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Mapping of soil properties from hyperspectral remote sensing: the DIGISOIL strategy for soil processes modelling.

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The use of very high spectral and spatial resolution remote sensing tools in soil mapping is becoming increasingly useful to reduce times and expenses, that are typical of conventional field surveys and of laboratory analysis.
Modern satellite- or air-borne hyperspectral imaging systems, working in the VNIR and SWIR spectral ranges, provide high-resolution reflectance spectra, characterized by hundreds of narrow, contiguous spectral bands, thus allowing identification and mapping of a wide range of surface materials.
In the framework of the EU FP7 DIGISOIL Project, VNIR and SWIR spectroscopy from airborne imagery was applied for mapping soil properties, such as clay, iron and calcite contents and used in synergy with other ground-based geophysical techniques, in order to develop a complete soil mapping procedure.
This study was carried out in the DIGISOIL test site of Mugello, north of Firenze (Italy), where agricultural soils are widely threaten by surface processes, such as erosion and landslides.
Images of some representative clayey bare fields were chosen from a high spatial resolution hyperspectral dataset, acquired with the airborne Hyper SIM-GA sensor from Selex Galileo, simultaneously with a ground soil spectral signatures and samples collection.
After preprocessing, calibration and georeferencing of SIM-GA data, classified maps of clay, iron and calcite content were retrieved and compared with correspondent properties maps obtained with the conventional method; in particular, data were obtained by means of XRD, XRF, Holgrem method dithionite-citrate iron extraction and De Astis calcimetry, each performed on 67 samples, and interpolated by means of IDW algorithm.
The achieved correlation between observed and predicted values is encouraging for extensive application of this technique in soil mapping and demonstrates reliability of imaging spectroscopy for soil conservation planning and protection actions.