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Impacts of physical heights adoption in Southern Brazilian Borders to Argentina and Uruguay

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Abstract 447

Introduction

Current values of Brazilian heights were obtained since 1993 from the so-called Preliminary Global Vertical Adjustment (AAGP, "*Ajustamento Altimétrico Global Preliminar*"), with only normal-orthometric correction (**Figure 1**).

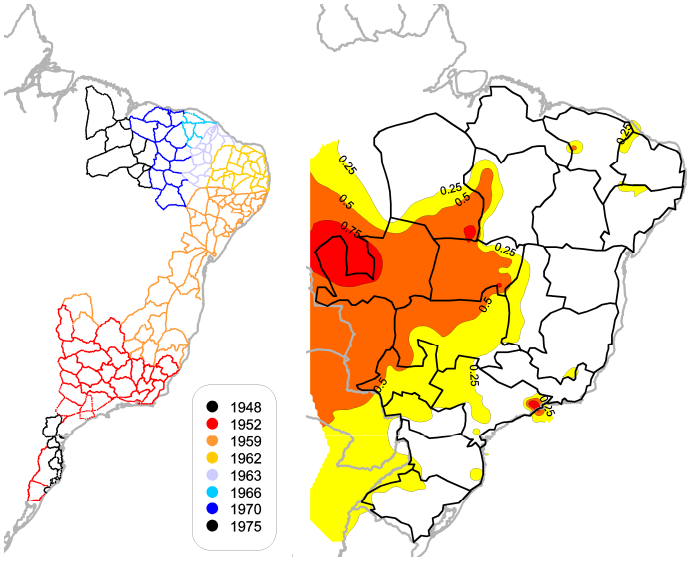

Figure 1 – RAAP's adjustments: "historical" (left) and AAGP, with the differences (meters) between both sets of heights (right)

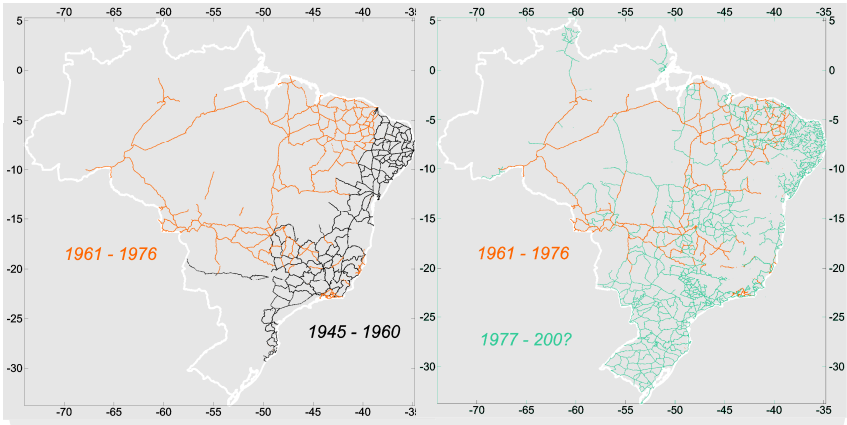

Figure 2 – Time evolution of RAAP, with the large gap between the beginning of leveling and the "filling" of southern Brazil

Previous Studies

Recent investigations have shown some distortions arising from the Brazilian Fundamental Vertical Network (RAAP, "*Rede Altimétrica de Alta Precisão*") partitioning strategy in AAGP and from the RAAP's temporal inhomogeneity around Imbituba Datum (**Figures 2 and 3**). Besides these network aspects, the lack of true gravity-related corrections was also dealt with. Gravity and leveling data from IBGE were analyzed from the point of view of the difficulties of their integration for the computation of their geopotential differences. Some scenarios of the lack of gravity over RAAP's benchmarks were simulated, assessing the quality of the interpolated values via least squares collocation (LSC) by the computer program PREDGRAV provided by SIRGAS Project. The simulations indicated an overestimation of the quality of interpolation by the program, especially in the more general cases of inadequate distribution of the reference values (LUZ, 2008). This paper presents the continuation of those studies, setting up a temporally homogeneous sub-network of the RAAP extending from Imbituba to the borders to Argentina and Uruguay (**Figure 4**).

