

Future Objectives of SIRGAS from Scientific Point of View

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Objectives of SIRGAS

The latest SIRGAS objectives were defined in 2008 for the IAG Sub-commission 1.3b:

- Determination and maintenance of a geocentric reference frame (a set of stations with high-precise geocentric coordinates $[X, Y, Z]$ and their variation with time $[V_x, V_y, V_z]$), as a regional densification of the global ITRF.
- Establishment of the geocentric datum in the member countries defined by the origin, orientation and scale of SIRGAS (i.e. IERS).
- Definition and realization of a unified vertical reference system composed by consistent physical and geometrical heights, as well as their variations with time, i.e. $[h, H, N, V_h, V_H, V_N]$.
- To promote and coordinate the efforts of the Latin American countries to achieve the defined objectives.



Objectives of SIRGAS

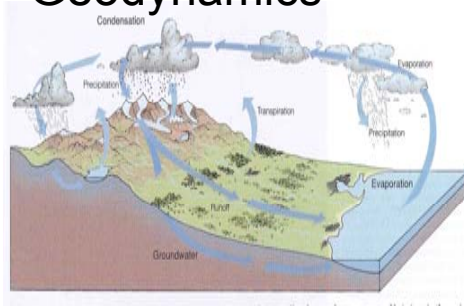
The objectives may be split into three principal tasks:

1. Reference frame for use in all the fields of geodesy & other sciences.

Positioning



Geodynamics



Global Change



2. National datums for correct use of geocentric GNSS orbits (ITRF).

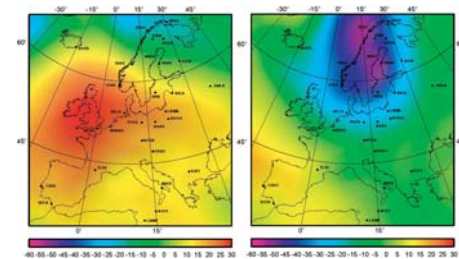


Reference for national networks (borders, navigation, cartography)



GIS, Land management, cadastre, agriculture, engineering)

3. Unified height systems for all applications, also related to gravity.



Vertical deformations



Navigation, engineering (water: bridges, tunnels, channels,..)

Objectives of SIRGAS

Characteristics of the requirements for the three tasks

1. Reference frame

Extremely accurate

The highest level of **theory**, technology and **data analysis** has to be used to achieve positions with mm-accuracy and velocities with 0.1 mm/a. **Stability** over decades has to be guaranteed.

2. National datums

Extremely reliable

National datums are basic for **legal** affairs (borders), **geo-information**, and constructions. Required precision is not as high, but it has easily to be handled & results have to be reliable.

3. Unified heights

Highly consistent

Heights for use in practice are in general physically defined, referring to the gravity field. Therefore position & gravity related parameters must be completely **consistent**.



Reference Frames Theory

Objectives

- To study and apply procedures beyond the current linear (constant velocity) models, treatment of periodic and discontinuous station position variations, understanding of their geophysical origins and related models.
- To better understand the models used for data reduction, identification of possible biases and systematic effects and to study their influence on the reference frame.
- Statistics of reference frames and quality measures.

