Geophysical Research Abstracts
Vol. 13, EGU2011-1214-3, 2011
EGU General Assembly 2011

Analysis of Gravimetric and GPS/BM derived Geoids for Saudi Arabia

Abdulaziz Alothman
Saudi Arabia (aalothman@kacst.edu.sa)

Historical gravity observations have been utilized to compute the gravimetric geoid for the kingdom of Saudi Arabia. Using the "remove and restore" techniques, the global geoid model (EGM2008) heights and free air anomaly have been computed using Moledensky formula. The gravimetric geoid model covers about 70 percent of the kingdom. Secondly, Observations by Space based Global Positioning System (GPS) obtained along with the leveling Bench Mark (BM) observations were also used to compute the GPS/BM geoid. Determination of GPS/BM geoid based on the vertical reference network of Saudi Arabia, which was built in early 1970's as first order vertical control network by spirit leveling based on tidal gauges along the Arabian Gulf and Red Sea. More than 5000 GPS/BM observations established by ARAMCO, with an accuracy of 1 to 10 ppm, have been used to compute the point geoid heights using the remove and restore techniques. Corrections for trend and high frequency signals have been applied using the least square method, and collocation predictions. Analysis of the two geoids reveals some geoid biases, which is possibly due to the systematic errors in the gravity data. These biases lead to an error of few meters in the gravimetric geoid. The GPS/BM geoid covers more area of the kingdom with a standard deviation of about 20 cm and maximum error of 10 cm. the corrections to the global geoid, long wavelength and high frequency collocation signals, is about 2.5 m northwest region. Further analysis is performed based on three independent data sets. First data is GPS/leveling geoid heights computed by subtracting orthometric height from ellipsoidal height at 390 BMs re-observed recently, in 2009. Second data set includes the geoid heights computed from the GPS/BM geoid model at these BMs stations. Residuals of these two data sets were computed at each benchmark and values are ranging from -2.45m to 2.86m with large standard deviation of $\pm$0.54m. Third data set includes geoid heights obtained from the global geoid model EGM08 which reveal a bias of -0.57m with standard deviation of $\pm$0.53m. Correlation is very high between these data sets reached 0.99.