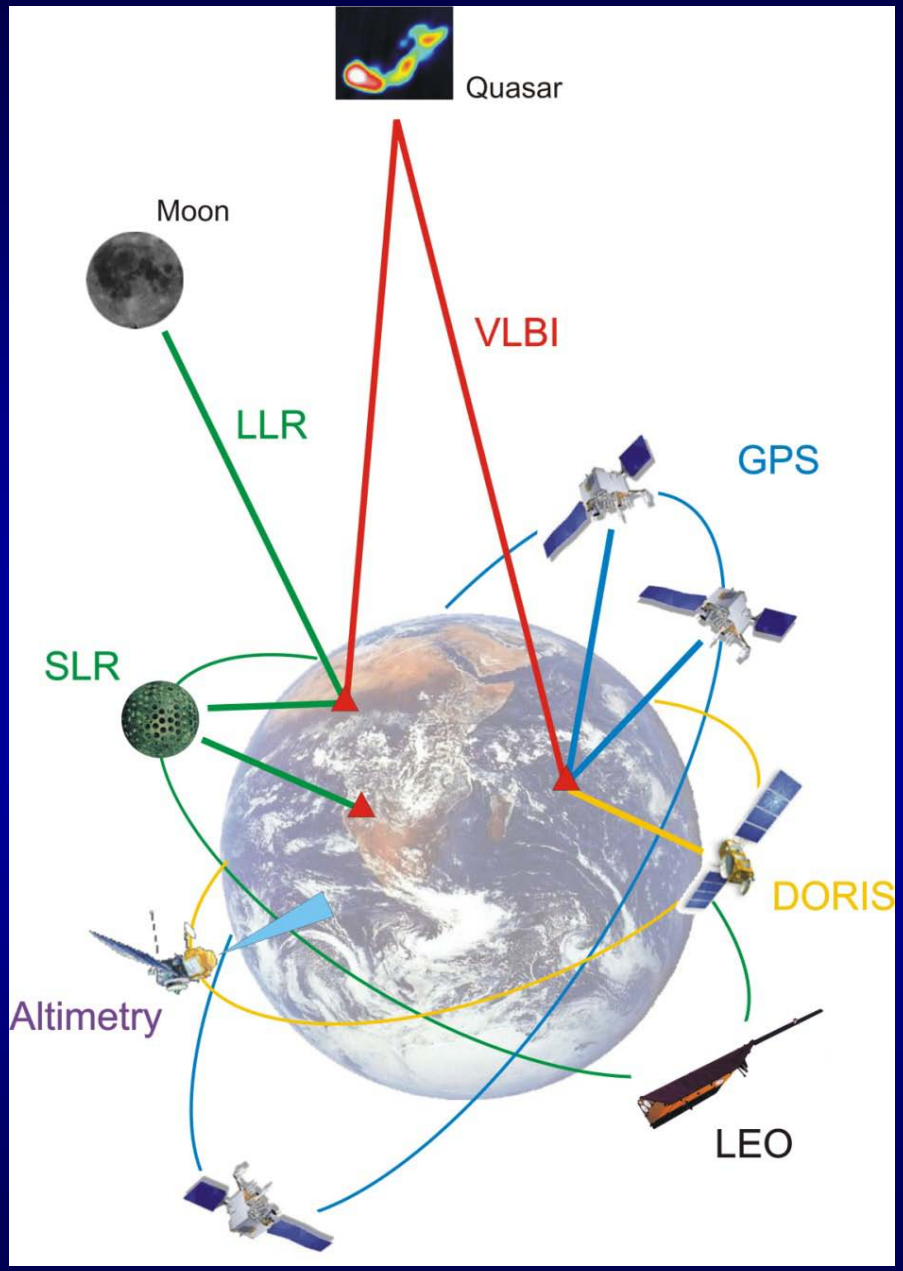


Unified Analysis Workshop 2011

Introduction

Markus Rothacher

Institute of Geodesy and Photogrammetry
ETH Zurich

Unified Analysis Workshop 2011
September 16-17, 2011
ETH Zurich, Switzerland

Organizational Issues

- Switzerland expensive, economic crisis
- Coffee breaks
- Lunch on Friday: “Dozentenfoyer”, top of this building
- Lunch on Saturday: sandwiches
- Social event: dinner at the “Altes Klösterli”, near the zoo
- Technical support, help: Arturo Villiger, Simon Häberling
- Archiving of presentations at IERS web pages, where already UAW 2007/2009 are located

