MAPPING SOIL SALINITY USING COKRIGING METHOD IN ARSANJAN PLAIN, SOUTHERN IRAN

Majid Baghernejad and Mostafa Emadi

Soil Science Department, College of Agriculture
Shiraz University
Shiraz, Fars Province, Iran

ABSTRACT

The objective of this study was to combine digital satellite data with ground based measurements of ECe by cokriging method to probably improve the soil salinity maps of semi-arid regions such as Arsanjan plain, southern Iran. Soil samples in the 85 sampling site (10187 ha) were collected from 0-30 cm depths, georefrenced using GPS receiver, analyzed for ECe in a saturated soil paste. A promising approach for the spatial prediction of soil property distribution taking into account secondary information ,from remotely sensed data from LISS-III receiver of IRS-P6 satellite, as application of cokriging methods that is given at a finer resolution than the sampled soil data. The results indicated that ECe is highly passively ($p \leq 0.01$) correlated with spectral values of band 1 of LISS-III receiver. Therefore, we used the spectral values of band 1 as secondary information for applying the cokriging method to predicate ECe in the study area. Mean square error (MSE) was used to evaluate the performance of the map prediction quality. The best prediction method for mapping ECe was cokriging in combination with the spectral data from spectral value of first band of IRS satellite with the smallest MSE indicating the highest precision. There was some similarity in the map pattern of pH and ECe as produced by ordinary kriging and cokriging methods. However, ordinary kriging was over-smoothed the spatial variability of ECe than cokriging. Comparatively, it seems that soil ECe produced map by cokriging reflects local variation more than ordinary kriging.

Keywords: Ordinary kriging, cokriging, ECe, Arsanjan plain

INTRODUCTION

Soil salinization is one of the most common land degradation processes in arid and semi-arid regions such as central and southern Iran, where precipitation exceeds over evaporation. Under such climatic conditions, soluble salts are accumulated in the soil surface, influencing soil properties and environment with ultimate decline in soil productivity. Therefore, mapping of saline and salt-affected areas is crucial for understanding resource for sustainable soil uses and management. Remote Sensing and GIS techniques can be an excellent tool for

mapping saline and waterlogged soils. Assessing soil salinity is complicated by the nature of its spatial and temporal variability (Emadi et al., 2010). Conducting soil salinity measurements at high sampling density is costly and time-consuming. Fortunately, it is possible to use quick in-situ methods of electrical conductivity (EC), which is related to soil salinity, to evaluate salinity.

The objective of the present study is to compare two famous methods of geostasistical analysis (ordinary kriging and cokriging) for establishing the accurate soil salinity map. Soil samples in the 85 sampling site (10187 ha) were collected from 0-30 cm depths in Arsanjan plain, georefrenced using GPS receiver, analyzed for ECe in a saturated soil paste The data analyses were conducted in three stages for ordinary and cokriging interpolation: (a) normality tests were applied (Kolmogrov-Smirnov); (b) distribution was analyzed by classical statistics; (c) geostatistical parameters were calculated for each variable as a result of corresponding semivariogram analysis (Gooarts, 1999).

RESULTS

The results indicated that ECe is highly passively ($p \leq 0.01$) correlated with spectral values of band 1 of LISS-III receiver. Therefore, we used the spectral values of band 1 as secondary information for applying the cokriging method to predicate ECe in the study area. Mean square error (MSE) was used to evaluate the performance of the map prediction quality. The best prediction method for mapping ECe was cokriging in combination with the spectral data from spectral value of first band of IRS satellite with the smallest MSE indicating the highest precision. There was some similarity in the map pattern of pH and ECe as produced by ordinary kriging and cokriging methods (figure 1 and 2). However, ordinary kriging was over-smoothed the spatial variability of ECe than cokriging. Comparatively, it seems that soil ECe produced map by cokriging reflects local variation more than ordinary kriging.

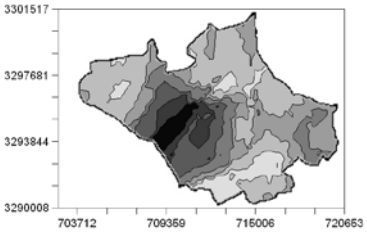

Fig. 1. Predicted map of EC_e by ordirary kriging

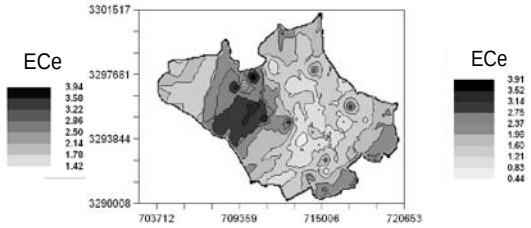

Fig. 2. Predicted map of EC_e by co-kriging

RERENCES

Emadi M.,· M. Baghernejad,· M. Pakparvar, S. A. Kowsar. 2010. An approach for land suitability evaluation using geostatistics, remote sensing, and geographic information system in arid and semiarid ecosystems. Environ Monit Assess. 164; 501–511.