ILRS Governing Board

Technical University of Vienna
SEM124
Vienna, Austria

April 21, 2009

Agenda

1. Opening Remarks (5 min.)   W. Gurtner
2. ILRS Status/Action Items (15 min.)   M. Pearlman
3. Working Group Briefs and Recommendations (5-10 min each)   WG Chairs
   - Analysis   E. Pavlis/C. Luceri
   - Missions   G. Appleby
   - Data Formats and Procedures   W. Seemueller
   - Networks and Engineering (including Stanford Counter tests)   W. Gurtner
   - Transponders   M. Pearlman
4. Task Force Reports (5 min. each)
   - Communications   E. Pavlis
   - Center-of-Mass Corrections   G. Appleby
5. Status of the next ITRF (5 min)   Z. Altamimi
6. ILRS Special Issue in Journal of Geodesy (5 min.)   E. Pavlis
7. GGOS Activities (5 min.)   M. Pearlman
8. Current Issues (10 min.)
   - Coping with Future Satellite Missions   W. Gurtner
9. New Business   W. Gurtner/WG Chairs
10. Other Business   W. Gurtner

Central Bureau Update

Network Status

- Thirty-three stations providing tracking data thus far in 2009

- Most productive stations are Yarragadee, San Juan, Mt. Stromlo, Graz, Wettzell, Zimmerwald, Herstmonceux, Riyadh, and Changchun

- Newly refurbished Grasse MEO station on-line; dedication in April

- Tahiti now operational; meeting with NASA, CNES, and UFP held October 20-22, 2008; recommended a plan for improving station operations;

- Data from Altay Russia submitted and will be released soon

  - ACs still reviewing data to calculate site position
  - Site log complete
  - Co-located GNSS data may be released

- TROS campaigns in KASI, Korea in 2008 and 2009

- FTLRS occupation currently underway in Grasse

- NGSLR now pretty robust tracking

  - In co-location with MOBLAS-7;
  - Tracked GLONASS-95, GLONASS-99 and GLONASS-102 with eyesafe laser; still not GPS-35 or 36;
  - Higher power laser has been tested in the system and is back out for some refinements;

INTERNATIONAL LASER RANGING SERVICE (ILRS) NETWORK IN 2008 Q4

Legend:
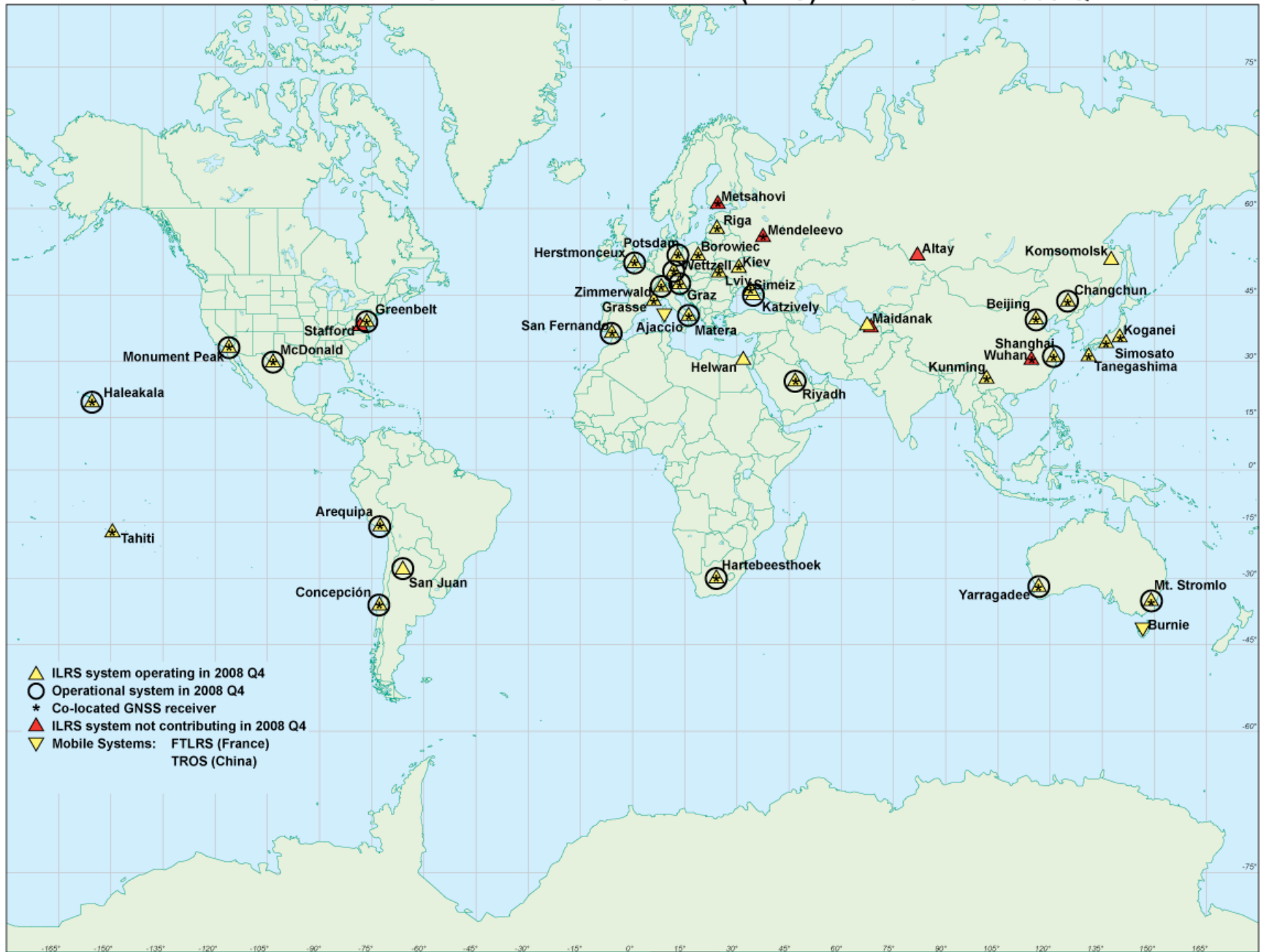
- △ ILRS system operating in 2008 Q4
- ○ Operational system in 2008 Q4
- ✳ Co-located GNSS receiver
- ▲ ILRS system not contributing in 2008 Q4
- ▽ Mobile Systems: FTLRS (France)
  TROS (China)

Station labels: Metsahovi, Riga, Mendeleevo, Altay, Komsomolsk, Potsdam, Borowiec, Herstmonceux, Wettzell, Kiev, Changchun, Zimmerwald, Lviv, Simeiz, Beijing, Koganei, Graz, Katzively, Maidanak, Shanghai, Simosato, Grasse, Wuhan, Tanegashima, San Fernando, Ajaccio, Matera, Kunming, Helwan, Greenbelt, Stafford, McDonald, Monument Peak, Riyadh, Haleakala, Arequipa, Tahiti, Hartebeesthoek, San Juan, Concepción, Yarragadee, Mt. Stromlo, Burnie

10/01/2008

Annual Data Yield
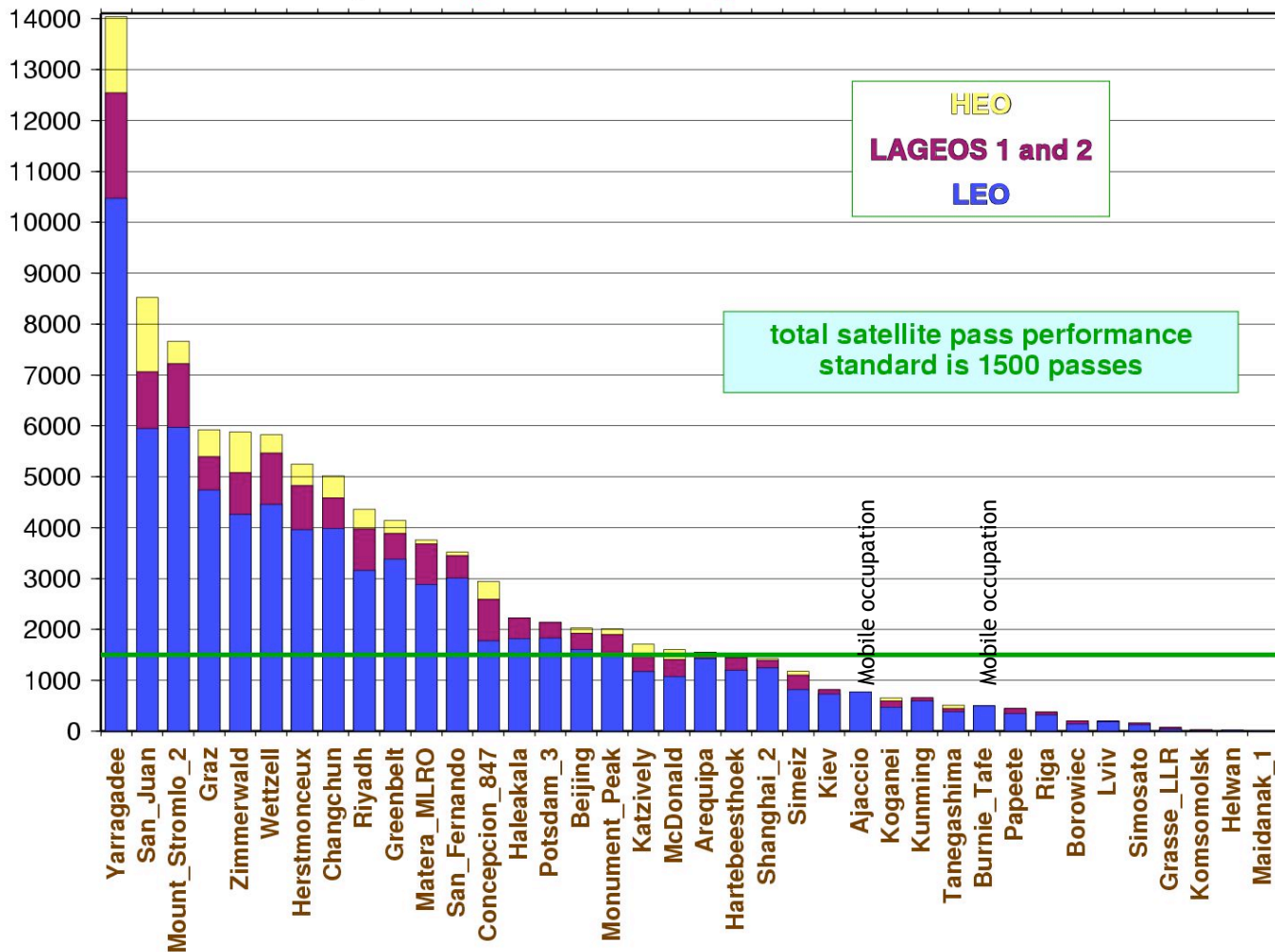
Slight increase in data yield in 2008

Station Performance
All Satellites (2008Q4)

total passes
from January 1, 2008 through December 31, 2008

HEO
LAGEOS 1 and 2
LEO

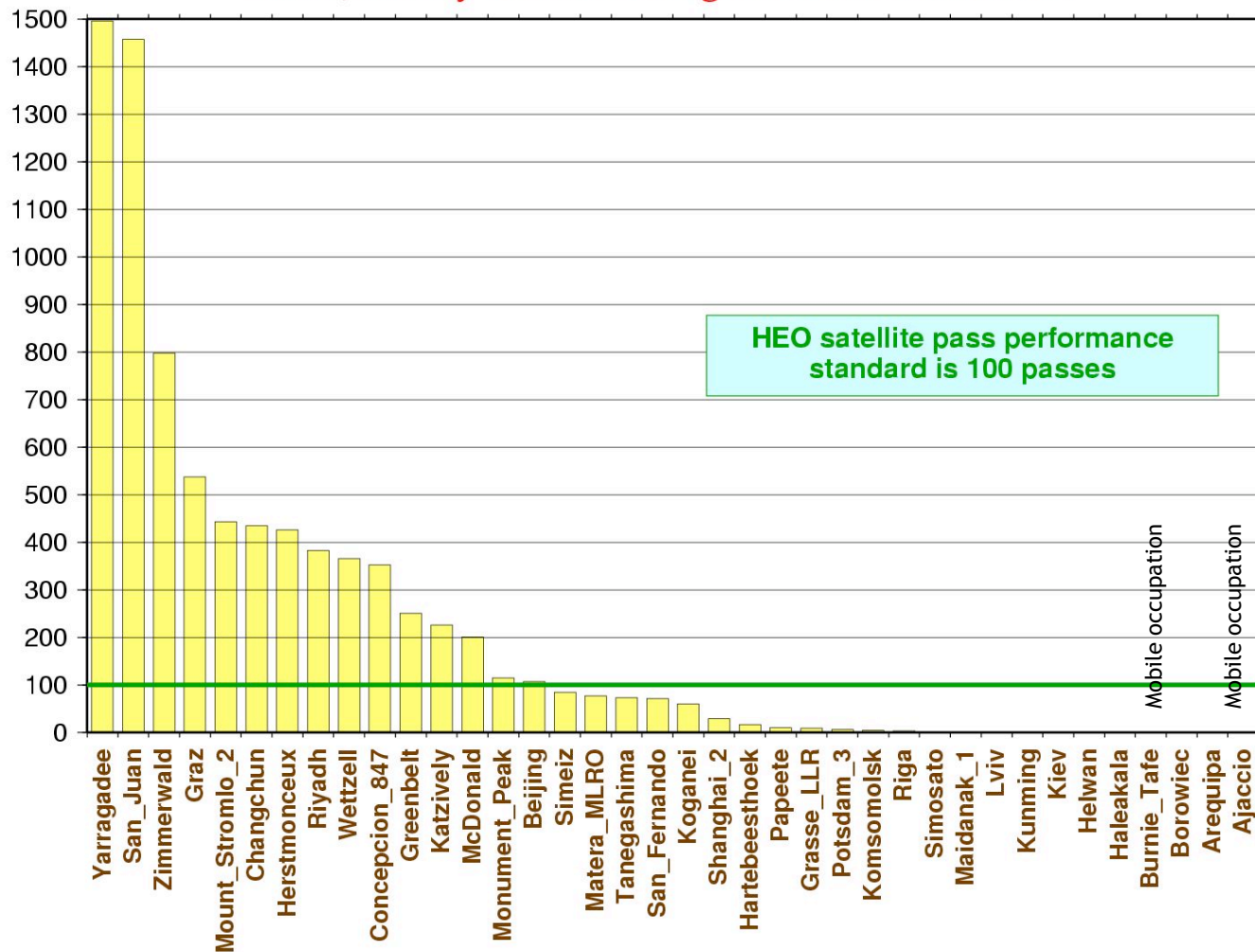total satellite pass performance
standard is 1500 passes

