International Service for the Geoid (ISG)

http://www.isgeoid.polimi.it

President: Riccardo Barzaghi (Italy, 2011-2013) - Mirko Reguzzoni (Italy, 2014-2015)
Director: Riccardo Barzaghi (Italy, 2011-2013) - Giovanna Sona (Italy, 2014-2015)

Overview

The International Geoid Service (IGeS) formally changed the name to International Service for the Geoid (ISG) on April 26th, 2014, during the IAG Executive Committee in Vienna. The service governance was changed too, nominating Mirko Reguzzoni as president and Giovanna Sona as director of the service.

In the period 2011-2015, the main scientific activities of ISG have been related to the following research lines:
- methods for merging local geoid estimates;
- methods for defining a global/regional unified height datum;
- GOCE data processing and merging with existing global gravity models;
- support to research centres and national institutions on geoid estimation;
- organization of schools on geoid and height datum estimation;
- ISG web site update and Newton's Bulletin publications.

High accuracy and reliable satellite-only global geopotential models can be used both to merge local geoid solutions and to properly define a unified global height datum. This second issue is particularly relevant and is one of the GGOS themes (i.e. Theme 1: Unified Height System). Both problems are strictly related to the ISG mission that is focussed on local/regional geoid estimation and evaluation.

The new methodologies that have been developed for merging local geoids and for defining a global/regional height datum are based on GOCE global geopotential models and in particular on the space-wise solutions which are computed with the support of ISG.

The procedure for merging geoids assumes that a bias (or more generally a systematic effect) exists between local estimates due to inconsistencies in defining the local height datum. It can be proved that this bias can be estimated and removed by comparing the local solutions with the GOCE derived model, since a satellite-only model is not affected by these height datum biases. The devised method for global/regional height datum unification relies on GOCE geopotential models too. Numerical tests have been performed on both methodologies with positive results. In the same line of research, a procedure to merge GOCE and EGM2008 global geoid models has been studied too.

Furthermore, the support activity on geoid computation continued. ISG has cooperated with the Centre for Geodesy and Geodynamics of Nigeria. Four researchers of this Centre were hosted at ISG in 2011 for two weeks. They attended a dedicated training course on geoid estimation theory and geoid estimation software. Similar training courses will be organized in the next months for researchers from Peru, Cameroun, Nigeria and Algeria. A delegation from the Republic Geodetic Authority of Serbia visited ISG in 2015 for three days in the framework of an EU Commission Programme. ISG also supported the computation of the geoid in the

San Paolo State in Brazil by hosting for one year (September 2011 to August 2012) a USP PhD student. ISG is currently involved in the computation of a geoid in the Jeddah area, Saudi Arabia, and it is supporting, together with BGI, the IGFS proposal for the computation of a new high resolution geoid model for the Mediterranean Sea (GEOMED-2 project). Moreover the computation of the new version of the Italian geoid has started in 2015.

An ISG school devoted to geoid estimation and height datum definition was organized during 2012 and held in October 7th-11th, 2013 at the Universidad Tecnica Particular de Loja in Loja, Ecuador. Contacts are now ongoing to organize a new geoid school in 2016.

ISG website has been totally renewed, updating information and improving the local geoid database by adding new models and by providing bibliographic references for any of the available models. Finally ISG is supporting the publication of a special issue of Newton's Bulletin 5 dedicated on the assessment of GOCE geopotential models.

Activities

1. A method for merging local geoid estimates

Local geoids estimated in neighbouring countries often display inconsistencies that can be mainly described by biases between local solutions. Sometimes, it is required to define a unique solution merging two different geoid estimates, thus removing the local biases. This can be properly done by using satellite-only models that are not perturbed by local datum effects entering in the local geoid estimates. A two-step procedure has been devised based on a GOCE geopotential model, assuming that the residuals in geoid after removing the GOCE model can be expressed as

$$N_{res} = N - N_L = b + N_H + e_{GOCE} + \nu$$

where b is the bias related to the local solution, N_L is the low frequency geoid component (the one that is assumed to be described by the GOCE model), N_H is the high frequency geoid component, e_{GOCE} is the GOCE model error and ν is the noise implied by the local geoid estimate. In the first step, by least squares adjustment, one can get the bias estimate as

$$b = \left(D^T Q^{-1} D\right)^{-1} D^T Q^{-1} N_{res}$$

with D the design matrix and

$$Q = C_{N_H} + C_{e_{GOCE}} + C_\nu \ .$$

This bias is then removed from N, thus obtaining an unbiased geoid, i.e.

$$N'_{res} = N - N_L - b \ .$$

This is done for the two geoid estimates to be merged. Then the two unbiased residual estimates can be combined via a standard collocation procedure to get a common geoid over the computation area. The final merged solution is then obtained by adding back the N_L component implied by the GOCE model. This procedure has been tested by merging the Swiss and the Italian geoids. In Figure 1 a North-South section is plotted: the effectiveness of the procedure is clearly visible.

