Investigating the Effect of Neglecting Parts of the EGD Geodetic Height on the Transformation from Helmert 1906 to WGS84

Mohamed ELMAGHRABY, Atef FAYAD, Egypt and Mohamed EL-HABIBY, Canada

Key words: Datum transformation, Molodensky, GPS, Terrestrial networks.

SUMMARY

Missing part of the information obtained from a set of data, is an interesting issue especially when dealing with old geodetic networks under modification. It is beneficial to study the effects of neglecting any unavailable part of the EGD height information, which could be the geoid undulation N^*, the orthometric height H or the geodetic height h altogether, relative to EGD at some or all of the network points, on the derived values of the seven transformation parameters, as well as on the computed values of the EGD Cartesian coordinates (x, y, z), as reflected later on the 3-D transformed coordinates to WGS84, have been theoretically analyzed. However, in this research such effects can be numerically investigated, particularly in case of analyzing the first order control networks. This is done, simply by determining the seven transformation parameters of Molodensky model twice, firstly by using the available geoid undulation, say from ASU2000 geoidal model, and secondly when neglecting such undulations. Then, each one of the two sets of transformation parameters will be used to transform selected check points to WGS84, from which the corresponding coordinate discrepancies can be computed. The required statistical parameters of these discrepancies is evaluated and analyzed. In addition, the same investigation of neglecting the geoid undulation N^*, is repeated once again when neglecting the entire EGD geodetic height h, in the process of estimating the corresponding transformation parameters. Neglecting any unavailable part of the EGD height information, has dual effects, firstly on estimating the transformation parameters of Molodensky model, and secondly on the computations of the 3-D Cartesian coordinates (x, y, z) relative to EGD. In this case, the WGS84 transformed coordinates will be affected by the wrongly estimated transformation parameters and/or the wrongly computed (X, Y, Z) Helmert coordinates. Both effects will be numerically analyzed here. In this context, three cases are studied: firstly the effect of wrong transformation parameters; secondly, the effect of wrong (x, y, z) Helmert only; and thirdly, the combined effect of wrong transformation parameters and wrong (x, y, z) Helmert combined together. The paper ends with conclusions and recommendations with respect to the suitability, accuracy and efficiency of the methods used.