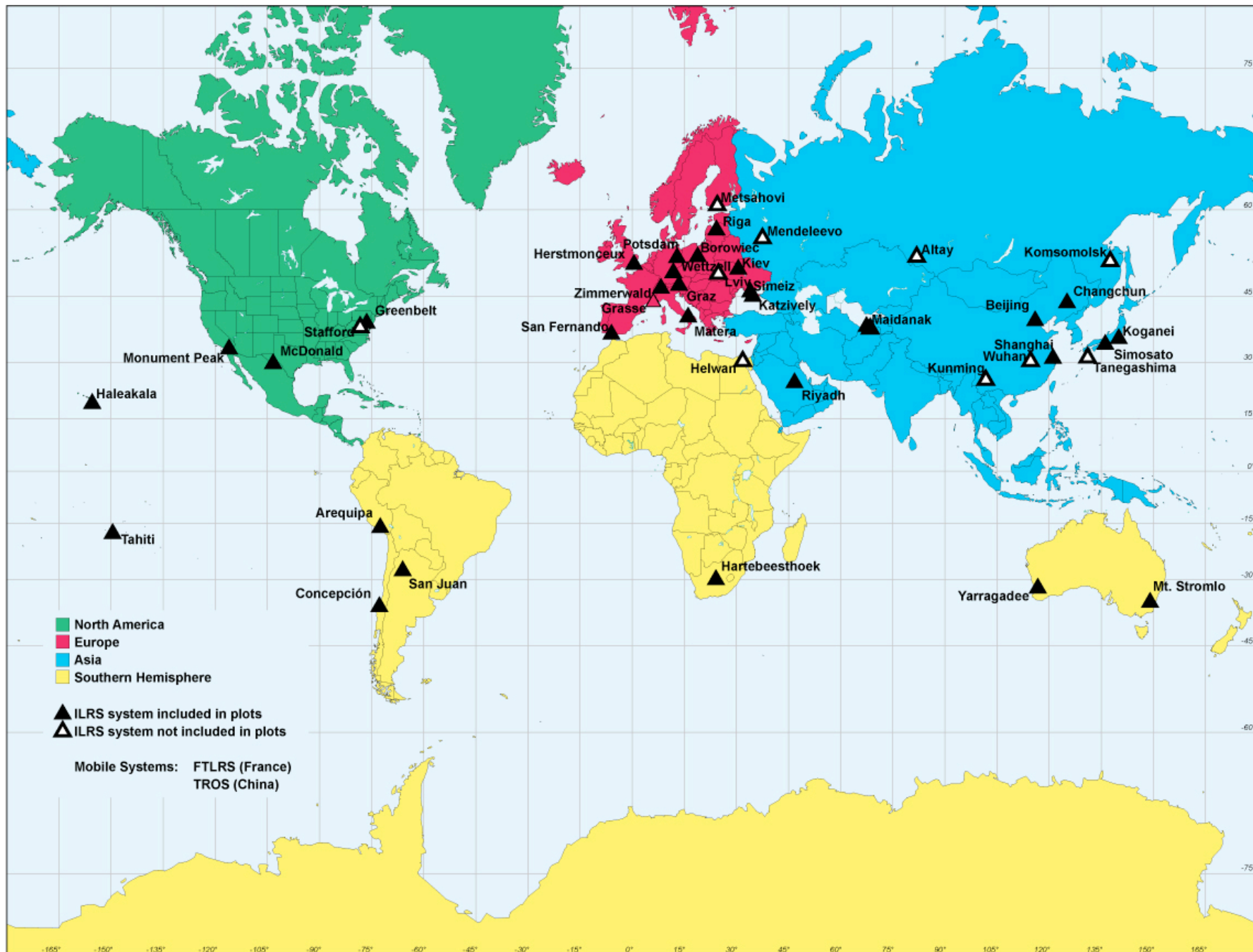*Note: Over one third of the stations do not achieve 1500 passes per year*

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Station Performance
High Satellites (2008Q4)

HEO passes
from January 1, 2008 through December 31, 2008

HEO satellite pass performance standard is 100 passes

ILRS Network by Region

North America
Europe
Asia
Southern Hemisphere

▲ ILRS system included in plots
△ ILRS system not included in plots

Mobile Systems: FTLRS (France)
TROS (China)

Metsahovi
Riga
Mendeleevo
Altay
Komsomolsk
Potsdam
Herstmonceux
Borowiec
Wettzell
Kiev
Changchun
Zimmerwald
Grasse
Lviv Simeiz
Beijing
Graz
Katzively
Koganei
San Fernando
Maidanak
Shanghai
Simosato
Matera
Wuhan
Tanegashima
Greenbelt
Kunming
Stafford
Helwan
McDonald
Monument Peak
Riyadh
Haleakala
Arequipa
Tahiti
Hartebeesthoek
San Juan
Concepción
Yarragadee
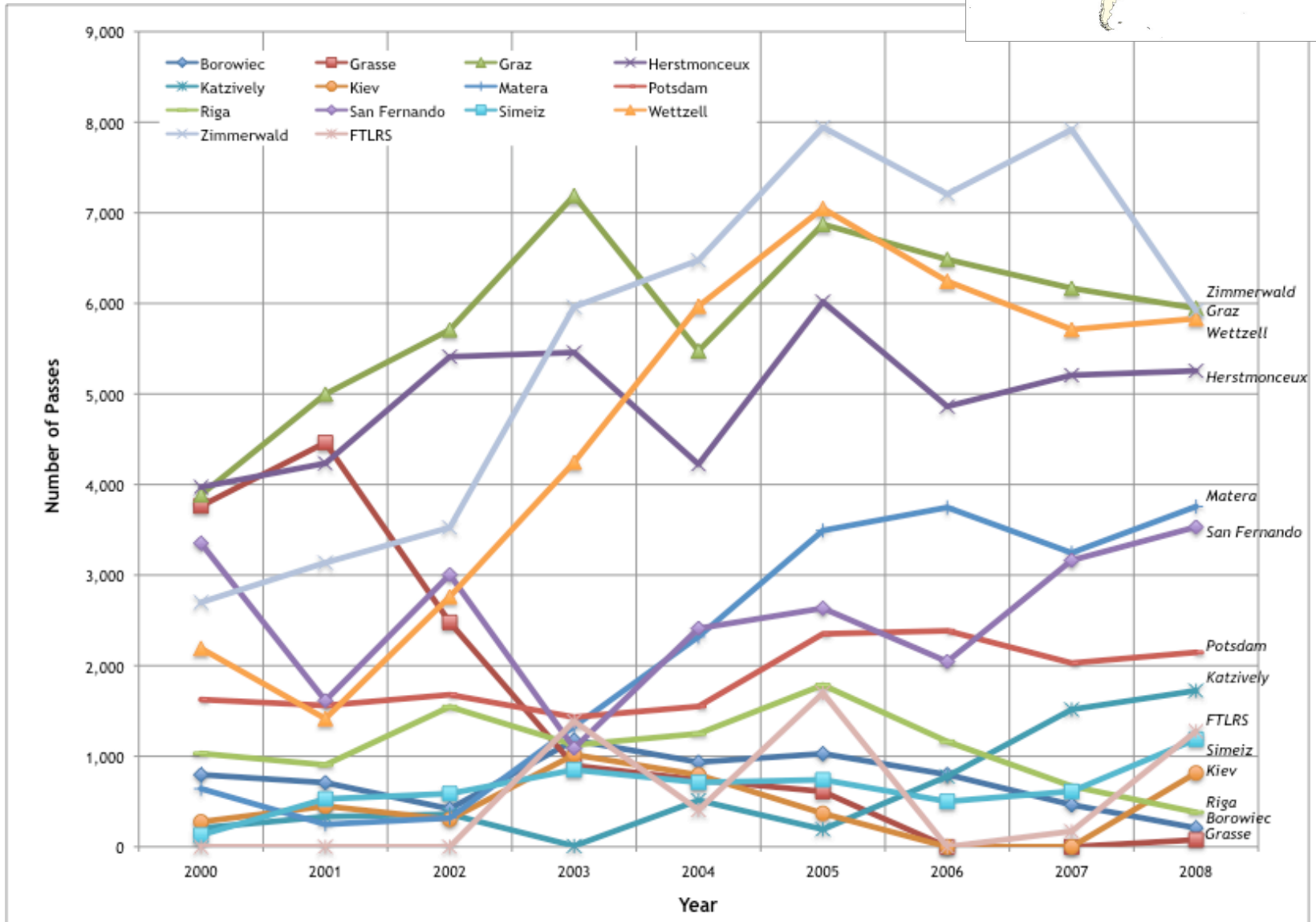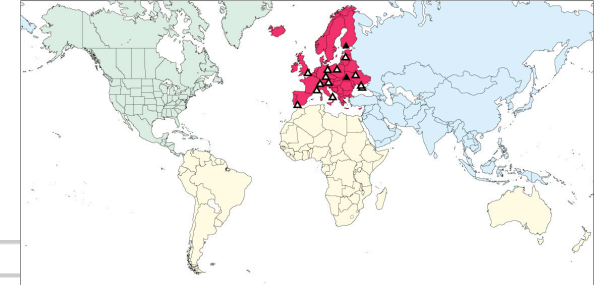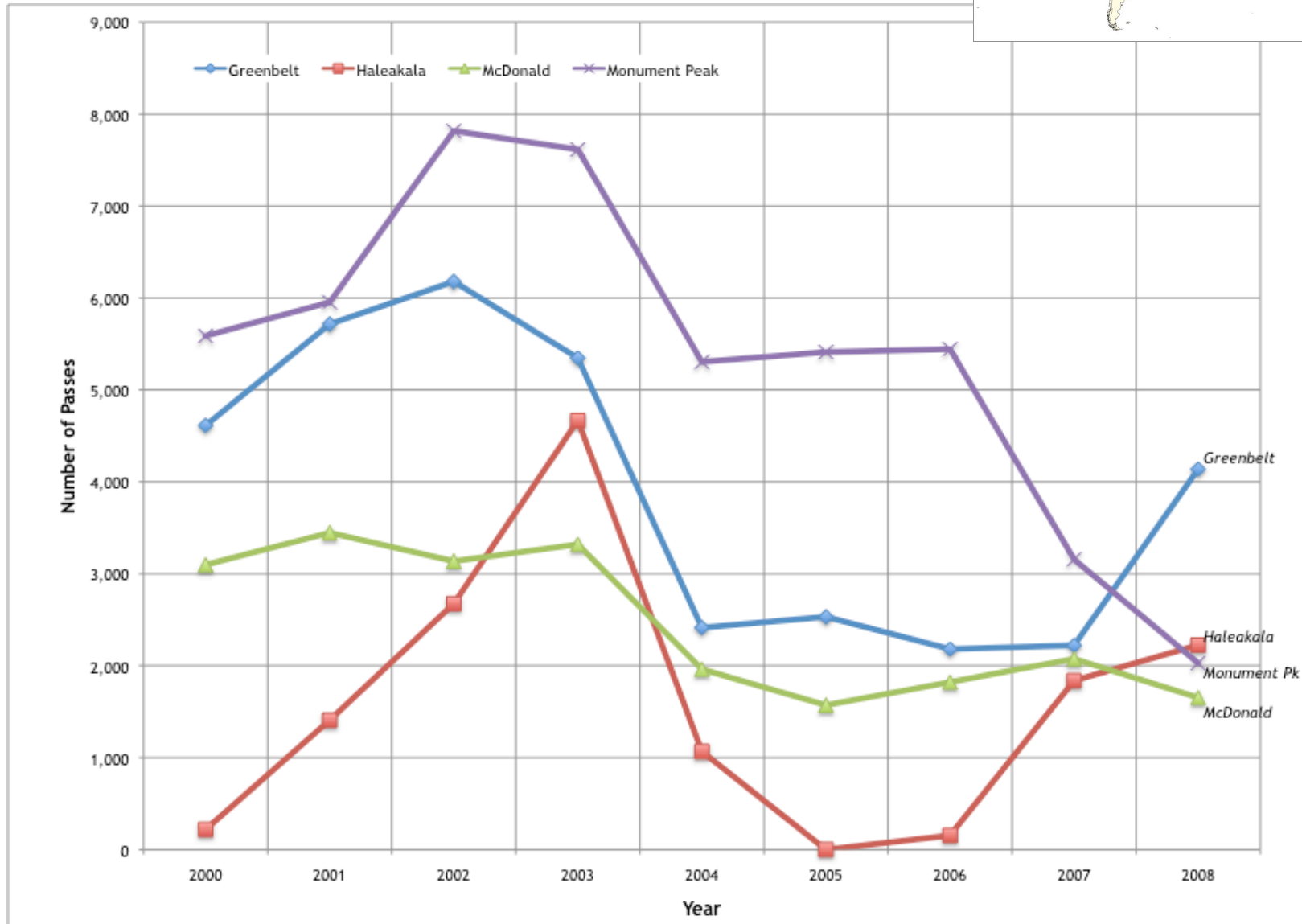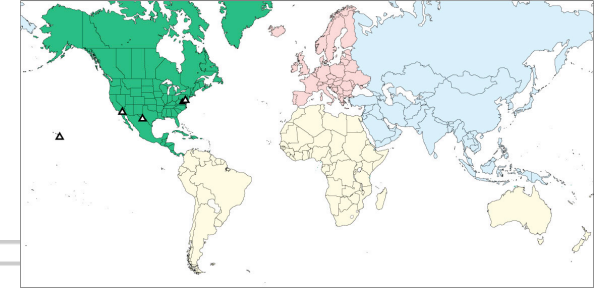Mt. Stromlo