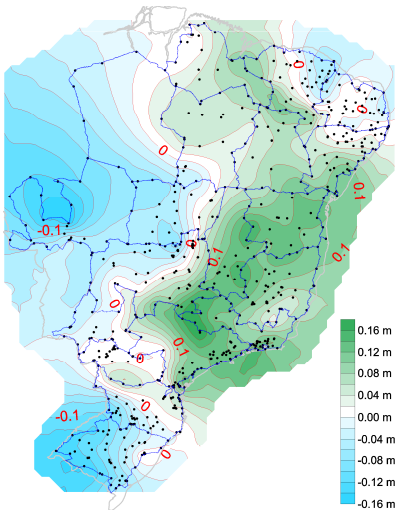

Figure 3 – Distortions of RAAP originated from AAGP's partitioning

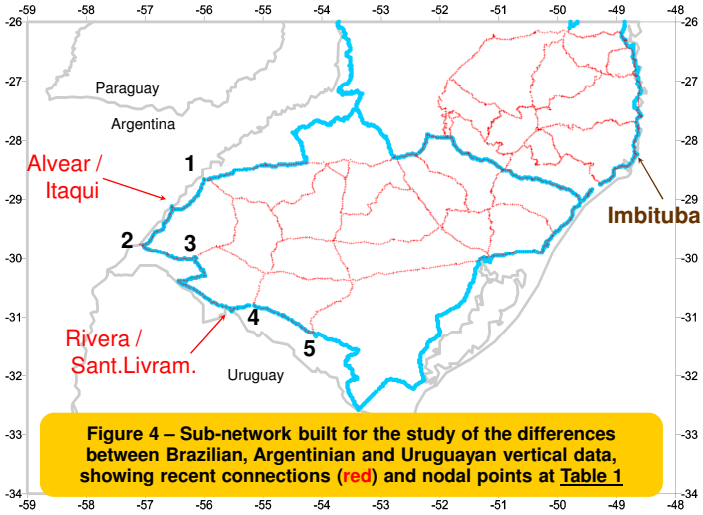

Figure 4 – Sub-network built for the study of the differences between Brazilian, Argentinian and Uruguayan vertical data, showing recent connections (red) and nodal points at Table 1

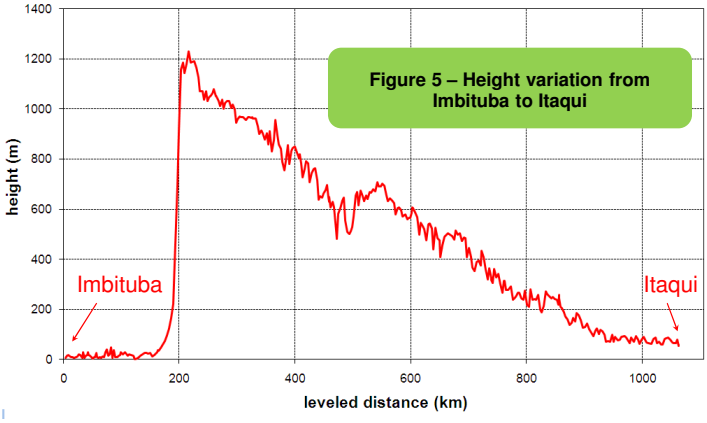

Figure 5 – Height variation from Imbituba to Itaqui

Physical Heights

The leveling loops close to Imbituba Datum show important differences arising from the gravity-related corrections, due to the steep mountains (e.g., **Figure 5**) running in north-south direction, parallel to the coast. The gravity values at the benchmarks were interpolated with PREDGRAV, from the gravity points provided by the former IAG Sub-Commission on Gravity and Geoid in South America (SCGGSA). The values of different types of heights were analysed focusing in two areas, at the borders with Argentina and Uruguay, where previous activities related to the objectives of SIRGAS WG-III were performed. Gravity and leveling connections between Alvear (Argentina) and Itaqui (Brazil) were recently established in the context of a bilateral cooperation coordinated by Paraná Federal University (UFPR) and La Plata National University (UNLP) with the participation of IBGE and IGM/Argentina. On the other hand, the connections between Uruguayan and Brazilian leveling networks were investigated by the Uruguayan University of the Republic (UdelaR) with GPS surveys at several connection points, showing anomalies in the height differences along the border. The experimental values of the physical heights in Southern Brazil are going to be computed and will be applied to these previous comparisons, aiming for the analysis of the effects of the adoption of each height type. While this is not accomplished, **Table 1** shows the heights from the three realizations available for this region, where "historical" heights are not computed in the "historical" adjustments shown in **Figure 1**.

Table 1 – Normal-orthometric height values for the nodal points around the working region

benchmark	"historical"	AAGP	distortion-corrected
5	300.2644	300.3454	300.2746
4	132.5037	132.5852	132.4893
3	187.8715	188.1540	188.0651
2	73.4957	73.7742	73.6881
1	90.9623	91.2390	91.1589

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Main Reference

LUZ, R. T. (2008) Estratégias para modernização da componente vertical do Sistema Geodésico Brasileiro e sua integração ao SIRGAS. < http:// www.sirgas.org / fileadmin / docs / Roberto_Teixeira_ Luz_Tese_de_Doutorado.pdf >