

# **An Improved Hybrid Geoid Model over Kingdom of Saudi Arabia Utilizing New GNSS Ellipsoidal Heights on Benchmarks of KSA National Vertical Network**

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## **SUMMARY**

The most recent GNSS/leveling campaign in Kingdom of Saudi Arabia (KSA) took approximately two years (2017 – 2019) and provides as outcome around ~3500 ellipsoidal heights of benchmarks of KSA National Vertical Network (KSA-NVN). An improved version of current KSA-GEOID17 of the Kingdom was determined based on common utilization of new GNSS/leveling data and terrestrial gravity measurements on KSA-NVN.

The applied hybrid geoid modelling procedure corresponds to the “classical” approach and was done according to the following consequence: (a) detecting and removal of systematic part from the data, based on rigorous Helmert transformation; (b) statistical analysis of geoid residuals after systematic part removal; (c) conversion of GNSS/leveling derived geoid heights into gravity anomalies; (d) forming difference between computed and observed terrestrial gravity anomalies; (e) statistical analysis of gravity differences (empirical and analytical covariance function construction); (f) transformation of derived gravity covariance function into geoid heights covariance function; (g) construction of transformation grid between gravimetric and hybrid geoids using least squares prediction of geoid differences.

Validation of improved hybrid geoid has been conducted by utilizing additional gravity and geoid heights data and information over KSA and conclusions regarding applicability of the new improved version of KSA-GEOID17 have been drawn.

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