Cooperation with IAG Study Groups

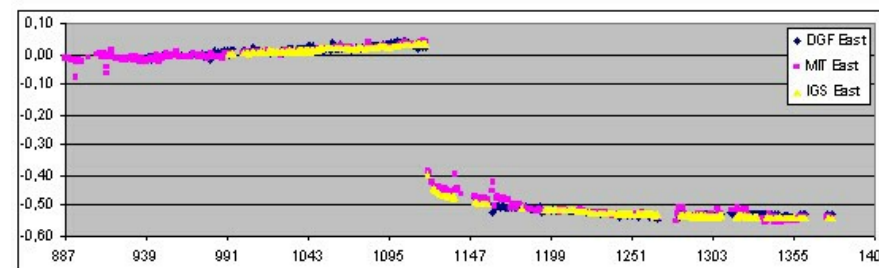
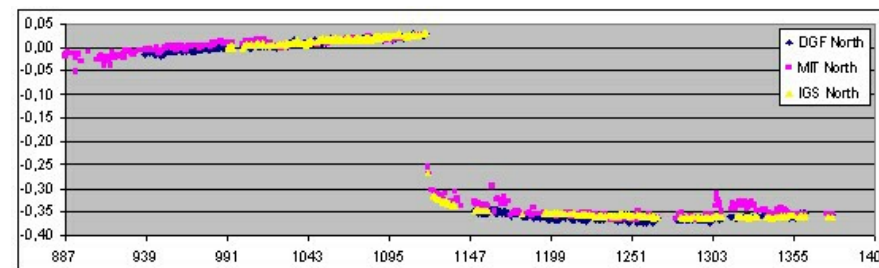
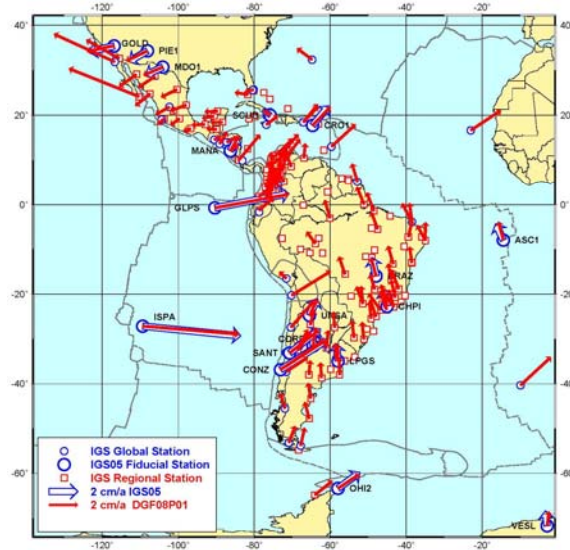
- IC-SG1: Theory, Implementation and Quality Assessment of Geodetic Reference Frames (A. Dermanis)
- IC-SG2: Quality of Geodetic Multi-Sensor Systems and Networks (H. Kutterer)



Reference Frames Analysis

Objectives

- To realize the global – continental – national hierarchy.
- To maintain a long-term stable reference frame with its velocities and episodic changes (earthquakes, volcanoes)



Integration into IAG Sub-commission and Service

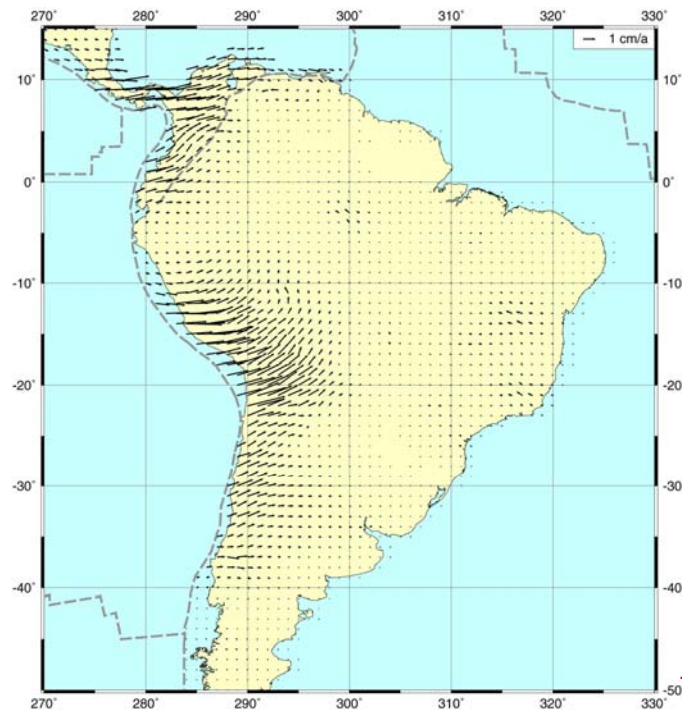
- ✓ SC1.3 b: South and Central America (C. Brunini) and
- ✓ IGS Regional Network Associate Analysis Centre



Reference Frames Stability (1)

