Geophysical Research Abstracts,
Vol. 11, EGU2009-6070, 2009
EGU General Assembly 2009

Indirect measure of the dielectric permittivity via GPR measurements on a cooperative target with unknown location.

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An accurate measure of the dielectric permittivity of the soil is of interest for several hydrological applications, as optimal irrigation and pollution monitoring, only to quote few examples [1, 2]. In addition, an accurate knowledge of the dielectric properties of the soil is of interest in the framework of inverse scattering approaches applied to GPR data in order to detect and image properly the buried targets of interest [3].
This work deals with an indirect measure of the dielectric permittivity of the soil starting from GPR surface data collected on a buried "cooperative" target, meant as an object buried on purpose whose extent is known a-priori and small in terms of the probing wavelength [4]. This target is exploited in order to achieve, from its image obtained from a suitable GPR data processing, an indirect measure of the dielectric permittivity of the embedding soil.
GPR data processing is based on a linear microwave tomographic approach funded on the Born Approximation. Using this Born approach on two-dimensional inversion tests, we investigate the effect of the soil's electrical conductivity and permittivity on this indirect measure and demonstrate that the electrical field scattered by a spot-like buried object permits a good estimation of the soil permittivity even when no accurate information of the soil conductivity is available [5].
The feasibility of the approach will be tested by a deep numerical analysis that will point out also the effect of the extent and of the location of the cooperative target. Experimental results will be also presented in the case of data collected in controlled conditions [6].

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