International Association of Geodesy

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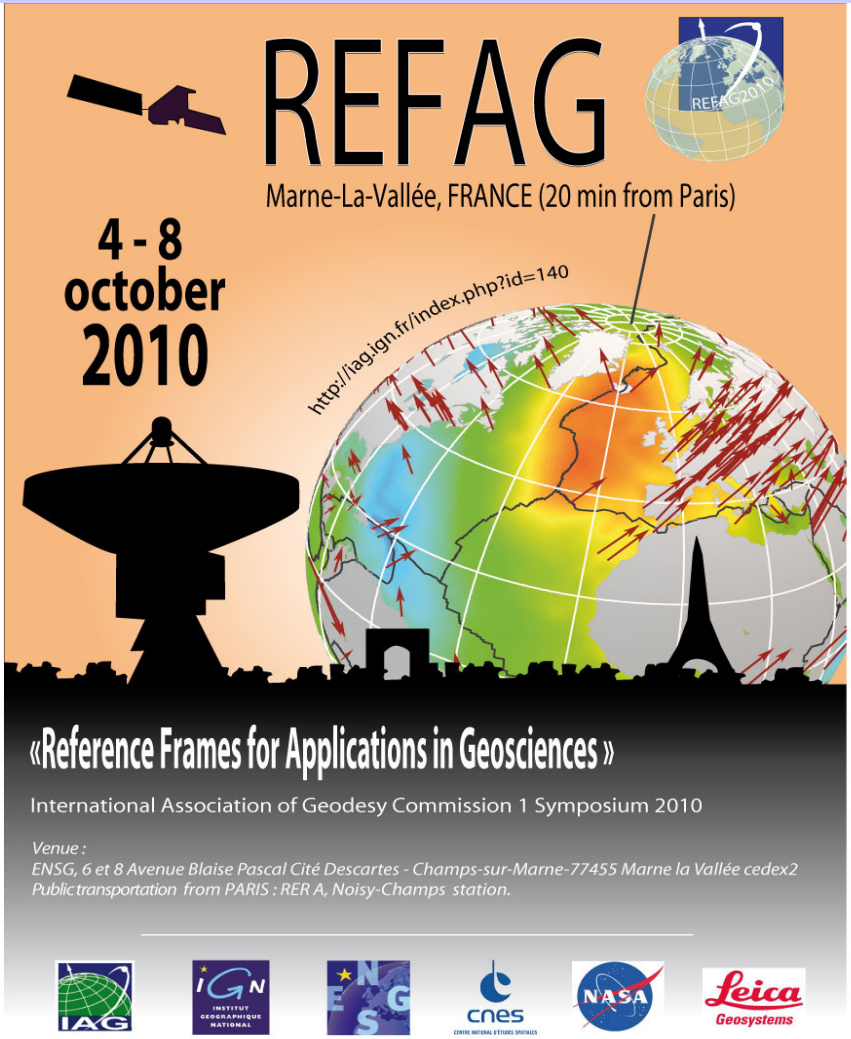
... advancing geodesy ...

Welcome to IAG Commission 1 Symposium: Reference Frames for Applications in Geosciences



Sessions

1. Theory and realization of global terrestrial reference systems. Conveners Claude Boucher & David Coulot
2. Strenghts, weaknesses, modelling standards and processing strategies of space geodetic techniques. Convener: Markus Rothacher
3. Definition, establishment, maintenance and integration of regional reference Frames. Conveners: Joao Torres & Mike Craymer
4. Interaction between the celestial and the terrestrial reference frame. Convener: Harald Schuh et al.
5. Definition and establishment of vertical reference systems. Conveners: Michael Sideris and Johannes Ihde
6. Usage and applications of reference frames in Geosciences. Conveners: Richard Gross and Frank Lemoine

Report on session 1

- 19 oral presentations (+ 2 cancelled)
- 2 posters

Main topics

- Recent search activities
- ITRF2008 : computation, quality assessment, both CC solutions
- Space techniques (SLR, VLBI, GNSS, DORIS) : individual TRF acctivities, contribution to ITRF2008, geocenter motion...
- Local ties and site stability
- IERS Conventions, Inspire directive, etc.

Report on session 1
Concluding remarks

- Very useful contribution to the IAG SC 1-2
-Focus on specific topics selected by Task forces:
  - External validation of TRF
  - Global geodetic observatories, local surveys and co-locations
-Some issues beyond the scientific geodetic community
  - Scientific service or operational service
  - Specification and validation by external communities (users, policy makers...)
  - Examples in climatology (IPCC), metrology (BIPM), oceanography (IOC) or meteorology (WMO)

Session 2 - Part 1

- Hugentobler et al.
  - Discrepancies between ITRS definition and realization (time and tide system) must be resolved
  - Handling of non-linear station motions: use models, parameters or both
- Böhm et al.
  - A priori Gradient model APG derived from ECMWF data
  - Impact only if different gradient mapping functions or constraints are used
  - Gradient mapping function by Chen and Herring recommended
- Fritsche et al.
  - Estimation of atmospheric and hydrological admittance factors from GPS
  - Models are suitable for observation reduction

Session 2 - Part 1

General remark:

- In future, **more an more external information** is going to be used to compute model parameters (e.g., ECMWF data for mapping functions, for a priori troposphere gradients and a priori dry delays …) . This may not be a **problem for** reprocessing efforts but for **near real-time products**, where the information (external data) required might not be available in time. In principle, the user of the reference frame would have to use the same external data, if he wants to be consistent with the ITRF generation strategy. This paradigm change (using external data as opposed to models that can be expressed by formulas with known parameter values) should be discussed thoroughly within the services.