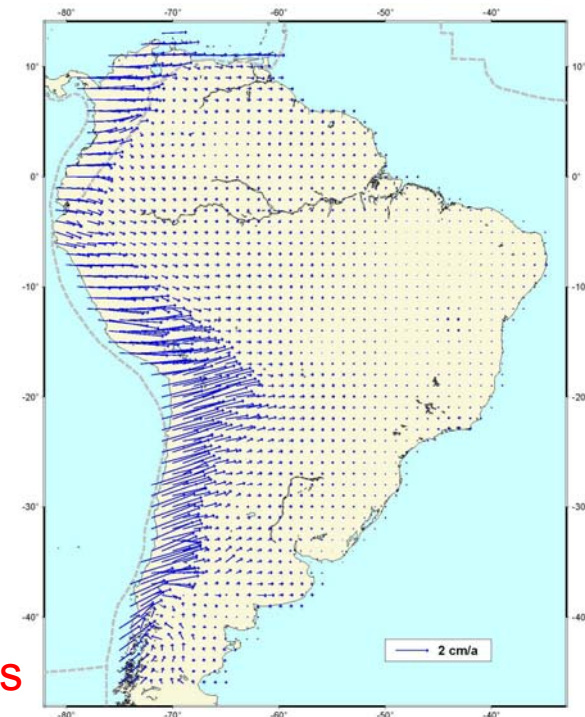
Objectives

- To develop harmonized and common specifications for the densification of the regional velocity fields.



Finite Element Model (left) and Least Squares Collocation Model (right)

→ linear velocities



Cooperation with IAG Working Group

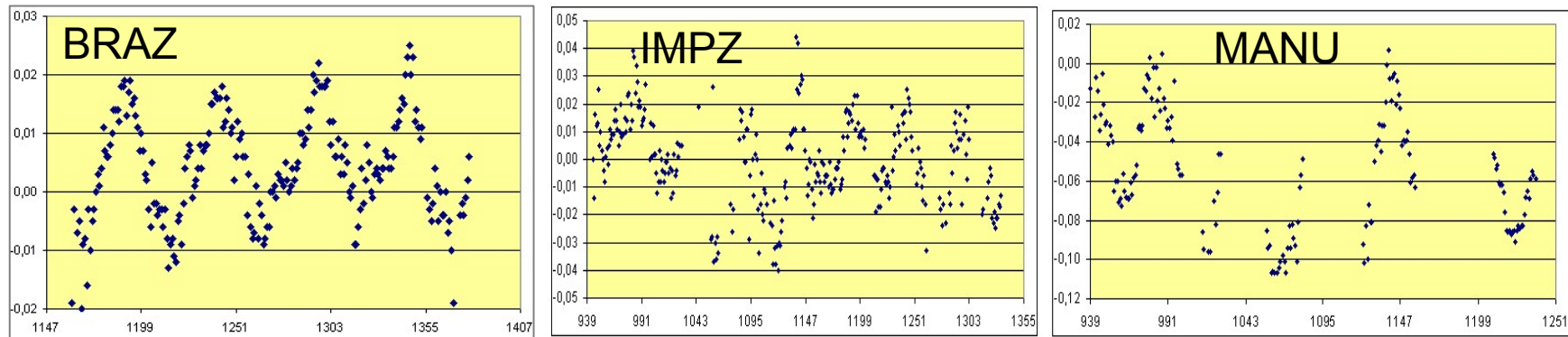
SC1.3-WG1: Regional Dense Velocity Fields (C. Bruyninx)



Reference Frames Stability (2)

Objectives

- To investigate optimal methods to mitigate loading effects in reference frame parameters and site coordinates



- Model effects mathematically (periodic functions? which?)
- Model effects physically (hydrology + geomorphology)

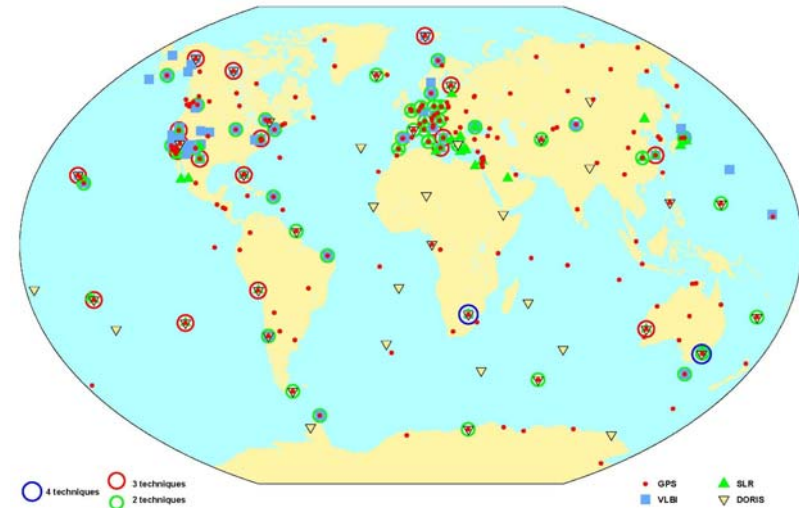
Cooperation with IAG Working Group

IC-WG1.1: Environment Loading: Modelling for Reference Frame and Positioning Applications (T. van Dam, J. Ray)



Reference Frame Consistency

The basis of the ITRF is the combination of SLR (for geo-centre), VLBI (for orientation), GNSS (for densification). The observatories of these techniques have to be connected.