Yearly Pass Totals
Asia

Yearly Pass Totals
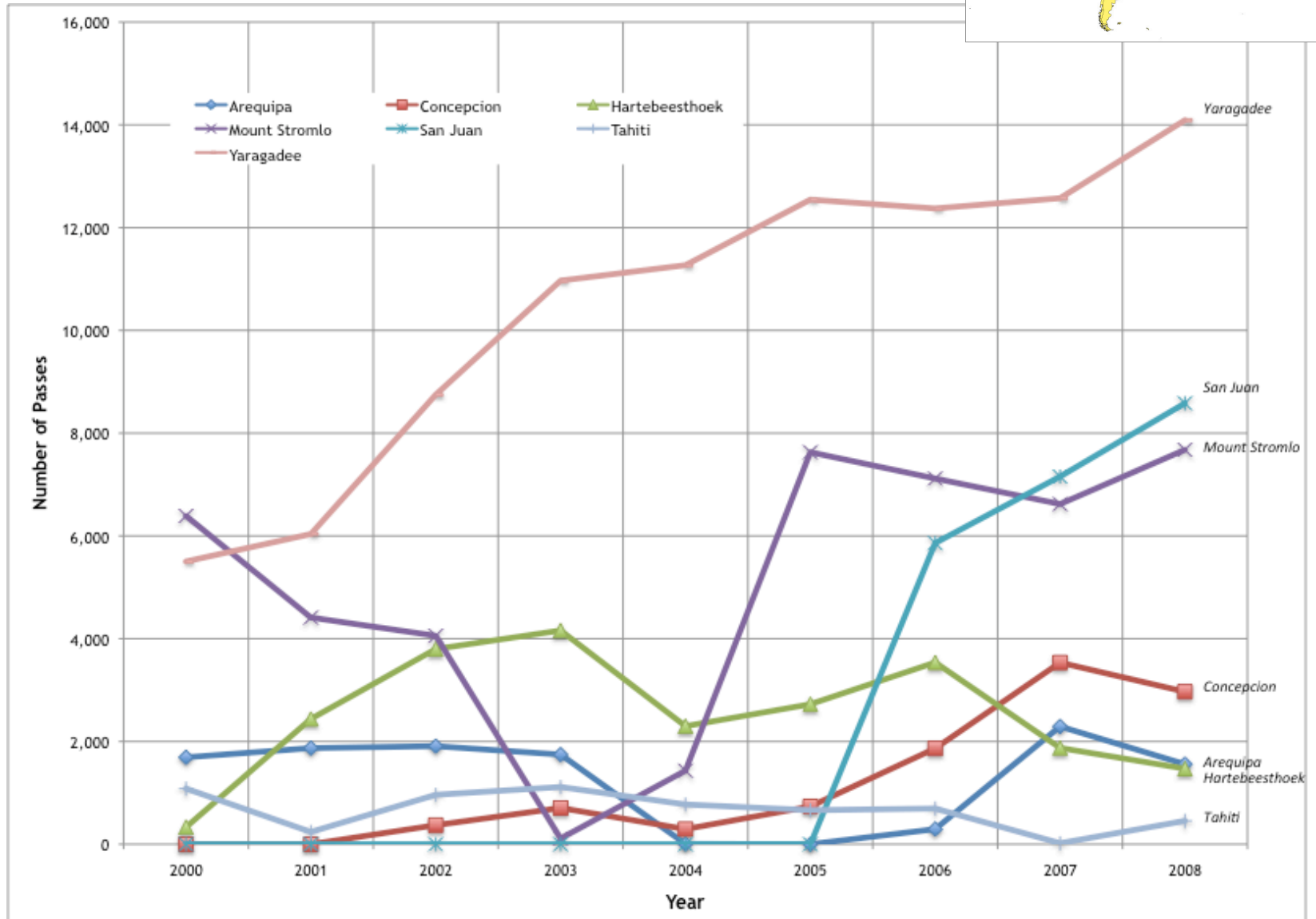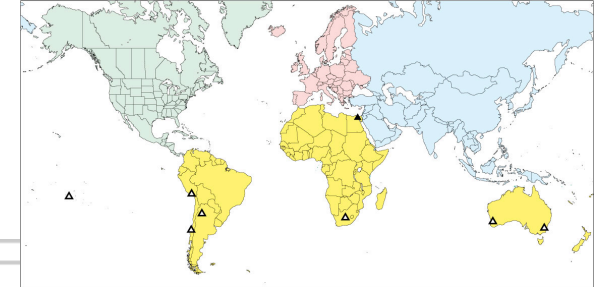## Europe

Yearly Pass Totals
North America

Yearly Pass Totals
Southern Hemisphere

Operational Station Status

CB Action: Survey stations not currently qualifying for operational status to ask what measures are being taken to reach operational status

Stations contacted: *Kiev*, Koganei, Kumning, *Tanegashima*, *Riga*, *Metsahovi*, *Boroweic*, Lviv, Simosato, Komsomolsk, Maidanak, and *Wuhan*

Responses:

- ✦ Riga
    - • Weather, atmospheric conditions, and funding are severe limitations
    - • Some modifications planned for the systems including daylight ranging
    - • Variations in accuracy assessment by the analysis centers is frustrating
- ✦ Metsahovi
    - • Upgrade underway with kHz laser, renovated mount and telescope
    - • Major rework of the software is underway
    - • Long term plan to replace the system, but funding very tight
    - • Expect to be operational by 2010
- ✦ Borowiec
    - • Modernization program has been underway, new telescope optics, detector, gating system, software, etc.
    - • Problems with many of the new systems including the software
    - • Should be ready by year end
    - • Weather is a severe problem
- ✦ Tanegashima
    - • Troubles with the equipment
    - • Bad weather condition
    - • Preparing a new backup power supply to avoid the past difficulties with the storm damage
    - • Trying to get back to normal operation soon.
- ✦ Wuhan
    - • Upgrade underway with Khz laser, new servo and event timer
    - • Expect to be operational later this year
- ✦ Kiev
    - • Personnel are trying; maybe 1-2 years

Mission Developments

- Supporting 31 missions and lunar tracking
- Jason-2 startup problems – problem with procedures *(CB Action)*
- SOHLA-1 launched on January 2009; first campaign in March, second campaign in fall probable
- GOCE launched March 17, 2009; tracking began March 31
    - problem with predictions due to non-drag free operation
    - cease tracking until operations are normalized *(CB Action)*
- GLONASS-115 replaced GLONASS-99 on March 31
- Currently tracking COMPASS-M1; issues with predictions, now cleared up
- Upcoming launches of approved missions:
    - STSAT-1: April 2009
    - ANDE: June 2009
    - BLITS: June 2009
    - LRO: June 2009
    - QZSS-1: 2009
- New Mission Support Request Form with more instructions and signature requirement:
    - *http://ilrs.gsfc.nasa.gov/docs/ilrsmsr_0901.pdf*
        - http://ilrs.gsfc.nasa.gov/docs/ilrsmsr_0901.pdf

Satellite Tracking (2008)
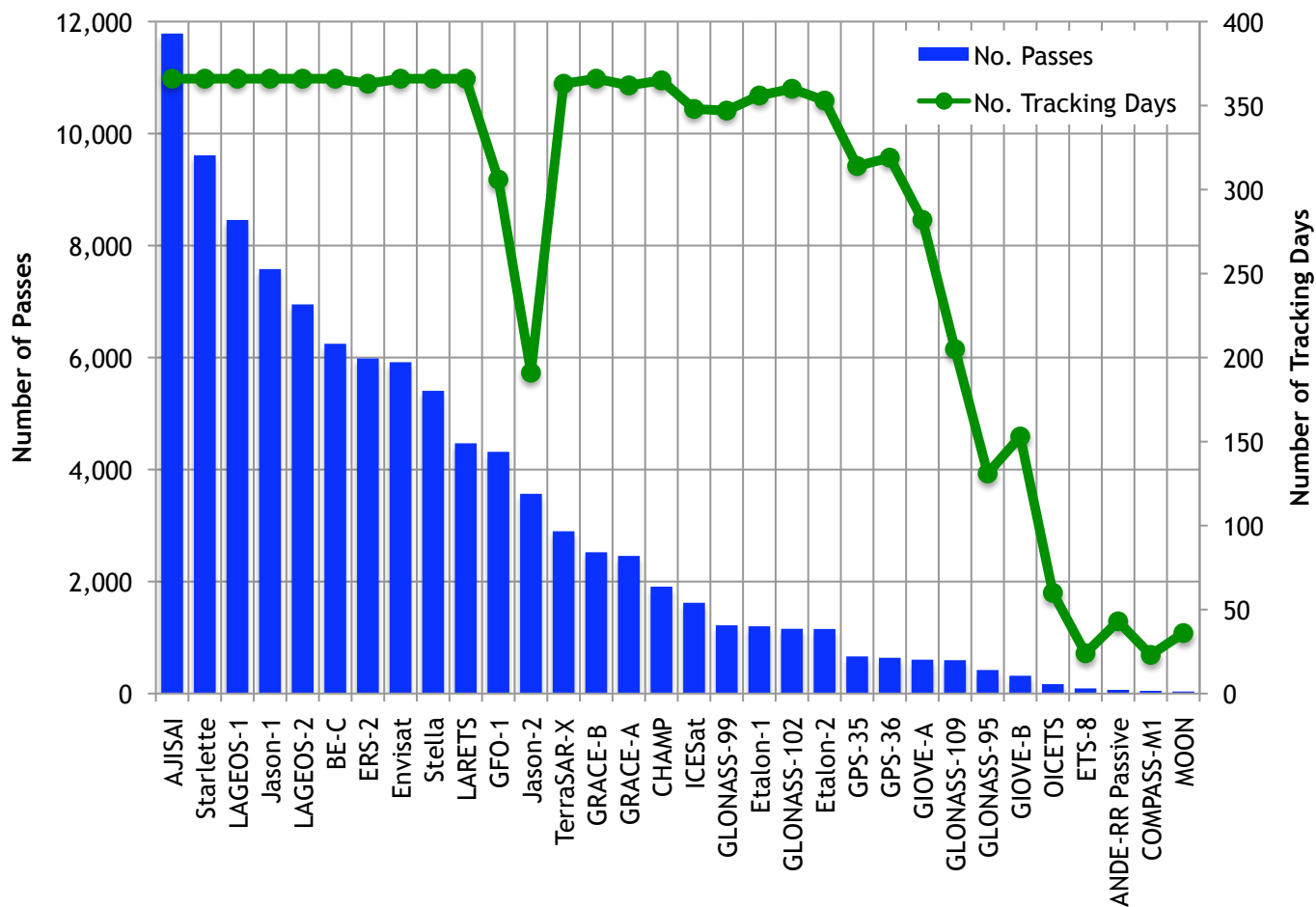
- Tracking about 1300 Lageos passes per month
- Tracking a minimum of 160 passes per month on LEO satellites

SLR Data User Survey (CB Action)

- Survey to analysis community in January 2009 (ACs and AACs) to determine:
  - ✦ Targets used,
  - ✦ Analysis topics,
  - ✦ ILRS performance, etc
- Response from 16 ACs/AACs (all 8 ACs)
- Results to be posted on the website
- All satellites have at least one customer

- Next step: survey mission contacts
  - ✦ Verify continued ILRS tracking support is required
  - ✦ Ensure ILRS is providing adequate support

