



**Seventh General Assembly of the ILRS
April 25, 2002
Nice, France**

Presentation Material

ILRS Chairman's Report

John Degnan

ILRS Governing Board Chairperson

Nice, France

April 25, 2001



International Laser Ranging Service (ILRS)

- ***Governing Board debates and sets policy for all aspects of SLR through its Working Groups***
 - Current 16 member Governing Board (GB) was installed in November, 2000 at the 12th International Workshop on Laser Ranging in Matera, Italy.
 - New Coordinators and Deputy Coordinators were chosen from the new GB membership to head the various working groups
 - Next GB elections are scheduled for Summer, 2002, prior to the 13th International Workshop on Laser Ranging in Washington, DC, during the week of Oct. 7-11, 2002.
- ***Central Bureau at NASA/GSFC oversees daily operations and communications, maintains databases, works to foster and implement GB policy, and produces annual reports.***
 - New Director: Dr. Michael Pearlman, Smithsonian Astrophysical Observatory (replaced John Bosworth who retired from NASA/GSFC on 1 June 2001)
 - New Secretary: Ms. Carey Noll, NASA/GSFC(replaces Dr. Michael Pearlman, SAO)
- ***2000 Annual Report is being distributed.***



Current ILRS Governing Board

(term ends October 2002)

Hermann Drewes	Ex-Officio, CSTG President	Germany
Michael Pearlman	Ex-Officio, Director ILRS Central Bureau	USA
Carey Noll	Ex-Officio, Secretary, ILRS Central Bureau	USA
Werner Gurtner	Appointed, EUROLAS, Networks & Eng. WG Coordinator	Switzerland
Wolfgang Schlueter	Appointed, EUROLAS, Networks & Eng. WG Deputy Coord.	Germany
David Carter	Appointed, NASA	USA
John Degnan	Appointed, NASA, Governing Board Chairperson	USA
Yang FuMin	Appointed, WPLTN	PRC
Hiroo Kunimori	Appointed, WPLTN, Missions WG Coordinator	Japan
Bob Schutz	Appointed, IERS Representative to ILRS	USA
Graham Appleby	Elected, Analysis Rep.	UK
Ron Noomen	Elected, Analysis Rep., Analysis WG Coordinator	Netherlands
Wolfgang Seemueller	Elected, Data Centers Rep., Data Formats & Procedures WG Deputy Coordinator	Germany
Peter Shelus	Elected, Lunar Rep., Analysis WG Deputy Coordinator	USA
Georg Kirchner	Elected, At-Large, Missions WG Deputy Coordinator	Austria
John Luck	Elected, At-Large, Data Formats & Procedures WG Coordinator	Australia



ILRS Working Group (WG) Activities

- *Missions WG* has formalized procedures for approving new missions and establishing tracking priorities
- *Analysis WG* has pilot project underway to compare results from different analysis centers and to develop a formal ILRS solution
- *Data Formats and Procedures WG* is streamlining and modernizing data formats and procedures to better handle new mission requirements and technologies.
- *Networks and Engineering WG* is upgrading procedures to expedite data flow and developing engineering data bases to improve network performance
- *Signal Processing Ad Hoc WG* is working to reduce remaining systematic ranging errors (satellite signature, refraction, etc.)



Central Bureau

- **Actively providing new conveniences for communications such as targeted email exploders and enhanced search capabilities within the ILRS web site <http://ilrs.gsfc.nasa.gov>**
- **Adding new material to the ILRS Web Site with following major topics:**
 - **ILRS structure, membership, and relationships to outside organizations**
 - **Current Events**
 - **Working Group membership and activities**
 - **Satellite missions and tracking plans with links to individual mission sites**
 - **ILRS stations with links to individual station sites**
 - **ILRS Data Products**
 - **Science and Analysis (including extensive bibliographies)**
 - **Engineering and Technology (including extensive bibliographies)**
 - **Reports and Meeting Minutes**
 - **Frequently Asked Questions (FAQ's)**
 - **Links to Related Web Sites**