This task leads to the following **Objectives**

- Develop, test, and set standards on site survey methods.
- Liaise with local and international survey teams undertaking site surveys at important co-location sites.
- Investigate new site survey methodologies.

Cooperation with IAG Working Group

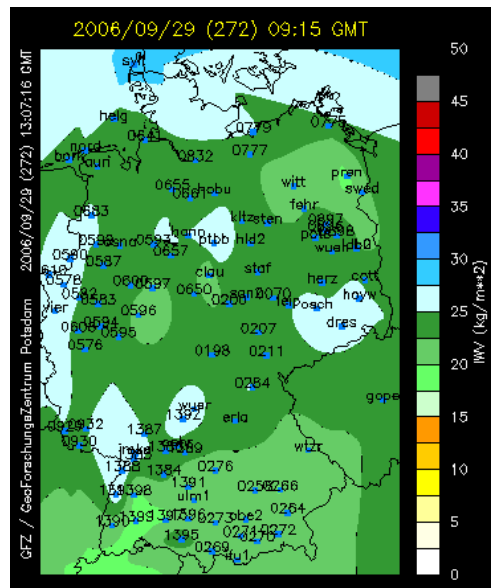
IC-WG1.4: Site Survey and Co-locations (G. Johnston)



Reference Frames for Global Change

Objectives

Provide parameters of the troposphere for the reduction of geodetic observations and as indicators of global change.



Cooperation with IAG Working Group

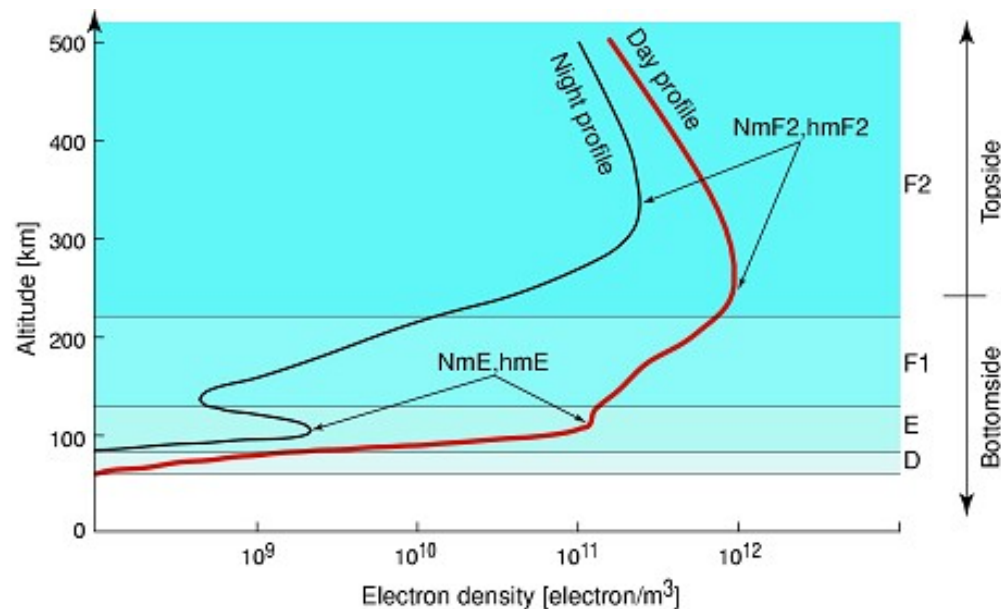
WG 1.1.3: Comparison and combination of atmospheric information derived from different space geodetic techniques



Reference Frames Applications

Objectives

To establish ionosphere models which can be used for both, the correction of electro-magnetic measurements and the study of ionospheric features and spatial-temporal evolution.



