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Grégory Dufréchoy, Audrey Hohmann, Gilles Grandjean, Anne Bourguignon

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Hyperspectral laboratory and remote sensing applied to clay minerals identification and mapping

Dufréchou Grégory, Hohmann Audrey, Grandjean Gilles, Bourguignon Anne

Bureau de Recherches Géologiques et Minières, 3 avenue Claude Guillemin, BP 36009,
45060 Orléans Cedex 2, France.

ABSTRACT

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, indexing the territory to low, moderate, or high swell susceptibility. At local scale, characterization of soil properties and identification of clay minerals using conventional soil analysis (DRX, chemical, and geotechnical analysis) are slow, expensive, and does not permit integrated measurements. VNIR (400-1100 nm) and SWIR (1100-2500 nm) spectral domains are characterized by significant spectral absorption bands that provide in France a largely unexploited tool for recognize swelling minerals. Hyperspectral laboratory (*i.e.* from samples) using an ASD Fieldspec Pro spectrometer provides thus a rapid and less expensive field surface sensing that permits to measure soil spectral properties. The BRGM aims to combine laboratory and remote (*i.e.* airborne measurement) sensing to apply and optimize hyperspectral reflectance imaging for mapping clay minerals and soil properties, so that local mapping of swelling clays susceptibility could be assessable from an economical point of view.