This method has been described in the paper "A least-squares collocation procedure to merge local geoids with the aid of satellite-only gravity models: the Italian/Swiss geoids case study", by Gilardoni, Reguzzoni and Sampietro, which has been published on Bollettino di Geofisica Teorica ed Applicata,Vol. 54, n. 4, in 2013.

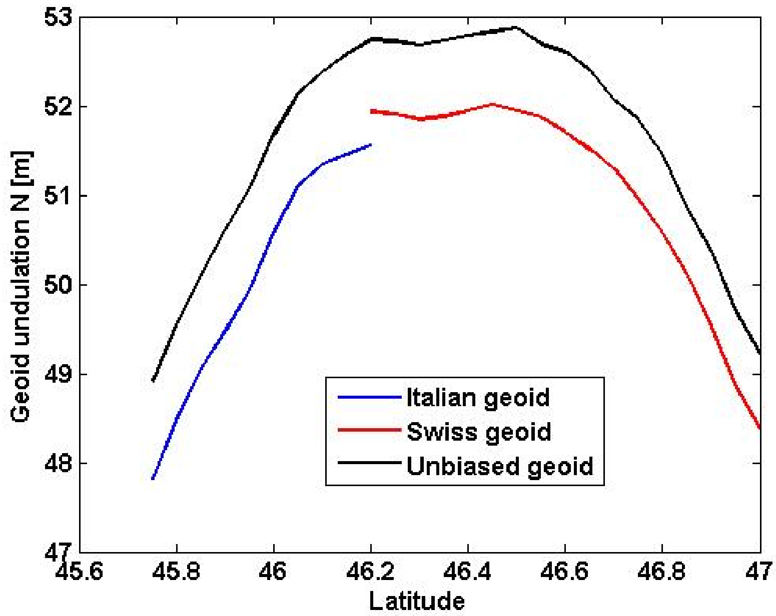

Figure 1: Merging the Italian and the Swiss geoid

The procedure has been generalized by considering not only a bias between two local geoids, but also a systematic effect due to a different reference ellipsoid. Furthermore, more than two regional geoids can be now merged together. This strategy has been tested for merging the geoid models of Spain, Portugal, France, Italy, Switzerland and part of the Mediterranean Sea. This study has been described in the paper "Using GOCE to straighten and sew European local geoids: preliminary study and first results" by Gilardoni, Reguzzoni and Sampietro, which has been published on IAG Symposia Series, Vol. 141, in 2014.

2. A method for global and local height datum estimation

The height datum problem has been revised in terms of the scalar Molodensky approach. It has been assumed that different height systems refer to their own benchmarks. So, the Earth surface can be patched into domains having different reference height systems. For each patch, a bias in the gravity potential is assumed, so that it holds

$$W(P_0^j) = W_0^j = W_0 + \delta W^j = U_0 + \delta W^j$$

where the patch S^j is referred to the benchmark point P_0^j. By developing this equation, one can get

$$\bar{\zeta}^j = -\frac{\delta W^j}{\gamma} = \tilde{\zeta}(P_l^j) - \frac{T(P_l^j)}{\gamma} = \tilde{\zeta}(P_l^j) - \frac{T_L(P_l^j)}{\gamma} - \frac{T_H(P_l^j)}{\gamma} \qquad l = 1,..., M \qquad j = 1,..., J$$

In this equation, the height anomaly biases $\bar{\zeta}^{j}$ of the different patches can be estimated using the observed (biased) height anomalies (P_l^j Earth surface point, $\tilde{P}_l^j$ point on the biased telluroids)

$$\tilde{\zeta}(P_l^j) = h(P_l^j) - h(\tilde{P}_l^j) \qquad l = 1,\ldots,M$$

and the anomalous potential estimate

$$T(P) = T_L(P) + T_H(P) = \sum_{n=2}^{200} \sum_{m=-n}^{n} T_{nm} Y_{nm}(P) + \sum_{n=201}^{+\infty} \sum_{m=-n}^{n} T_{nm} Y_{nm}(P) \ .$$

Here the T_L component (the low frequency part) is given by the unbiased GOCE-only model, while the T_L component (the high frequency part) is assumed to be accounted for by the EGM2008 model up to *n=2190* (indeed this component is biased by the height datum but it can be proved that the induced error is of few millimetres).

Using this approach, an error budget has been performed. The Earth surface has been divided into 158 patches and a data distribution has been assumed in order to have at least one point per patch. Furthermore, different precisions for ellipsoidal and normal heights have been considered on the different patches. Assuming to estimate the δW^j by least squares, their standard deviation can be obtained. In Figure 2, the bias standard deviations are plotted.

