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Effect of wetting and drying cycles on the spatial variability characteristics of the internal structures of soil aggregates

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Soil aggregates play an important role in many micro-scale soil processes, including transport of water and solutes, storage for various nutrients and organic matters, and places for diverse microbial activities. Past research indicates that microbial activities within soil matrix are highly spatially heterogeneous due to complex pore structure of soil aggregates. With advances in X-ray microtomography, we are able to examine pore networks of intact soil aggregates with a resolution of only several microns. X-ray microtomography is a great tool that allows quantitatively describing, summarizing and comparing aggregate structure and internal organization in aggregates from different soil types, agricultural practices and land uses. Geostatistical and multifractal methods can provide concise characteristics of pore spatial distributions within the aggregates and potentially can be useful in comparing those among different soils and land uses. In this study, we compared naturally air-dry aggregates with the aggregates from the same soil but pretreated by subjecting them to several wetting and drying (WD) cycles. We hypothesize that WD cycles cause swelling and shrinkage of the soil pores, thus will greatly alter spatial arrangement of the soil pores and particles within the aggregate. Soil aggregate samples were scanned on the bending magnet beam line, station 13-BM-D of the GeoSoilEnvironCARS (GSECARS) at the Advanced Photon Source (APS), Argonne National Laboratory (ANL) with 28 keV incident energy and a resolution of 13.1 microns. Geostatistical analysis showed that the aggregates with WD pretreatment tended to have greater spatial correlation ranges which indicate de-

velopment of stronger spatial dependencies in those aggregates in response to WD. We also will explore q-th order structure functions to examine the multifractal behavior of the natural and WD pretreated aggregates.