



Measuring the spatial variation of soil water content at the Selhausen test site with the ground wave of ground penetrating radar (GPR)

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The FLOWatch project investigates the relationship between field scale (effective) fluxes of water and carbon dioxide and the spatial variation of these fluxes. The variability of water and carbon dioxide fluxes is strongly related to the variation of soil water content. Therefore, a range of soil water content measurement techniques is investigated at the Selhausen test site. GPR is a promising method to measure the spatial variation of soil water content. Although there are several methods to measure soil water content with GPR, here we focus on measurements based on the ground wave. The ground wave is the wave that travels directly between the transmitting and receiving antenna of the GPR system when the antennas are placed on the soil surface. As a first step to measuring soil water content with the ground wave, a 60 m transect consisting of 20 WARR measurement was measured. After careful inspection of these measurements, it was decided to use the 450 MHz GPR antenna with an antenna separation of 1.2 meter. However, the complexity of these WARR measurements indicated that considerable problems could be expected in the interpretation of the fixed-offset GPR measurements required for soil water content mapping. Next, four transects of 148.5 meter with a sampling distance of 0.5 meter were measured and TDR (0-0.10 m) and volumetric water content measurements (0-0.05 m) were obtained for comparison. As expected from the WARR measurement, the fixed-offset GPR measurements were difficult to interpret. The correspondence between the GPR measurements and the other measurement techniques was low. Potential explanations for these discrepancies are the difficult site conditions for GPR measurement (strong contrast in soil water content, reflections from shallow soil layers and the varying and heavy soil texture) and the difference in sampling depth between GPR and the reference measurements.