(Not only the TEC or selected parameters of models (e.g. NeQuick, IRI) but 4D models from GNSS, satellite altimetry, occultation)

Cooperation with IAG Study Group

SG 4.3.1 Ionosphere Modeling and Analysis (M. Schmidt)



Objectives of National Datums

Objectives

- To provide the basis for the establishment of the geocentric reference frame in SIRGAS member countries.
- To assist the SIRGAS member countries in their activities concerning the science of measurement acquisition of accurate and reliable survey data.
- To organize courses for capacity building and training of scientists and professionals in the member countries.
(Priority at present to Central America and Caribbean)

Cooperation with

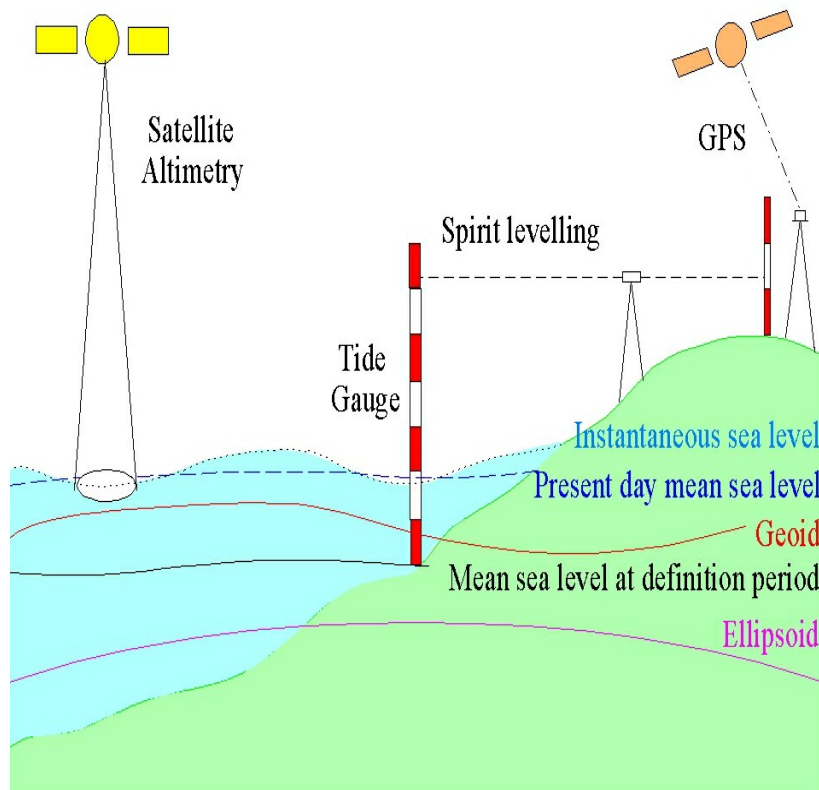
FIG Commission 5 Positioning and Measurement
WG5.2 Reference Frame in Practice

IAG (GGOS) / GEO Committee on Capacity Building



Objectives of Unified Height Systems

To guarantee the relation $H=h-N$ (classic) $H=h-\zeta$ (modern)



This requires

- A unique vertical datum (reference geopotential W_0),
- Relation of all reference tide gauges to W_0 ,
- Connection of all national levelling networks,
- Geopotential numbers of all reference frame stations,
- Reference surface (geoid or quasigeoid, respectively).