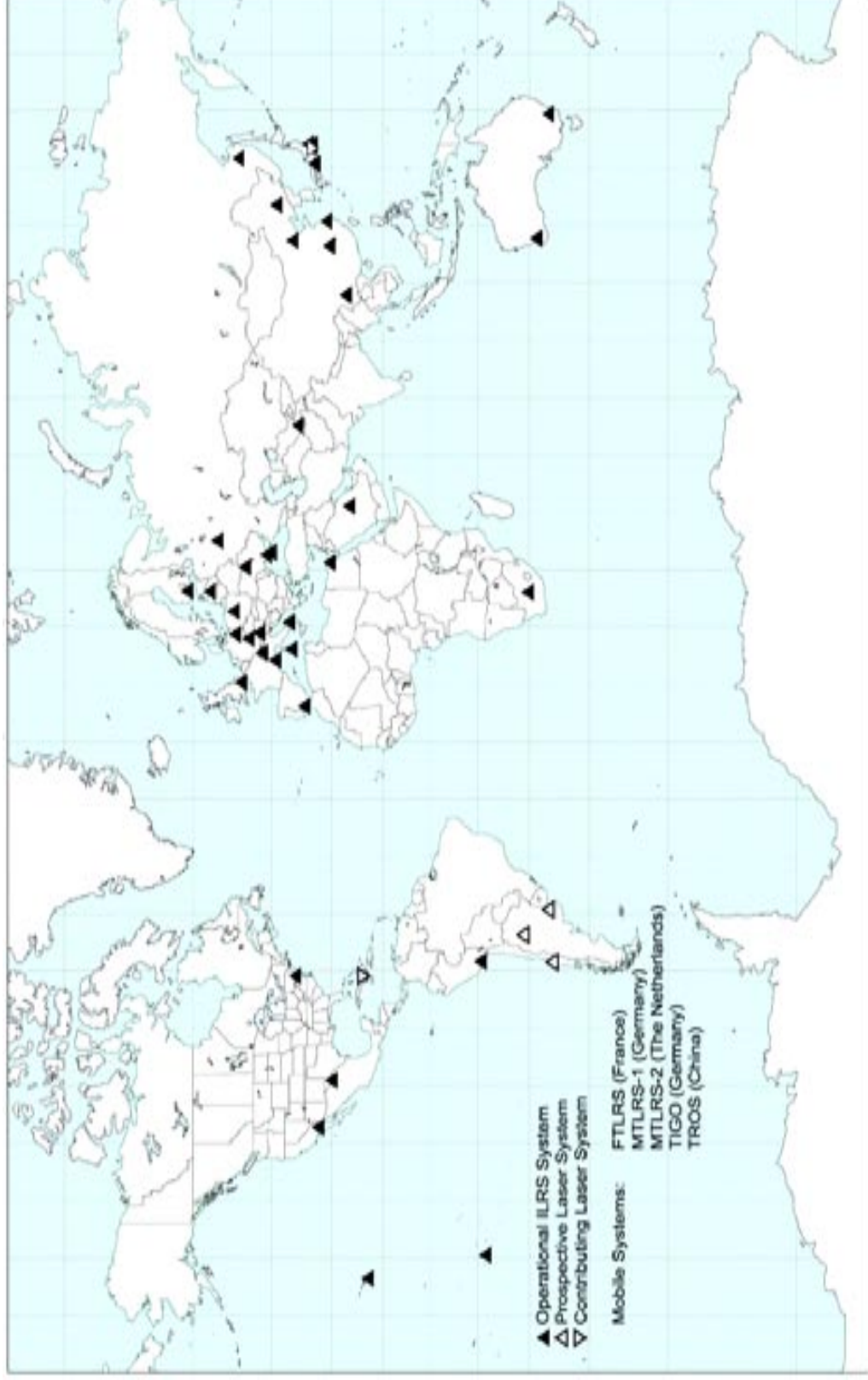


SLR Network Improvements

- *Improvements in Southern Hemisphere Coverage*
 - Tahiti and South Africa NASA partnership SLR sites are operational
 - New German multi-technique (SLR, VLBI, GPS, gravimeter) station in Concepcion, Chile (TIGO)
 - New SLR sites in Argentina under consideration (NASA, China)
- *Other Network Updates*
 - New state-of-the-art systems in
 - Italy (Matera) - includes two-color and lunar capability
 - Australia (Mt. Stromlo)
 - Several new stations under development
 - Russia (Moscow, Novosibirsk)
 - China (Kunming plus two mobile units)
 - Fully automated systems under development (NASA SLR2000, EOS Keystone)



Current SLR Network



ILRS Tracking Priorities (Jan 2002)

<u>Priority</u>	<u>Mission</u>	<u>Sponsor</u>	<u>Altitude (km)</u>	<u>Inclination (degrees)</u>	<u>Comments</u>
1	CHAMP	GFZ, Germany	429-474	87.27	Gravity research
2	Starshine 3	US Cooperative	470	67	Drag research / no other tracking technique available
3	GFO1	US Navy	790	108.0	Altimeter POD/calibration / no other tracking technique
4	ERS2	ESA	800	98.6	Altimeter calibration /PRARE backup
5	Jason	NASA/CNES	1,350	66.0	Altimeter / DORIS and GPS backup
6	TOPEX/Poseidon	NASA/CNES	1,350	66.0	Altimeter calibration / DORIS and GPS backup
7	Stella	CNES	815	98.6	Geodetic // no other tracking technique available
8	Starlette	CNES	815-1,100	49.8	Geodetic // no other tracking technique available
9	Meteor-3M	NASA/IPIE, Russia	1020	99.64	Retroreflector research / Tracking by 2 NASA sites only
10	REFLECTOR	IPIE, Russia	1,020	99.6	POD research for space debris detection
11	BeaconC	NASA	950-1300	41	Gravity Research / upgraded to ongoing mission (Jan 2002)
12	Ajisai	NASDA	1,485	50	Geodetic // no other tracking technique available
13	LAGEOS2	NASA/ASI, Italy	5625	52.6	Geodetic // no other tracking technique available
14	LAGEOS1	NASA	5850	109.8	Geodetic // no other tracking technique available
15	Etalon1	Russia	19,100	65.3	Geodetic // no other tracking technique available
16	Etalon2	Russia	19,100	65.2	Geodetic // no other tracking technique available
17	GLONASS80	Russia	19,100	65	Positioning POD enhancement / replaced G70 as of 10/20/99
18	GLONASS78	Russia	19,100	65	Positioning POD enhancement / replaced G72 as of 6/29/00
19	GLONASS84	Russia	19,100	65	Positioning POD enhancement / replaced G79as of 2/22/01
20	GPS35	US DoD	20,100	54.2	Positioning POD enhancement
21	GPS36	US DoD	20,100	55.0	Positioning POD enhancement



ILRS Tracking Campaigns

- **Recent Campaigns**
 - Revived ERS-1 tracking to support tandem Synthetic Aperture Radar (SAR) measurements with ERS-2
 - GFO-1 was moved to full tracking status (now totally reliant on SLR due to failure of 4 redundant GPS receivers)
 - South African SUNSAT remote sensing mission (now terminated)
 - Japanese LRE mission (highly elliptical orbit)
 - Revived GEOS-3 and Beacon-C tracking for gravity field improvement in preparation for GRACE
 - Initiated intensified ETALON 1 & 2 campaign at the request of the ILRS Analysis Working Group to better understand usefulness of SLR in measuring Earth Orientation Parameters
 - Test new retroreflector designs on Russian Meteor-3M and Reflector satellites (SAGE Project has since requested regular SLR tracking due to failure of onboard GPS/GLONASS receiver).



Upcoming ILRS Missions

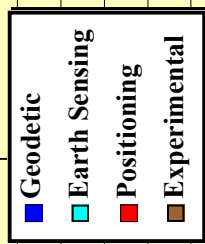
(Status as of January 22, 2002)

Satellite	Owner	Mission Type	Planned Launch Date	Mission Duration	Received Mission Request Form	Received ILRS GB Approval
Starshine 2	NASA, NRL, etc	Atmospheric Drag, Education Outreach	End November 2001	Approximately 5 months	Yes	Conditionally for limited testing Have not started Tracking
Envisat-1	ESA	Altimeter POD/calibration	February 28, 2002	5 years	Yes	Yes
OICETS	NASDA	Experimental	February 2002	1 year	No	No
Grace	NASA / GFZ	Gravity	March 5, 2002	5 years	Yes	Yes
IceSat (GLAS)	NASA	Ice/land topography Laser Altimeter POD/ calibration	September 8, 2002	3-5 years	Yes	Yes
Gravity Probe B	NASA	Relativity	October 30, 2002	1-2 years	Yes	Yes
ADEOS-II	NASDA	Altimeter POD/ calibration	November 2002	3 years	Yes	Yes
IRS-P5	ISRO	Experimental	Late 2002	5 years	No	No
ALOS	NASDA	Altimeter calibration	Jul/Aug. 2003	3 years	No	No
ETS-VIII	NASDA	Time transfer	Jul./Aug. 2003	3 years	No	No
CryoSat	ESA	Sea Ice/ Ice cap	Apr/May 2004	3.5 years	Yes	Awaiting MWG Recommendation
VCL	NASA	Laser Altimeter POD/calibration for Vegetation studies	Delayed indefinitely	18 months	Yes	No