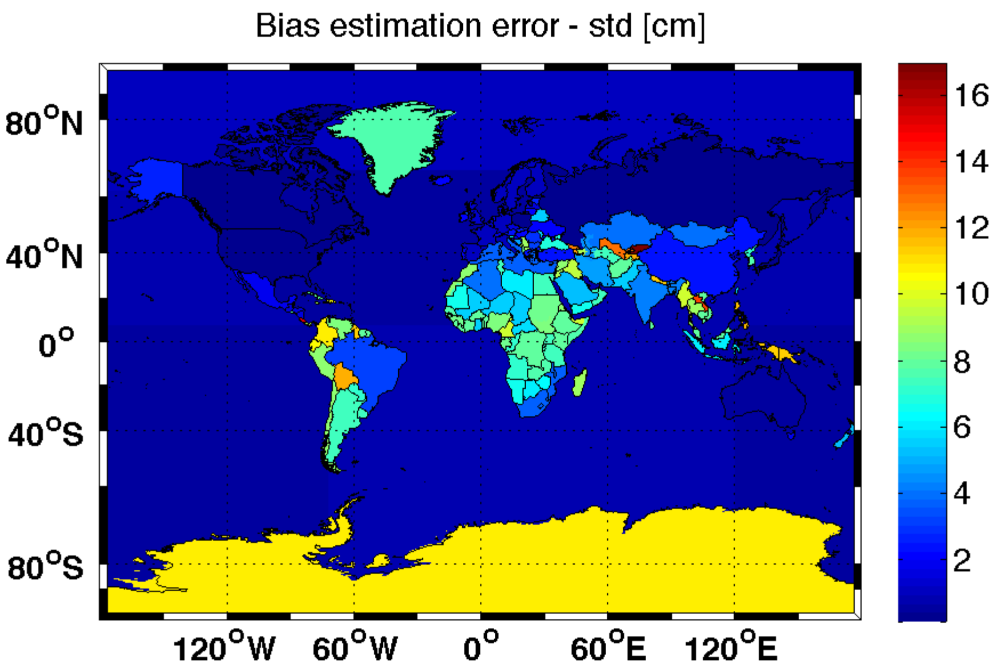

Figure 2: The δW^j standard deviations

The standard deviation values range from 1-2 cm up to 15 cm in limited areas of the Earth. This procedure seems to be feasible and, therefore, it has been initially applied to local areas, such as Italy to estimate a unified height system among mainland and Sicily and Sardinia islands, and it will be applied in the next future on EUVN data to estimate a unified European height system.

The theoretical base of the method has been described in the paper “The height datum problem and the role of satellite gravity models” by Gatti, Reguzzoni and Venuti, which has been published on Journal of Geodesy, Vol. 87, n. 1, in 2013. The simulation has been presented at EGU in Vienna in 2012 with a presentation entitled “A solution to the global height datum problem based on satellite derived global models and the corresponding error budget” by Barzaghi, Gatti, Reguzzoni and Venuti. Finally the application to the Italian case has been described in the paper “A feasibility study on the unification of the Italian height systems using GNSS-leveling data and global satellite gravity models” by Barzaghi, Carrion, Reguzzoni and Venuti, which will be published on IAG Symposia Series, Vol. 143.

3. GOCE data processing and a method to merge GOCE-only and EGM2008 models

Since the launch of the GOCE satellite (March 17th, 2009), ISG has been actively involved in estimating a global geopotential model based on GOCE data by supporting the implementation of the space-wise approach. Recently the space-wise processing scheme has been revised to produce global grids of gravity gradients at satellite altitude instead of spherical harmonic coefficients as the main product. Both SST and SGG GOCE data are used into the solution. The core of the processing scheme consists of:

- data filtering along the orbit by a successive application of a Wiener filter and a whitening filter with the aim of reducing noise variance and correlation.
- data gridding by collocation after subdividing data into local geographical patches.

From the estimated grids, spherical harmonic coefficients can be easily derived by numerical integration and by applying a global regularization. The error description of all products is based on Monte Carlo simulations.

The space-wise approach has been initially tested on a dataset based on a limited time span (from November 2009 to June 2010 corresponding to GOCE release 2 spherical harmonic global models). The method has been then applied to the full data set at nominal satellite altitude (corresponding to GOCE release 4 global models). A new solution, also including data of the GOCE altitude lowering phase (corresponding to GOCE release 5 global models) is currently under computation. Release 4 space-wise global grids and spherical harmonic coefficients have been presented at the 5th International GOCE User Workshop in Paris in 2014, with a presentation entitled “Space-wise grids of gravity gradients from GOCE data at nominal satellite altitude” by Gatti, Reguzzoni, Migliaccio and Sansò. A comparison among release 4 space-wise grids and other solutions has been presented at EGU in Vienna in 2015, with a poster entitled “Comparison of the GOCE space-wise grids and other GOCE solutions” by Gatti and Reguzzoni.

