



University of Stuttgart

Germany

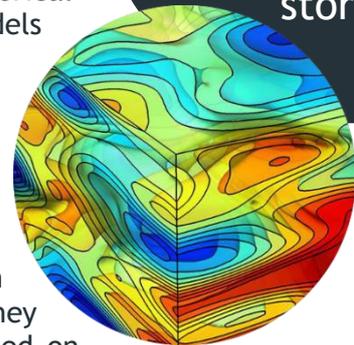
Department for Stochastic Simulation
and Safety Research for Hydrosystems (LS³)

M.Sc. Topic (UMW/BAU/SimTech/BAU/WAREM)

Global groundwater depletion is a major threat to sustainable groundwater use. Total groundwater storage (TGS) in a river catchment is influenced by climate, hydrological processes, land use and other forms of anthropogenic exploitation. Even before sustainable management can start, water managers must be enabled to estimate TGS and trace its evolution. Thus, there is a need to monitor changes in TGS. Numerical groundwater models could be used to estimate TGS, but such models are often very complex, data hungry and time-intensive to operate.

Fortunately, satellite data like GRACE provide a handle on monthly TGS variations at regional scale all across the globe. However, such satellite data products need to be validated from independent data, e.g., by conventional monitoring. But how to estimate TGS from piezometric data? The observed time series from piezometric wells are scattered, single points that require spatial interpolation and spatial integration to obtain TGS. As an additional challenge, they may provide a biased picture as most monitoring activities focused on areas with strong anthropogenic groundwater abstraction. To solve this problem, the proposed thesis will use statistical data analysis and statistical spatial modelling of piezometric time series from many wells. The goal is to obtain an independent TGS estimate with accurate confidence intervals that serves to validate GRACE-derived TGS dynamics.

Statistical
modelling of
groundwater data
to estimate
dynamics of total
groundwater
storage



Prospective Tasks

- Import, clean & visualize piezometric data (spatial, temporal),
- Simple grid-wise averaging, regression analysis with various external data sets (e.g. seasons, population density, elevation, land use, distance-to-draining-river, etc.),
- Statistical cross-validation tests, (variogram) analyses of residuals,
- Comparison of total groundwater storage (TGS) as estimated from the steps above with GRACE-derived TGS estimates

Advisors:

- Fahad Ejaz, M.Sc. and Prof. Dr.-Ing. Wolfgang Nowak (Stuttgart)
- Jun.-Prof. Dr.-Ing. Maike Schumacher (Hohenheim)

Desireable Skills:

- Statistics and affinity for mathematics, knowledge of geostatistics
- Programming experience in MATLAB



Apply now!

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