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An overview of SIRGAS activities towards the IHRF

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Since 2015, when the International Association of Geodesy (IAG) defined the International Height Reference System, the Geodetic Reference System for the Americas (SIRGAS) has been focusing efforts on this topic. This presentation has the purpose to show an overview of SIRGAS activities towards the IHRF, especially in Central and South America. In these regions, 19 stations distributed in 10 countries, have selected to compose the IHRF network (Fig. 1).

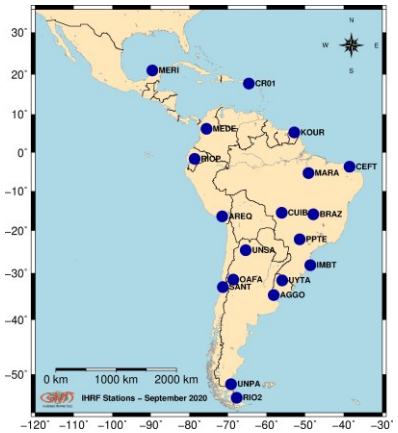


Fig. 1: IHRF stations in Central and South America.

A unified height system requires that the national leveling networks are based on geopotential numbers. Besides that, international leveling crossings, and leveling connections with IHRF stations are important tasks for the countries. For this reason, in the last years, some workshops have been conducted by SIRGAS (Bolivia 2014, Brazil 2015, Ecuador 2016, Costa Rica 2017 and Mexico 2018). As a result of these events associated with the national geographic institutes' efforts, 3 countries (Argentina, Brazil and Uruguay) adjusted their leveling network based on geopotential numbers and 3 countries (Ecuador, Colombia and Venezuela) are preparing their data to complete this task Furthermore, many international crossings have been carried out in recent years (Fig. 2).

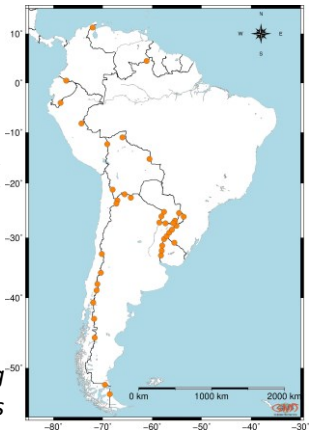


Fig. 2: Leveling international connections

To support the SIRGAS community, two technical guides have been developed and are under final revision: **Guidelines to select IHRF stations** and **Guide for Gravimetric Measurements around IHRF stations**. These documents also inform how to ensure the usability and long-term sustainability of the IHRF. The documents have been based on the recommendations and guidelines published by the "Unified Height System" focus area of the Global Geodetic Observing System (GGOS) and WG 0.1.2 "Strategy for the realization of the IHRS" (Ihde et al., 2017; Sánchez 2019; Sánchez & Barzaghi 2020; Sánchez et al., 2021). Besides that, a comparison in terms of normal heights, has been carried out from the following strategy:

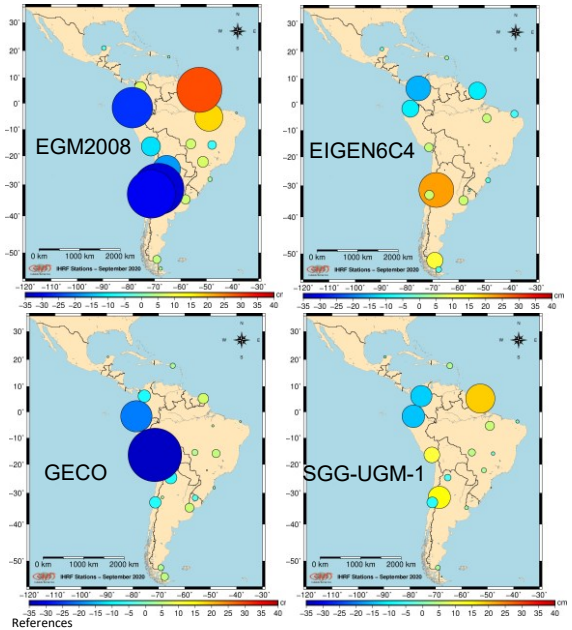
- Computation geopotential values $W_{(P)}$ at the IHRF stations using EGM2008, EIGEN6C4, GECO, SGG-UGM-1 and XGM2019 Global Geopotential Models (GGMs).
- Computation of geopotential numbers: $C_{(P)}=W_0 - W_{(P)}$,
- Transformation of the normal heights: $H^N_{(P)}=C_{(P)}/\gamma$.
- Comparison of the results with XGM2019 model (Table 1).

Table 1: Statistics involving GGMs (in centimeters)

	EGM2008	EIGEN6C4	GECO	SGGUGM-1
Mean	−2.33	0.24	-2.60	1.07
SD	±15.85	±8.56	±10.13	±8.22
Max neg	−32.98	−16.05	−34.45	−14.56
Max pos	28.97	22.44	6.66	18.78

Fig. 3 shows the normal height difference between XGM2019 and the value obtained with EGM2008, EIGEN6C4, GECO and SGG-UGM-1 GGMs. Most of the differences are located in the Andes region. New gravity measurements combined with topographic models can contribute to the GGMs precision. The discrepancies between normal heights inferred from GGMs make evident the necessity of improving the surface gravity data distribution and quality in order to increase the reliability of IHRF coordinates in the region. Our next step is to infer potential values from existing regional and local geoid/quasigeoid models, as it is expected that they include more terrestrial gravity data and more detailed topographical models than the GGMs.

Fig. 3: Normal heights differences (in centimeters)



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