Mapping soil magnetic susceptibility and mineralogy in Ukraine

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Soil suatainable planning is fundamental for agricultural areas. Soil mapping and modeling are increasingly used in agricultural areas in the entire world (Brevik et al., 2016). They are beneficial to land managers, to reduce soil degradation, increase soil productivity and their restoration. Magnetic susceptibility (MS) methods are low cost and accurate for the developing maps of agricultural areas.. The objective of this work is to identify the minerals responsible for MS increase in soils from the two study areas in Poltava and Kharkiv region. The thermomagnetic analyses were conducted using the KLY-4 with an oven apparatus. The hysteresis parameters were measured with the Rotating Magnetometer at the Geophysical Centre Dourbes, Belgium. The results showed that all of samples from Kharkiv area and the majortity of the samples collected in Poltava area represent the pseudo single domain (PSD) zone particles in Day plot. According to Hanesch et al. (2006), the transformation of goethite, ferrihydrite or hematite to a stronger ferrimagnetic phase like magnetite or maghemite is common in strongly magnetic soils with high values of organic carbon content. In our case of thermomagnetic study, the first peak on the heating curve near 260 ˚C indicates the presence of ferrihydrite which gradually transforms into maghemite (Jordanova et al., 2013). A further decrease in the MS identified on the heating curve may be related to the transformation of the maghemite to hematite. A second MS peak on the heating curve near 530 ˚ and the ultimate loss of magnetic susceptibility near 580 ˚ were caused by the reduction of hematite to magnetite. The shape of the thermomagnetic curves suggests the presence of single domain (SD) particles at room temperature and their transformation to a superparamagnetic (SP) state under heating. Magnetic mineralogical analyses suggest the presence of highly magnetic minerals like magnetite and maghemite as well as slightly magnetic goethite, ferrihydrite, and hematite. Pseudosingle-domain, single-domain, and superparamagnetic grains of pedogenic origin dominate in the chernozem soils of the Kharkiv and Poltava region.

References

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