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GGOS Focus Area 1: Unified Height System, and JWG 0.1.2: Strategy for the Realization of the International Height Reference System (IHRF)

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Present Status and Progress

The objectives and planned activities of the GGOS-FA1 are described in the Geodesist's Handbook 2016 (Drewes, H., et al., 2016, J Geod 90(10): 1091, doi:10.1007/s00190-016-0948-z). The main goal at present is the implementation of the International Height Reference System (IHRF) defined by the IAG 2015 Resolution No. 1 (ibid. page 981); especially, the establishment of the International Height Reference Frame (IHRF). The corresponding activities are being conducted by the joint working group (JWG) *Strategy for the Realization of the IHRF*. It is supported by the International Gravity Field Service (IGFS), the IAG Commissions 1 and 2 (Reference Frames and Gravity field), the Inter-commission Committee on Theory (ICCT), the regional sub-commissions for reference frames and geoid modelling, and both GGOS Bureaus (Networks and Observations and Products and Standards). The progress is summarized as follows:

- During the GGOS Days 2016 (Boston (MA), USA, October 2016), a preliminary station selection for the IHRF was performed. This selection is based on a global network with worldwide distribution, including a core network (to ensure sustainability and long-term stability of the reference frame) and regional/national densifications (to provide local accessibility to the global frame).
- Based on this preliminary station selection, regional and national experts were asked
 - to evaluate whether the preliminary selected sites are suitable to be included in the IHRF (availability of gravity data or possibilities to survey them), and
 - to propose additional geodetic sites to improve the density and distribution of the IHRF stations in their regions/countries.
- After the feedback from the regional/national experts, the first approximation to the IHRF is based on about 170 reference stations (Fig. 1).
- A web site summarizing the main characteristics of the GGOS-FA “Unified Height System” has been prepared and is now available at <http://ihrs.dgfi.tum.de/>. This information is also mirrored at <http://www.ggos.org>.

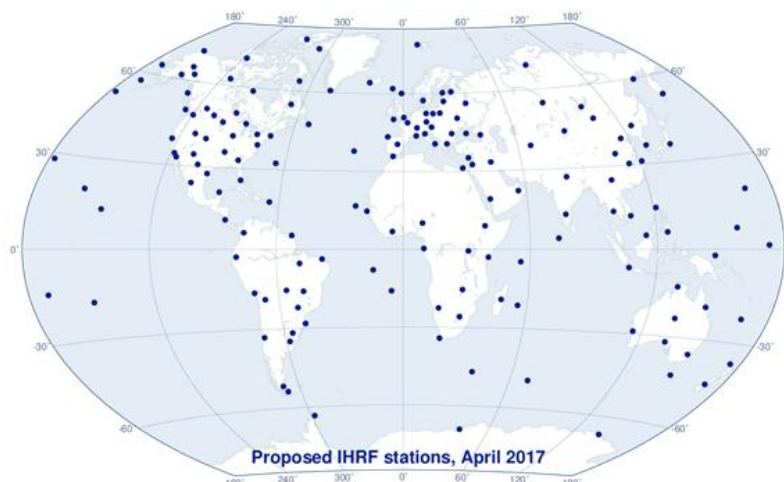


Fig. 1. Proposed IHRF stations as of April 2017.



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Ongoing activities and planned actions for 2018

- With the preliminary IHRF station selection, next efforts concentrate on the computation of the station potential values and the assessment of their accuracy. Different approaches are being evaluated:
 - As national/regional experts provided the JWG with terrestrial gravity data around some IHRF sites, a direct computation of potential values (and their accuracy) is being performed. In this case, following experiments are being conducted:
 - simulations about the distribution and quantity of gravity points needed around the IHRF stations,
 - simulations about the variation of potential values with time,
 - comparison of different mathematical formulations (least-squares collocation, FFT, radial basis functions, etc.).
 - Computation of potential values (and their accuracy) by national/regional experts responsible for the geoid modelling using their own data and.
 - Computation of potential values (and their accuracy) based on global gravity models of high-degree (like XGM2016, EIGEN-6C, EGM2008, etc.).
 - Recovering potential values from existing local quasi-geoid models.
 - This activity is strongly supported by:
 - IAG SC 2.2: Methodology for geoid and physical height systems (chair: Jonas Ågren)
 - ICCT JSG 0.15: Regional geoid/quasi-geoid modelling - Theoretical framework for the sub-centimetre accuracy (chair: Jianliang Huang)
 - JWG 2.2.2: The 1 cm geoid experiment (chair: Yan Ming Wang)
 - Jaakko Mäkinen – tide system issues for the IHRF
- The comparison of the results obtained from these different approaches will provide a basis to outline further steps; especially, the identification of detailed standards and conventions for the IHRS realization and the implementation of a roadmap based on the available geodetic data.