Cooperation with IAG Project

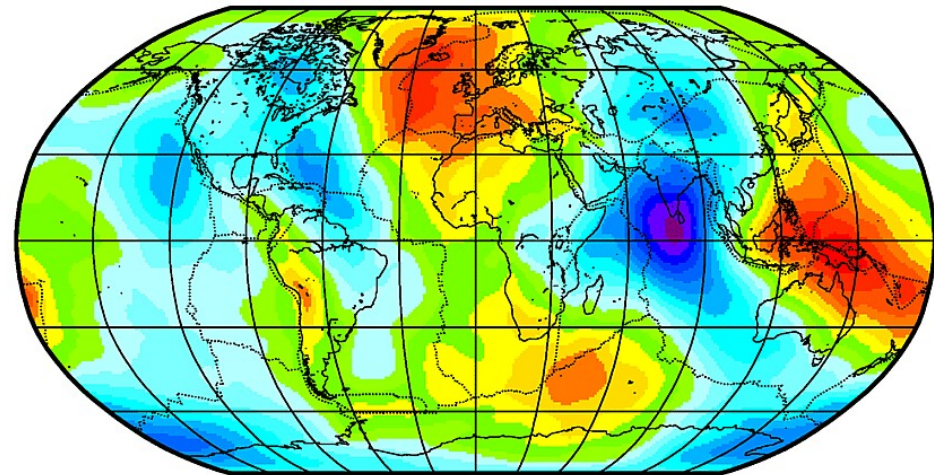
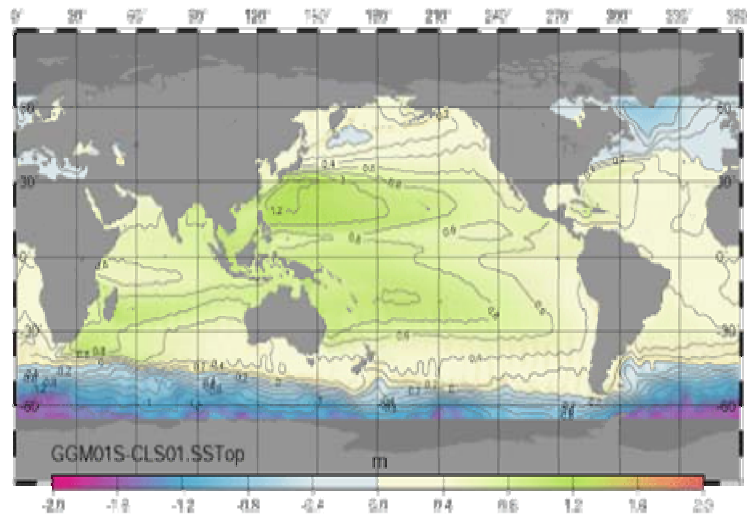
IC-P 1.2: Vertical Reference Frames (J. Ihde)



Unified Reference Potential W_0

Objectives

- Combination of sea surface models (from satellite altimetry) and gravity field models.
- Compute the time dependent mean sea level potential.



Cooperation with IAG Altimeter Service (IAS) and International Centre on Global Earth Models (ICGEM)



Connection of Tide Gauges by Sea

Objectives

- Determine the time-dependent mean sea level at all reference tide gauges in the area by satellite altimetry.
- Determine the time-dependent mean sea level at all reference tide gauges in the area from the tide gauge records.



Cooperation with International Altimetry Service (IAS)
and Permanent Service of Mean Sea Level (PSMSL)

