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First results of the DIGISOIL multi-sensor system for mapping soil properties

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The purposes of the multidisciplinary DIGISOIL project are the integration and improvement of in situ and proximal measurement technologies for the assessment of soil properties and soil degradation indicators, going from the sensing technologies to their integration and their application in (digital) soil mapping (DSM).
In order to assess and prevent soil degradation and to benefit from the different ecological, economical and historical functions of the soil in a sustainable way, high resolution and accurate maps of soil properties are needed. The core objective of the project is to explore and exploit new capabilities of advanced geophysical technologies for answering this societal demand. To this aim, DIGISOIL addresses four issues covering technological, soil science and economic aspects (Figure 1): (i) the validation of geophysical (in situ, proximal and airborne) technologies and integrated pedo-geophysical inversion techniques (mechanistic data fusion) (ii) the relation between the geophysical parameters and the soil properties, (iii) the integration of the derived soil properties for mapping soil functions and soil threats, (iv) the evaluation, standardisation and sub-industrialization of the proposed methodologies, including technical and economical studies.
With respect to these issues, the preliminary tasks of the DIGISOIL project were to develop, test and validate the most relevant geophysical technologies for mapping soil properties. The different field tests, realized at this time, allow focusing on technological suitable solutions for each of identified methods: geoelectric, GPR, seismics, magnetic and hyperspectral. Data acquisition systems, sensor geometry, data processing are thus presented and discussed in the perspectives of producing information layers for Digital Soil Mapping.
Next tasks will be dedicated to (i) establish correlations between the measured geophysical measurements and the soil properties involved in soil functions / threats (erosion, compaction, organic matter decline and shallow landslides) by using innovative data processing (inversion) and correlation protocols; (ii) to evaluate the societal impact of the developed techniques by investigating their relevance relative to the end-user needs, the technical feasibility and the cost effectiveness; (iii) to produce an exploitation plan including the standardization of the processes and the technical specifications of the developed methodologies describing the system components in terms of equipment (sensors, acquisition system, mobile vector), techniques (signal processing, inversion or fusion processes, specialization) and operational protocols.