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Analysis of vertical distribution of magnetic susceptibility in soil profiles developed on natural and anthropogenic background – a case study from the Izera Mountains (the Western Sudetes – SW Poland).

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Topsoil magnetic measurements in Orle forest glade, located in the Izera Mountains (the Western Sudetes – SW Poland) was conducted in 2015–2016, as a pre-screening for the further deeper geophysical investigations and geochemical prospection aimed on precise location of buried historical wastes. The western part of the glade is located on the slope of Granicznik Hill, whereas the eastern part (on the both sides of the creek cutting the glade) is generally flat but uneven, intersected by small hollows and dry channels as a result of gully erosions. Measurements of volume magnetic susceptibility (k) were carried out using the MS2D Bartington loop sensor, whereas vertical distribution of k was measured in 30 cm deep cores using MS2C Bartington laboratory sensor. Topsoil cores were collected in 27 from the total 87 points where the surface k value was measured. About 85% of studied area exhibits low k values <25×10-5SI units. Two strong magnetic anomalies were revealed in northern and eastern part of the glade, on the left (western) bank of the creek. Analysis of vertical distribution of magnetic susceptibility in all 27 collected cores revealed different distribution of k values. Most cores collected in the glade outside the "hot spots" show a vertical distribution of k values, which is typical for soils formed on a diamagnetic or paramagnetic background, in relatively clean areas, showing low and stable k with a noticeable enhancement in the uppermost layer (0-5 cm). The enhancement observed in organic horizon may be caused by anthropogenic deposition associated with long-distance transport or small local sources. The deposition peak is more stronger in the cores taken in the forest margin. In cores sampled on weathered granite debris (eastern bank), k is close to zero. In the profiles collected on the slope of the Granicznik Hill, the subsoil consists of a clay material with paramagnetic properties, showing slightly higher k values up to 10×10-5SI. The cores collected at the foot of the slope show a multi-peak distribution of k values, which is the effect of gravitational translocation on the slope. Cores collected close to the creek bank show a noticeable increase in k values above 30 ×10-5SI with vertical distribution not typical for deposition curve. The vertical distribution of k value in the cores taken from the area of magnetic anomaly is completely different with maximum k usually > 200 ×10-5SI. The k distribution curve in the northern “hots spot” looks like a typical deposition curve in highly polluted areas with maximum k over 400 ×10-5SI, located at the depth of 3 cm below surface. It is result of translocation of waste material or dusting from the uncovered dumping site in the past. Going along the anomaly, in south direction through the area where surface magnetic susceptibility did not show the existence of anomaly, the displacement of the peak of the maximum k value into the deeper layers was observed.
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