Erosivity parameters estimation using Artificial Neural Networks and Satellite imageries

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In this study, satellite imageries, soil analysis and artificial intelligence were employed in order to improve the prediction of K-factor (erosivity factor). Real in-situ data were available through the collection and analysis of soil samples from 30 different locations at Akrotiri Peninsula in Chania, Crete, Greece. These data were used as a training set for an Artificial Neural Network (ANN) together with the satellite images data available in a number of spectral bands and the location (X and Y coordinates) of the sampling point. For the needs of the study, Sentinel-2 satellite images were used at 20m resolution. The simulation parameters investigated separately were the Soil Organic Matter (SOM), $CaCO_3$ and the K-factor. Due to the small size of available data timeseries and in order to reduce the uncertainty involved, a Monte Carlo ensemble of ANNs was used. Specifically, 100 different realizations of each ANN were deployed, having different training/testing and evaluation datasets as well as different initial random neural weights. The ANN results are presented as the mean of the 100 simulations performed, as well as the minimum and maximum values. The spatial distribution of the parameters is presented in GIS environment and is compared, in terms of accuracy, with standard spatial interpolation methods, such as Co-Kriging. The results suggest a successful simulation, having a mean R-square value of 0.87 for SOM, 0.82 for $CaCO_3$ and 0.6 for K-factor simulation. Especially in the case of SOM and $CacO_3$ the results are very close to the observed field values, while in the case of K-factor the performance of the ANNs is decreased. In any case, results suggest that using satellite images in conjunction with real soil data, combined through artificial intelligence methods, can produce reliable spatial maps with finer resolution compared to maps produced by real data combined with interpolation methods.
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