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Soil properties mapping with the DIGISOIL multi-sensor system

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The multidisciplinary DIGISOIL project aimed to integrate and improve 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 quantitative 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: (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 pre-evaluation, standardisation and sub-industrialization of the proposed methodologies, including technical and economical studies related to the societal demand. With respect to these issues, the DIGISOIL project allows to develop, test and validate the most relevant geophysical technologies for mapping soil properties. The system was tested on different field tests, and validated the proposed technologies and solutions for each of the identified methods: geoelectric, GPR, EMI, seismics, magnetic and hyperspectral. After data acquisition systems, sensor geometry, and advanced data processing techniques have been developed and validated, we present now the solutions for going from geophysical data to soil properties maps. For two test sites, located respectively in Luxembourg (LU) and Mugello (IT) a set of soil properties maps have been produced. They give information about the C content, water content, clays content and soil thickness, allowing to deal with the main threats to soils related to erosion, SOC decreasing, water management and soil erosion.