Targets Used by Analysis Community
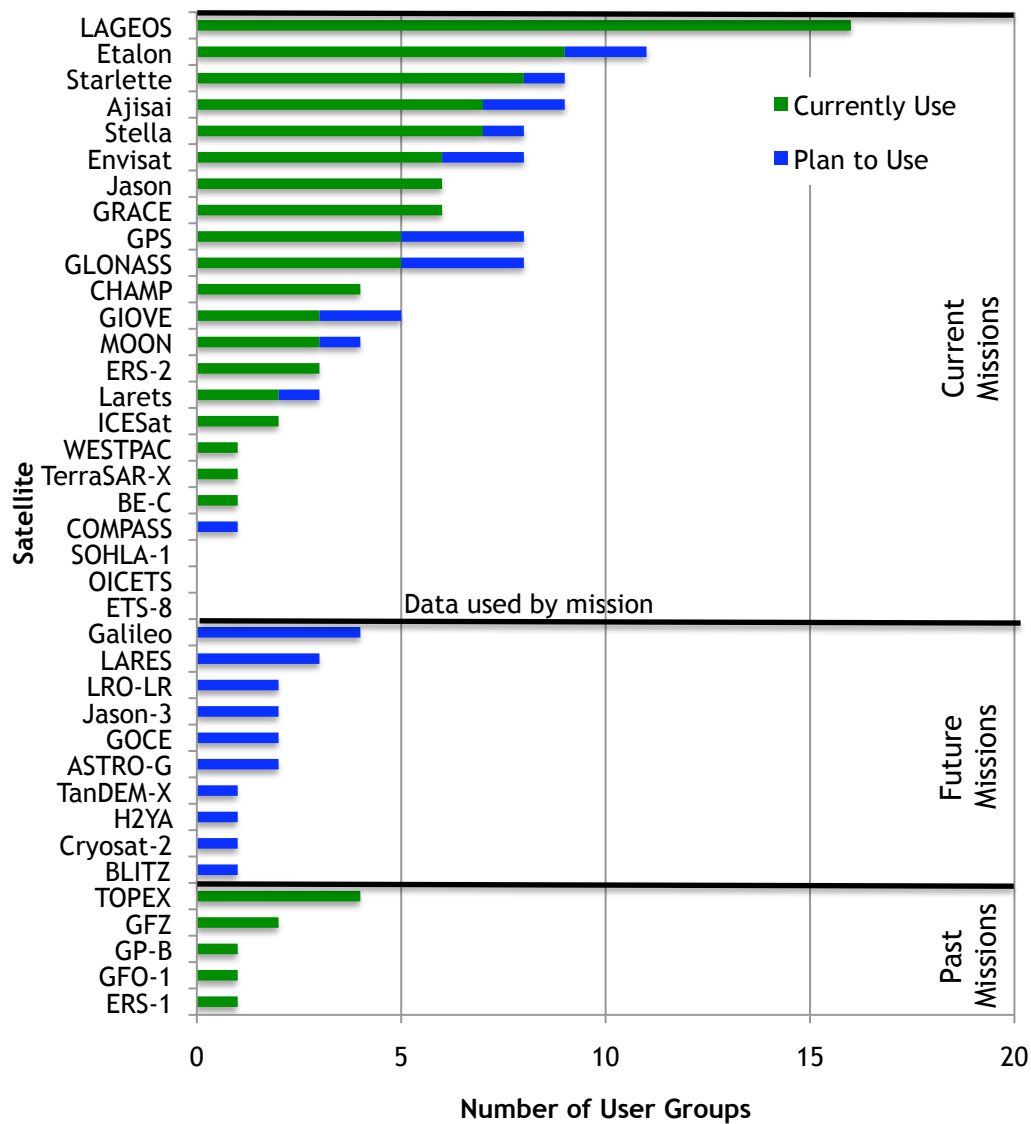
Data from every satellite is being used or planned for use by at least one group

Applications of Analysis Community
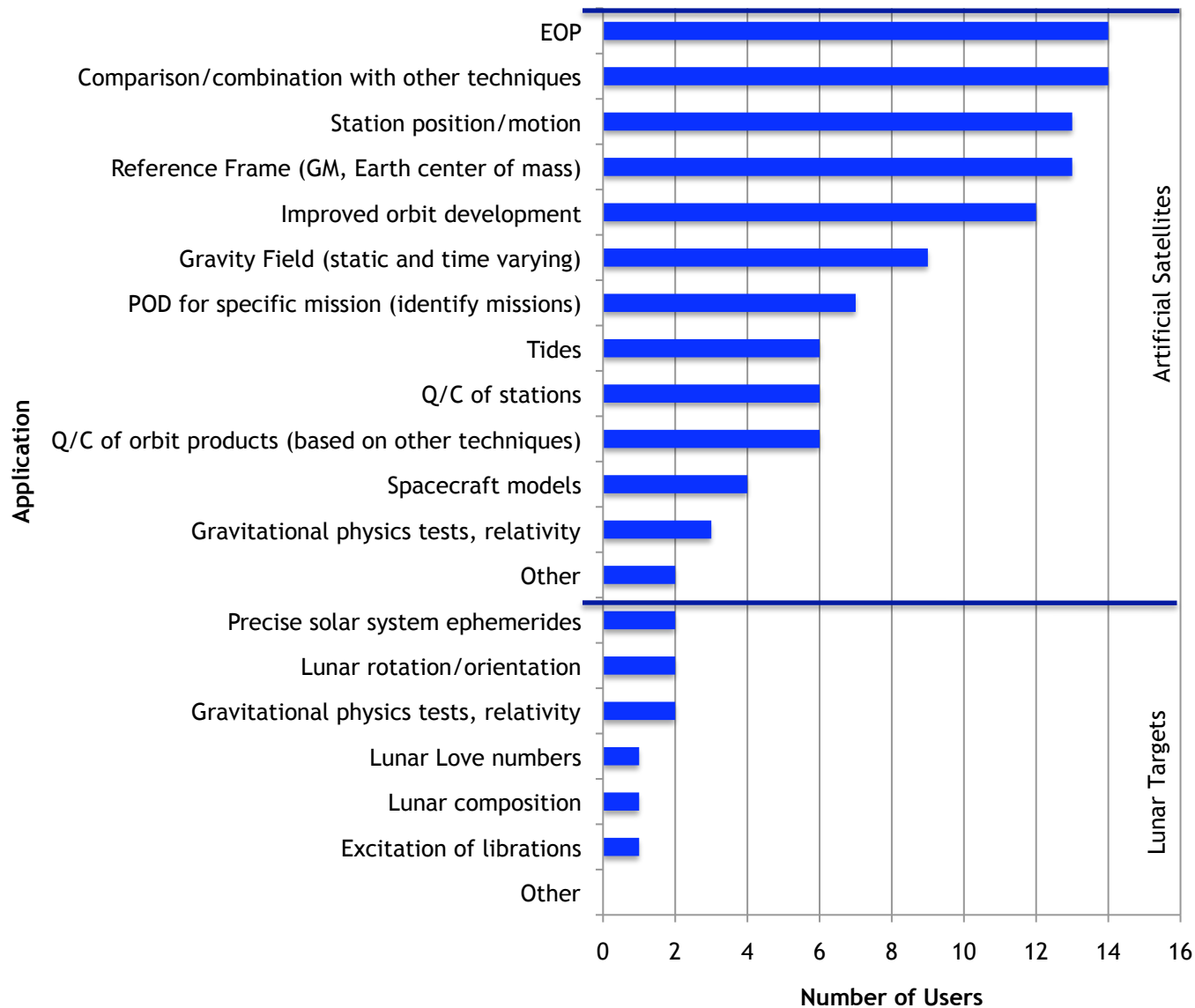
Other CB Action Items

- CRD Format (New)
  - ✦ **Monthly monitoring of the full process**
  - ✦ **Remind stations and Analysis Centers of the deadlines**
- Link more closely with the WG's – maybe monthly reports, telecons? (New)
- Organized GNSS comparison test campaign in March (done)
  - ✦ Report from Graham on the results so far
- Take action to join FAGS (on hold)
  - ✦ FAGS disbanded to be replaced by WDS
  - ✦ New members not accepted in the interim
  - ✦ Procedures to join WDS TBD
- Assemble the ILRS 2007-2008 Report (in process)
  - ✦ Inputs due April 15
  - ✦ Some responses already
- Contact designated stations for Stanford Counter testing (Status unclear)
- Editorial Board to to develop a table of contents and a plan for the ILRS special issue for the Journal of Geodesy;
- Query the stations on plans to use a dynamic priority tool and work with the Working Groups to formulate some simple algorithms to encourage stations to better distribute their tracking efforts;

Remaining Items

- Some papers still outstanding for the 16th Laser Ranging Workshop; printing planned for June 2009
- New ILRS exploders implemented in April

GNSS Retroreflector Arrays

- ILRS Standard for GNSS retroreflectors is posted and advertised
  - Some additional constraints on ground pattern have been suggested
- Talk given at the Third Meeting of the International Committee on GNSS in Pasadena on December 8 -12, 2008
- GPS
  - Meeting at Lockheed-Martin on February 18 to discuss placement options for arrays on GPS-3 series (2014 – 17 timeframe)
  - Talk invited at the Users Partnership Council on May 14
  - Keep feeding NASA material to argue for the arrays
- Galileo
  - Met with the Director of ASI to discuss our needs and requirements on Galileo
  - Dialogue underway; they are focused on the ILRS Standard with uncoated cubes
  - Trying to get some cubes to INFN for testing
- COMPASS
  - Success with the uncoated cubes on COMPASS
- Signal link test underway on the GNSS satellites – Graham Appleby

Meetings

- April 19-24, 2009: EGU General Assembly, Vienna Austria
    - ILRS DF&PWG, MWG, AWG meetings
    - GGOS SC, Networks and Communications Bureau meetings
- August 31-September 04, 2009: IAG Scientific Assembly, Buenos Aires Argentina
- ***September, 2009: ILRS Workshop (Tracking GNSS), Metsovo Greece***
- December 2009: 2nd GGOS Unified Analysis Workshop
- December 14-18, 2009: Fall 2009 AGU
    - GGOS SC, Networks and Communications Bureau meetings
- January 2011: 17th International Workshop on Laser Ranging, Concepción Chile
- 2011: IUGG General Assembly, Melbourne Australia

Analysis Working Group Report

ILRS Governing Board Meeting

Vienna, Austria, Wednesday, April 22, 2009

Erricos C. Pavlis

Analysis Coordinator

AWG Projects

- Eight AC: ASI (AC & CC), BKG, DGFI (AC & CC), GA, GFZ, GRGS, JCET, and NSGF

- Candidate AC/AAC: **AIUB**, **ESOC, NCL** and MCC

- Operational products (weekly & daily) are delivered routinely on time

- Re-analysis for 1993 to present by seven ACs:
  ASI, DGFI, GA, GFZ, GRGS, JCET, NSGF

- Historical data re-analysis 1983 to 1992 by six ACs:

  ASI, DGFI, GA, GFZ, JCET, NSGF

- Both CCs submitted combinations to ITRF2008

current ILRS AC solutions: weekly reanalysis pos+eop versions
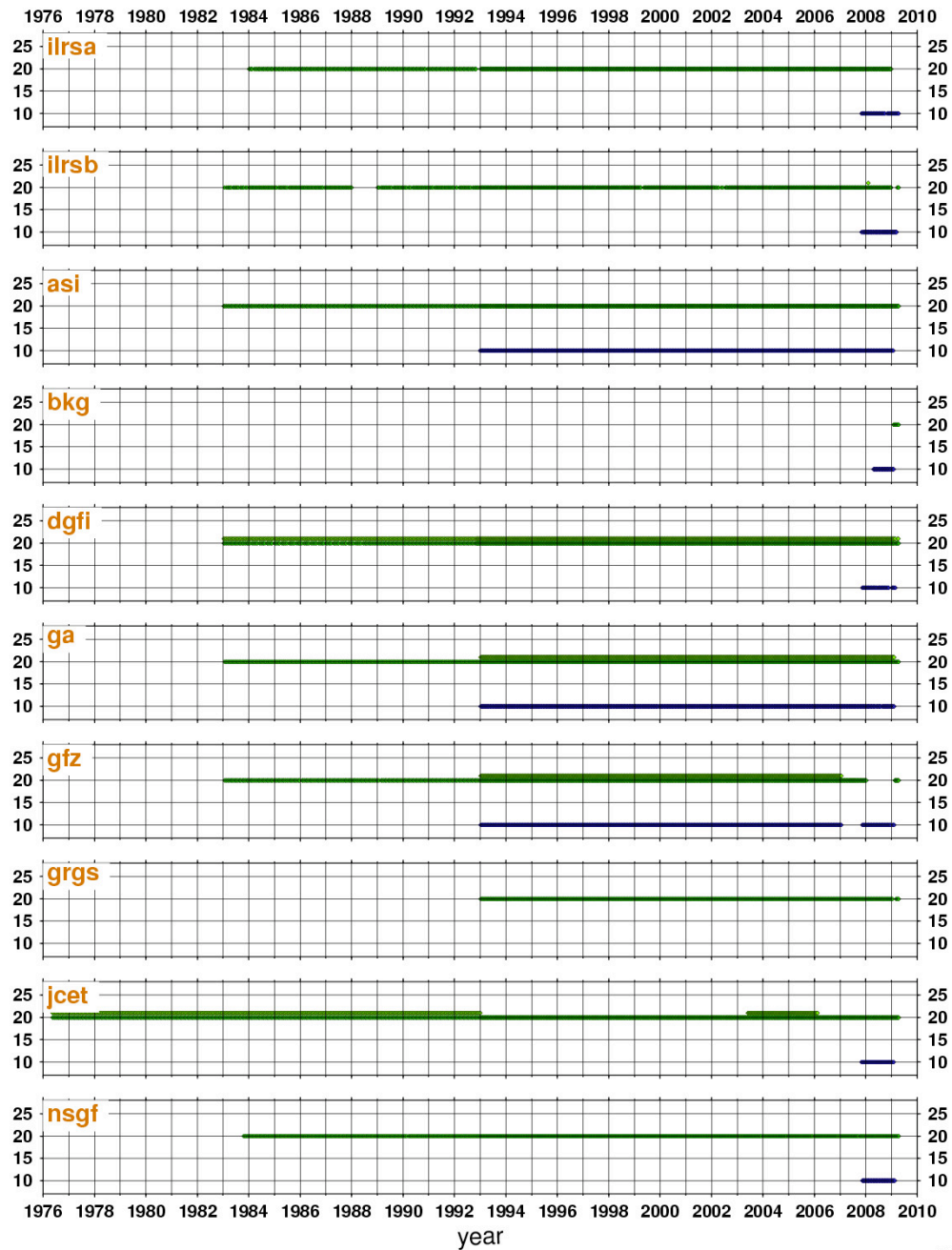
RMS values for differences between Helmert parameters w.r.t. ITRF2005S (SLRF2005) of successive weekly ILRS solutions (January 1993 - December 2008)

