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Assessing of the accuracy of interpolation methods to map soil properties at regional scale in Extremadura (SW Spain)

Jesús Barrena González, Anthony Gabourel, and J. Francisco Lavado Contador

Institute for Sustainable Land Development (INTERRA), Department of Art and Territorial Sciences, University of Extremadura, Spain (jesusbarrena@unex.es)

Identifying the most appropriate interpolation method for a given area is a necessary step to properly map soil properties. The aim of this work was to evaluate the accuracy and usefulness of 9 interpolation methods (deterministic and geostatistical) with data of 12 soil properties: clay, silt, and sand content, pH, cation exchange capacity, and calcium, magnesium, sodium, nitrogen, phosphorus, potassium and organic matter content, that were measured at three different depth ranges, i.e., 0-5 cm, 5-10 cm and > 10 cm. Data gathered from more than 400 sampling points were used to map these soil properties in the Spanish region of Extremadura (ca. 41,000 km² of land surface). Data showed a high variability, both in terms of the different parameters and the depth intervals. The coefficient of determination (r^2) and root mean square error (RMSE) were used as statistics to determine the accuracy and decide the most suitable interpolation method in each case. The results were variable, and the most appropriate interpolation method varied according to the property of the soil and the depth under consideration. As some instances, for the 0-5 cm clay content data the best method was the ordinary kriging (0.714 r^2 and 3.629 RMSE), while for the 5-10 cm data Spline with Tension (0.56 r^2 and 5.855 RMSE) produced better results. In the case of pH values, however, the Completely Regularized Spline method yielded good results both for depths of 0-5 cm (0.678 r^2 and 0.487 RMSE) and 5-10 cm (0.610 r^2 and 0.603 RMSE), being preferable the ordinary kriging to the depths > 10 cm (0.667 r^2 and 0.639 RMSE). In general, it was the Inverse Distance Weighting (IDW) method which showed the best results, followed by other deterministic methods such as Completely Regularized Spline (CRS) and Spline with Tension (SwT). Furthermore, Empirical Bayesian Kriging (EBK) was the geostatistical method that yielded the best results. In view of the results obtained, the need to consider various interpolation methods when mapping soil properties becomes evident.