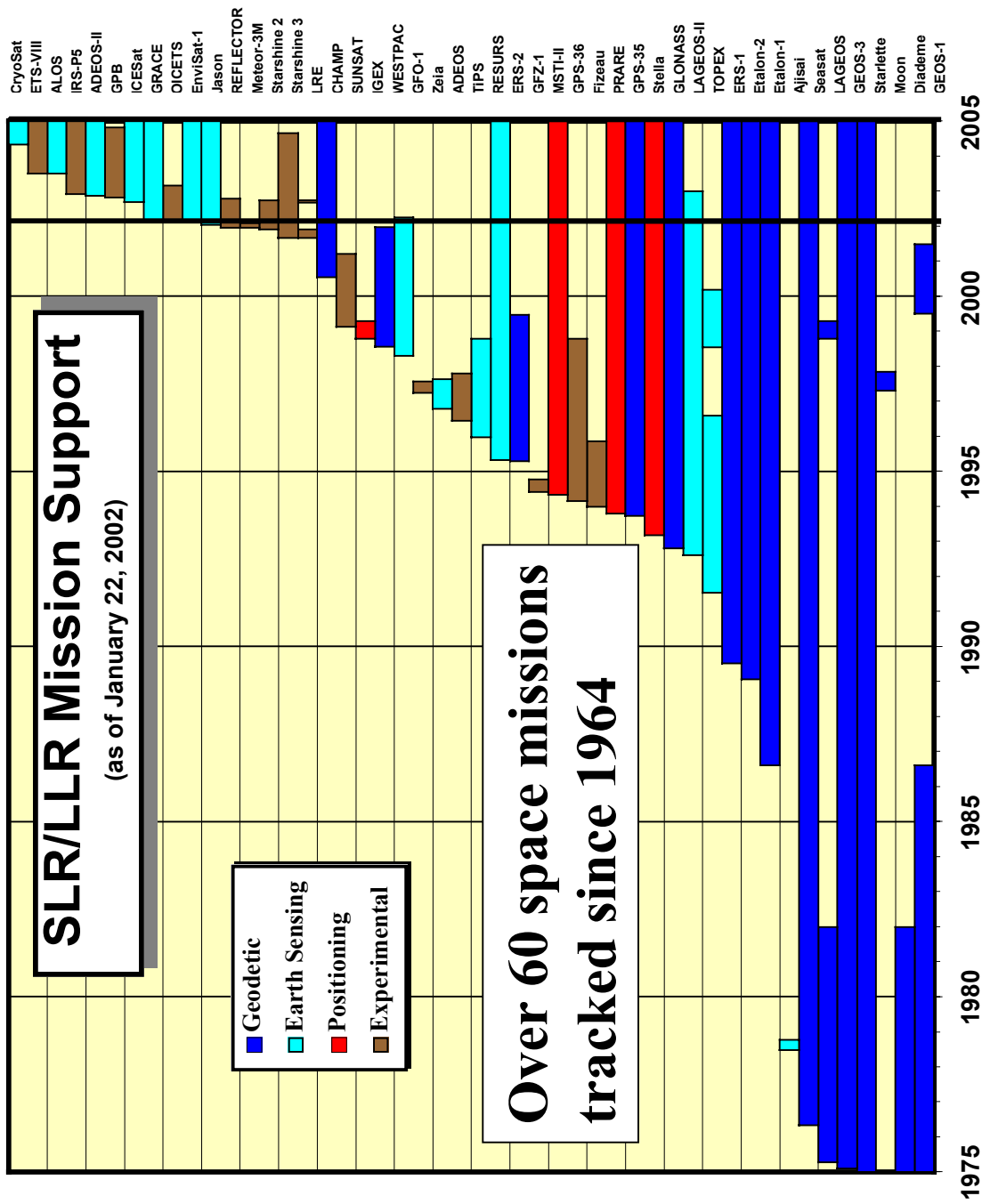


SLR/LLR Mission Support

(as of January 22, 2002)



Over 60 space missions tracked since 1964



Next ILRS General Assembly

- **13th International Workshop on Laser Ranging and 8th ILRS General Assembly**
 - **October 7-11, 2002, Washington, DC**
 - **Hosted by NASA Goddard Space Flight Center and Smithsonian Astrophysical Observatory**
 - **Tour of Goddard Geophysical and Astronomical Observatory (GGAO)**
 - **SLR2000**
 - **MOBLAS-7**
 - **TLRS-4**
 - **1.2 Meter Experimental Ranging Facility**
 - **Banquet at the Smithsonian**



Certificate of Appreciation

This certificate is awarded to

Dr. Francois Barlier

in appreciation of his many contributions to Satellite Laser Ranging and his meritorious service as an elected At-Large Representative on the first ILRS Governing Board, 1998-2000



John J. Degnan, Chairperson, ILRS Governing Board

Michael R. Pearlman, Director, ILRS Central Bureau

Carey E. Noll, ILRS Secretary



Central Bureau Report

NETWORK TRACKING PRIORITIES

Tracking priorities have been ordered as follows:

1. priorities decrease with:
 - a. increasing orbital altitude; and
 - b. increasing orbital inclination (at a given altitude).
2. priority of some satellites may then be increased to intensify support for:
 - a. active missions (such as altimetry);
 - b. special campaigns (such as IGEX 98); or
 - c. post-launch intensive tracking phases; and
3. some slight reordering may be done to give slightly higher priority to missions with increased importance to the analysis community.

ILRS SATELLITE TRACKING PRIORITIES

April 2002

Priority	Mission	Sponsor	Altitude(km)	Comments
1.	GRACE	GFZ/JPL	485 - 500	Special Priority/Active Sat.
2.	CHAMP	GFZ	429 - 474	Special Priority/Active Sat.
3.	GFO-1	US Navy	790	Active Sat/no other tracking
4.	ENVISAT	ESA	796	Tandem with ERS-2
5.	ERS-2	ESA	800	
6.	JASON	CNES/NASA	1,350	Tandem with Topex
7.	TOPEX/Poseidon	NASA/CNES	1,350	
8.	Starlette	CNES	815 - 1,100	
9.	Stella	CNES	815	
10.	Beacon-C	NASDA	1,485	
11.	Reflector	IPIE	1,020	
12.	Ajsai	NASDA	1,485	
13.	LAGEOS-2	ASI/NASA	5,625	
14.	LAGEOS-1	NASA	5,625	
15.	Etalon-1	Russian Fed.	19,100	Campaign thru April 2002
16.	Etalon-2	Russian Fed.	19,100	Campaign thru April 2002
17.	GLONASS 86	Russian Fed.	19,100	Replaced GLONASS 80
18.	GLONASS 87	Russian Fed.	19,100	Replaced GLONASS 88
19.	GLONASS 84	Russian Fed.	19,100	Replaced GLONASS 79
20.	GPS-35	US DoD	20,100	
21.	GPS-36	US DoD	20,100	
LUNAR TARGETS				
	Apollo 11	NASA	356,400	
	Apollo 14	NASA	356,400	
	Apollo 15	NASA	356,400	
	Luna 17	Russian Fed.	356,400	
	Luna 21	Russian Fed.	356,400	



QUALIFICATION OF ILRS TRACKING STATIONS

Proposal

Assign all ILRS stations to one of three categories based on an annual performance review by the Analysis Working Group:

- **Core Stations: meet the "highest standards" of performance in terms of data quantity and quality;**
- **Contributing Stations: contribute significantly to the scientific and/or technical goals of the ILRS; and**
- **Associate Stations: presently provide intermittent, varying quality, less useful data.**



CORE STATIONS

- consistently provide a large quantity of accurate range data that can be used by the analyst with a high level of confidence;
- meet all of the Recommended Performance Criteria (RPC) as first presented at the Tenth Workshop on Laser Ranging in Shanghai in November 1996;
- can be added as stations achieve RPC performance level as verified by the Analysis Working Group; and
- can be deleted if stations fall below the RPC performance level

CONTRIBUTING STATIONS

- provide data of sufficient quantity and quality to have a positive impact on analysis results as determined through an annual review process by the Analysis Working Group; and
- produce data that is regularly and continuously analyzed by at least one ILRS Analysis Center or one mission specific Associate Analysis Center

ASSOCIATE STATIONS

- do not meet the performance criteria for a Contributing Station during the prior annual review;
- may be under development or protracted programs of upgrading; and
- would be encouraged to submit data so that analysis groups could provide scrutiny and advice as the station works toward a higher classification.