	AC	Tx [mm]	Ty [mm]	Tz [mm]	Sc [mm]
Individual	ASI	5	5	10	5
	DGFI	8	6	13	5
	GA	7	6	11	5
	GFZ	6	5	11	5
	GRGS	7	7	11	7
	JCET	5	5	11	5
	NSGF	12	12	23	9
Combination	**ILRS-A**	**4**	**4**	**9**	**4**

All Sites - Residuals WRMS wrt SLRF2005

Legend:
ASI
GA
GRGS
DGFI
JCET
NSGF
GFZ
C
12 per. Mov. Avg. (GFZ)
12 per. Mov. Avg. (NSGF)
12 per. Mov. Avg. (JCET)
12 per. Mov. Avg. (DGFI)
12 per. Mov. Avg. (GRGS)
12 per. Mov. Avg. (GA)
12 per. Mov. Avg. (ASI)
12 per. Mov. Avg. (C)

Core Sites - Residuals WRMS wrt SLRF2005

Legend:
ASI
GA
GRGS
DGFI
JCET
NSGF
GFZ
C
12 per. Mov. Avg. (GFZ)
12 per. Mov. Avg. (NSGF)
12 per. Mov. Avg. (JCET)
12 per. Mov. Avg. (DGFI)
12 per. Mov. Avg. (GRGS)
12 per. Mov. Avg. (GA)
12 per. Mov. Avg. (ASI)
12 per. Mov. Avg. (C)

Scale

Legend:
- ASI
- GA
- GRGS
- DGFI
- JCET
- NSGF
- GFZ
- C
- 12 per. Mov. Avg. (GFZ)
- 12 per. Mov. Avg. (NSGF)
- 12 per. Mov. Avg. (JCET)
- 12 per. Mov. Avg. (DGFI)
- 12 per. Mov. Avg. (GRGS)
- 12 per. Mov. Avg. (GA)
- 12 per. Mov. Avg. (ASI)
- 12 per. Mov. Avg. (C)

Y-axis: mm (from -10 to 30)

X-axis: 9/19/91, 6/15/94, 3/11/97, 12/6/99, 9/1/02, 5/28/05, 2/22/08, 11/18/10

AWG New Projects

- Pilot Projects currently in progress:

    - *Orbit products (SP3C) -- 6 AC in testing (ASI, BKG, DGFI, GA, GRGS, JCET)*

    - *Daily solutions of 7-day arcs for 1^d EOP for NEOS (5 ACs + DGFI soon!?)*

    - *CRD data format submission station qualification process: ASI, GFZ, GRGS, JCET (so far only JCET has tested MLRS CRD vs. ILRS QL NP data)*

- New Potential projects:

    - *Testing the application of atmospheric effects in ILRS products*

    - *Generation of a "low degree ~2 harmonics" series (for CPP/GGOS)*

    - *3-4 ACs to study the possibility of a new definition of NP generation procedure*

    - *Use of Starlette and Ajisai initially for EOP and eventually for TRF products with improved modeling (e.g. atmospheric effects)*

    - *Near real-time analysis of SLR data for "station health"/bias Rpts.*

AWG Meetings, Past/Future

- The AWG met twice so far in 2008:

  - *EGU 2008, Vienna, Austria*

  - *16th International Laser Workshop, Poznań, Poland*

- Next two meetings in 2009:

  - EGU 2009, TUW, Friday, April 24

  - **METSOVO Workshop**, Friday or Saturday, Sept. 18/19, (see dedicated, separate presentation)

AWG Documentation

- All ACs and CCs have submitted online documentation (required by IAG/IERS) describing the models and standards used in their routine analysis, some AACs *(need to remind them often!)*

- A LR-dedicated special issue of the *Journal of Geodesy* to be compiled this year for better and wider documentation of ILRS (ground segment, space segment, data analysis and interpretation)

ILRS Missions Working Group report to GB
Wednesday April 22nd 2009, TU Vienna

Agenda from MWG 22nd April 2009

Reports on current & future missions:
    SHOLA-A, OICETS, ETS-VIII, QZSS;
    Ande
    T2L2 (report submitted by P Exertier)

GNSS laser return tests:
    SGF prelim. results,
    Any other results?

Restricted Tracking Status Report

Routine procedure for support recommendations

- As well as asking MWG members for comments:

- Use expertise in other Working Groups too:
  - Analysis WG regarding need for POD
  - Signal Processing for comments on LRA suitability
  - DFPWG and NEWG regarding operational issues (go-nogo flags, available CPFs, etc)

- Chairs of these WGs are ex-officio members of MWG

Missions 'processed' since October 2008

- BLITS – ball lens in Space - (IPIE) – approved. Useful discussion with IPIE regarding details of CoM correction. June 2009 launch.

Ready for testing

- ANDE (Castor & Pollux) - (NRL) – approved. May 2009 launch
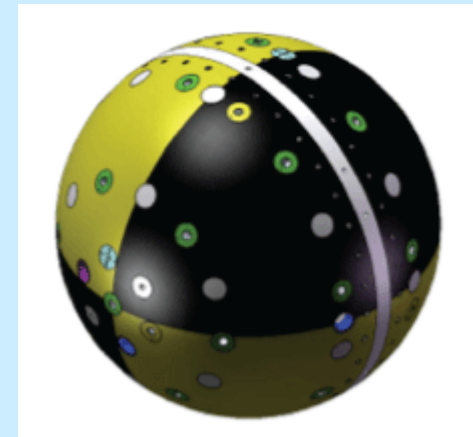
GNSS Retroreflector Tracking Tests 03/09

- A tracking Campaign to test the efficiency of in particular the un-coated cubes on COMPASS-M1;
  - Organised for March 2009

- Main contributing stations:
  - Yarragadee, Monument Peak, Conception, Herstmonceux

- Preliminary data analysis
  - Carried out on full-rate data at SGF Herstmonceux (Wilkinson an Appleby)

  - Based on return rates as computed from numbers of returns per 5-minute 'bins', taking account of rep-rate

- Sample results follow.

Yarragadee -- 2009 -- Adjusted for range

Average Return Rate vs Elevation for HEO satellites from Yaragadee since 2009.00 at 5Hz
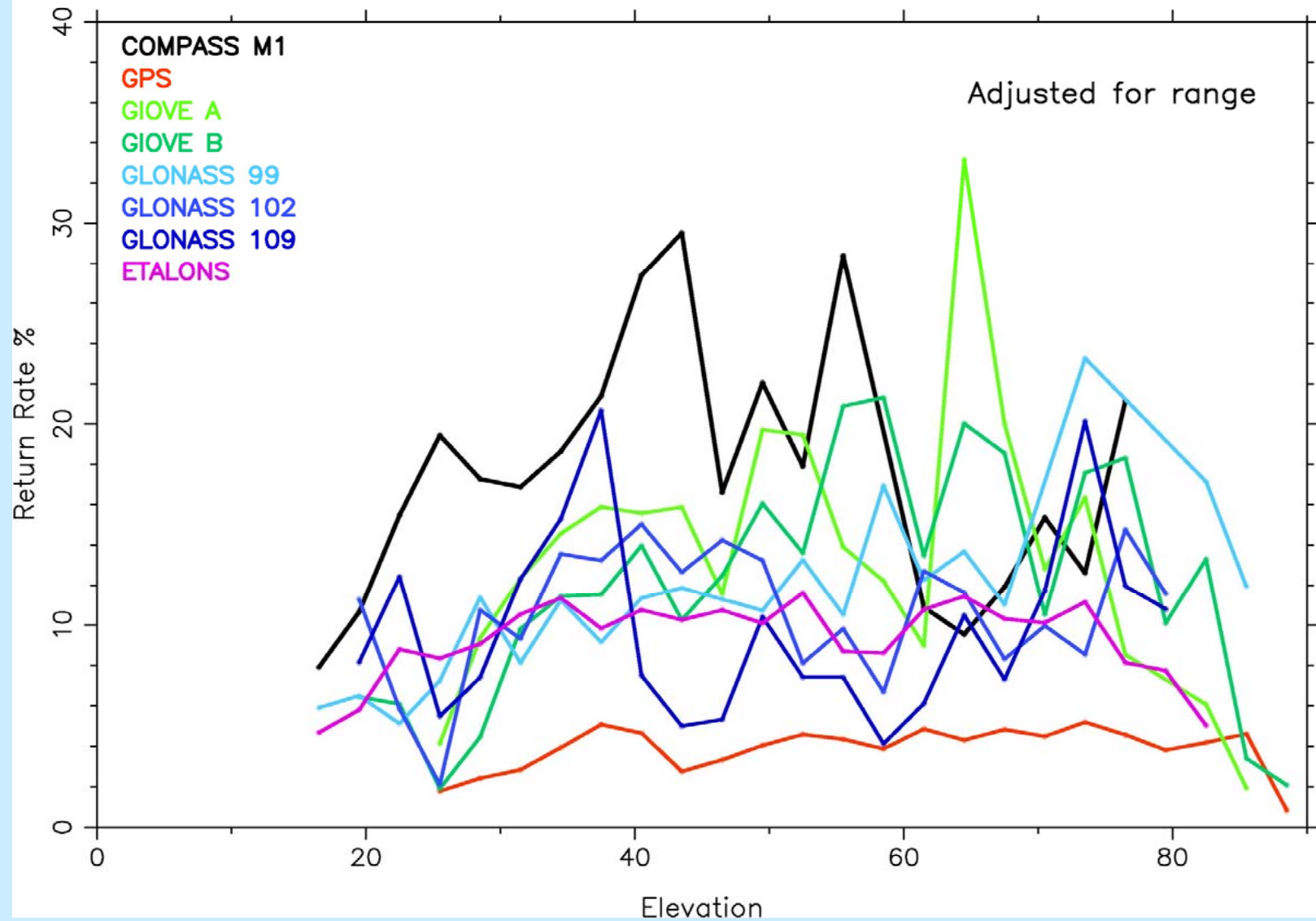
Monument Peak   -- March 2009 -- Adjusted for range

Average Return Rate vs Elevation for HEO satellites from Monument Peak for March 2009 at   5Hz

COMPASS M1
GPS
GIOVE A
GIOVE B
GLONASS 99
GLONASS 102
GLONASS 109
ETALONS

Adjusted for range
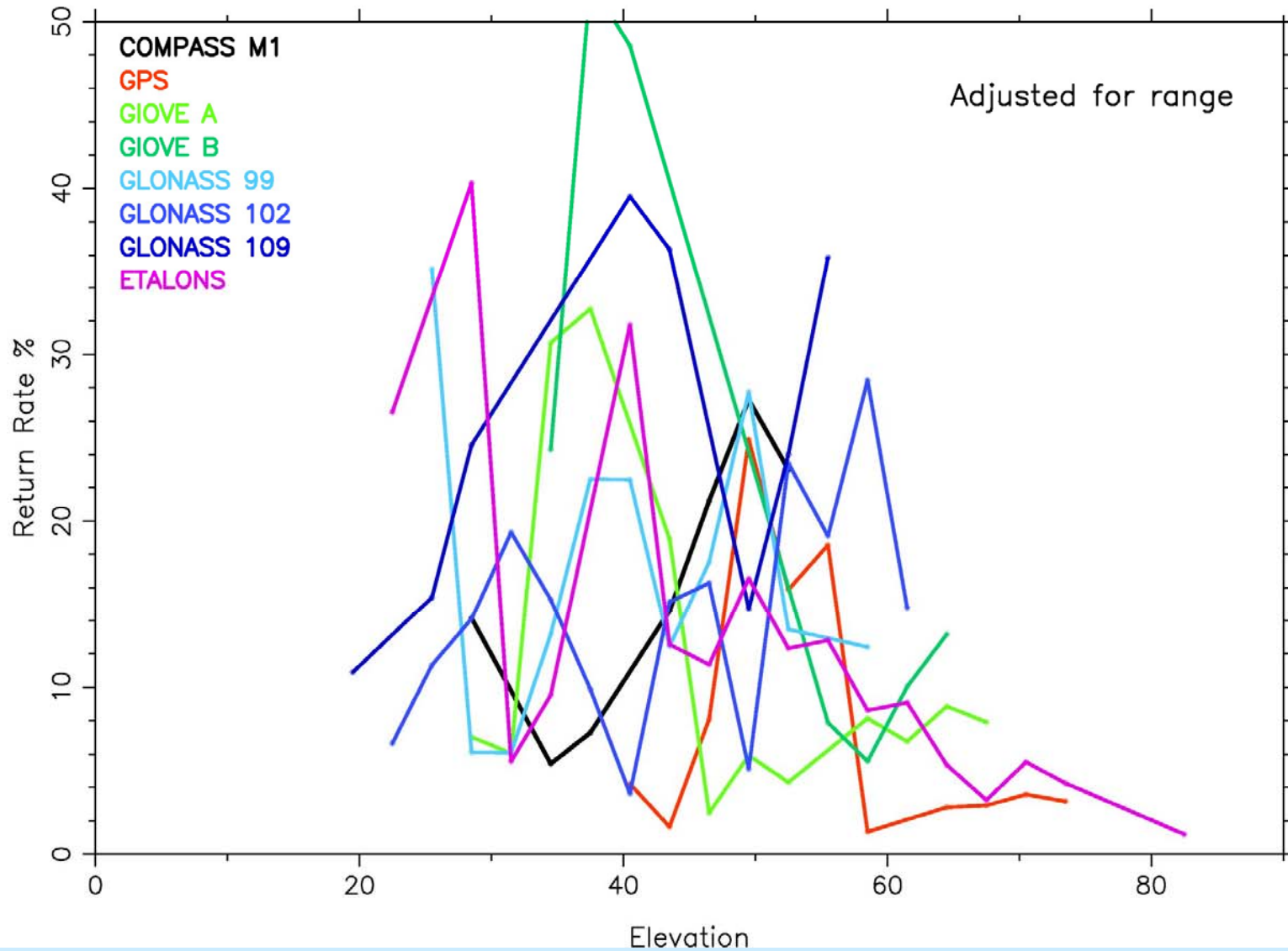
Monument Peak   -- 2009

