

Joint Working Group 0.1.1

Vertical Datum Standardisation

A common initiative of

GGOS Theme 1:
Global Height System

International Gravity
Field Service (IGFS)

IAG Commission 2:
Gravity Field

IAG Commission 1:
Reference Frames

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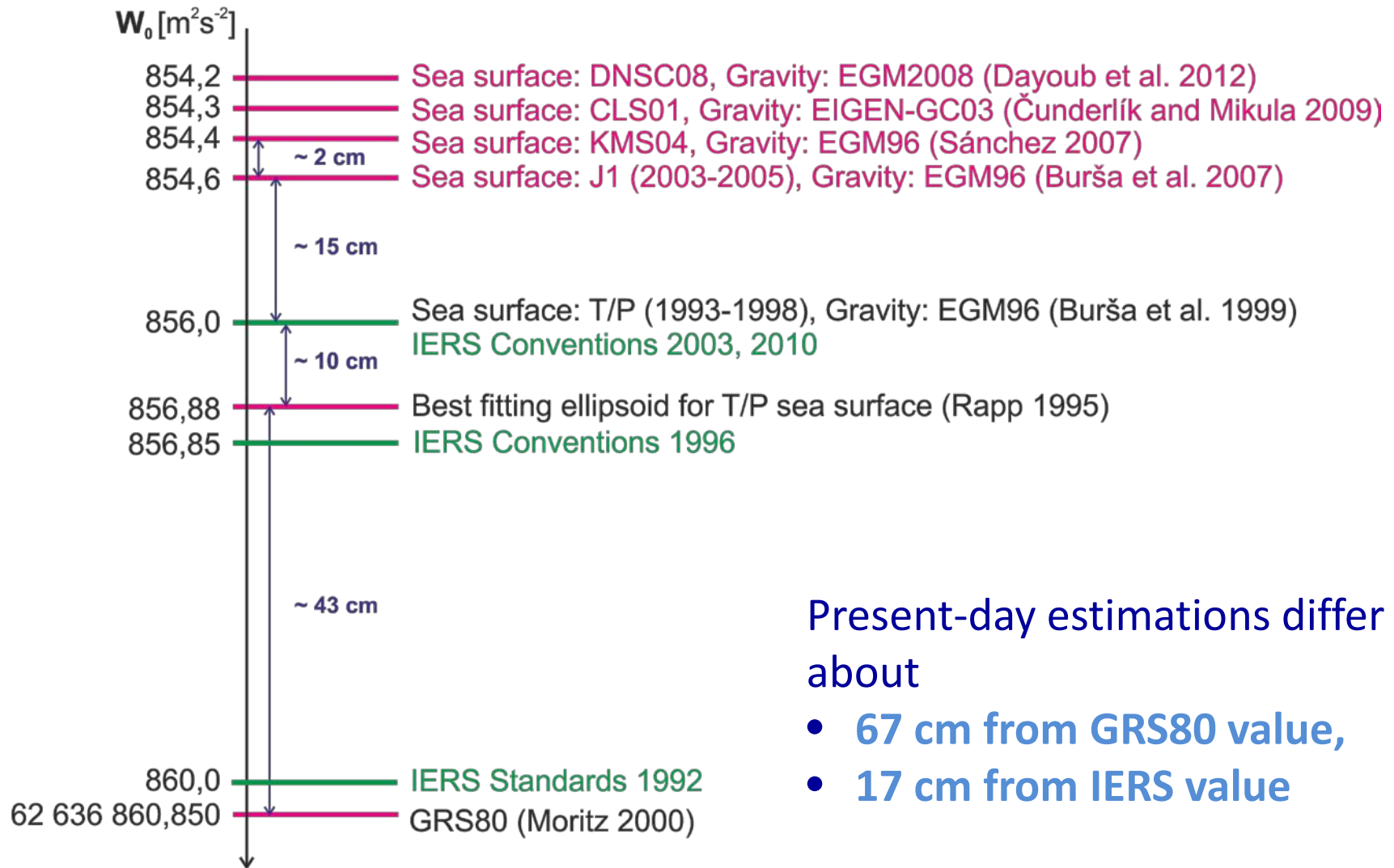
GGOS Theme 1: Short-term items (IAG Geodesist Handbook 2012)

01: Refinement of standards and conventions for the definition and realisation of a Global Unified Height System...