Table 1. Recommended Performance Criteria (RPC)

Daytime and nighttime Ranging Capability

Data Yield:

LEO satellites 1000 passes

LAGEOS 1/2 400 passes

Data Quality:

LAGEOS NP precision: 1.0 cm

Short term range bias stability: 2.0 cm (STD of the pass by pass biases)

Long term range bias stability: 1.0 cm (STD of the monthly range 2.0 cm

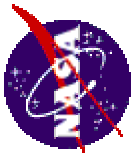
biases for 8 of the last 12 months) within 24 hours

Data delivery



Table 2. Station Performance during the Period 1 July 2000 through 30 June 2001		
	Core Stations	Contributing Stations
Europe	Herstmonceux Graz Grasse (SLR +LLR) Zimmerwald Matera (MLRO)*	Potsdam San Fernando Riga Borowiec Wetzell
Africa	Hartebeesthoek*	
Asia	Changchun	Shanghai Beijing Kunming Simosato Keystone Systems
Australia/S. Pacific	Mt Stromlo Yarragadee	Tahiti
North/South America	Monument Peak Greenbelt McDonald	Arequipa Mt Haleakala Concepcion (TIGO)*
* indicates high performance station recently moved to a new site or ready to move		

Table 3. Associate Stations		
Metsahovi Wuhan Helwan Golosiiv	Maidanak Simiez Katsively	Mendeleevo Komsomolsk Cagliari



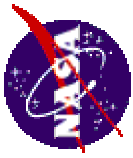
Honeywell

ILRS Operational Issues & Network Performance

Van Husson
ILRS Central Bureau



Operational Issues & Network Performance
CB Report, April 2002



Operational Issues (Apr 2002)

Honeywell

PREDICTS

- Daily predicts, except sub-daily predicts for CHAMP and GRACE + drag functions
- Real time system status exchange (W. Gurtner)

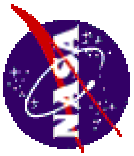
DATA LATENCY – excellent

SITE LOGS – good progress, need to make logs current

LOCAL SITE TIES – need a lot of work, need to communicate importance

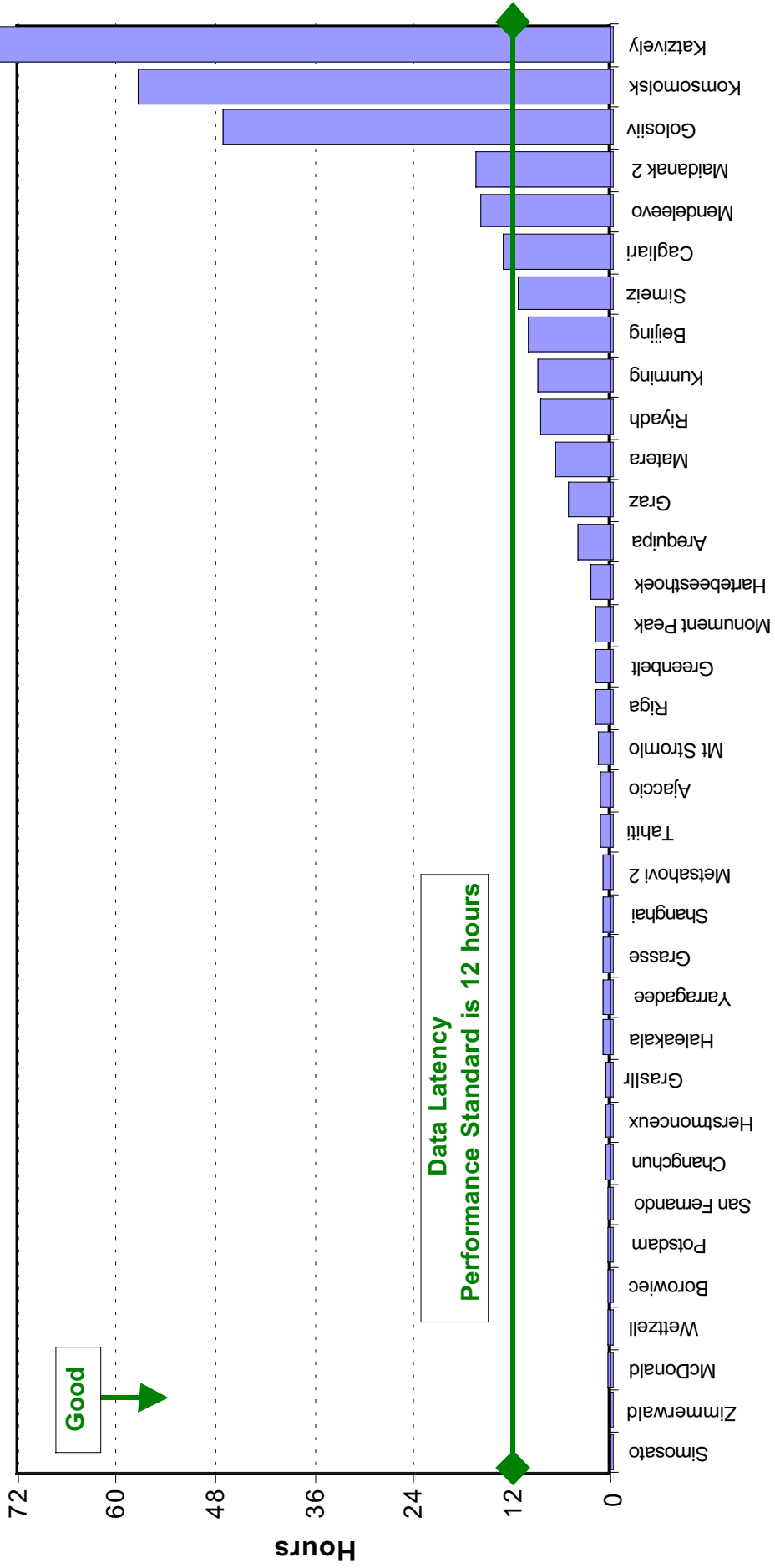
NEW ILRS WEB SITE – operational on April 18, 2002

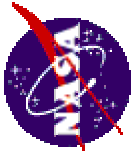




Honeywell

Data Latency (1st Quarter 2002)





Site Log Status

Honeywell

44 site logs received and on-line at:

