Geophysical Research Abstracts,
Vol. 11, EGU2009-3592, 2009
EGU General Assembly 2009

Impact of recent Global Digital Bathymetry and Topography Models on geoid modelling: Results from two case studies in Balearic and Aegean Seas

D. Delikaraoglou, I. Mintourakis, and F. Kallianou

National Technical University of Athens, Department of Surveying Engineering, Athens, Greece
(mintioan@survey.ntua.gr/0030-210-7722670)

With the realization of the Shuttle Radar Topographic Mission (SRTM) and the free distribution of its global elevation dataset with 3 arcsec (90 m) resolution and less than 16 m vertical accuracy, together with the availability of the higher resolution (30 m) and accuracy (10 m) Digital Terrain Models (DTM) from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), these two valuable sources of uniform DEM data represent a revolution in the world of terrain modelling. DEMs are an important source of data for the generation of high resolution geoids since they provide the high-frequency content of the gravity field spectrum and are suitable for the computation of terrain effects to gravity and indirect effects to the geoid, thus allowing the combination of global geopotential models, local gravity anomalies and information about the earth's topography (represented by a given DEM). However, although such models are available for land, there are no readily accessible Digital Bathymetry Models (DBMs) of equivalent quality for the coastal and oceanic regions. Most of the global DBM's (e.g. ETOPO1, SRTM30, and GEBCO global bathymetric grid) are compilations of heterogeneous data with medium resolution and accuracy. This prevents to exploit the potential of the recent high resolution (1 arcmin) marine free-air gravity anomalies datasets derived from satellite altimetry (such as the DNSC08, and the Sandwell & Smith v18.1 (S&Sv18.1) global solutions) in conjunction with such global DBM's. Fortunately, for some regions, recently have become available DBM's of much better accuracy and resolution, such as the DBM of 1 km resolution for many regions of the Mediterranean Sea which is distributed by IFREMER, the French Research Institute for Exploitation of the Sea.

The scope of this study is to use this latest regional DBM in combination with the newly available DNSC08 and SSV18.1 global marine free-air gravity anomalies datasets for marine and near shore geoid modelling of archipelagic (island) areas. We have concentrated in two test regions: (a) the Catalano-Balearic Sea (South of Spain in the NW Meditteranean), where adequate marine and land gravity data allow a detailed evaluation of our processing methodologies and their results and, (b) the Aegean Sea where the presence of many islands in varying distances from the mainland Greece and located on the continental shelf and/or divided by steep sea floor topography present some unique challenges for any high resolution geoid modelling efforts. For both test regions, we generated a combined DEM (C-DEM) using the IFREMER and SRTM 30 arcsec bathymetric data for the sea areas and SRTM 3 arcsec data for the surrounding land areas. In this contribution, we discuss various computational aspects relating to the so-called "Direct Topographical Effect" (DTE) and the "Indirect Topographical Effect" (ITE), the two most significant topographical effects that have to be evaluated when a precise geoid is being compiled. In addition, we outline the evaluation and the impact of the results obtained, especially with regard to the differences in the geoid models when different elevation data are used, and point out the main limitations and possibilities for further improvements in the use of the aforementioned satellite and terrestrial data for regional and local geoid mapping in coastal and island regions.

Keywords: IFREMER, SRTM, terrain effects, free-air gravity anomalies, geoid modelling,Digital Bathymetry Models.