Average Return Rate vs Elevation for HEO satellites from Monument Peak since 2009.00 at   5Hz

COMPASS M1
GPS
GIOVE A
GIOVE B
GLONASS 99
GLONASS 102
GLONASS 109
ETALONS

Return Rate %

Elevation
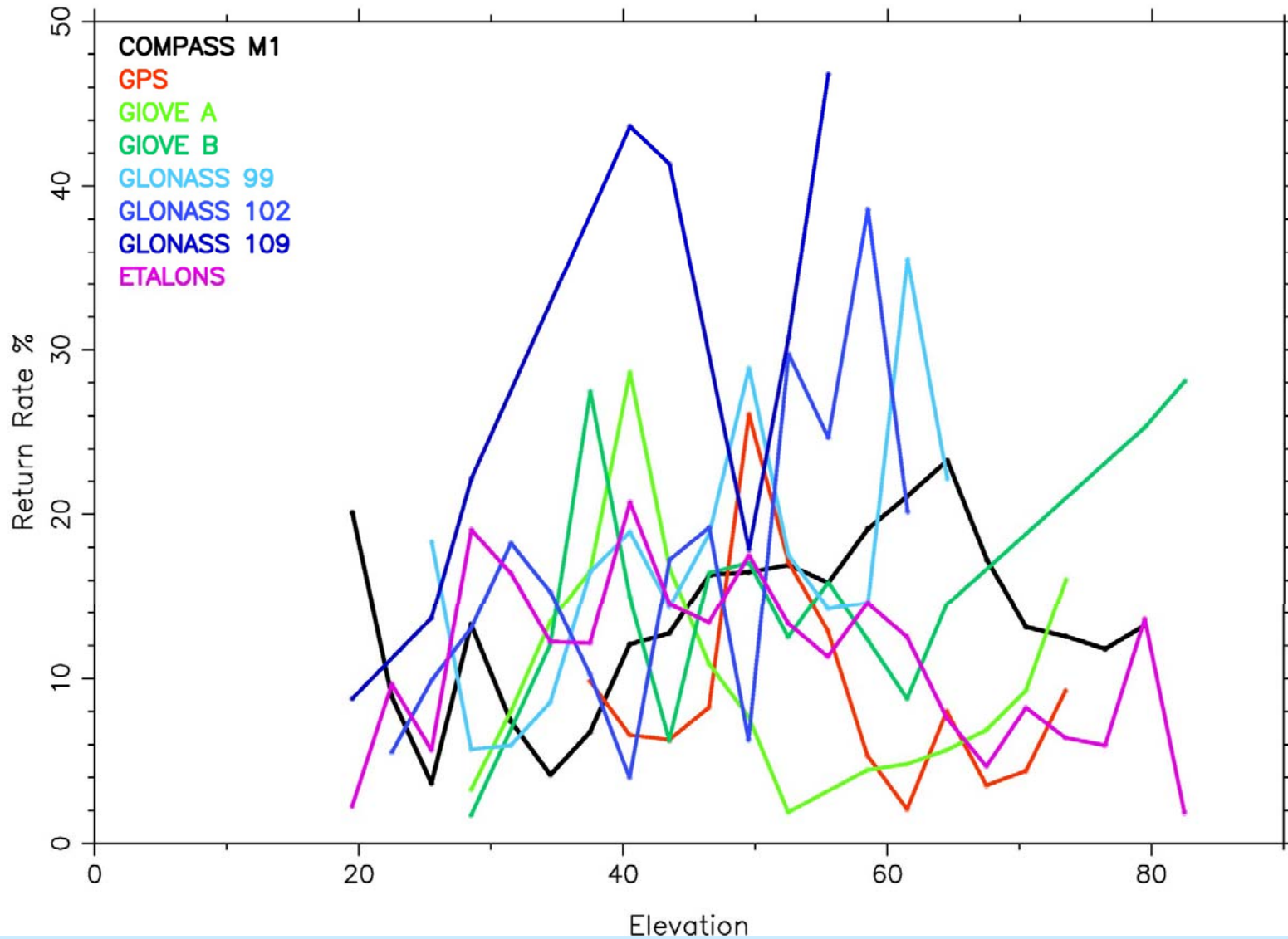
GNSS Retroreflector Tracking Tests 03/09
Summary

- The range-adjusted results for March 2009 suggest that the COMPASS-M1 56-cube array is at the level of efficiency of the 132-cube array on the current ILRS GLONASS targets;
  - But results not clear-cut e.g. for Mon Peak and Conception

- The COMPASS-M1 array appears to be more efficient than the arrays on GIOVE

- Using more, non-campaign, FR, data as available in the data centres tends to support this conclusion, with increased precision

- Comment – difficult to manage a campaign such as this:
  - Busy stations have mapped out an efficient satellite-hopping schedule to maximise yields

CRD Format Status

Stations providing CRD format

- 10 stations deliver CRD npt-data, these are Simeiz (1873), Changchun (7237), Concepcion (7405), Zimmerwald (7810), Mount Stromlo (7825), Herstmonceux (7840), Grasse (7845), Matera (7941), Wettzell (8834), McDonald (7080)

- 10 Stations deliver CRD fr-data (T2L2), these are Simeiz, Changchun, Zimmerwald, Mount Stromlo, Herstmonceux, Grasse, Matera, Wettzell, Grasse/ FTLRS (7829), McDonald

CRD Format Status (cont'd)

- Most of the stations send their crd data in correct format and with correct content, only some stations have minor problems, which will be solved soon

- Katsively (1893) announced to provide crd data soon

- Decision: Every month an update of current crd data delivery will be reported

CRD Format Status (cont'd)

- Proposal: we should start with the daily crd data exchange next month before the transition to the hourly delivery

- Another proposal if requested by SLR stations: we would install a web page where the stations can put their crd data, and will receive the outputs of the crd check and the quality check before sending them to the data centre to avoid additional more work

Quarantining of data from new stations or updated stations

Decision:

- First - the Network and Engineering WG should provide a procedure to test the new data

- Second - the Analysis WG should validate the new data

Other business, next meeting

- New satellites, new missions: Before the start of observations of new satellites/ missions the procedures for the CPF predictions, etc. should be tested

- Next meeting: During the ILRS Workshop (Tracking GNSS), Metsovo Greece, September 14-19, 2009; about exact day and time of the meeting the members will be informed

NEWG – Network & Engineering WG (1)

- China: Extensive kHz Station Upgrades:

  - 4 Lasers Photonics: 3.0 mJ, 1 kHz, 10-25 ps; (delivery June 2009)

  - 1 Laser Photonics : 3.0 mJ, 1 kHz, 10-25 ps (San Juan, to be approved soon ...)

  - 2 Lasers Photonics: 1.5 mJ, 1 kHz, 10-25 ps;

  - 1 High-Q-Laser : 1-2 kHz; Ordered; Beijing

  - First kHz operations expected August / September 2009 (Shanghai, Changchun)

Vienna, 2009-04-21

NEWG – Network & Engineering WG (2)

SOHLA-1:

- 5 s returns

- 15 s gap

- 59 k returns remain

- BUT: RMS ≈ 20 mm

- Due to Retros !!!

- BETTER DESIGNS

  for full SLR accuracy
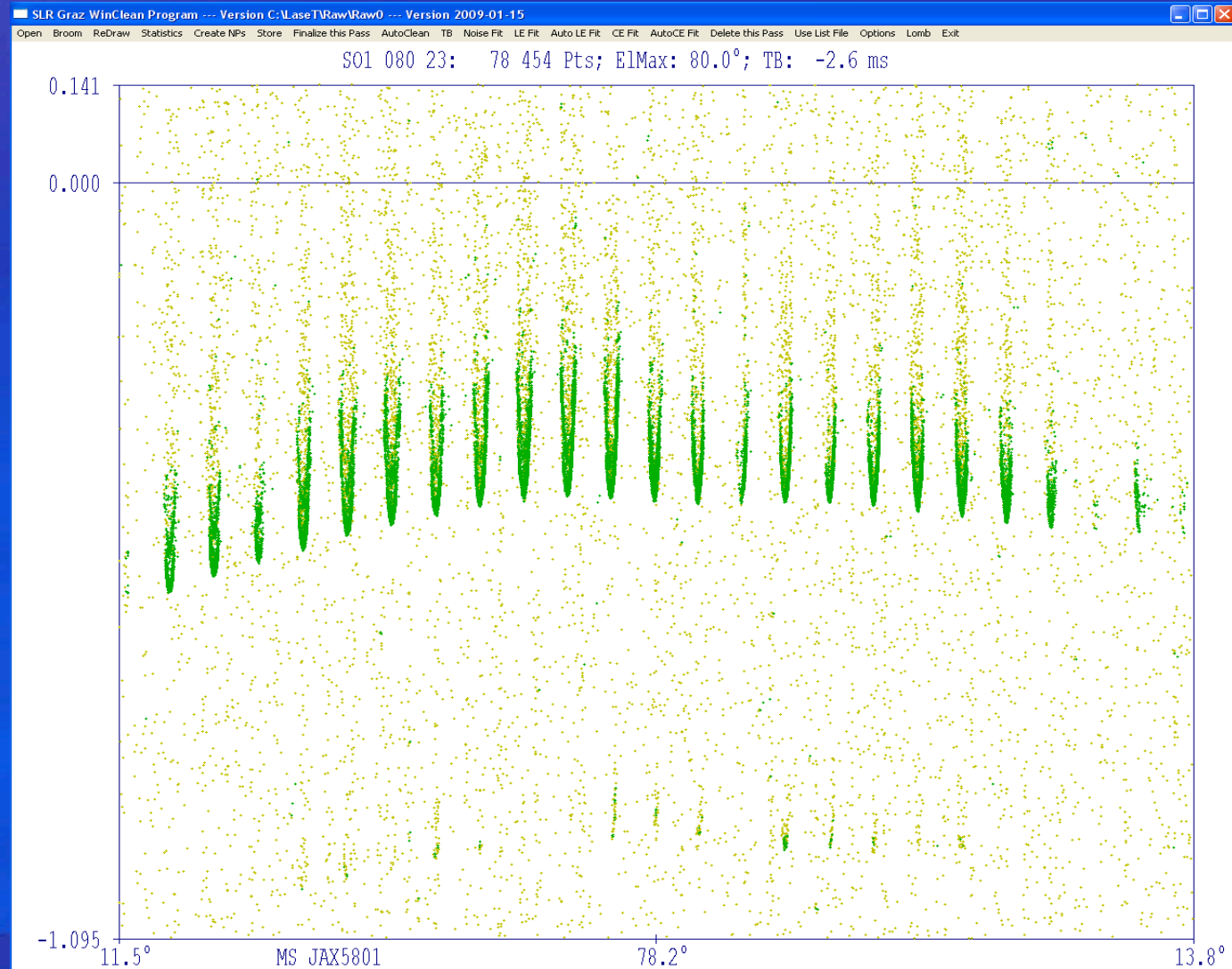
NEWG – Network & Engineering WG (3)

Other SLR Stations / Tasks:

Korea: 40 cm Mobile Station: Design is progressing; Close cooperation with Graz,
          Herstmonceux, Zimmerwald

Metsahovi: Working on kHz Control Software; major portions operational

Compass-M1 Retro Efficiency tests: Suggest to continue / to collect more data ...

