Publications and Presentations

There is an extensive list of publications and presentations that cannot be listed in this brief report. However, many of them can be found in the following web sites:

Special issue of *Journal of Geodetic Science* on Regional and Global Geoid-based Vertical Datums, Eds. Michael Sideris and Georgia Fotopoulos: http://www.degruyter.com/view/j/jogs. 2012.2.issue-4/issue-files/jogs.2012.2.issue-4.xml

ESA project final documents: http://www.goceplushsu.eu/gpweb/gc-cont.php?p=65

ESA project presentations/publications: http://www.goceplushsu.eu/gpweb/gc-cont.php?menu=16

Joint Working Group 0.1.1: Vertical Datum Standardisation (JWG 0.1.1)

supported by GGOS Focus Area 1, IAG Commission 1 (Reference Frames), IAG Commission 2 (Gravity Field) and the International Gravity Field Service (IGFS)

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J. Huang (Canada)
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Report of Activities

During the 2011 IUGG General Assembly, GGOS, the IAG Commissions 1 (Reference Frames) and 2 (Gravity Field) and the IGFS established a joint working group devoted to the Vertical Datum Standardization. This working group (called JWG 0.1.1) supports the activities of GGOS Focus Area 1 (formerly Theme 1) Unified Global Height System; in particular, to recommend a reliable geopotential value W_0 to be introduced as the conventional reference level for the realization of an International Height Reference System (IHRS). At present, the most commonly accepted W_0 value corresponds to the best estimate available in 1998 (see Petit and Luzum 2010, Table 1.1); however, this value presents discrepancies larger than 2 m^2s^{-2} with respect to recent computations based on the latest Earth's surface and gravity field models. In this context, the first activities faced by JWG 0.1.1 concentrated on (1) making an inventory about the published W_0 computations to identify methodologies, conventions, standards, and models presently applied (cf. Sánchez 2012) and (2) bringing together the different groups working on the determination of a global W_0 in order to coordinate these individual initiatives for a unified computation (cf. Sánchez et al. 2014).

Following aspects were analysed in the unified computation:

- Sensitivity of the W_0 estimation on the Earth's gravity field model
- Dependence of W_0 on the omission error of the global gravity model
- Influence of the time-dependent Earth's gravity field changes on W_0
- Sensitivity of the W_0 estimation on the mean sea surface model
- Influence of time-dependent sea surface changes on W_0
- Effects of the sea surface topography on the estimation of W_0
- Dependence of the W_0 empirical estimation on the tide system
- Weighted computation based on the accuracy of the input data to estimate the influence of the input data uncertainties on the W_0 estimation.

The different calculations carried out within the JWG 0.1.1 demonstrate that the 1998 W_0 value (62 636 856.0 ± 0.5 m^2s^{-2}) is not in agreement with the newest geodetic models describing geometry and physics of the Earth (see Table 4). The estimations without considering the accuracy of the input data suggest as a best estimate the value 62 636 854.0 m^2s^{-2} (see presentation at the IAG General Assembly 2013 in Potsdam, Germany). However, if weights based on the accuracy of the input data are considered, the W_0 estimation decreases about 0.3 m^2s^{-2} (Fig. 1). Since the computations are based on yearly mean sea surface models, the mean value for W_0 would refer to the mean epoch between 1992.9 and 2013.5 (i.e. 2003.2). However, it would be convenient to adopt a W_0 value valid for a more recent epoch, for example 2010.0. As reference level, the adopted W_0 has to be fixed (without time variations); but it has to have a clear relationship with the mean sea surface level (as this is the convention for the realization of the geoid). According to this, a suitable recommendation for the IHRS reference level is to introduce the potential value (rounded to one decimal) obtained for the year 2010 after fitting the weighted yearly W_0 estimations by means of a lineal regression: 62 636 853.4 m^2s^{-2}. At the time presenting this report (May 2015), two publications are in preparation: the first one describes in detail the computation strategy, conventions and models applied for the W_0 estimation; the second one concentrates on supporting the recommendation of the W_0 value as reference level for the IHRS, including a description about the procedure to realize this value at regional and local level.

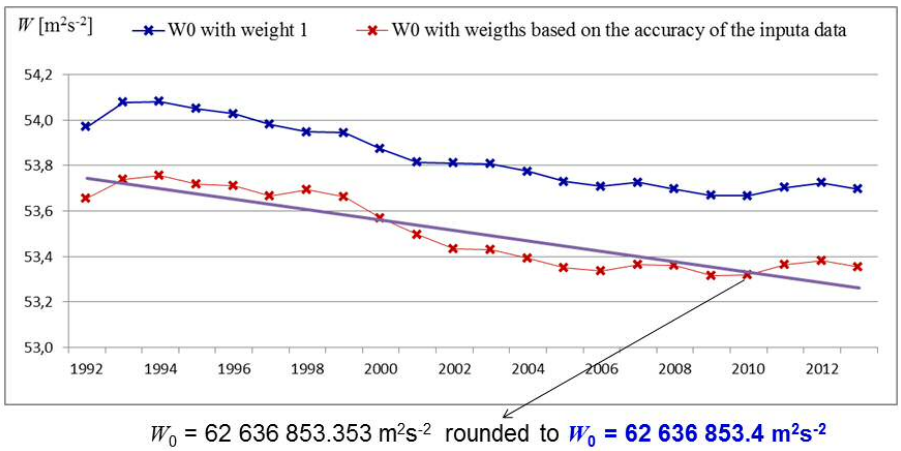

Fig. 1: Comparison of the W_0 estimation assuming the input data free of error and a weighed estimation including the inverse of the input data variances as weighting factor. The potential value (rounded to one decimal) obtained for the year 2010 after fitting the weighted yearly W_0 estimations by means of a lineal regression is a suitable recommendation to define the reference level of the International Height Reference System.