<ftp://cddisa.gsfc.nasa.gov/pub/reports/srlog/>

Outstanding Site Logs

- 1863 Maidanak-1
- 1864 Maidanak-2
- 1868 Komsomolsk

Master file has been created in MS EXCEL

- One Worksheet per section
- Auto Filter (i.e. search) enabled
- Initial QC of most sections complete (e.g. corrected numerous format/data integrity issues)
- Incorporated some manufacturer specifications

International Laser Ranging Service Home Page

- About the ILRS
- What's New
- Satellite Missions
- Global Network
- Science & Analysis
- Data & Products
- Working Groups
- Engineering & Technology
- Publications
- Links
- Contact ILRS
- Site Map
- Search



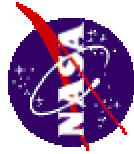
Satellite laser ranging (SLR [brochure](#) and [cartoon](#)) uses lasers to measure ranges from ground stations to satellite borne retro-reflectors to the millimeter level. The primary mission of the ILRS as stated in the organization's [Terms of Reference](#) is "to support, through *satellite and lunar laser tracking data and related products, geodetic and geophysical research activities.*"

If you have a suggestion or complaint about our service, please send an email to the [ILRS CB Secretary](#).

NASA's [Privacy Statement](#)
 NASA's [IT Security Warning Banner](#)
 ILRS Web Site Curator(s): ilrsweb@ilrs.gsfc.nasa.gov
 Responsible Government Official: [Carey Noll \(noll@oddisa.gsfc.nasa.gov\)](mailto:careynoll@oddisa.gsfc.nasa.gov)
 undefined

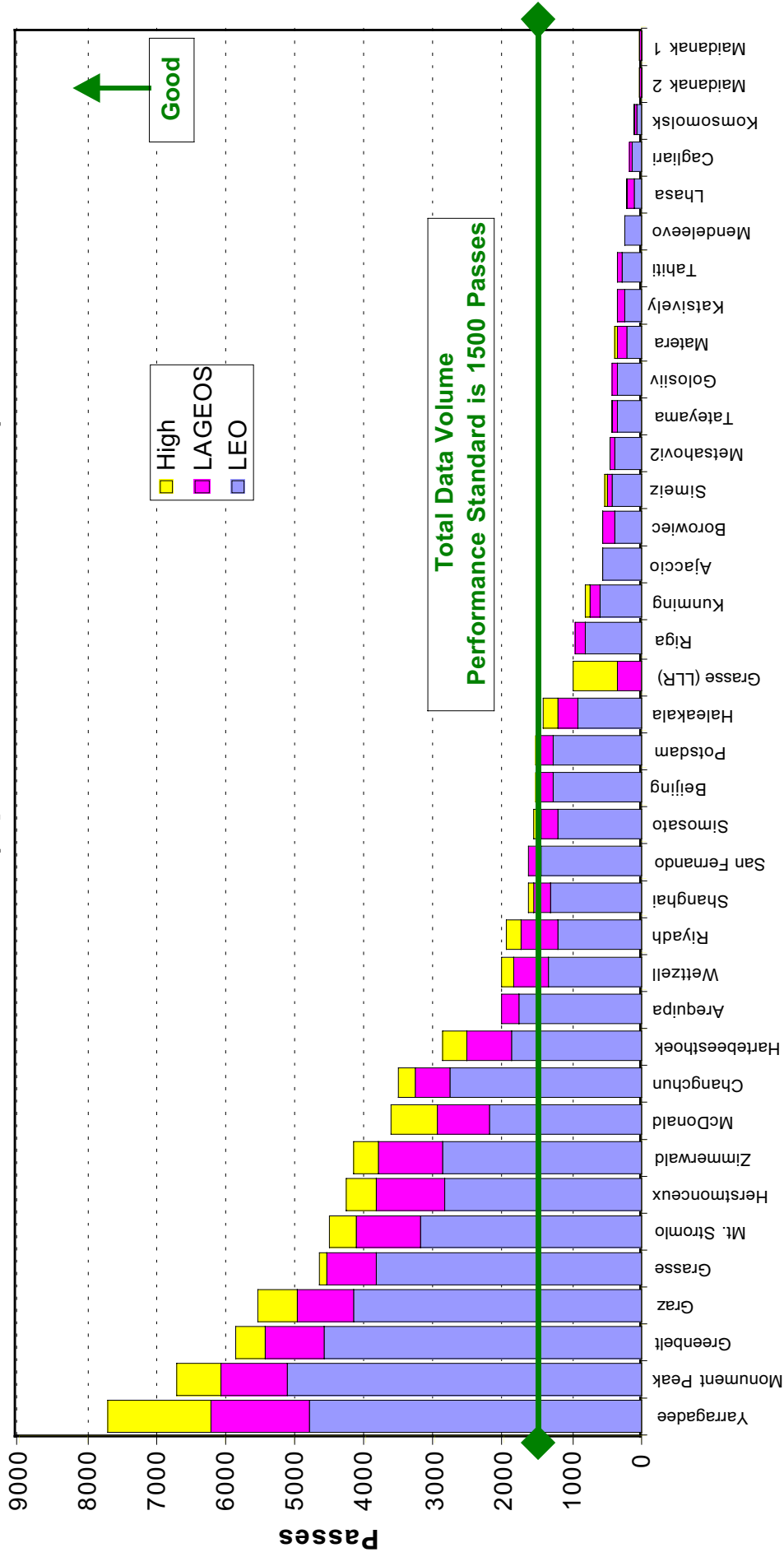
Thank you for visiting this NASA website. NASA may provide links to web pages that are not part of the NASA web family, or nasa.gov domain. These sites are managed by organizations, companies, or individuals not under NASA control, and NASA is not responsible for the information or links you may find there. NASA provides these links merely as a convenience and the presence of these links is not NASA endorsement of the site.

