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2025

2024-12-16 11:22:34

85. Jahrestagung der Deutschen Geophysikalischen Gesellschaft

Topic: Genaral sessions: OG - Oberflächennahe Geophysik: Archäogeophysik / Bio-u. Hydrogeophysik / Ingenieur-u. Umweltgeophysik
Type: Oral Presentation
Abstract no.: A-155
Status: submitted
Awards Yes, my abstract is eligible for the award
Language: English

Geophysical Monitoring of Infiltration Processes in a Managed Artificial Recharge Pond – Part B

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Theme
The Vombverket water supply facility in southern Scania, Sweden, operates 54 infiltration ponds as part of its Managed Aquifer Recharge (MAR) system, a vital component of the region's water infrastructure. Each pond features a 1-meter-thick layer of washed sand overlying well-sorted glaciofluvial sediments. However, infiltration processes at the pond scale are inadequately understood, posing challenges as population growth, industrial and agricultural demands, and climate change drive the need for increased MAR system production.
To address these gaps, a pilot pond was studied using advanced geophysical monitoring techniques. The study integrated a Direct Current Resistivity (DC) system, sensors for water conductivity, soil moisture, and temperature, alongside periodic Ground Penetrating Radar (GPR) surveys. These methods captured temporal and spatial variations in water content and unsaturated zone changes during infiltration.
Sandy sediments above the groundwater table exhibited high resistivity values exceeding 1 kΩm, while saturated zones displayed lower resistivity, ranging from a few hundred Ωm. Time-lapse resistivity data, calculated by subtracting baseline values from seasonal measurements, revealed infiltration dynamics, where water initially concentrated in localized areas before spreading. Profiles such as the South-North Pond (SNP) and West-East Pond (WEP) lines demonstrated significant infiltration patterns tied to groundwater movement and soil characteristics.
GPR surveys (170 MHz) provided 3D subsurface models, identifying groundwater levels at depths of 4–6 meters. Reflections highlighted geological material variations related to sediment grain size. The two geophysical methods indicated similar results, showing consistent groundwater levels and infiltration patterns.
These findings enhance the understanding of MAR system infiltration, forming a basis for optimizing efficiency. Future work will estimate soil hydrological properties and incorporate findings into hydrogeological models, supporting sustainable water management strategies. This approach addresses increased water demand and mitigates climate change impacts in Scania.

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