

Report of the Joint Working Group 0.1.1: Vertical Datum Standardization (JWG 0.1.1)

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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 Theme 1 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. 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 $2 \text{ m}^2\text{s}^{-2}$ 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
- Rigorous error propagation analysis to estimate the influence of the input data uncertainties on the W_0 estimation.

The different computations carried out within the JWG 0.1.1 demonstrate that the 1998 W_0 value ($62\,636\,856.0 \pm 0.5 \text{ m}^2\text{s}^{-2}$) is not in agreement (and consequently it is not reproducible) with the newest geodetic models describing geometry and physics of the

Earth. This leads us to conclude that the 1998 W_0 value is not suitable as a conventional reference value and a better estimate for W_0 has to be adopted by the IAG. The recommended new value is 62 636 853.4 m²s⁻². Sánchez et al. 2016 describe in detail the computation strategy, conventions and models applied for this computation, and the procedure for the regional realization of this global reference level.

References

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