Apart from processing GOCE data, a method to merge the satellite-only GOCE global model with the ultra-high resolution EGM2008 global model has been also studied and implemented.

Particular attention has been paid to the EGM2008 error modelling into the combination. EGM2008 is in fact delivered with two, not fully consistent, sources of information on its error: spherical harmonic coefficient variances and a geographical map of error variances, e.g. in terms of geoid undulation.

A GOCE-only global gravity model can be used to improve EGM2008 in the low-medium frequencies, especially in areas where no data were available at the time of EGM2008 computation. The easiest way to combine a GOCE-only model with EGM2008 is to set up a least-squares adjustment considering the spherical harmonic coefficients of the two global gravity models

$$\underline{T}_{GECO-CC} = \left[\Sigma_E^{-1} + \Sigma_G^{-1}\right]^{-1}\left[\Sigma_E^{-1} \cdot \underline{T}_E + \Sigma_G^{-1} \cdot \underline{T}_G\right]$$

where $\underline{T}_{GECO-CC}$ is the spherical harmonic coefficient vector of the combined model, called GECO-CC (GOCE and EGM2008 combination using Coefficient Covariances), Σ_E is the diagonal covariance matrix of EGM2008, Σ_G is the block-diagonal covariance matrix of the GOCE-only model, $\underline{T}_E$ and $\underline{T}_G$ are the spherical harmonic coefficient vector of EGM2008 and of the GOCE-only model respectively (see Figure 3).

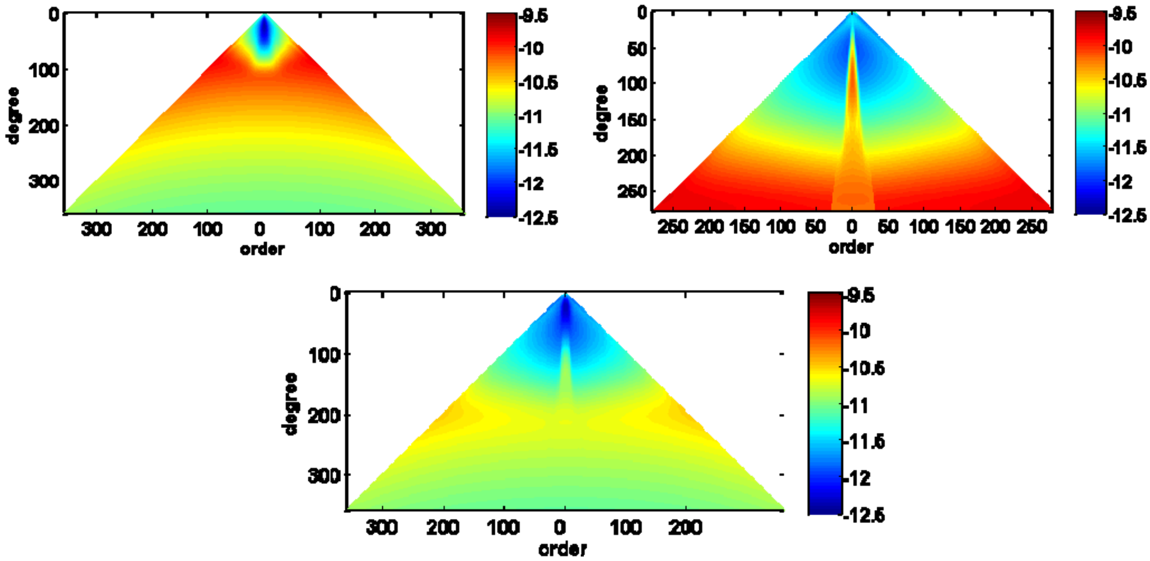

Figure 3. EGM2008 error coefficient standard deviation, GRACE contribution below degree 100 (upper-left). GOCE-only coefficient error standard deviation, polar gaps effect at low order (upper-right). GECO-CC coefficient error standard deviation, GOCE correction to EGM2008 up to about degree 200 (lower-center). All plots are in log10 scale.

A more refined way to combine GOCE and EGM2008 is to improve the EGM2008 error modelling by adding local information given by the freely available EGM2008 geographic map of error variances in terms of geoid undulations. In this locally adapted optimal combination, called GECO, the full error covariance matrix of the GOCE spherical harmonic coefficients is approximated by an order-wise block-diagonal matrix (as in GECO-CC), while for EGM2008, the error spatial correlations are taken from spherical harmonic coefficients while the point-wise error variances are taken from the provided geoid error map:

$$L_E^{NN} = S_E \cdot \left(D_E\right)^{-1} \cdot C_E^{NN} \cdot D_E^{-1} \cdot S_E$$

where L_E^{NN} is the localized covariance of $\underline{T}_E$, S_E is a diagonal matrix such that the elements of its diagonal are just the standard deviations of the geoid error map, D_E is a diagonal matrix containing the square root of the values of the main diagonal of C_E^{NN}, where C_E^{NN} is the covariance matrix obtained propagating the error coefficient variances to the geoid.