- WLAN: Network: **public**
  Login: **UAW**
  Password: **UAW_2011**

Unified Analysis Workshop 2011: Scope and Goals

- Involve **the experts** from GGOS, IERS, IGS, IVS, ILRS, IDS and IGFS
- Increase the **common understanding** of all techniques for each individual technique as they contribute to a GGOS
- Make **concrete progress** on (i.e. action items, deadlines):
  - Fill the GGOS protal with important products from the Services
  - Handling of technique-specific systematic biases
  - Use of external data for modeling: importance and problems
  - Converge on new/updated standards (models, parameters)
  - Improve strategies for the combination of the different techniques and parameters → toward the next ITRF20xx
  - Work on co-location on ground and in space
  - New technologies needed at GGOS core sites

Characteristics of the products we are looking for

- ***Easy access to products:*** meta data for GGOS portal, meta data format and flow
- ***Consistency of products:*** Consistency of the modeling and parameterization within one technique and among different techniques
- ***Accuracy of products:*** best possible geodetic / geophysical models have to be used; reduction of biases
- ***Rigorous combination:*** combination of all parameters common to more than one technique; co-location on ground and in space:

  quasar coord., nutation, troposphere, low-degree SH, clocks, …
- ***Product Latency:*** products with different latencies (and accuracies) have to be generated

  multi-year, weekly, daily, predicted
- ***GGOS integrated products:*** combination of geometry and gravity; integrated products

  global vertical datum, mass balance, surface deformation/strain, …

Unified Analysis Workshop 2011: Program

Welcome and Introduction

Session 1 **Products by the Services, Filling the GGOS Portal**
Chairs: Richter B., Noll C.

Session 2 **Modeling Based on External Data (Atmosphere, Ocean, ...), Modeling Deficiencies and Standards**
Chairs: Van Dam T., Böhm J., Angermann D.

Session 3 **ITRF 20xx and Other Combined Products**
Chairs: Altamimi Z., Seitz M., Biancale R.,

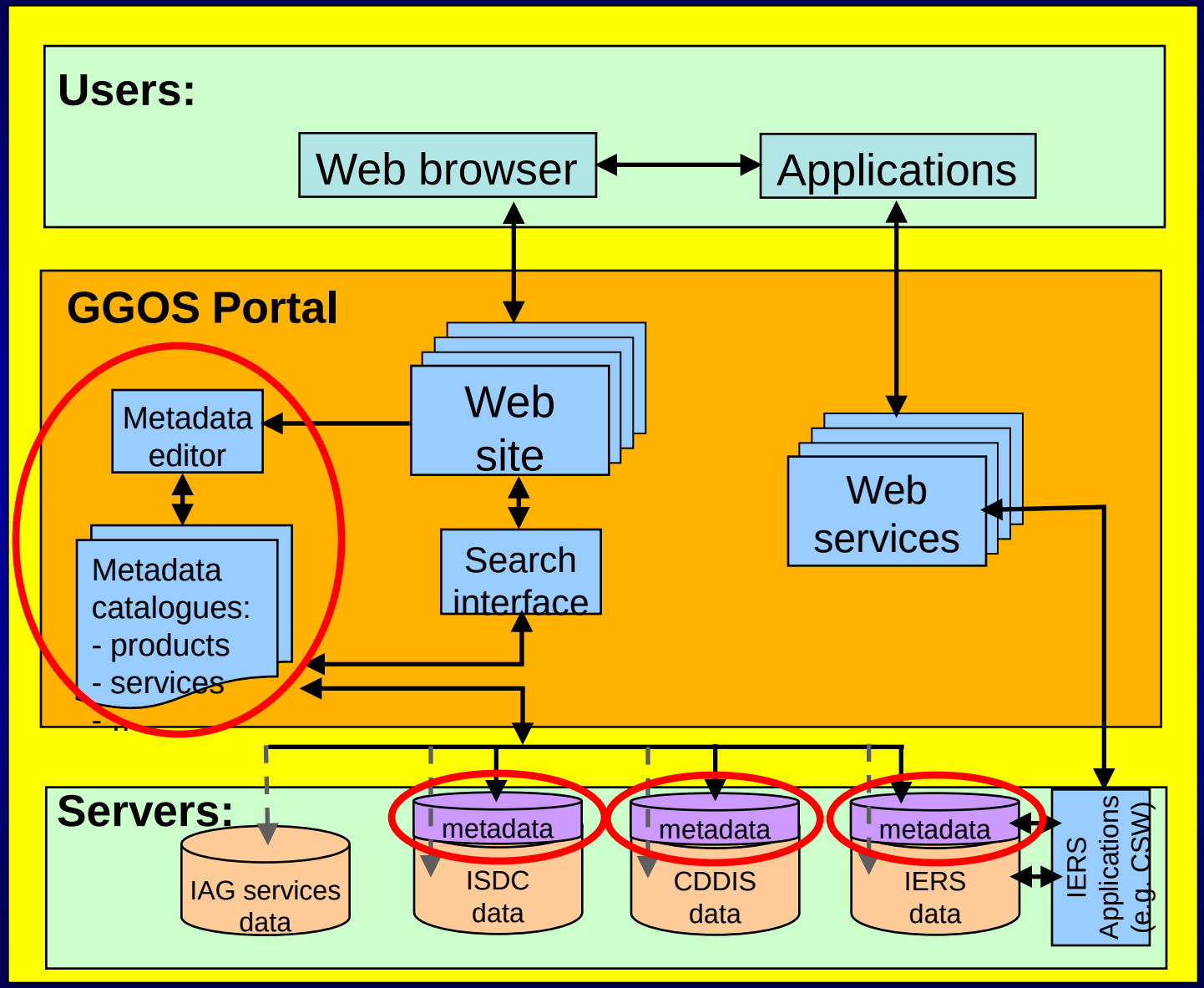
Session 4 **Co-location on Ground and in Space, GGOS Core Sites**
Chair: Schuh H., Pearlman M., Pavlis E.