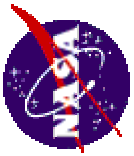




Honeywell

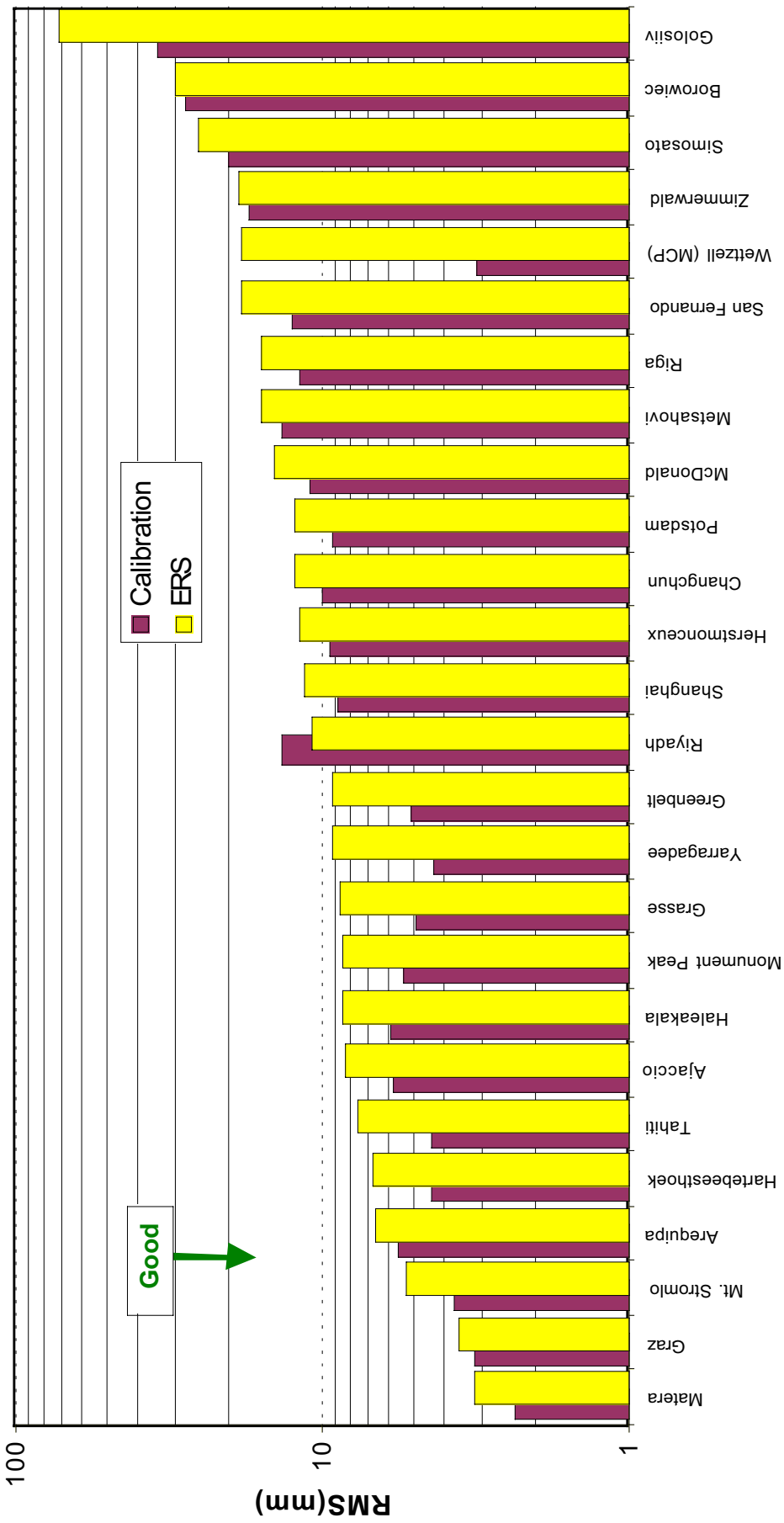
Total Data Volume (April 2001 to March 2002)

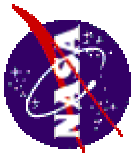




Honeywell

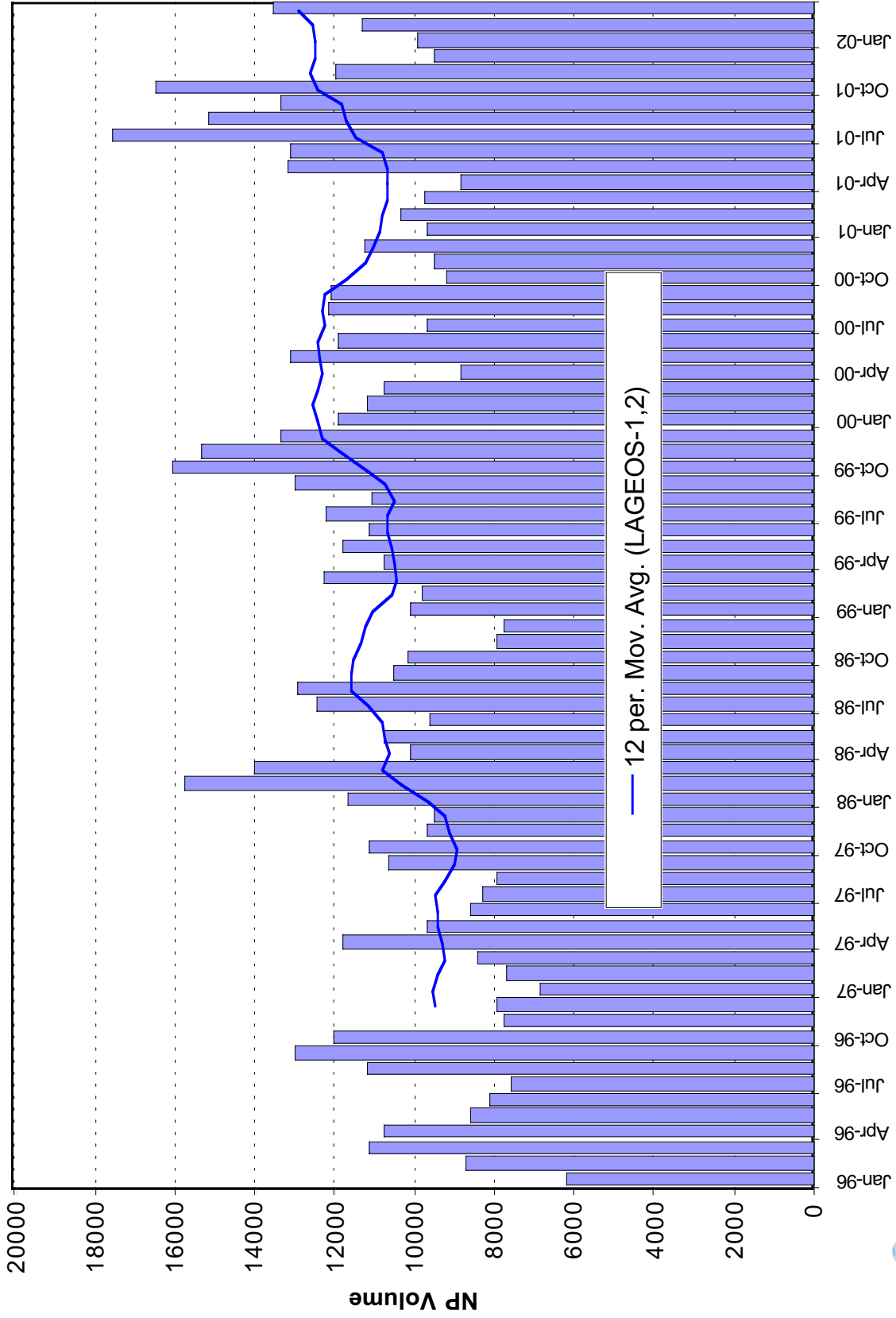
ERS Single Shot RMS (1st Quarter 2002)