Table 4: W_0 estimations carried out by the members of the JWG 0.1.1 (taken from Sánchez et al. 2014, page 208)

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Table 1 Summary of the W_0 estimates delivered by the four groups working on the W_0 determination in the frame of the JWG 0.1.1

Group	MSS	Area	GOCO03S	EIGEN-6C	EGM2008
Prague	Jason 1	67°N/S	54.28	54.25	54.24
		60°N/S	53.75	53.73	53.96
Bratislava	DTU10	82°N/S	54.00	53.95	53.96
		67°N/S	53.53	53.49	53.49
	CLS11	82°N/S	54.30	54.26	54.26
		67°N/S	53.82	53.79	53.79
Latakia	DTU10	80°N/S	54.11	54.11	54.11
		70°N/S	53.91	53.92	53.92
		60°N/S	53.07	53.08	53.07
	CLS11	80°N/S	54.42	54.43	54.43
		70°N/S	54.23	54.24	54.23
		60°N/S	53.38	53.40	53.39
	DTU10 + ECCO2	70°N/S	53.94	53.95	53.95
		60°N/S	53.87	53.88	53.87
	CLS11 + ECCO2	70°N/S	54.26	54.27	54.26
		60°N/S	54.18	54.20	54.19
Munich	DTU10	82°N/S	54.02	53.98	53.97
		67°N/S	53.55	53.53	53.53
		60°N/S	53.11	53.12	53.12
	CLS11	82°N/S	54.31	54.29	54.30
		67°N/S	53.86	53.82	53.83
		60°N/S	53.44	53.41	53.40

The values are given in [$m^2\ s^{-2}$] and the constant 62,636,800 should be added. Applied methodologies are described in Burša et al. (1999), Čunderlik and Mikula (2009), Dayoub et al. (2012) and Sánchez (2009), respectively

Publications

Čunderlík R.: Determination of Wo from the GOCE Measurements Using the Method of Fundamental Solutions. In: International Association of Geodesy Symposia, forts on-line, doi: 10.1007/1345_2015_39, 2015

Čunderlik R., Minarechová Z., and Mikula K.: Realization of WHS Based on the Static Gravity Field Observed by GOCE. In: Marti U. (ed,), Gravity, Geoid and Height Systems. IAG Symposia Series 141: 211-220, doi: 10.1007/978-3-319-10837-7_27, 2014

Dayoub N., Edwards S.J. and Moore P.: The Gauss-Listing potential value Wo and its rate from altimetric mean sea level and GRACE, J Geod, 86(9): 681-694, doi: 10.1007/s00190-012-1547-6, 2012. Sánchez L.: Towards a vertical datum standardisation under the umbrella of Global Geodetic Observing System. Journal of Geodetic Science 2(4): 325-342, Versita, 10.2478/v10156-012-0002-x, 2012

Sánchez L., Dayoub N., Cunderlík R., Minarechová Z., Mikula K., Vatrt V., Vojtísková M., Síma Z.: W0 estimates in the frame of the GGOS Working Group on Vertical Datum Standardisation. In: Marti U. (Ed.) Gravity, Geoid and Height Systems (GGHS2012), IAG Symposia 141: 203-210, 10.1007/978-3-319-10837-7_26, 2014

Presentations

Sánchez L., Cunderlík R., Dayoub N., Mikula K., Minarechová Z., Síma Z., Vatrt V., Vojtísková M.: Towards a new best estimate for the conventional value of W0. 3rd International Gravity Field Service (IGFS) General Assembly, 2014-07-02

Sánchez L., Dayoub N., Cunderlík R., Mikula K., Minarechová Z., Sí-ma Z., Vatrt V., Vojtíšková M.: Conventional reference level for a global unified height system. IAG Scientific Assembly, Potsdam, Germany, 2013-09-01

Sánchez L.: Vertical datum standardisation: a fundamental step towards a global vertical reference system. AGU Meeting of the Americas, Cancun, Mexico, 2013-05-16

Sánchez L.: Report on the activities of the Working Group Vertical Datum Standardisation. GGHS 2012, Venice, Italy, 2012-10-09

Sánchez L.: Towards a Vertical Datum Standardisation. AOGS-AGU (WPGM) Joint Assembly, Singapore, 2012-08-14

Sánchez L.: Towards a vertical datum standardisation based on a joint analysis of TIGA, satellite altimetry and gravity field modelling products. IGS Workshop 2012, Olsztyn, Poland, 2012-07-23/27