Discussion, Conclusions and Action Items

Session 1: Products by the Services, Filling the GGOS Portal

- **Fill the GGOS Portal** with the products of the Services and GGOS (meta data, characterization of the products, …). Which products should be there ?
- Formats, data structures and data flows for **meta data** for the **GGOS Portal**
- **Who** is going to prepare the meta data ? Data centers, Analysis Centers, a mixture ?

GGOS Portal: Meta Data Required



Session 2: Modeling Based on External Data (Atmosphere, Ocean, ...), Modeling Deficiencies and Standards

- ***Paradigm change:*** modeling of corrections more and more based on **large amounts of external data** than based on "simple" mathematical formulas
- ***Examples:***
  - Mapping functions, hydrostatic delays, troposphere gradients derived from meteorological models
  - Atmospheric, hydrological and non-tidal oceanic loading corrections based atmosphere, ocean and hydrological models
- Assess the **benefits** of correction models based on large external data sets
- Discuss the **implications** of the paradigm change, i.e. of using large amounts of external data (availablility, reliability, consistency, real-time issues, …)

Session 2: Modeling Based on External Data (Atmosphere, Ocean, ...), Modeling Deficiencies and Standards

- Improve the accuracy and consistency of the **geodetic / geophysical models** used
- Reduction of **(technique-specific) biases** like
  - Antenna phase center corrections, CoM corrections
  - Range biases
  - Antenna deformation (gravitational, thermal, …)
  - Higher-order ionospheric effects

Session 3: ITRF 20xx and Other Combined Products

- **ITRF20xx:** modeling and parameterization for the next ITRF solution
- Development of **SINEX** for more complex combination strategies
- Improve common understanding of **combination strategies**
- Benefits of **observation level combination**
- Concepts for the combination of more parameters: **UT1/LOD**, **nutation offsets/rates, quasar coord., …**
- Steps towards **new combined products** (daily, weekly combined products; troposphere; …)

Vision: Future Parameter Space

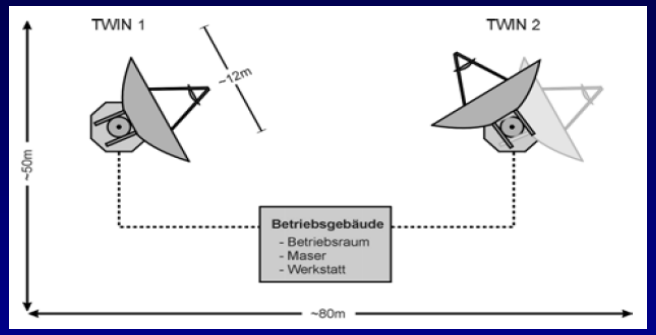
Parameter space for a rigorous combination:

	Parameter Type	VLBI	GPS/ GLON.	DORIS/ PRARE	SLR	LLR	Alti- metry
ICRF	Quasar Coord. (ICRF)	X					
Earth Rotation	Nutation	X	(X)		(X)	X	
Earth Rotation	Polar Motion	X	X	X	X	X	
Earth Rotation	UT1	X					
Earth Rotation	Length of Day (LOD)	X	X	X	X	X	
ITRF	Coord.+Veloc.(ITRF)	X	X	X	X	X	(X)
Gravity Field	Geocenter		X	X	X		X
Gravity Field	Gravity Field		X	X	X	(X)	X
Gravity Field	Orbits		X	X	X	X	X
Gravity Field	LEO Orbits		X	X	X		X
Atmosphere	Ionosphere	X	X	X			X
Atmosphere	Troposphere	X	X	X			X
	Time/Freq.; Clocks	(X)	X		(X)		

Session 4: Co-location on Ground and in Space, GGOS Core Sites

- **Co-location on ground:** new technologies, twin telescopes, GNSS antenna arrays
- **Co-location on satellites:** problems with existing co-location, new satellite missions (GRASP, NanoGEM), co-location on GNSS
- How to treat **discrepancies in local ties** (local survey ←→ technique results)
- **New technologies** at GGOS core sites: twin telescopes, kHz laser, multi-freq. GNSS, …

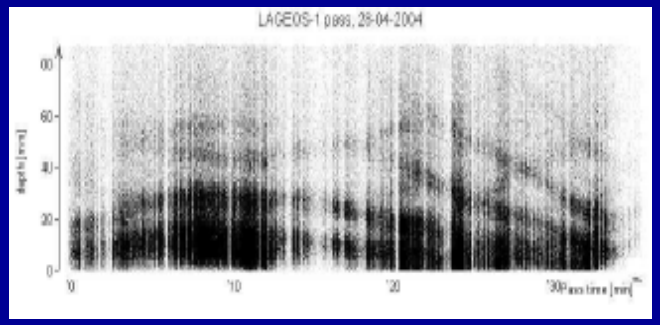
Innovation in Ground-Based Infrastructure:



VLBI Twin Telescope (Wettzell)

VLBI:

- High slew rates (> 5 deg/s)
- 1-3 small telescopes at a site
- Continuous frequency range (2-18 GHz)



kHz Laser: Lageos Spin (Graz)

SLR:

- kHz laser technology
- 2 frequency systems
- Higher quantum efficiency

DORIS Beacon (Thule)

DORIS:

- 3rd generation DORIS systems

Galileo Experimental Sensor Station (GESS)

GNSS:

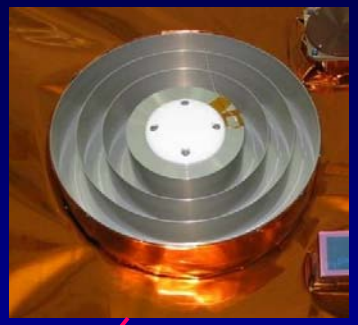
- GPS, Glonass, Galileo, Compass, …
- Sampling > 10 Hz
- Real-time
- 3 antennas/receivers