Due to computational limits, the combination is performed in terms of geoid undulation values over a regular grid on local areas. Repeating the combination for overlapping areas all over the world and then performing a harmonic analysis, the spherical harmonic coefficients of the new model are obtained. To be precise the combination is done till maximum degree 359 corresponding to 0.5° x 0.5° resolution and then the model is extended till degree 2159 using EGM2008.

The theoretical base of the combination is described in the paper “Combining EGM2008 with GOCE gravity models” by Gilardoni, Reguzzoni, Sampietro and Sansò, which has been published on Bollettino di Geofisica Teorica ed Applicata, Vol. 54, n. 4, in 2013. The practical application of the combination to produce a new global model has been described in the paper: ‘‘GECO: a global gravity model by locally combining GOCE data and EGM2008’’ by Gilardoni, Reguzzoni and Sampietro, which has been submitted to Studia Geophysica et Geodaetica in 2015.

4. The support to researches and activities on geoid estimation

In spring 2011, from May 30th to June 14th, four researchers of the Centre of Geodesy and Geodynamics (National Space Resource and Development Agency, Nigeria) attended at ISG a Special Course on Determination and Use of the Geoid. Every day, there were lectures for two or three hours. The rest of the day was devoted to individual learning with tutoring and to practice on geoid computation software using the computer facilities at ISG. The detailed program is listed below:

- May 30th — Basic concepts in geodesy and geoid computation
- May 31st — Study of Lecture Notes with tutoring
- June 1st — Global Models
- June 6th, morning: — Terrain effect in geoid computation
- June 6th, afternoon: — Residual Terrain Correction
- June 7th — Practical examples on Terrain Effect computation
- June 8th, morning: — The core solution: theory of Collocation
- June 8th, afternoon: — The core solution: Stokes and FFT
- June 9th — Practical examples on core solution computation
- June 10th — Local geoid computation: review of all the steps
- June 13th — Comparison of residual undulation computation methods
- June 14th — Practical examples on geoid computation

The aim of this special course was, as requested from the researchers of the Centre of Geodesy and Geodynamics, to have an intensive training on geoid estimation allowing them to have the basic notions for estimating their own national geoid based on the available data in Nigeria. After this course, contacts between them and ISG have been maintained.

In 2012, one PhD student from USP, San Paulo, Brazil, was hosted at ISG in the framework of a cooperation between the two Institutions. He was involved in a project aiming at estimating the geoid in the San Paulo State. During his stay at ISG, he was trained in geoid estimation procedure based on collocation and the “remove-restore” method. In order to estimate the RTC effect, a detailed DTM/bathymetry model was set up. This has been accomplished by merging the SRTM DTM with the available NOAA bathymetry of the Atlantic Ocean in the computation area. A check for possible outliers both in the gravity and in the GPS/levelling databases to be used in the geoid estimation process was also performed.

Different global geopotential models (including those based on GOCE data) were tested to check for their impact on the estimate. The final geoid estimate based on collocation has been then compared to GPS/levelling data and previous geoid computations obtained with different methods (i.e. Helmert-Stokes). The collocation estimated geoid proved to be equivalent to the existing ones and close to the GPS/levelling independent data. Statistics related to this comparison are detailed in Table 1.

Table 1: San Paulo geoid statistics. Residuals between geoid estimates and GPS/levelling (363 points)

Geoid Model	E(m)	R.m.s. (m)	Max. (m)	Min. (m)
FFT(EGM2008-360)	0.13	0.23	0.58	-0.41
LSC(EGM2008-360)	0.16	0.25	0.72	-0.47
FFT(GOCE-DIR_R3)	0.11	0.21	0.49	-0.44
LSC(GOCE-DIR_R3)	0.09	0.20	0.56	-0.50
FFT(GOCE-TIM_R3)	0.11	0.22	0.51	-0.43
LSC(GOCE-TIM_R3)	0.09	0.20	0.58	-0.47
FFT(GOCO03S)	0.12	0.22	0.51	-0.43
LSC(GOCO03S)	0.09	0.20	0.54	-0.47
FFT(EIGEN-6C)	0.11	0.22	0.51	-0.45
LSC(EIGEN-6C)	0.09	0.20	0.51	-0.49

The geoid estimate based on Least Squares Collocation is displayed in Figure 4.

