Geophysical Research Abstracts
Vol. 21, EGU2019-12775, 2019
EGU General Assembly 2019

Random forest based pedotransfer functions and geostatistical methods for mapping soil moisture retention capacity at 100 m resolution

Brigitta Toth (1,2), Gábor Szatmári (1), Katalin Takács (1), Annamária Laborczi (1), András Makó (1), Kálmán Rajkai (1), and László Pásztor (1)

(1) Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Budapest, Hungary (toth.brigitta@agrar.mta.hu), (2) Georgikon Faculty, University of Pannonia, Keszthely, Hungary

3D spatial information on soil hydraulic properties can contribute to increase performance of hydrological, crop, climate and other environmental models and support climate conscious, water preserving planning of soil management practices. Direct measurement of soil hydraulic properties is costly and time consuming, therefore measurement-based catchment scale mapping of these soil properties is usually not possible.
Our aim was to compare performance of soil water retention maps derived with i) pedotransfer functions (PTFs) and ii) geostatistical methods, both using random forest algorithm. Maps of saturated water content (THS), field capacity (FC) and wilting point (WP) were prepared at 0–30, 30–60 and 60–90 cm depths at 100 m resolution for the Balaton catchment (5,775 km^2).
For the construction of the PTFs we related the soil water retention values to basic soil properties and other environmental parameters, which are available for the catchment. The analysis was performed with random forest method on some 10000 samples of the Hungarian Detailed Soil Hydrophysical Database (Hungarian acronym: MARTHA) complemented with information on topography, climate, parent material, vegetation and land use. As a geostatistical method we used random forest combined with kriging (RFK). For this direct mapping data of 359 soil profiles located in the Balaton catchment was used from the MARTHA dataset.
The performance of the PTFs based and RFK maps were similar in case of six out of nine layers. The PTF significantly outperformed the RFK in mapping THS at 30–60 and 60–90 cm soil depth. In case of WP at 60–90 cm depth RFK was significantly more accurate. The difference between predicted soil hydraulic values derived by RFK and applying PTFs were less than 0.025 $cm^3 cm^{-3}$ for 65–86 % of the mapped area. Generalized PTFs applied on soil property maps and spatial auxiliary data was found to be an efficient alternate for mapping soil moisture retention capacity when the database used for the establishment of the predictions is hydropedologically similar to that of the mapped area.

The research was supported by the Hungarian National Research, Development and Innovation Office (NRDI) under grants KH124765 and the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.