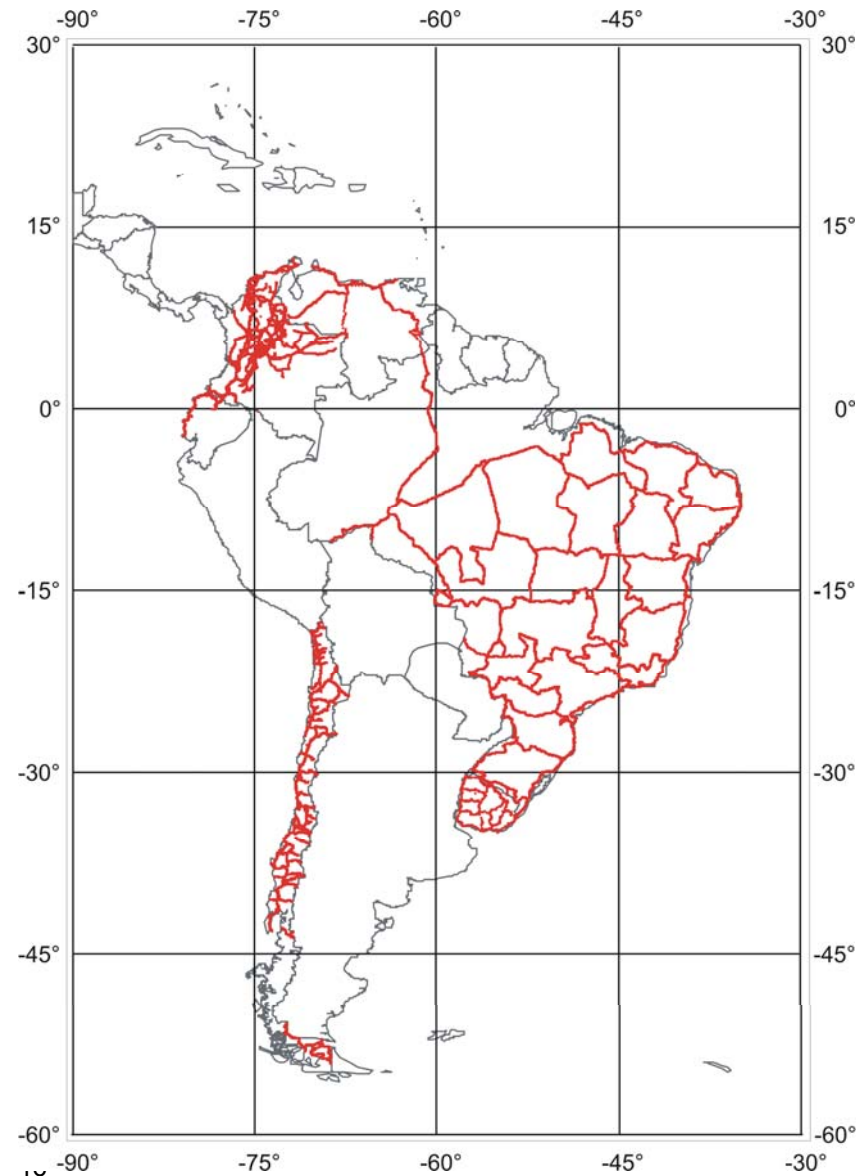


Connection of Height Systems by Land

Objectives

- Gravimetric corrections of all national levelling lines,
- Connection of levelling lines between neighbouring countries.
- Common adjustment of a continental levelling base network.

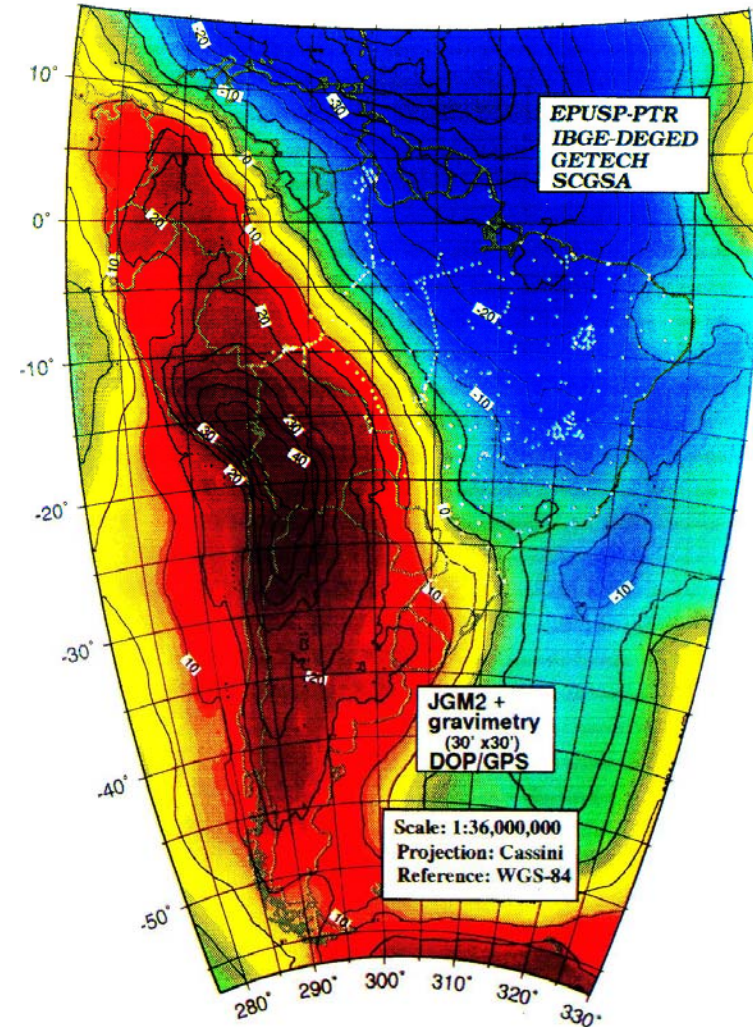
SIRGAS Working Group III



Determination of the Reference Surface

Objectives

- Calculation of a continental geopotential model (geoid / quasigeoid) from gravity satellite missions (GRACE / GOCE), terrestrial gravimetry, digital terrain models).
- Calculation of the geopotential (W) at stations of the vertical reference frame with cm-accuracy.



Cooperation with IAG Project



CP2.5: Gravity and Geoid in South America (M.C. Pacino)



Conclusions

- SIRGAS must provide the unique and best geocentric and vertical reference system in Latin America.
- Only methods of the recent state of science and technology have to be applied.
- Cooperation with international associations, projects, etc. is indispensable.

¡Dejanos trabajar!

(sin vacaciones)