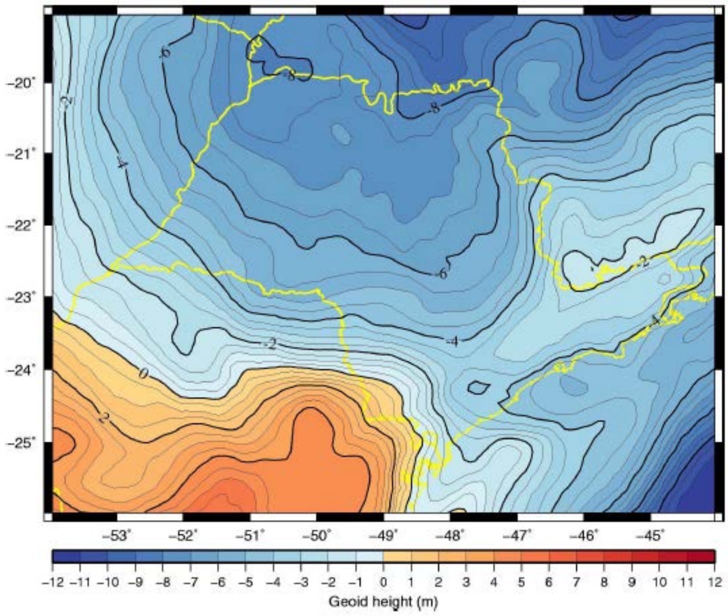

Figure 4: San Paulo geoid estimate using LSC

The student got a joint PhD between USP and Politecnico di Milano, discussing a PhD thesis entitled "A geoid model in the State of Sao Paulo: An attempt for the evaluation of different methodologies" (Brazilian tutor Prof. Denizar Blitzkow, Italian tutor Prof. Riccardo Barzaghi). In spring 2015, from April 22nd to April 24th, three officers of the Republic Geodetic Authority of Serbia visited ISG in the framework of the TAIEX (Technical Assistance and

Information Exchange) programme supported by the European Commission. The aim of this study visit was to present the activities performed by ISG on local and global geoid computation and on the use of the computed geoid. The study visit agenda was the following:

- April 22nd, morning: Local geoid computation by using remove-restore technique
- April 22nd, afternoon: The use of DTMs for RTC computation
- April 23rd, morning: Global model computation from satellite missions
- April 23rd, afternoon: The importance of preprocessing and orthometric corrections in the geoid computation - the Italian case
- April 24th, morning: The use of geoid models for ocean circulation modelling
- April 24th, afternoon: Presentation of the ISG website and activities

In 2015, training activities are planned for supporting researchers coming from developing countries. In particular, a Special Course on Determination and Use of the Geoid (similar to the one given in Spring 2011 to the Nigerian researchers) will be given to two researches of the Coodinacion Tecnica de Aerodromos and Coodinacion Tecnica de Navegacion Aerea (Peru) and from 13rd to 28th November, 2015 (date to be fixed) to three or four researchers of the Institut National de Cartographie (Cameroun). Furthermore study visits are foreseen for a researcher from the Nigerian College of Aviation Technology (from 8th to 12th June, 2015), for an Algerian researcher (from 1st to 30th September, 2015). Finally three officers of BGI will attend an advance training course on the software for geoid computation at ISG.

As for the projects dedicated to geoid estimation ISG has been involved in the computation of a high resolution geoid in the Jeddah area, Saudi Arabia, which is currently under evaluation process. ISG is also supporting, together with BGI, the IGFS proposal for the computation of a high resolution geoid of the Mediterranean Sea (GEOMED-2 project) submitted to ESA. Apart from the IGFS/BGI/ISG services, the proposal partners are:

- Politecnico di Milano (Italy)
- GET, OCA/Geoazur and SHOM (France)
- University of Thessaloniki (Greece)
- DTU Space (Denmark)
- General Command of Mapping (Turkey)
- University of Zagreb (Croatia)
- University of Jaén (Spain)

A two years project is planned to estimate the geoid and the DOT of the Mediterranean Sea.
In 2015 the computation of the new version of the Italian geoid has started. For this purpose, the Italian gravity database has been validated: the database has been formed by merging different sources on the sea and on the land, the data have been cross-checked to look for outliers. The database has also been purged from double points. The database improvement, in addition to a refinement in the collocation estimation of the residuals, led to a reduction of 2 cm in the standard deviation of the residuals of the gravimetric geoid with respect to the GPS/levelling (from 11 cm to 9 cm). A refinement of the adaptation of the gravimetric geoid to the GPS/levelling data is still ongoing.

In cooperation with the IGM (Istituto Geografico Militare) the impact of the orthometric correction to the Italian network levelling loops misclosure is being evaluated. It has been verified that the Italian geoid gravity database can be used to fill the existing gaps in the gravity measures corresponding to the levelling lines. This will allow to obtain orthometric, normal and dynamic heights for the Italian levelling network. The computation of the corrections is still ongoing. The feasibility of the method has been described in the paper "Orthometric correction and normal heights for Italian levelling network: a case study", by Barzaghi, Betti, Carrion, Gentile, Maseroli, Sacerdote, which has been published on Applied Geomatics, Vol. 6, in 2014. A further discussion about the correction equations can be found in the paper "The observation equation of spirit leveling in Molodensky's context" by Betti, Carrion, Sacerdote and Venuti, which will be published in IAG Symposia Series (Proceedings of the VIII Hotine Marussi Symnposium).

