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The use of electrical anisotropy measurements to monitor soil crack dynamics – laboratory evaluation

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Swelling and shrinking of soil cracks is a key factor determining water fluxes in many irrigated soils. Most previous studies have used time-intensive and destructive methods for crack characterization, such as depth and volume determination from simplified geometrical measurements or liquid latex filling. Because of their destructive and time-consuming nature, these methods have only provided instantaneous estimates of the geometry and/or volume of cracks. The aim of this study is to evaluate the use of anisotropy in electrical resistivity measured with a square electrode array to determine crack depth dynamics. In a first step, the performance of the method was analyzed using a laboratory experiment where an artificial soil crack was emulated using a plastic plate in a water bath. Since cracking depth was precisely known, this experiment allowed to develop a method to estimate soil crack depth from measurements of the electrical anisotropy. In a second step, electrical anisotropy was measured during soil crack development within a soil monolith consisting of a mix of sand and bentonite. The cracking depth estimated from electrical measurement compared well with reference ruler measurements. These laboratory measurements inspired confidence in the use of electrical anisotropy for soil crack investigations, and consequently the developed methods will be applied to investigate soil crack dynamics in the field in a next step.