Using laboratory Vis-NIR spectroscopy to rapidly estimate soil aggregate stability in the Belgian loam belt

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Soil aggregate stability determines the susceptibility of soil aggregates to the kinetic impact of raindrops and the shear stress of surface runoff, thus in turn largely controls the rates of erosion. Subtle variations in soil organic carbon (SOC) content, clay content, soil water conditions, soil microbial activity, and tillage operations can cause substantial changes in aggregate stability. Numerous studies have shown the suitability of aggregate stability as an indicator of soil erodibility. This highlights the necessity to treat soil erodibility as a spatiotemporal dynamic parameter that evolves with seasons and agricultural practices, rather than an inherently constant property for any given soil type. However, large scale soil aggregate stability monitoring remains to be a laborious endeavor using conventional methods. We intend to explore the possibility of using laboratory Vis-NIR spectroscopy as an alternative method to assess the spatial dynamics of soil aggregate stability in the loam belt of Wallonia, Belgium. Topsoil samples were subjected to Fast Wetting tests to determine the aggregate stability, and to laboratory Vis-NIR spectroscopic scans to obtain the soil spectra. We will present two different approaches of estimating soil aggregate stability using soil spectroscopy. The first approach directly estimates aggregate stability, as expressed by mean weight diameter, via laboratory Vis-NIR spectra using multivariate regressions, and the second approach firstly estimates soil elementary properties using Vis-NIR spectra, which are then used to predict aggregate stability via pedotransfer functions. Finally, the performance of these two approaches and different multivariate regression methods are discussed and the primary control of SOC over aggregate stability is highlighted.