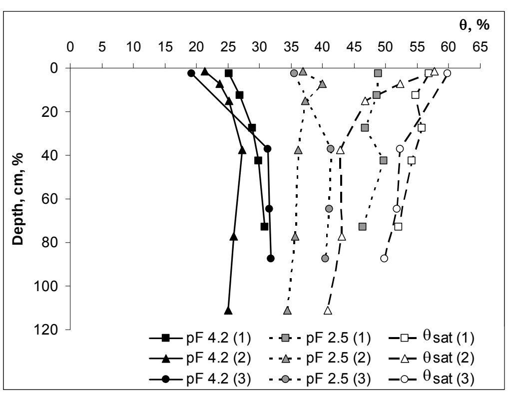
The aim of this study was to estimate the thermal characteristics of clay soils with different humus content from the Sofia field by applying the model of de Vries at soil water contents at different suctions. The influence of water content on the apparent thermal diffusivity of the surface humic horizon was estimated by applying the Harmonic method on longterm soil moisture and temperature field data measured in one of the studied sites.

MATERIALS AND METHODS

Three soil profiles from the Sofia field with almost homogeneous with depth fine texture were selected in this study: (1) non-cultivated Vertisols from, Bozhurishte; (2) non-cultivated Deluvial-meadow soil and (3) cultivated Vertisol (Bathycalcic) from Gorni Lozen.

Content of clay (<0.002 mm) and humus in topsoil and subsoil soil layers. Classification according to USDA.

Profile	clay, %		humus, %		Texture class
	0-20 cm	20-100 cm	0-20 cm	20-100 cm	
(1) non-cultivated Vertisols, Bozhurishte	60-64	62-65	4.4 - 3.4	3.1 - 1.4	Heavy clay
(2) non-cultivated Deluvial-meadow soil, Gorni Lozen	45-48	43-47	5.2 - 1.6	1.3 - 1.2	Clay
(3) cultivated Vertisol (Bathycalcic), Gorni Lozen	47-50	53-57	2.6 - 1.9	1.7 - 1.0	Clay



Water content (θ, %vol.) at saturation (θsat), at suctions pF 2.5 (field capacity) and pF 4.2 (wilting point) along the depth of profiles 1, 2 and 3.

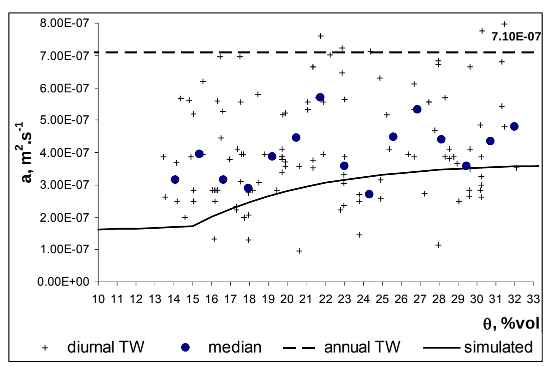
The thermal properties of the studied soils were estimated using de Vries model (de Vries, 1963).

An estimate of λs=2.0 W.m^{-1}.K^{-1} was found to fit with the data measured on samples from Profile 1 as well as with the data measured with KD2-Pro device of air-dried and water saturated samples of Profile 2. The heat capacity of soil was calculated as the weighted sum of the heat capacities of the soil constituents. Thermal diffusivity (a) of soil is expressed as $a = \lambda / Cv$.

RESULTS AND DISCUSSION

*Thermal conductivity (λ,W.m^{-1}.K^{-1}), volumetric heat capacity (Cv, J.m^{-3}.K^{-1}) and thermal diffusivity (a, m^2.s^{-1}) of **top**soil and **sub**soil of profiles (Pr.) for dry, saturated and moist soil at pF4.2 and pF 2.5 suctions.*

Pr.		λ		C_v×10^{-6}		a×10^7	
		top	sub	top	sub	top	sub
1	θ=0	0.15	0.16	0.9	0.9	1.68	1.76
	$\theta_{pF4.2}$	0.60	0.74	2.0	2.2	2.99	3.38
	$\theta_{pF2.5}$	0.98	1.02	2.9	2.9	3.32	3.50
	θ_{sat}	1.05	1.09	3.2	3.2	3.23	3.41
2	θ=0	0.18	0.23	1.0	1.2	1.80	2.03
	$\theta_{pF4.2}$	0.63	0.96	2.0	2.3	3.20	4.25
	$\theta_{pF2.5}$	0.97	1.16	2.6	2.7	3.79	4.37
	θ_{sat}	1.11	1.24	3.2	3.0	3.53	4.20
3	θ=0	0.14	0.18	0.8	1.0	1.69	1.80
	$\theta_{pF4.2}$	0.36	0.84	1.6	2.3	2.20	3.65
	$\theta_{pF2.5}$	0.80	1.02	2.3	2.7	3.46	3.77
	θ_{sat}	1.02	1.12	3.3	3.1	3.06	3.59



Apparent thermal diffusivity (a, m^2.s^{-1}) of humic horizon of Deluvial-meadow soil at different water content determined by diurnal and annual temperature wave (TW) methods, and model of de Vries (with λs=2.0 W.m^{-1}.K^{-1}).

CONCLUSION

The obtained information is a base for further improvement of the estimations using direct measurements and accounting the effect of swelling-shrinkage of these soils.

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