5. The organization of schools on geoid and height datum estimation

The XI International IGS School was held in Ecuador from 7th to 11th October, 2013, at the Universidad Tecnica Particular de Loja in Loja. The title of the school was "heights and datum height" and, differently from the previous ISG schools, it was not dedicated only to the standard methods on geoid computation, but also to new items on height systems. More specifically, the school program was the following:

Geodetic Heights (October 7th, 2015)

Definition of ellipsoidal, dynamical and orthometric heights and their observation equations; geoid and telluroid; the GBVP, reduction to the ellipsoid, mapping to the sphere, spherical harmonics.

The Global Gravitational Model EGM2008 (October 8th, 2015)

Creation of a Global Geopotential Model and in particular of EGM2008; computation of different functionals.

Modelling the topographic effect (October 9th, 2015)

Terrain Correction, Helmert reduction; from TC to Residual TC.

Local improvements of the geoid (October 9th, 2015)

Remove-Restore method; collocation; geoid computation using FFT.

Exercises (October 10th, 2015)

Exercises on the use of global geopotential models and on the computation of local geoid models.

Vertical Datum Standardization (October 11th, 2015)

Vertical datum establishment, standardization and unification: the South American case.

The total number of participant was 15. They come from Brazil, Colombia, Dominic Republic, Ecuador, Egypt, Greece, Mexico, United States of America and Venezuela. Students had some printed lectures notes, and the ISG CD-rom with software and data for exercises. At the end of the School, the Local Committee gave to the students also a CD-rom with all the lectures presented in the School, photos and Loja city video. Each student and professor received a Participation Certificate. The teachers of this school were F. Sansò, N. Pavlis, D. Blitzkow, R. Barzaghi and L. Sánchez.

A new ISG School is going to be held next year. There are many candidates to organize the school (e.g. Universities of the Dominican Republic, Mexico, Jordan, etc.); a final decision on the location will be taken in the next months. Furthermore, different formats will be studied and proposed in order to have schools on a broader set of possible topics in physical geodesy.

6. The new ISG website and Newton's Bulletin publications

During 2012, the ISG website has been completely revised and improved. The geoid repository has been enriched with new local solutions, namely the Switzerland, the French, the new European EGG2008 and the US geoids. In the last two years, the number of available geoid models has been further increased, e.g. adding the Ukrainian and the Hungarian geoids, see Figure 5, and two models in the Antarctica.

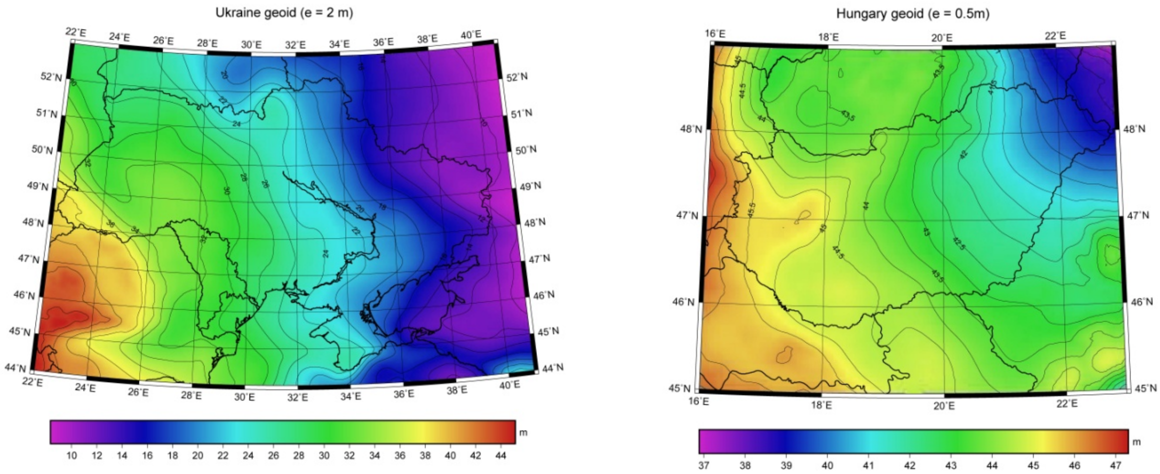

Figure 5: Ukrainian geoid (on the left) and Hungarian geoid (on the right).

A total number of 41 regional models in GRD format are currently stored in the repository and retrievable by users according to the defined distribution policy. Geoids can be freely downloaded if coded as public, available on demand in case the authors asked to be informed before made them available, private if the geoid owners decided not to distribute them. The geoid model to retrieve can be selected from a complete list of available geoids or by clicking on a geographical map. As for the global geoid models, a link to ICGEM is provided. A new regional model can be submitted to ISG via website (sending an email with proper information); in addition, email requests for acquiring new regional models are directly and quite frequently sent by ISG secretariat to the geoid authors/owners. Finally, at least a bibliographic reference for any regional model is now given.

