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Hyperspectral laboratory and airborne measurements as tools for local mapping of swelling soils in Orléans area (France)

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Swelling soils contain clay minerals that change volume with water content and cause extensive and expensive damage on infrastructures. Based on spatial distribution of infrastructure damages and existing geological maps, the Bureau de Recherches Géologiques et Minières (BRGM, the French Geological Survey) published in 2010 a 1:50 000 swelling hazard map of France. This map indexes the territory to low, intermediate, or high swell susceptibility, but does not display smallest and isolated clays lithologies. At local scale, identification of clay minerals and characterization of swell potential of soils using conventional soil analysis (DRX, chemical, and geotechnical analysis) are slow, expensive, and does not permit integrated measurements. Shortwave infrared (SWIR: 1100-2500 nm) spectral domains are characterized by significant spectral absorption bands that provide an underused tool for estimate the swell potential of soils. Reflectance spectroscopy, using an ASD Fieldspec Pro spectrometer, permits a rapid and less expensive measurement of soil reflectance spectra in the field and laboratory. In order to produce high precision map of expansive soils, the BRGM aims to optimize laboratory reflectance spectroscopy for mapping swelling soils. Geotechnical use of laboratory reflectance spectroscopy for local characterization of swell potential of soils could be assessable from an economical point of view. A new high resolution airborne hyperspectral survey (covering ca. 280 km², 380 channels ranging from 400 to 2500 nm) located at the W of Orléans (Loiret, France) will also be combined with field and laboratory measurements to detect and map swelling soils.