Herstmonceux: SR620 calibrations finished; no more reactions from other SLR's

       kHz Laser: Still fighting with laser problems

Astro-G: Data Screening Problems; waiting for further details / requirements from
      the mission operation team

Transponder Working Group (Ad hoc)

- T2L2
  - Wettzell, Zimmerwald, Herstmonceux, Matera, Herstmonceux, Zimmerwald, Mt. Stromlo, and Changchun are submitting data in CRD format;
  - Randy has been working with Etienne Samain to clean up data issues;
- LRO-LR
  - Launch now scheduled for June, 2009; operational ranging will begin about a month after launch;
  - Four ILRS partner stations participating: MLRS, Zimmerwald, Herstmonceux and Wettzell; Agreement with Wettzell underway;
  - NGSLR has just successfully gone through the LRO Flight Operations Review; ready for laser ranging to LRO;
  - Testing of LRO enabling modification for the MOBLAS systems should be completed by mid-May;
  - First data flow test for ILRS stations participating in LRO-LR went well.
- Proposals and Studies for transponder programs on ACES, EGE, a NASA Lunar Missions and a NASA Mars Missions.

Task Force-1

Charter:

Address concerns about inadequate two-way communication between the stations and the analysis centers to provide:

(a) unambiguous, timely reports to the stations regarding data quality and bias information, and

(b) timely reports to the analysis centers on configuration changes and other events that could affect system biases.

Task Force-1

Membership: W. Gurtner, G. Kirchner, T. Otsubo, E. Pavlis, M. Pearlman, and M. Torrence (lead)

Ongoing items:

- Methodologies and parameterization information obtained from each "quick-look" analysis center (QLAC), and will be posted at the ILRS web site.

- Communication of bias observation by QLAC's has been by T. Otsubo, H. Müller and E. C. Pavlis through direct email contact with the station(s).

Task Force-1

Open items:

- Solicit and coordinate Analysis Center concerns to the stations.

- Solicit and coordinate station engineering/configuration information to the AC's and QLAC's

Task Force-2

ILRS Stations
System Configuration and CoM Corrections for LAGEOS (PDF)

(as of 02-Feb-2009)

Stn Pad ID	Name	Pulse Length (ps)	Detector	Regime (single, few, multi)	Editing Level (x s)	Calib. St. Error (mm)	LAGEOS St. error (mm)	LAGEOS CoM range (mm)	ETAOLN CoM ADOPTED (mm)
1873	Simeiz	350	PMT	No CNTL	2.0	60	70	248-244	598
1884	Riga	130	PMT	CNTLD s->m	2.0	10	15	252-248	607
7080	McDonald	200	MCP	CNTLD s->m	3.0	8.5	13	250-248	603
7090	Yaragadee	200	MCP	CNTLD f->m	3.0	4.5	10	250-248	603
7105	Greenbelt	200	MCP	CNTLD f->m	3.0	5	10	250-248	603
7110	Mon. Peak	200	MCP	CNTLD f->m	3.0	5	10	250-248	603
7124	Tahiti	200	MCP	CNTLD f->m	3.0	6	10	250-248	603
7237	Changchung	200	CSPAD	CNTLD s->m	2.5	10	15	250-245	603
7249	Beijing	200	CSPAD	No CNTL, m	2.5	8	15	255-247	603
7355	Urumqui	30	CSPAD	No CNTL	2.5	15	30	255-247	610
7405	Conception	200	CSPAD	CNTLD s	2.5	15	20	246-245	603
7501	Harteb.	200	PMT	CNTLD f->m	3.0	5	10	250-244	603
7806	Metsahovi	50	PMT	?	2.5	15	17	254-248	603
7810	Zimmerwald	300	CSPAD	CNTLD s->f	2.5	20	23	246-244	586
7811	Borowiec	40	PMT	No CNTL f	2.5	16	23	256-250	609
7824	San Fernando	100	CSPAD	No CNTL s->m	2.5	30	25	252-246	604
7825	Stromlo	10	CSPAD	CNTLD s->m	2.5	4	10	257-247	613
7832	Riyadh	100	CSPAD	CNTLD s->m	2.5	10	15	252-246	604
7835	Grasse	50	CSPAD	CNTLD s->m	2.5	6	15	255-246	609
7836	Potsdam	35	PMT	CNTLD s->m	2.5	10	20	256-252	609
7838	Simosato	100	MCP	CNTLD s->m	3.0	20	40	252-248	607
7839	Graz	35	CSPAD	No CNTL m	2.2	3	9	255-250	610
7839	Graz kHz	10	CSPAD	No CNTL s->f	2.2	3	9	255-250?	610
7840	Herstmonceux	100	CSPAD	CNTLD s	3.0	6	15	246-244	571
7840	Hx kHz	10	CSPAD	CNTLD s	-1.5,+2.5	3	9	245	573
7841	Potsdam 3	50	PMT	CNTLD s->f	2.5	10	18	254-248	609
7941	Matera	40	MCP	No CNTL m	3.0	1	5	252-248	610
8834	Wettzell	80	MCP	No CNTL f->m	2.5	10	20	252-248	608

J of G Guest EB

- *J of Geodesy Editor contacted*
- *Procedures and limitations imposed by JoG provided*
- *ILRS Special Issue Editors:*
  - *Pavlis, Gurtner, Luceri, Pearlman*
- *Delayed due to higher priority for the development of the ILRS contribution to ITRF2008*
- *Realistic time-table for soliciting papers: Spring '09 (soon)*

ILRS JoG Special Issue

Dear Erricos,

Sorry for my late answer. I am very much interested in a special ILRS issue in Journal of Geodesy.Coming back to your questions: I don't see the 60 pages per special issue as a hard limit. We can talk about this. The background of this rule is that we have a lot of accepted papers in the queue and the delay between offline publication and print is several months; authors complain about this delay (and they are right). Therefore, I made an arrangements with Springer to reduce this queue (by increasing the number of issues a year) to an acceptable level, but we are not there were we would like to be. Springer cannot increase the number of issues a year unlimited.

Coming back to your e-mail: I would suggest that you first send me a draft table-of-contents as you suggested; scientific quality and relevance of the papers is the main criterion. I would like to achieve that the special issue addresses a broad community. I also find it important that ILRS data products are properly referenced in literature. If one of the papers of the special issue can serve as such a reference, that would be great.We also need to get an idea of how many pages (roughly) we can expect and, if necessary, talk about the range of page numbers for the papers.Hoping that helps you. If you have questions, please don't hesitate to contact me.

Regards, Roland Klees EiC JOGE

Global Geodetic Observing System (GGOS)

- Organized to provide an overall coordinating/ organizing umbrella for (space) geodesy;

- Became a permanent entity of the IAG in 2008;

- GGOS 2020 Plan in preparation for publishing by the Springer;

- GGOS Bureau for Networks and Communication established on January 1, 2009.

Bureau of Networks and Communications Role

- Develop a strategy to design, integrate and maintain the fundamental geodetic network of co-located instruments and supporting infrastructure in a sustainable way to satisfy the long-term (10 - 20 years) requirements identified by the GGOS Science Council.

- At the base of such a strategy would be the sensors and the observatories situated around the world providing the timely, precise, and fundamental data essential for creating the GGOS products.

- Primary emphasis would be placed on sustaining the infrastructure needed to maintain the evolving global reference frames, while at the same time ensuring the broader support of the scientific applications of the collected data;

- The strategy would exploit synergistic opportunities to better integrate or co-locate with the infrastructure and communications networks of the many other Earth Observation disciplines organized under GEOSS should be considered and exploited.

GGOS Bureau for Networks and Communication
Tasks - 1

It is recognized from the onset, that although the Bureau will provide coordination among the Services, it is really an entity that helps to represent the Services within GGOS and requires their support in order to function. Initially the Bureau will focus on the tasks below.
It is assumed that other tasks will be undertaken as the need arises:

*   Promote communication and integration among the Services;

*   Develop and maintain a ground network station information base and data product directory;

*   Develop a model that predicts the accuracy and stability of the reference frame as a function of the number of co-located SLR, VLBI, GNSS, and DORIS stations, their geographic distribution, their data quality and yield, and other properties to address GGOS requirements; utilize the model to provide guidelines for the design of the core ITRF network;

*   Estimate the size and distribution of the GNSS network necessary to provide reference frame access globally, commensurate with GGOS requirements;

*   Work with the Satellite Missions Bureau to establish the design of the ground network needed to meet mission POD requirements;

GGOS Bureau for Networks and Communication
Tasks - 2

- **Work with the IGFS to define its network requirements and to scope the size and geometry of the IGFS ground network;**

- **Establish and maintain a database of co-location survey vectors, data and procedures used to infer these vectors, and a database of misclosures between the co-location vectors and the analysis results**

- **Seek more effective ways to monitor inter-technique vectors at co-location sites;**

- **Maintain a database for co-location-vector time series;**

- **Identify and facilitate the communications services necessary to support data flow from the stations through to archiving of data and data products;**

- **Establish a database of the meteorological instruments, measurements, and procedures at all network stations; review the information for consistency and establish standards for meteorological measurements.**

GGOS Bureau for
Networks and Communication

Primary Organization: NASA/GSFC

Supporting Organizations: IGS, IVS, ILRS, IDS, IGFS, IERS

Bureau Director: Dr. Michael Pearlman/CfA

Associate Director: Ms Carey Noll/ NASA GSFC

Science Coordinator: Dr. Erricos Pavlis/JCET

Co-location Coordinator: Dr. Zuheir Altamimi

IAG Service Representatives:

- IERS: Bernd Richter
- IGS: Steve Fisher
- IVS: Dirk Behrend
- IDS: Frank Lemoine
- ILRS: Michael Pearlman
- IGFS: Steve Kenyon

Still need to make connections with other IAG entities

GGOS Bureau Networks and Communications
Technical University
Room SEM124/CB0308,
April 22, 2009, 18:30 -21:00

- GGOS Bureau for Networks and Communications   Mike Pearlman   15 min
- IAG Service Networks in Google Earth   Carey Noll
10 min
- Network scoping activity   Erricos Pavlis   15 min
- Charter of IERS Working Group on Local Survey   Pierguido Sarti   10 min
- Comments on survey data base/survey priorities   Zuheir Altamimi   5 min
- Workshop on Ground Survey Measurements   John Gipson   15 min
- GRASP – A concept for ground survey with satellites   Yoaz Bar-Sever
10 Min
- Meteorological data base   Arthur Niell/Mike Pearlman   10 min
- GNSS retroreflector update   Mike Pearlman   5 min
- Service Reports (IGS, IVS, ILRS, IDS, IERS, IGFS)   5 minutes each/one chart

All of the presentations will be posted on the GGOS website

MEO Satellite Tracking

Werner Gurtner

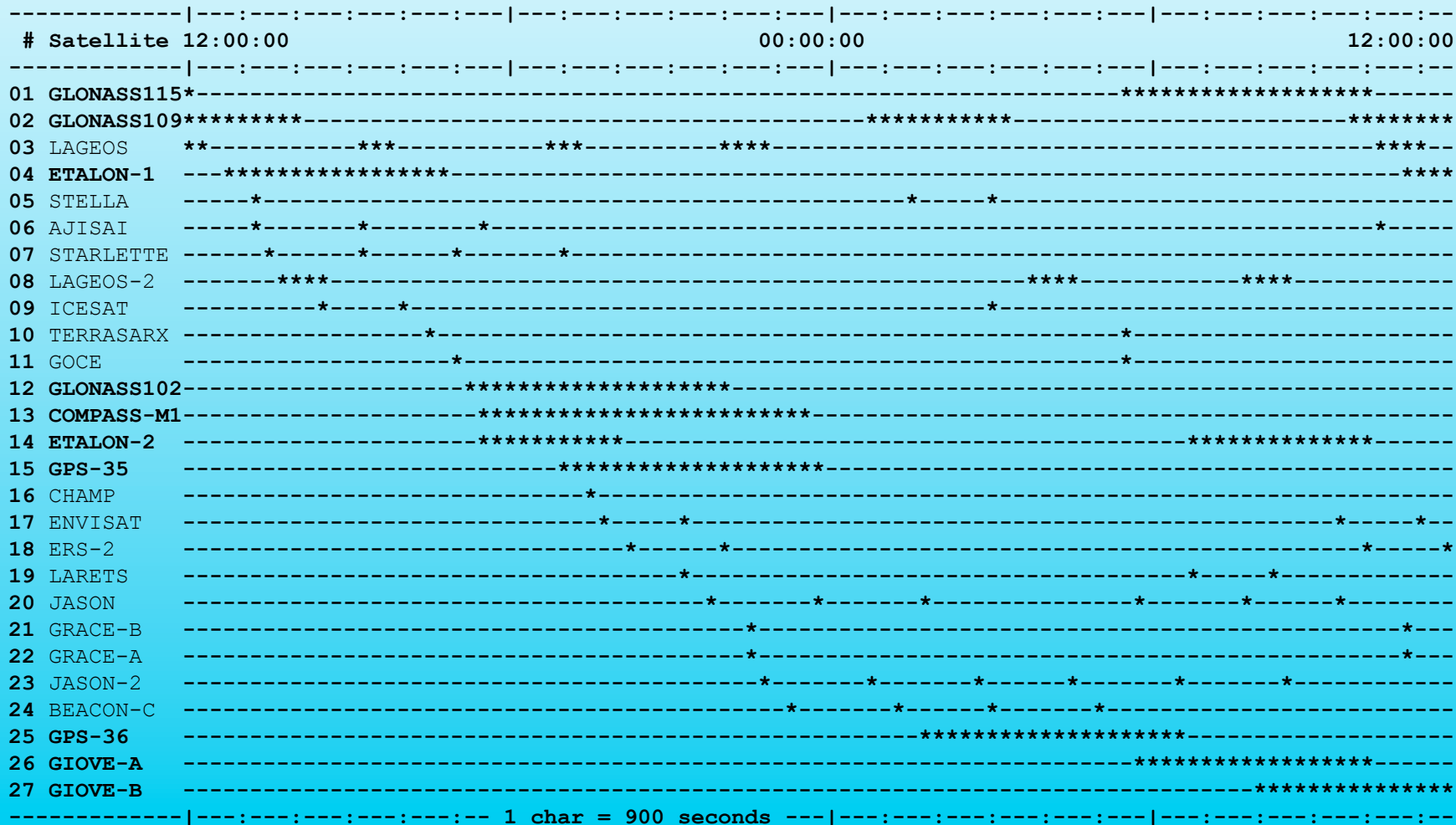GB Meeting, Vienna 2009

Current MEO Satellites

- Glonass 102, 109, 115
- GPS 35, 36
- Etalon 1,2
- Giove A, B
- Compass M1

- Total: 10 MEO satellites

Network load

- Need tracking/data requirements by our customers
- Tracking strategy to satisfy needs
- How many satellites per station/day can be tracked?