As for the software section, a free and open source program for synthesizing different gravity field functional from ultra-high degree spherical harmonic models has been made available. This software is supported by the Italian Space Agency (ASI) through the GOCE-Italy project (rif. dr. tec-001-GOCEI-1.0).

As for the ISG publications, in the new website the IGeS Bulletins' archive has been made available. Any single issue can be downloaded directly from the webpage (note that IGeS Bulletin is not published anymore since 2003). Moreover, Newton's Bulletin issues are now available online. In this case, either the full issue or single papers (online first) can be downloaded by readers. The new ISG main webpage is shown in Figure 6.

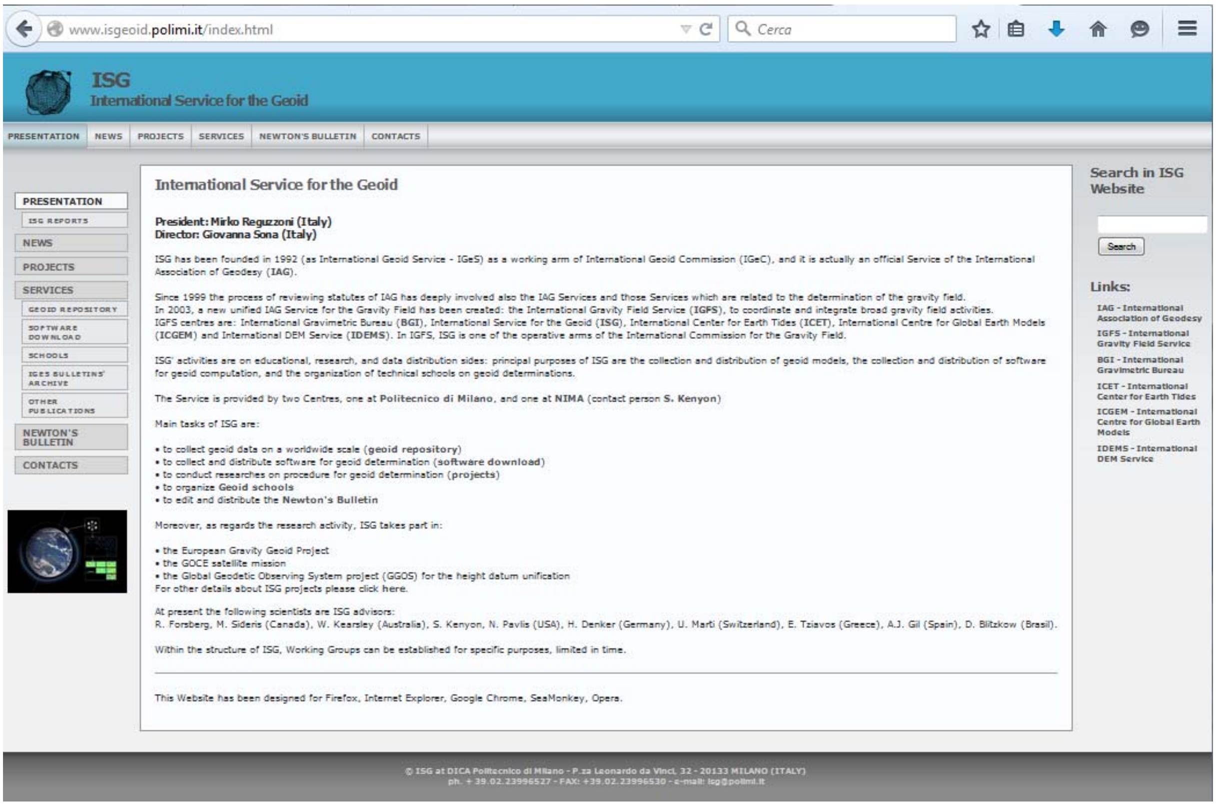

Figure 6: The new ISG webpage

In the last years two peer-reviewed papers have been accepted for publication on Newton's Bulletin and they are now published "online first". During a JWG2.3 splinter meeting in Shanghai, China, in the occasion of the last IGFS general assembly (June 30th - July 6th, 2014), it was decided to collect contributions for a special issue of Newton's Bulletin 5 dedicated on the assessment of GOCE geopotential models, and in particular HPF release R5 model (TIM05 and DIR05). Jianliang Huang is editor of this issue, supported by Mirko Reguzzoni and Thomas Gruber as associated editors. A total number of 13 submissions have been received. The plan is to complete the whole review process and published the accepted manuscripts for the IUGG2015 general assembly in Prague.