



## **Spatial distribution and temporal variation of groundwater storage in Saudi Arabia: Space-based observation Approach**

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Worldwide, water management decisions are usually depending on the in-situ observation networks, which decline in coverage recently. The decision-makers need information about the groundwater resources for optimum management. Due to the incompleteness of ground-based observations, space-based observation of global freshwater resources is critical. GRACE (GRAVITY RECOVERY AND CLIMATE EXPERIMENT) satellite mission has become very important water management tool since its initiation many years ago. GRACE detects lateral variations in the gravitational potential in the earth, which is mostly caused by changes in terrestrial water storage or  $\Delta TWS$  (Terrestrial Water Storage variation). The main objective of this study was to analyze the spatiotemporal groundwater variations using GRACE in the Saudi Arabia from 2007 to 2016 and to compare the GRACE result with the in-situ observations. The result of this study reveal that the groundwater depletion in north-west and central Saudi Arabia estimated to be about  $7.848 \pm 0.44$  mm/year per year. Groundwater Depletion in the Eastern Province Arabia estimated to be about  $6.384 \pm 0.409$  mm/year. In this study, spatial down-scaling of the coarse scale GRACE data was applied directly using spatial correlation through variograms analysis. Sequential Gaussian Simulation (SGS) was used and multi realizations were apply for uncertainty quantification for different scenarios. In Saudi Arabia, freshwater over-exploitation for irrigation purpose attributed to groundwater depletion instead of climate variability. It is worth to say that the use of GRACE and other satellite data for monitoring the groundwater charge and discharge regionally could enhance by integrating them with the land surface models.