- Assume: 6 normal points per pass (i.e. 30 min with current normal point width)

Satellite coverage for one day

```
------------|---:---:---:---:---:---|---:---:---:---:---:---|---:---:---:---:---:---|---:---:---:---:---:--
 # Satellite 12:00:00                                    00:00:00                                    12:00:00
------------|---:---:---:---:---:---|---:---:---:---:---:---|---:---:---:---:---:---|---:---:---:---:---:--
01 GLONASS115*-------------------------------------------------********************-----
02 GLONASS109*********----------------------------***********-------------------------********
03 LAGEOS    **------------***-----------***------****-------------------------------****--
04 ETALON-1  ---*****************-------------------------------------------------****
05 STELLA    -----*-------------------------------------*-----*-------------------------------
06 AJISAI    -----*-------*--------*-------------*-------------------------------------*-----
07 STARLETTE ------*-------*------*-------*-----*-------------------------------------------
08 LAGEOS-2  -------****-------------------------------------****-------------****-------------
09 ICESAT    ----------*------*-------------------------*-------------------------------------
10 TERRASARX ----------------*-----------------------------*-------------------------------
11 GOCE      ----------------*-----------------------------*-------------------------------
12 GLONASS102------------------********************-------------------------------------
13 COMPASS-M1-----------------*************************-------------------------------------
14 ETALON-2  ----------------***********--------------------------***************------
15 GPS-35    -----------------*******************---------------------------------------
16 CHAMP     -------------------------*-------------------------------------------------------
17 ENVISAT   --------------------------*-----*-------------------------------------*-----*--
18 ERS-2     --------------------------*-----*-------------------------------------*-----*
19 LARETS    ---------------------------*-----------------------------*-----*-------------
20 JASON     --------------------------*------*-----------*-------------*-------*------*--------
21 GRACE-B   ----------------------------*---------------------------------------------*--
22 GRACE-A   ----------------------------*---------------------------------------------*--
23 JASON-2   --------------------*-------*-------*------*-------*------*------*---------
24 BEACON-C  -------------------------*-------*------*------*----------------------------
25 GPS-36    ----------------------------********************-------------------
26 GIOVE-A   --------------------------------------------*****************-----
27 GIOVE-B   -------------------------------------------------****************
------------|---:---:---:---:---:-- 1 char = 900 seconds ---|---:---:---:---:---:---|---:---:---:---:---:--
```

# Tracking Distribution

- MEO satellites: 23:05 h per day
- No satellites: 00:47 h per day

- **LEO satellites: 06:25 h per day**
- **Time for MEOs: 17:35 h per day**

- Time per MEO: 00:30 h per pass (6 np)
- MEO passes: 35   per day

(Example for Zimmerwald, 20/21 April 2009)

Limiting MEO tracking

- Daytime tracking capability

- Meteorological conditions
  - Bad weather (no tracking)
  - Haze (MEO tracking impossible)

- Tracking hours per day, days per week

MEO passes (2008)
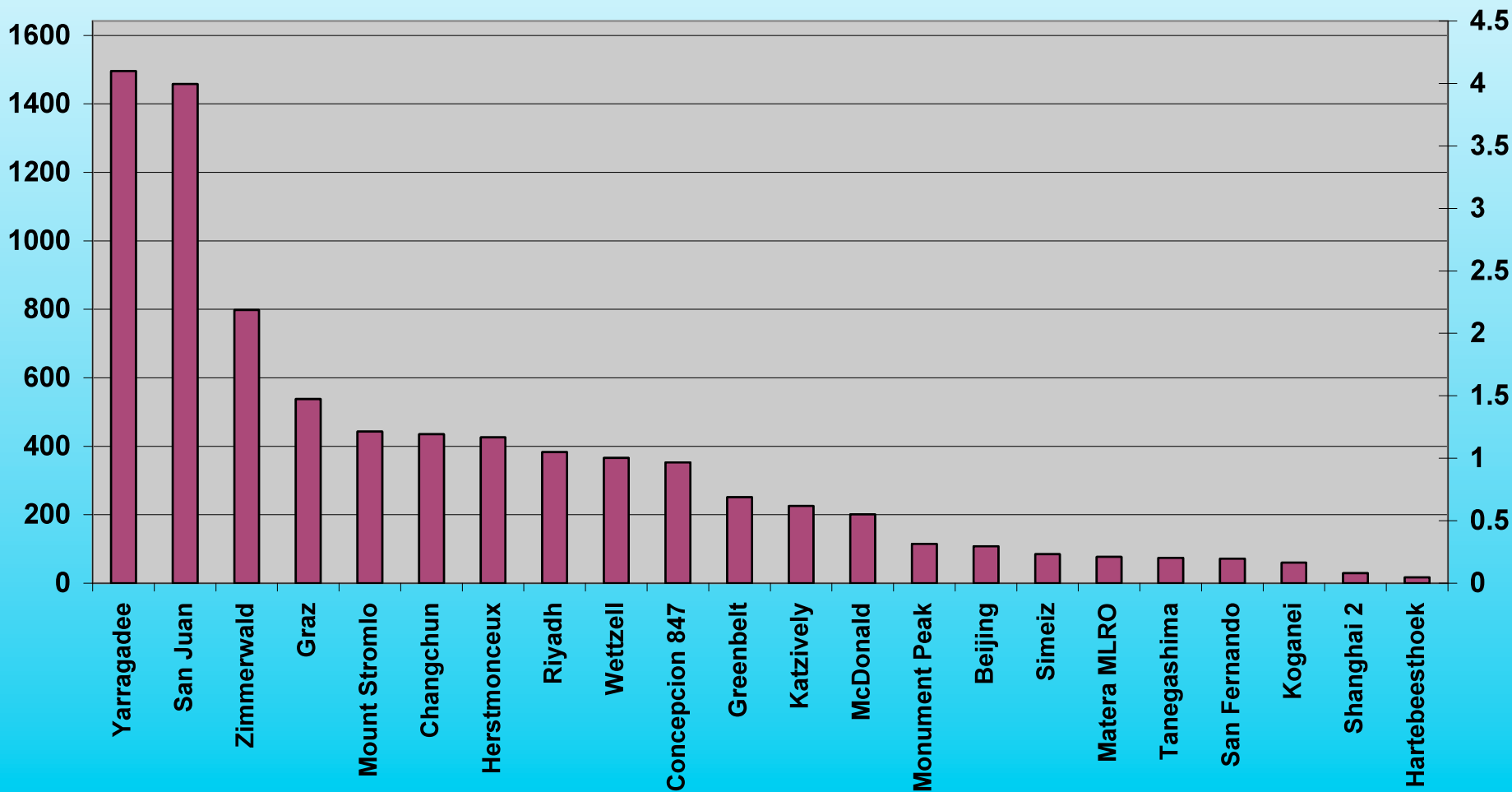
MEO Satellite Passes 2008

ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ (ΕΜΠ)
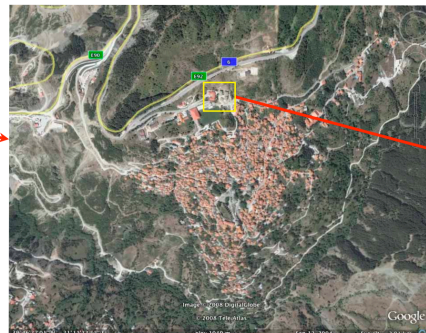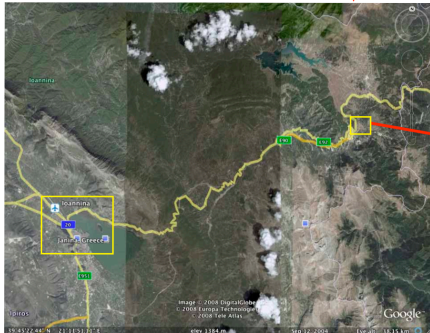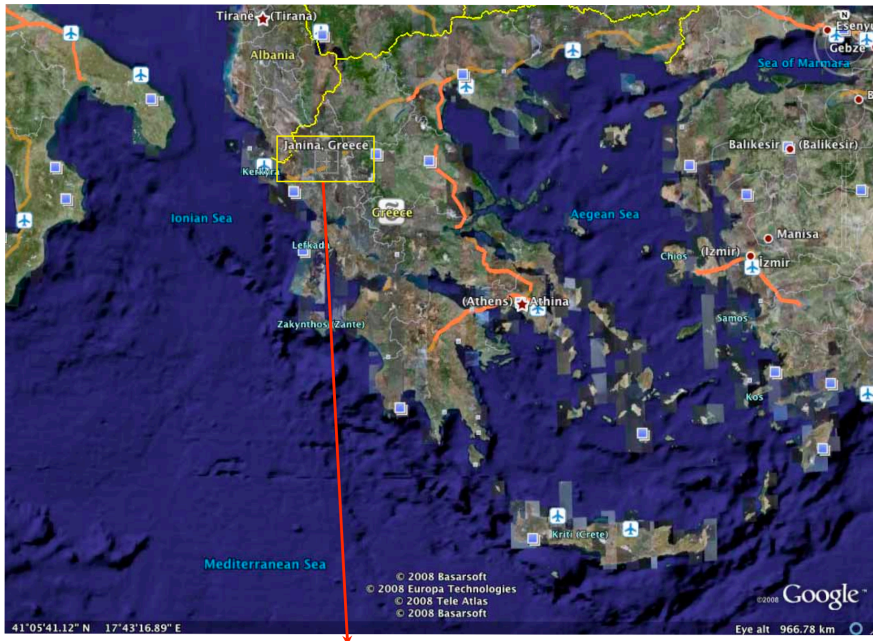**ΜΕΤΣΟΒΙΟ ΚΕΝΤΡΟ ΔΙΕΠΙΣΤΗΜΟΝΙΚΗΣ ΕΡΕΥΝΑΣ (ΜΕ.Κ.Δ.Ε.)**

NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA)
METSOVO CENTER FOR INTERDISCIPLINARY RESEARCH (MCFIR)

NATIONAL TECHNICAL UNIVERSITY OF ATHENS (NTUA) METSOVO CENTER FOR INTERDISCIPLINARY RESEARCH (MCFIR)

Workshop Themes

- Overview of applications & results of two techniques; emphasis on areas of expected synergism

- Review of status of GNSS and SLR constellations and networks and the current state of the art in geodetic products

- Position papers demonstrating likely gains from SLR tracking of GNSS constellations

- Approaches in accomplishing GGOS' goals minimizing additional burden on the tracking networks (to avoid impacting current missions)

- Investigate options such as higher repetition rates, optimal normal point formulation, interleaving tracking targets, better sampling of orbits, allocating targets to sub-networks, etc.

- Trade-off studies optimizing on different aspects to guide the design of the tracking networks and the deployment of the appropriate space segment

- POD studies to highlight and discuss the fundamental differences between geodetic targets (like LAGEOS) and the complicated GNSS spacecraft

- Discussion of other possible applications that are specifically enabled through the synergistic conjunction of the two techniques, e.g. LEO POD (radar and laser altimetry, geopotential missions, atmospheric lidar and sounding missions, topography missions, SAR and InSAR missions, etc.)

Scientific Program Committee

- ~Dr. Y. Bar-Sever   JPL, NASA, USA (need commitment!!!)

- Dr. P. England   Oxford, UK (need to substitute !!!)

- *Dr. Yang Fumin   Shanghai Astronomical Observatory,
  Chinese Academy of Sciences, CN

- *Dr. Werner Gurtner   Astronomical Institute,
  University of Bern, Switzerland

- ~Dr. James Davis   Harvard-Smithsonian Center for
  Astrophysics, USA (awaiting answer)

- *Dr. Kostas Katsambalos   Aristotle University of Thessaloniki, GR

- *Dr. Demitris Paradissis   Nat. Tech. University of Athens, GR

- *Dr. Erricos C. Pavlis   JCET/UMBC - NASA Goddard, USA

- *Dr. Michael Pearlman   Harvard-Smithsonian, CfA, USA

- ?Dr. James Slater   NGA, USA (awaiting answer)

- ~Dr. Tim Springer   ESOC, ESA (awaiting travel approval)

- *Dr. Vladimir Vasiliev   RSA, Moscow, Russia

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