Saline soils spectral library as a tool for digital soil mapping

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Soil information is needed at regional to global scales for proper land management. Soil scientist has been historically interested in mapping soil classes and properties to represent and explore the spatial distribution of soil characteristics. Fortunately, soil mapping came into the digital era decades ago, enabling the dissemination of computationally intensive techniques (e.g., geostatistics). Digital soil mapping is moving forward in recent decades. Digital soil mapping has evolved from "traditional" studies that employed a set of soils to build soil maps, to more recent approaches that exploit the increasing computing facilities to combine soil databases with ancillary data such as digital elevation models, remote sensing imagery and proximal sensing datasets. The inclusion of VNIR spectroscopy in digital soil mapping approaches is an outstanding research field. VNIR spectroscopy has largely been employed to quantify soil properties with proximal sensor and remote sensor (i.e. imaging spectroscopy). One of the traditional problems in soil mapping is the time needed to compile a soil database large enough to allow for mapping with robustness. Therefore there is a growing interest in using the less time consuming, immutability of the sample and increasing accuracy of soil spectroscopy to obtain accurate enough soil maps but with lower data requirements. This research trend is particularly interesting for the study of highly dynamic soil processes for which is necessary to know the spatial and temporal changes of certain properties for a correct soil assessment.

The objective of this work was the study of soil salinity which is a dynamic property responding to seasonal (i.e. vertical upwelling) and inter-annual (i.e. salinization) changes. Soil salinity is a major constraint for agriculture by limiting or excluding certain crops. Thus, a continuous monitoring of soil salinity is needed to select the most suitable crops and to prevent future salinization. Large arid and semiarid Mediterranean areas are affected by severe salinization processes by converging salinity problems due to parent material salinity, water scarcity and poor quality of irrigation water.

A soils database in the South-East of Spain (semiarid Mediterranean environments) is being developed, by sampling and analyzing soils properties but especially salinity, besides recording their VNIR spectral signatures in field conditions. Also a spectral library related to soil type and salinity in these environments was determined in laboratory and it is a promising tool to monitor soil spectral signature changes. Positive relations between salinity, spectral data and soil type have been found using this technique. Soil spectra could be employed for quantitative spectroscopic analyses of soil properties, as ancillary data for digital soil mapping and for spectral calibration of remotely sensed imagery.