Session 2 - Part 2

- Lemoine et al.
  - IDS provided the first time a combined DORIS contribution for ITRF; DORIS has made big improvements and is now much closer to the precision level reached by SLR & VLBI
- Rebischung and Garayt
  - Improvements in operational IGS RF generation
  - IGS08 combination strategy and IGS08 core network
- Collilieux and Schmid
  - Different estimation strategies have an impact of up to 3 cm on the GNSS satellite antenna z-offsets
  - ITRF2008 GPS scale drift between -0.20 and 0.00 ppb/y
- Loyer et al.
  - GRGS IGS AC achieved a performance comparable to other IGS ACs
  - Ambiguity resolution on the ZD level, "integer PPP"

Session 2 - Part 3

- Biancale et al.
  - IERS WG Combination on the Observation Level (CoL)
- Pollot et al.
  - Impact of different strategies on the multi-technique combination
  - Inclusion of multi-technique satellites (e.g., JASON-1)
- Thaller et al.
  - Space ties: GNSS SAO+PCV; SLR LRA offset
  - SLR scale can be transferred to GNSS: SAO estimation

Session 2 - Part 4

- Nothnagel and Böckmann
  - The ITRF2008 from a VLBI perspective
- Boomkamp
  - Distributed processing
- Biagi and Caldera
  - The automation of permanent networks monitoring: remarks and case studies
- Steigenberger et al.
  - GNSS antenna array at the Geodetic Observatory Wettzell
- Svehla
  - The Next Generation Lunar Geodesy

Session 3: Definition, establishment, maintenance and integration of regional reference frames – Chairs: João Torres & Mike Craymer

- Highlights
  - Most regional sub-commissions in reprocessing mode except for…
  - AFREF & APREF just starting to get organized but intend to follow path laid out by established EUREF/NAREF/SIRGAS
  - Most also moving to ITRF2008 as soon as IGS08 ready
  - SIRGAS pointed out the problem of realizing regional frames with linear velocity models
    - Frame will be affected by non-linear signals and, esp. seismic events
    - Suggested to use, e.g., weekly solutions instead
  - SC1.3-WG on regional dense velocity fields is at a crossroads
    - Difficult to coordinate discontinuities and solution numbering
    - Need to conduct some tests to recommend the way forward

- Recommendation
  - Minimize the “network effect” by using a global network to realize regional reference frames

Section 5: Definition and establishment of vertical reference systems
Chairs: Michael Sideris, Johannes Ihde

6 Invited talks

4 of them gave a **theoretical review** about:

- Precise definition of the conventions needed for the realisation of a World Height System (WHS)
- Solution of the geodetic boundary problem applying satellite gravity observations to unify vertical datums
- Advantages offered by global gravity models to unify vertical datums, specially those located in different continents
- Advances and remaining challenges of the IAG Inter-Commission Project 1.2 on Vertical Reference Frames

The other **2** invited talks presented

- Status and coming activities regarding the vertical datums in North America and Australia and New Zealand

Section 5: Definition and establishment of vertical reference systems
Chairs: Michael Sideris, Johannes Ihde

8 oral contributions concentrated on:

- Fixed gravimetric boundary value problem for the realisation of vertical datums
- Influence of vertical datum inconsistencies on the gravity field modelling
- Combination of geometric and gravity observations to
  - Modell crustal motions
  - Realise vertical reference surfaces
  - Calibrate altimeters and to monitor sea level
- A transformation model for vertical reference frames
- Towards a vertical datum unification in South America

Section 5: Definition and establishment of vertical reference systems
Chairs: Michael Sideris, Johannes Ihde

4 posters showing

- Vertical datum and GPS measurements in Jordan
- Geoid models of high resolution vs GPS/levelling in Japan
- Combination of GOCE and gravity terrestrial data in France
- Gravimetric applications of Topex/Poseidon data

In total 21 contributions, 3 were cancelled (1 oral, 2 posters)

Main conclusions:

•The vertical datum problem is being intensively study by many groups over the world, using different kind of data, different analysis strategies, and different perspectives.

•Important achievements have been made in the combination of geometrical and physical parameters to make the vertical datum unification reliable.

•However, the vertical datum problem still remains a big challenge for the geodetic community.

Usage & Applications of Reference Frames in Geosciences

- Reference frames are fundamental to
  - Earth science
    - Sea level change
  - Planetary science
    - Interplanetary spacecraft navigation
  - Society
    - Precision agriculture
- Improved reference frames
  - Enable greater understanding of Earth structure & processes
    - Lower mantle viscosity from improved estimates of secular geocenter motion
    - Constrain present-day ice mass change
- Concept for improving terrestrial reference frame
  - Co-locate measurement techniques on Moon

Proceedings

- To be published by Springer as an IAG Symposia Volume
- Free copy to each registred participant
- Paper submission deadline:
  - January 08, 2011
- Follow instructions available at REFAG Website
- Peer reviewed papers managed by session conveners