Towards reliable large scale soil water content estimation: GPR for measuring soil moisture in the Urumqi region

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In the context of the BMBF future megacities project RECAST Urumqi, remote sensing tools are developed and calibrated in order to assess large-scale soil moisture distribution and dynamics in the Urumqi-Changji region. The aim is to provide a proxy index for the variations of the hydrologic state and to monitor and quantify the impact of regional changes. A first field campaign was carried out in April and March 2010 when different measurement sites at the desert rim in the Northeast of the city of Urumqi were characterized with electromagnetic ground measurements, mainly Ground-Penetrating Radar (GPR) and Time-Domain Reflectometry (TDR).

GPR represents a ground-based, non-invasive geophysical method which can be operated at scales from several meters up to a few kilometers. In principle, GPR methods give simultaneous access to both surface water content as well as the average water content in underlying soil layers at scales applicable for efficient ground truth measurements for remote sensing applications. The here presented GPR measurements were aimed at determining the spatio-temporal structures and variations of near-surface soil moisture contents at scales up to several hundred meters.

As air temperatures ranged between -15°C in March and about 30°C in late April, the field campaign took place in a highly dynamical environment with vastly changing regimes over a very short time period. Still, GPR methods were applied successfully to monitor these seasonal changes and their influence on near-surface soil moisture content at multiple sites in the semi-desert environment. We show our current results and discuss objectives for further research with a focus on applications in remote sensing frameworks.