Egyptian Geoid using Ultra High–Degree Tailored Geopotential Model

Hussein Abd-Elmotaal (Egypt)

Key words: tailored geopotential models; harmonic analysis; window technique; Egypt; geoid determination

SUMMARY

In the framework of the remove-restore technique, the residual field should be unbiased and have a small variance. Hence, an ultra high-degree (complete to degree and order 2160) reference geopotential model tailored to Egypt is developed within this investigation. The local and global data sets, in terms of isostatic gravity anomalies, are merged and used to estimate the harmonic coefficients of the ultra high-degree tailored reference model by an FFT technique using an iterative process to enhance the accuracy of the obtained harmonic coefficients and to minimize the residual field (Abd-Elmotaal, 2004). This tailored geopotential model has then been used to compute a gravimetric geoid for Egypt in the framework of the remove-restore technique. The window technique (Abd-Elmotaal and Kuehtreiber, 2003) has been used to avoid the double consideration of some of the topographic-isostatic masses in the neighbourhood of the computational point. The commonly used Airy-Heiskanen isostatic hypothesis is applied. For the sake of comparison, the EGM2008 global geopotential model has also been used. The gravimetric geoids are computed for Egypt using Stokes' integral in the frequency domain by 1-D FFT technique. The computed geoids are scaled/fitted to the GPS/levelling derived geoid. The results show that the tailored ultra high-degree geopotential model created in this investigation gives better residual gravity anomalies (unbiased and have smaller variance) as well as better geoid accuracy. The variance of the residual gravity anomalies has dropped by about 35%. The external accuracy of the fitted geoid has improved by about 20 %.