GGOS Core Sites

→ **We are on a good way towards GGOS 2020 !**

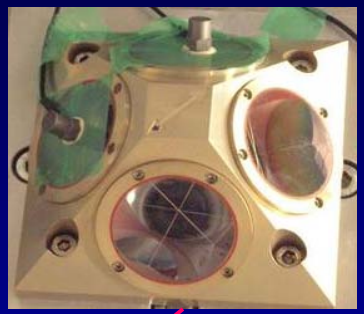
Co-location Satellites. GRASP / NanoGEM

RO Antenna



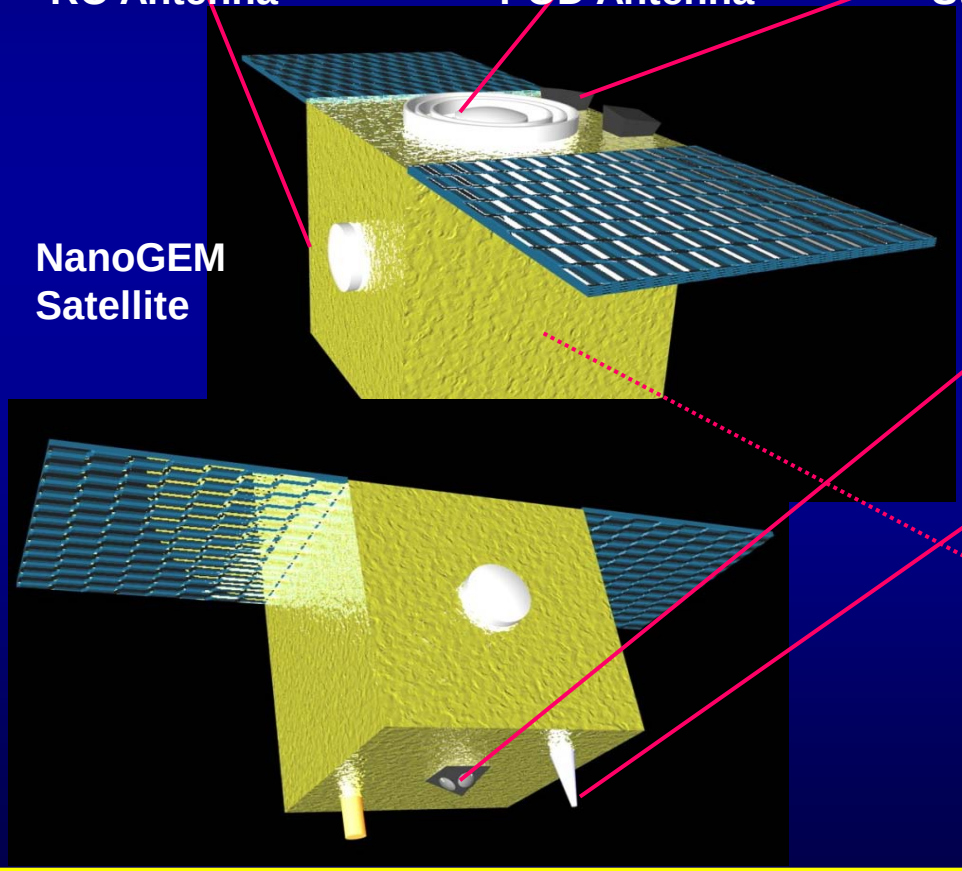
POD Antenna

Star Sensors

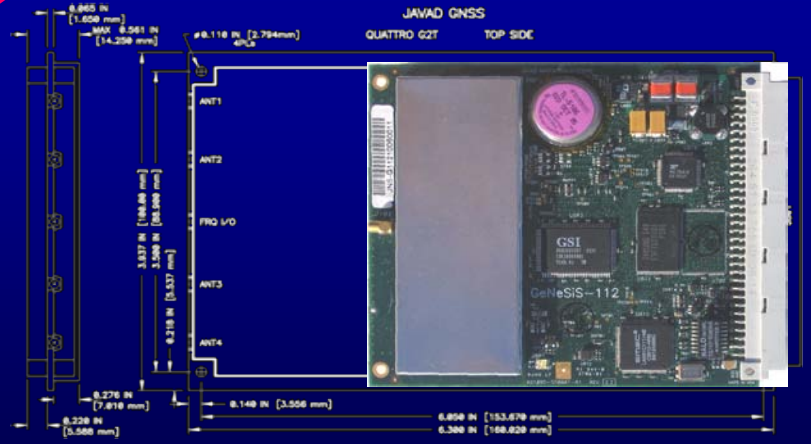


SLR Retro-Reflector

VLBI Sender



NanoGEM Satellite



3 GPS Receiver Board (redundancy)

UAW Organizational Aspects

- **Intensify cooperation** between the Services IERS, IGFS, IGS, IVS, ILRS, IDS and with GGOS

- Consider **organizational improvements** on how to make progress in a certain field:
  - Distribution of work among few ?
  - Setup of expert groups ? Setup of Working Groups ?
  - Regular meetings of all Analysis Coordinators and Chairs ?
  - Discussion forum (Wiki) for exchange of information ?
  - Repeat the UAW concept ? Improve it ?

General Remarks

- Keep your presentations **short**: save the discussion time.
- Concentrate on the **problems and challenges** to be solved and not on the status quo (we are all experts !)
- Chairmen: keep the time (without preventing important discussions), discussion time should lead to **recommendations / action items**
- Discussions and questions during the presentations are welcome (workshop atmosphere)
- Everybody to **work toward concrete problem solutions**, action items, time planning etc.; this should be the final goal of the discussions
- Consider **new organizational ways** to achieve progress (expert groups, WGs, meetings, workshops, …)