



Electrical resistivity measurements to estimate groundwater recharge potential of latosolos in Brasília as a working part of the IWAS Água DF Project

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The IWAS Água DF Project is a bilateral cooperation project initiated in 2009, coordinated by German and Brazilian institutions, with the main objective to develop an Integrated Water Resource Management System, in order to guarantee the safe water supply of the Federal District of Brazil and its surrounding urban areas. In this project a working package for Water Cycle is settled in with a special task for a feasibility study for artificial groundwater recharge with pretreated municipal wastewater in typical regional soils of Brasília.

Brazil's Federal District with the capital Brasília developed rapidly in the last 50 years and counts about 2.5 million inhabitants by now. The predicted water scarcity, caused by climate change, growing population and increasing agriculture requires short-term action in water resources management.

Basically this part of the IWAS Água DF project is focusing on the investigation of artificial groundwater recharge to estimate the retardation potential of different soils by infiltration of pretreated wastewater. Therefore in São Sebastião (37 km SE of Brasilia) a field test site with two infiltration basins (5 x 5 m) has been established to investigate the infiltration processes. Pretreated municipal waste water originating from the local waste water treatment plant serving the city of São Sebastião and surrounding areas is used for infiltration. In this treatment plant the waste water is treated in three steps. After a first mechanical treatment step the pretreated waste water is pumped through a temporary basin for anaerobic treating. Following this, the water is spread over large area sloped meadows by a branched piping system where the main part of the treatment of waste water takes place. The waste water percolates through the upper soil layer and gets filtrated in the clayey horizons of the local latosols. As a result, an artificial O/A horizon of 10 to 15 cm is build up because of the high nutrient content of the pretreated waste water.

To prepare the upper soil layer of the infiltration basin root penetration was removed. For the observation of the wetting front during infiltration a 3D-geoelectrical monitoring grid with 64 decoders was constructed. The grid (15 x 6 m) was made up of four decoder lines in parallel. With this setup an investigation depth of approximately 3 m below ground surface could be reached. The infiltration basins are located in the center of the 3D monitoring grid. A dipole-dipole electrode configuration was used in this application. The monitoring of the wetting front started with a measurement of the local subsurface electrical resistivity background values. After this, the basin have been flooded with pretreated municipal waste water and repeated monitoring measurements of electrical resistivity have been conducted and compared to the background values afterwards. Because of the high nutrient content of the municipal waste water, the electrical resistivity in the soil drops as a function of the infiltration rate. For proper balancing of the infiltration processes in the field application also data of precipitation and evaporation need to be considered. In the future the determination of the geochemical parameters of the percolated water with special soil moisture samplers is planned.