Geophysical Research Abstracts
Vol. 12, EGU2010-5444-2, 2010
EGU General Assembly 2010

GPR ground wave measurements of soil moisture as local ground truth for remote sensing

Patrick Klenk, Stefan Jaumann, Xicai Pan, Ute Wollschlaeger, and Kurt Roth

Heidelberg University, Institute of Environmental Physics, Heidelberg, Germany (patrick.klenk@iup.uni-heidelberg.de, +49 6221 54-6405)

Near-surface soil moisture plays an important role for the water and energy cycle at various scales. At the point scale, processes are already well understood and rapid sensor development has minimized much of the inherent uncertainty (e.g. Vereecken, 2008). For estimating soil moisture content at the field to catchment scale, resort is taken to remote sensing methods, which often rely on extensive ground truth measurements for calibration (e.g. Robinson, 2008). Up to now, mostly point measurements are used for this. However, due to subsurface heterogeneity, achieving a representative and robust soil moisture estimate based on point measurements quickly becomes impractical with growing spatial extent. Consequently, there is the need to advance fast and efficient methods for reliable estimation of near-surface soil moisture content to provide local ground truth for remote sensing measurements.

At scales from a few meters up to a few kilometers, ground-penetrating radar (GPR) offers fast and efficient access to soil moisture content in the shallow subsurface. Evaluating the ground wave signal in a GPR survey can yield soil moisture contents in the uppermost soil section (e.g. Grote (2003), Huisman et al. (2003b)), while multi-channel GPR constitutes a measurement technique which provides direct access to deeper sections of the soil profile (Gerhards (2008)).

For achieving a better understanding of the GPR ground wave signal, multi-channel GPR measurements were carried out on sandy soils at field sites in the Twente area in eastern Netherlands in October 2008. We here interpret these measurements and verify our experimental results through numerical simulations. Especially the influence of shallow reflections and near surface gradients are discussed.

Gerhards, H. (2008). *Ground Penetrating Radar as a Quantitative Tool with Applications in Soil Hydrology*, PhD thesis, Heidelberg University. http://katalog.ub.uni-heidelberg.de/titel/66618434.
Grote, K., Hubbard, S. and Rubin, Y. (2003). Field-scale estimation of volumetric water content using ground-penetrating radar ground wave techniques. *Water Resour. Research* **39**:1321.
Huisman, J., Hubbard, S., Redman, J. and Annan, A. (2003b). Measuring soil water content with ground penetrating radar: A review. *Vadose Zone Journal* **2**:476-491.
Robinson, D. A., Campbell, C. S., Hopmans, J. W., Hornbuckle, B. K., Jones, S. B., Knight, R., Ogden, F., Selker, J. and Wendroth, O. (2008). Soil moisture measurement for ecological and hydrological watershed-scale observatories: A review. *Vadose Zone Journal* **7**:358-389.
Vereecken, H., Huisman, J. A., Bogena, H., Vanderborght, J., Vrugt, J. A. and Hopmans, J. W. (2008). On the value of soil moisture measurements in vadose zone hydrology: A review. *Water Resour. Research* **44**:W00D06.