Case Study on Heterogeneous Geoid / Quasi-geoid Based on Space Borne and Terrestrial Data Combination with Special Consideration of GOCE Mission Data Impact

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The main purpose of this proposal is to perform a case study on geoid based on optimal combination of space-and- ground-based data . For this purpose, the space-borne long wavelength geoid solution coming from different satellite missions will be assessed with respect to ground data. Therefore one might say that this study also is concerned with satellite gravity models validation. Main accent here will be put on assessment of the available GOCE mission gravity models. For this purpose a suitable test area in China and in Finland will be selected and the GOCE models will be assessed in that area. As ground measurements we will use gravity anomalies on land and sea together with the deflections of the vertical, GPS/leveling data and the altimetry-based marine geoid. This is not a trivial task due to the data distribution, data accuracy as well as the fact that the GOCE models contain only limited information about the gravity field, mainly very long wavelength of about 100km. However in the ground data we have all wavelengths present. We will apply for this purpose the so-called Spectral Enhancement Method and will study also some low-pass filtering techniques in order to be able to compare GOCE with the properly filtered ground data (and vice versa). In the second phase of the project, estimation of the geoid/quasigeoid for part of China and Finland will be performed. We will use the well-known remove-restore technique where we reduce the long wavelength part in our observations from the GOCE model. This will give one geoid/quasigeoid solution based on the GOCE model(s). Thus computed geoids for continental and offshore China part as well as for Finland will be compared to available GPS/leveling points. This will give us insight on how well GOCE performs. We will use also for this purpose other long wavelength models and the results will be compared to that of GOCE. This will give also insight about how GOCE performs as compared to other satellite models. Also studies on improvement of the geoid/quasigeoid accuracy by combining GOCE with other long wavelength models will be performed and analyzed. This project will lead to PhD thesis of one person at the Finnish Geodetic Institute (FGI) funded by the FGI primary budget, and also couple PhD thesis in China funded by the CASM budget. Both students will be supervised by Dr. Kirco Arsov and Prof. Wen Hanjiang.

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融合GOCE重力场模型以及多种空间和地面观测数据的局部大地水准面/似大地水准面精化研究

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此项目的主要目的是开展基于空间和地面多种观测数据最佳融合的大地水准面精化研究。将根据地面观测数据对不同卫星重力观测获得的长波大地水准面精度进行评估，也可看作是对卫星重力场模型的检校，研究的重点在于评估GOCE重力卫星获取的地球重力场模型的精度。

研究的第一阶段将分别在中国和芬兰选取合适的测试区域，对GOCE地球重力场模型进行评估。用于重力场模型检核的数据主要包括陆地和海上的重力异常、垂线偏差、GPS/水准数据、以及卫星测高数据确定的海域大地水准面等。 这项研究工作具有一定的难度，主要是由于数据分布密度和数据精度的影响，由于GOCE模型只包含有限波段的重力场信息，而且GOCE卫星重力场模型的在波长为100km左右的长波上的精度较好。而地面数据包含全波段信息，需要首先使用频谱增强方法以及低通滤波等技术进行处理，然后比较GOCE数据和经过最佳滤波的地面数据。

研究的第二阶段将计算中国和芬兰试验区的大地水准面/似大地水准面。将使用移去-恢复技术，利用GOCE模型移去观测数据的长波部分，进而形成基于GOCE模型来建立大地水准面/似大地水准面的方法。计算出试验区大陆和近海地区的大地水准面后，与已有GPS/水准点进行比较，从而评估GOCE模型的精度。此外，在计算大地水准面时还将采用其他的重力场模型，并与GOCE模型得出的结果进行比较分析，了解GOCE模型和其他重力场模型的差异，并通过融合GOCE模型和其他重力场模型，提高大地水准面/似大地水准面的精度。

通过本项目的研究，芬兰大地测量研究所（FGI）和中国测绘科学研究院（CASM）将由Kirco Arsov博士和文汉江博士分别指导博士生一名。