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THE IMPACT OF TERRAIN AND SPECTRAL VARIABLES IN ESTIMATING SOIL ORGANIC MATTER USING REMOTE SENSING IN SEMI-ARID MOUNTAINOUS AREAS

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Abstract

Modeling of soil properties, i.e. soil organic matter (SOM) through remote sensing (RS) technique is done only with environmental static or dynamic variables. The purpose of this study was to use both series of these variables to model SOM in mountainous areas in northern Iran. The SOM map zoning was performed through kriging method using 148 soil samples. The SOM was modeled using i) terrain attributes obtained from global digital elevation model (GDEM), ii) spectral indices/variables derived from satellite imagery (Landsat_8; TM), and iii) combining terrestrial {topographic factor, aspect, elevation, mid slope position, maximum difference from mean elevation, multi resolution ridge top flatness, general curvature, convergence index, total curvature, hill shade and catchment area} and RS {albedo, land surface temperature, emissivity, incidence, normalized difference vegetation index (NDVI) and bare soil index (BSI)} variables. The VarImp function was used to determine the degree of importance of each variable in modeling by creating regression trees in SAGA software. The results showed that hybrid model (using a combination of both terrestrial and spectral variables) significantly increases the accuracy of SOM modeling with the highest correlation coefficient (R^2) and the lowest root mean square error RMSE. The R^2 values of the three models were 0.60, 0.64 and 0.78 and the RMSE values were 0.86, 0.68 and 0.53, respectively. Elevation and mid slope position, emissivity, BSI, NDVI were the most important terrain and spectral variables in SOM modeling with an importance of 53.2, 58.3, 87.6, 65 and 61 %, respectively. As such, the results of this study are of particular importance to provide a statistical and theoretical basis for predicting the SOM based on readily available remotely-sensed and terrain data, with potential for use in similar semi-arid mountainous areas internationally.

Key words: global digital elevation model (GDEM), modeling, satellite imagery, semiarid land, soil organic matter (SOM)

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