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Application of Multi-Channel Ground-Penetrating Radar for Estimating Volumetric Soil Water Content at the Field Scale

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There is an increasing interest in using geophysical methods to non-invasively measure proxy variables for estimating soil hydraulic parameters. Actually, ground-penetrating radar (GPR) is intensively applied to deduce volumetric soil water content from measured dielectric properties. Therefore, data both from direct waves and reflected waves are used.
We present an application of an antenna array where radargrams at different antenna separations are measured simultaneously. In addition to the classical measurements of ground-wave and reflected wave, this setup enables us to determine the depths of the respective reflections from their traveltimes measured at different antenna separations. This way, volumetric water contents can be measured to greater depths without the need of ground-truth data from drillings or soil profiles.