02: Divulcation and integration of the global height system standards and conventions within the IAG components (Commissions, Services, GGOS)...

03: Establishment of a global vertical reference level: to make a recommendation about the W_0 value to be adopted as the conventional reference level for the Unified Global Height System. This W_0 value must also be promoted as a defining parameter for the computation of an improved mean Earth ellipsoid and as a reference value for the computation of the constant L_G within the IERS conventions. **A formal recommendation about the W_0 value to be adopted within IAG is a responsibility of the GGOS Working Group on “Vertical Datum Standardisation”**, which is a joint initiative of GGOS Theme 1, IAG Commissions 1 and 2 and the International Gravity Field Service.

Some examples of W_0 values



Present-day estimations differ about

- 67 cm from GRS80 value,
- 17 cm from IERS value

Status

- At present, the most accepted W_0 value corresponds to the “best estimate” available in 2004. It is included in the IERS Conventions and was computed by Burša et al. (1999).

New estimations:

- Computations started in 2005 produce four very close W_0 values (differences of about $0,2 \text{ m}^2\text{s}^{-2}$): Burša et al. (2007), Čunderlik et al. (2008, 2009), Dayoub et al. (2010, 2012), Sánchez et al. (2005, 2007, 2008).

What to do?

- To keep the IERS value, although it differs about $\sim 2 \text{ m}^2\text{s}^{-2}$ from the recent estimations?
- To recommend a (new) “best present estimate” for W_0 ?

WG on Vertical Datum Standardization

Objectives

- To **bring together all teams working on the computation of W_0** to elaborate an inventory describing individual methodologies, conventions, standards, and models presently applied;
- To implement **a new W_0 computation** following individual (own) methodologies, but applying the same input geodetic models;
- To make a proposal for a **formal IAG/GGOS convention about W_0** supported by a document containing the detailed computation of the recommended value.
- To provide **a standard about the usage of W_0 in the vertical datum unification** describing an appropriate strategy to connect (unify, transform) any local height system with the global W_0 reference level.

Activities faced in 2011-2012

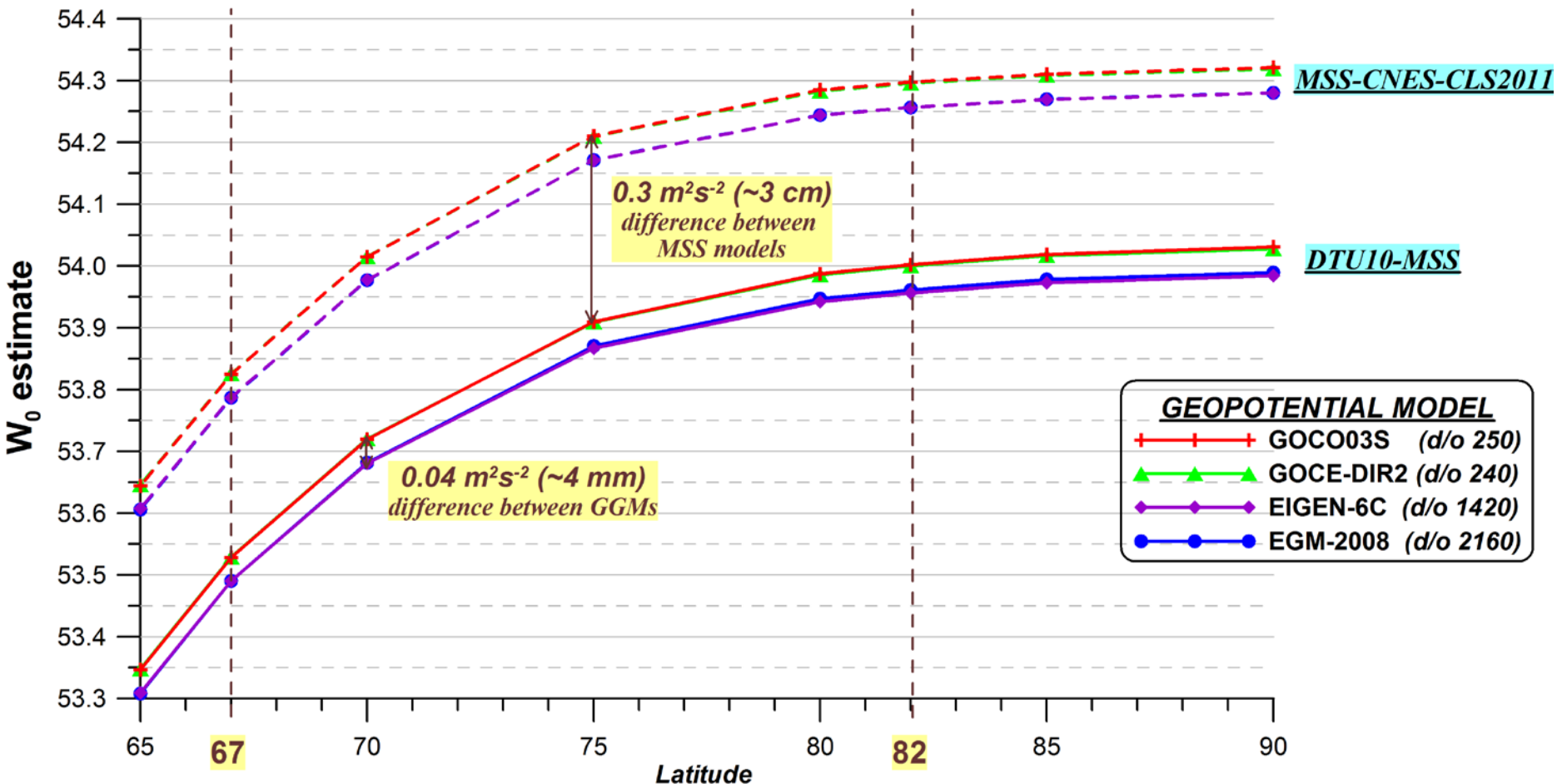
Different teams computed W_0 using the same input data, but their own methodologies:

Input data

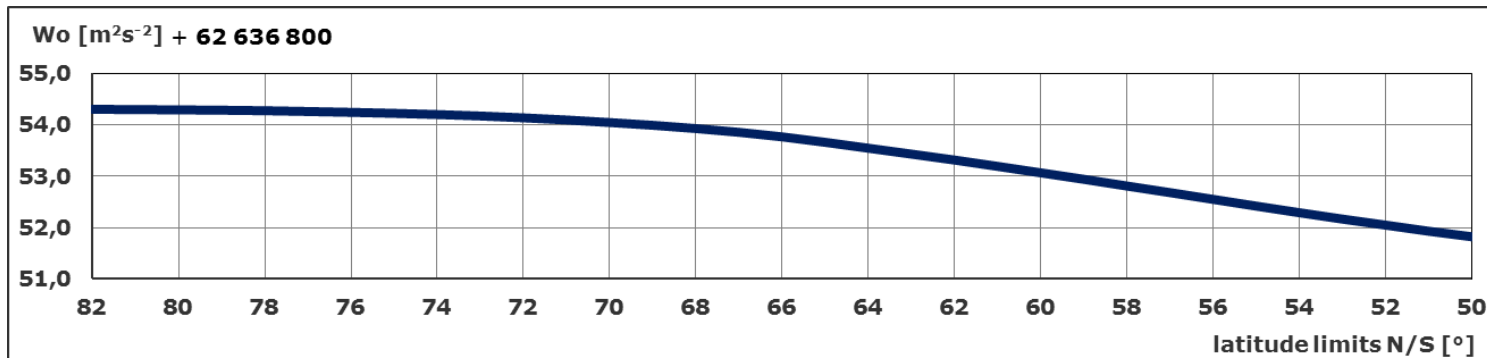
- mean sea surface models (MSS):
 - CLS11 (Schaeffer et al. 2012)
 - DTU10 (Andersen 2010)
- global gravity model (GGM)
 - EGM2008 (Pavlis et al, 2012)
 - EIGEN6C (Förste et al. 2011)
 - GOCO3S (Mayer-Gürr et al. 2012)

