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Soil drying and soil structure

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Classical soil water retention curves relate tension and water content in soil. Often, the tension is equated with the equivalent diameter of the largest water-filled pores, using the capillary rise equation. This relationship is known to be an approximate one as most soils contain clay minerals that swell and shrink with wetting and drying, respectively. Most notably, cracks are created during drying which may then close again under subsequent wetting. The aim of this study was to investigate how potential soil microbial habitats are influenced under drying. I used three-dimensional X-ray imaging to quantify local volume changes and the associated evolution of the pore-network morphology in 8 undisturbed soil samples (diameter: 67 mm, height 60 mm), sampled at 4 different field sites. In general, cracks formed in all investigated samples. The crack formation corresponded to an increased volume of large pores on the expense of smaller ones. As a result, a larger and better connected macropore network led to an improved aeration of the soil matrix, adding to the increased oxygen supply associated with draining pores. This study demonstrates the large potential of non-invasive imaging methods to advance knowledge on the interaction between soil physics and soil microbiology.