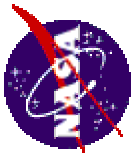




Honeywell

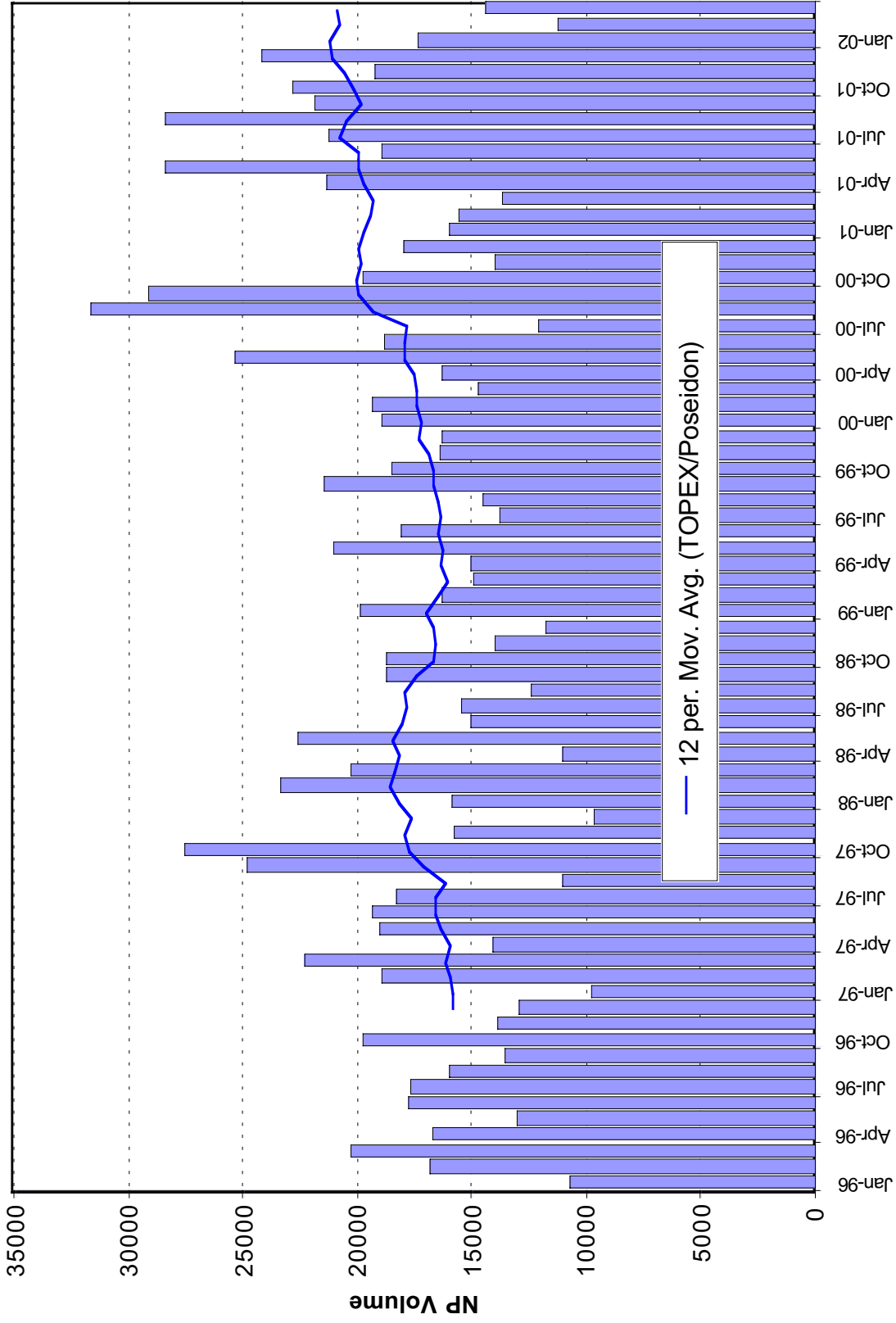
LAGEOS NP Volume

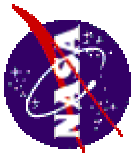




Honeywell

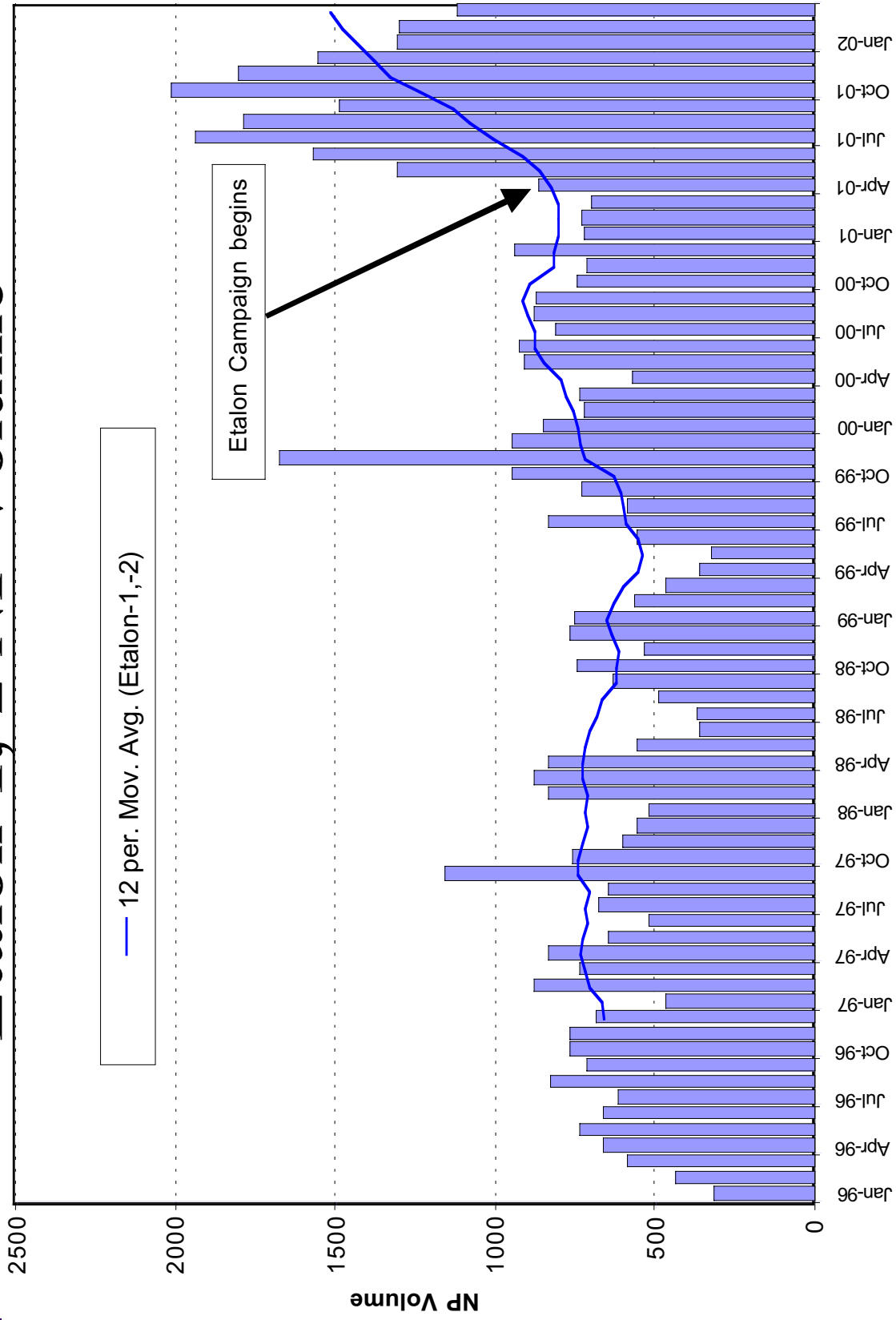
TOPEX/Poseidon NP Volume





Honeywell

Etalon-1,-2 NP Volume

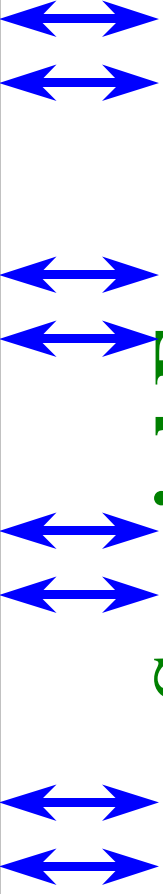


— 12 per. Mov. Avg. (Etalon-1,-2)

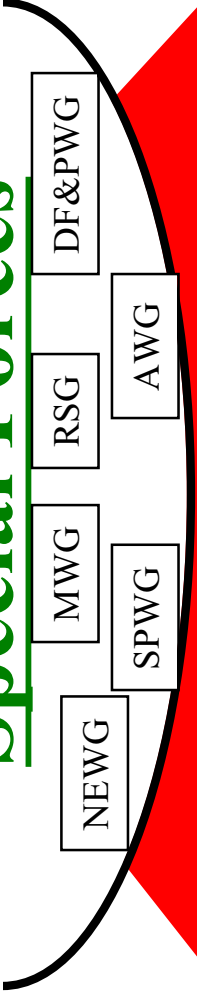
Etalon Campaign begins



ILRS GB and CB

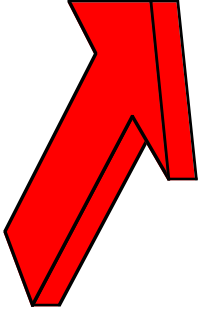


Special Forces



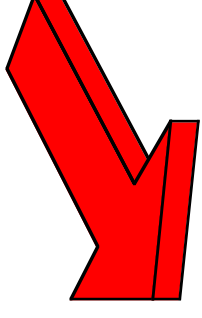
