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Geoid of Northern Algeria.

Note by C.C.Tscherning.

The computation of a geoid of Northern Algeria has revealed a number of problems and difficulties.

Data:
Gravity.
It must be checked that the BGI data are free-air anomalies and that they are in the IGSN1971 gravity reference system.
There is a difference between the data-set created by the program selectn and the data-set used originally by Aissa. Why this difference.
There seems to be many duplicate values in the data. They must be removed.
The subtraction of EGM96 have the expected result, i.e. the variance and the mean-value became smaller.
The subtraction of the DTM rtm contribution using tc1 did not reduce the variance very much. Why not ? But the mean value became small.
The contour map (GMT) shows that there are several outliers in the gravity data.
There are a few absolute stations. One must check that they are consistent with the BGI data. (Compute associated free-air gravity anomaly, and compare this value with neighbouring values. Geocol can be used to predict the values from the BGI data).

More gravity data should be used. Petroleum companies must have data. Or GETEC in Leeds. Also gravity derived from altimetry could be used in the coastal area. Contact Ole Andersen at oa@kms.dk. The altimetry may also be used directly as observations.

GPS.
The expected error of the GPS/Levelling data is 0.5 m, primarily due to errors in the levelling. However, after subtraction of EGM96 and prediction by gravity, large differences (about 2 m) between observed and predicted are found for 5 – 6 stations. Why these large differences ? It could be antenna height problems or erroneous identification of the levelling point. It could also be due to tectonic movements in the period between the levelling and the GPS.
It is very strange, that when the RTM effect is subtracted, the variance of the residual data increases. One would normally expect the variance the be 50% lower.

There is normally a difference between the local (national) height datum and the global mean sea level. Do we have any indication about this ? The differences between the gravimetrically predicted GPS/levelling and the observed values indicate a difference of about 0.3 m.

Are the height system normal heights or orthometric heights ? The difference is largest in mountains.

DTM.

ETOPO5 has been used. It probably has many errors. The output from tc1 gives some statistics of the differences between the heights associated with the gravity data and the DTM. Some differences are of the order of 1 m. – This is too much.
Use of the DTM2002 from NASA should be investigated. Compare ETOPO5 and DTM2002 using geogrid. (Predict the one from the other and compare).
One must not densify a DTM using prediction (geogrid).

Geoid (or height anomaly) computation using colloction.

COVFIT gave fine results (Bjerhammar sphere, etc.). The solution using only gravity and EGM96 is probably the best. The (residual) height-anomalies should be computed at terrain level and not at a fixed altitude. The 5' DTM could be used to generate prediction points.
Remember to add back the contribution from EGM96 and from RTM, if used.

$$\zeta = \zeta_c + \zeta_{EGM96} + \zeta_{RTM}$$

Graphical output:

Make contour maps of the predicted height anomalies and of the error-estimates. GMT may generate POSTSCRIPT files, which can be imported in Word documents.