Spatial distribution of soil moisture in precision farming using integrated soil scanning and field telemetry data

Charalampos Kalopesas (1), George Galanis (2), Eleni Kalopesa (3), Fotis Katsogiannos (4), Panagiotis Kalafatis (5), George Bilas (6), Aggelos Patakas (7), and George Zalidis (8)

(1) Lab of Remote Sensing and GIS, Aristotle University of Thessaloniki,Greece (xkalopesas@gmail.com), (2) Interbalkan Environment Center (i-BEC), Lagkadas, Greece (gegalani@hotmail.com), (3) Interbalkan Environment Center (i-BEC), Lagkadas, Greece (ellikalopesa@gmail.com), (4) Interbalkan Environment Center (i-BEC), Lagkadas, Greece (fkatsog@agro.auth.gr), (5) Interbalkan Environment Center (i-BEC), Lagkadas, Greece (panagiotis8kalafatis@gmail.com), (6) Lab of Applied Soil Science, Aristotle University of Thessaloniki, Thessaloniki, Greece (bilas@agro.auth.gr), (7) Lab of Plant Production, University of Patras, Patra, Greece (apatakas@cc.uoi.gr), (8) Lab of Remote Sensing and GIS, Aristotle University of Thessaloniki,Greece (zalidis@agro.auth.gr)

Mapping the spatial variation of soil moisture content is a vital parameter for precision agriculture techniques. The aim of this study was to examine the correlation of soil moisture and conductivity (EC) data obtained through scanning techniques with field telemetry data and to spatially separate the field into discrete irrigation management zones.

Using the Veris MSP3 model, geo-referenced data for electrical conductivity and organic matter preliminary maps were produced in a pilot kiwifruit field in Chrysoupoli, Kavala. Data from 15 stratified sampling points was used in order to produce the corresponding soil maps. Fusion of the Veris produced maps (OM, pH, ECa) resulted on the delineation of the field into three zones of specific management interest. An appropriate pedotransfer function was used in order to estimate a capacity soil indicator, the saturated volumetric water content (θs) for each zone, while the relationship between ECs and ECa was established for each zone. Validation of the uniformity of the three management zones was achieved by measuring specific electrical conductivity (ECs) along a transect in each zone and corresponding semivariograms for ECs within each zone. Near real-time data produced by a telemetric network consisting of soil moisture and electrical conductivity sensors, were used in order to integrate the temporal component of the specific management zones, enabling the calculation of time specific volumetric water contents on a 10 minute interval, an intensity soil indicator necessary to be incorporated to differentiate spatially the irrigation strategies for each zone.

This study emphasizes the benefits yielded by fusing near real time telemetric data with soil scanning data and spatial interpolation techniques, enhancing the precision and validity of the desired results. Furthermore the use of telemetric data in combination with modern database management and geospatial software leads to timely produced operational results, thus enhancing the desired productivity and quality indicator targets.