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Visual Evaluation of Soil Structure (VESS) at Clod scale (ClodVESS)

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Visual soil structure evaluation in the field is very popular. It is fast, easy and inexpensive to perform. It opens exciting perspectives in terms of soil quality diagnosis and rapid survey. Some studies attempted to compare the scorings with measured physical properties, but most physical methods do not operate at the same scale. Visual evaluation is performed on a whole soil pit or layers, while physical measurements are usually performed on undisturbed soil samples collected in a layer. The match between the pit or layer VESS scores and the measured physical property can be poor due to short scale variability, even with numerous sample characterizations. This is particularly true with tilled soils. Moreover the field water content is heterogeneous, which introduces additional sources of variability. How far what we see matches with physical properties should be tested on the same sample, prior to handle the variability issue.
Therefore, we adapted the VESS method to score soil cores of approximatively 150 cm3 in the laboratory, on which we performed also the physical characterization using shrinkage analysis. We collected 150 samples in a large area from the Swiss plateau (120 km long) in different land management (permanent pasture, no-till, conventional tillage), different seasons. The clay contents ranged from 10 to 30%. The samples were scored after performing shrinkage analysis according to the following criteria. The samples were equilibrated at -100 hPa to standardize the moisture conditions. Some criteria of the original method had to be discarded due to the small size of the soil core, namely (i) the indication on aggregate size over a few centimetres, (ii) rooting was found not consistent enough to be used, especially in cultivated soils where sampling season is determinant for root density. Three criteria could consistently be observed on all samples and were retained: (i) breaking difficulty, (ii) aggregate shape, (iii) visible porosity, and the corresponding scoring sheet is provided.
The ClodVESS showed good relation with the shrinkage parameters, such as bulk density, porosities, water content and air content at controlled matric potential, with R2 ranging from 0.4 to 0.55. Therefore, visual scoring appeared to be very consistent with soil physical measurements when performed at the same scale on the same sample. The ClodVESS method has, moreover, two major advantages, namely (i) objectivity: the samples can be evaluated as a blind test and the observer is not influenced by the surroundings, and, (ii) independence of field moisture conditions by putting all the samples at the same matric potential (100 hPa).