Analysis of

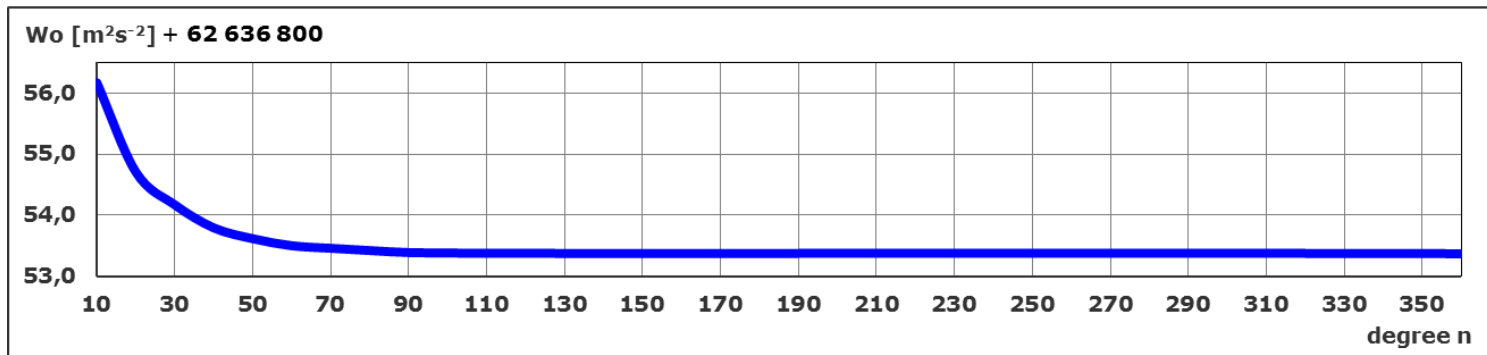
- W_0 -dependence on the MSS latitude coverage.
- W_0 -dependence on the retained degree n of the GGM.
- W_0 -dependence on the reference epoch of the MSS and GGM.



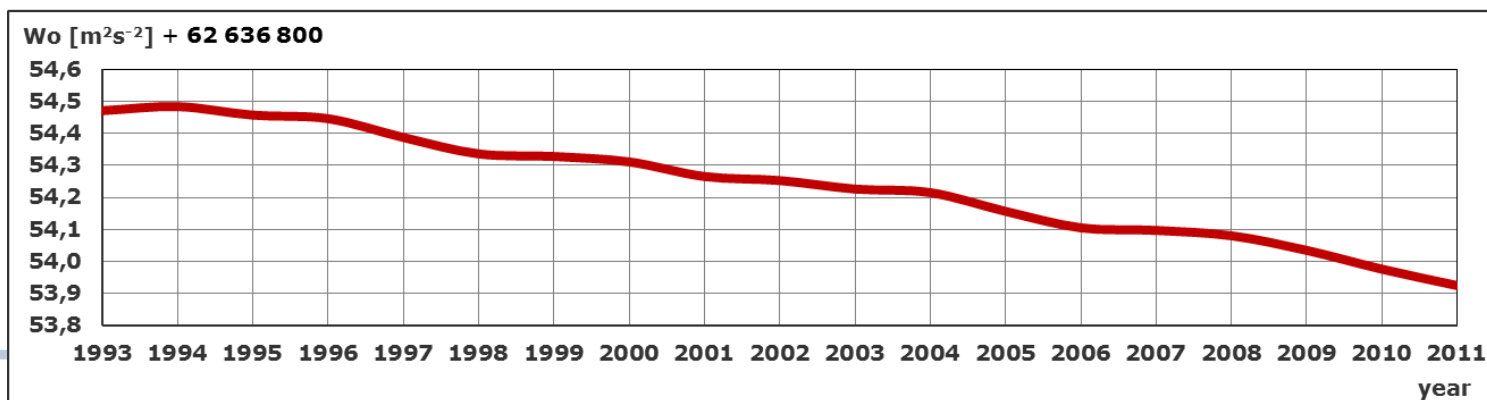
Estimates provided by R. Čunderlík, Z. Faskova, K. Mikula



W_0 -variation
with latitudinal
coverage.



W_0 -variation
with degree n of
the GGM.



W_0 -variation
with time.

- All the computations are delivering very close results (**around 62 636 854 m²s⁻²**), but there are still differences of about **0,5 m²s⁻²** (~ 5 cm). It is necessary to start defining the standards and conventions for a formal recommendation on W_0 .
- Activities to be faced in the close future:
 - Combination of a “geodetic” sea surface model and an “oceanographic” DOT-model to reproduce a sea surface closer to an equipotential surface (geoid);
 - Integration of polar regions on the Earth’s surface representation;
 - Differences between W_0 values obtained from a long-term mean sea surface model and yearly mean sea surface models;
 - A formal procedure for the error propagation analysis.

More details at <http://whs.dgfi.badw.de>