Site Biases

- Electronics
- Optics
- Meteorological System
- Normal Point Software
- Local Survey Ties



Format & Integrity

- Normal Point Format
- Meteorological Data

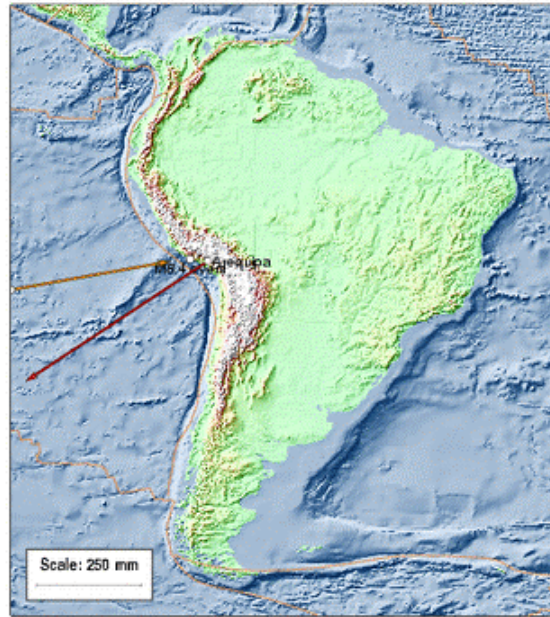


Modeling

- Atmosphere
- GM
- Ocean
- Earth CoG
- Plate Tectonics
- Site Positions
- Gravity
- Earth Rotation
- Satellite Forces
- Satellite CoM
- Site Biases

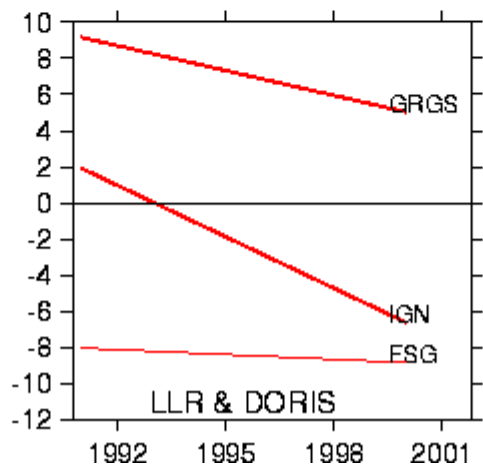
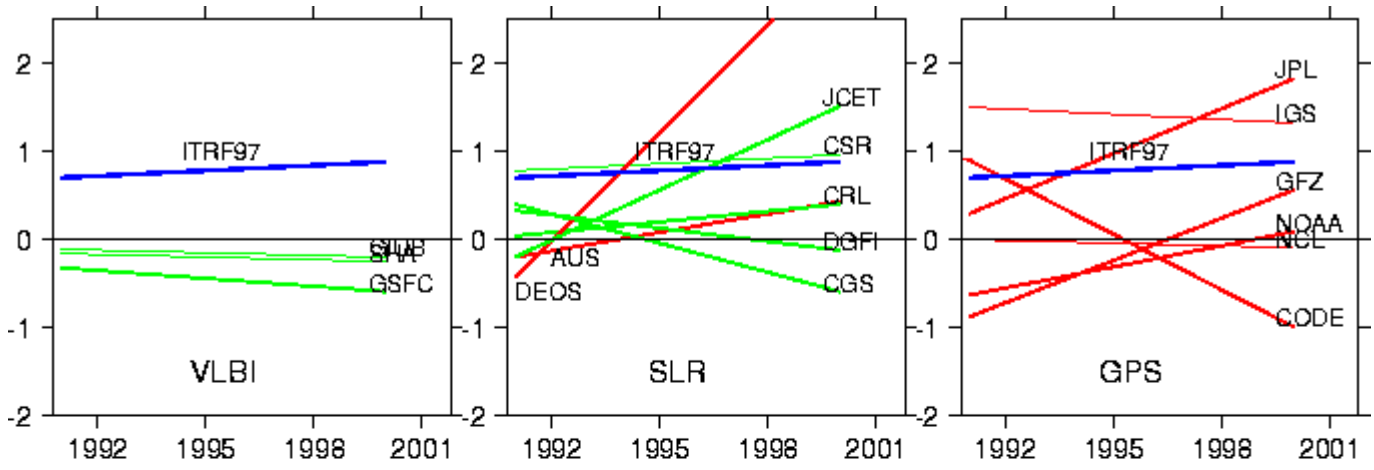
Millimeter Accuracy

Displacement at Arequipa June 23 2001

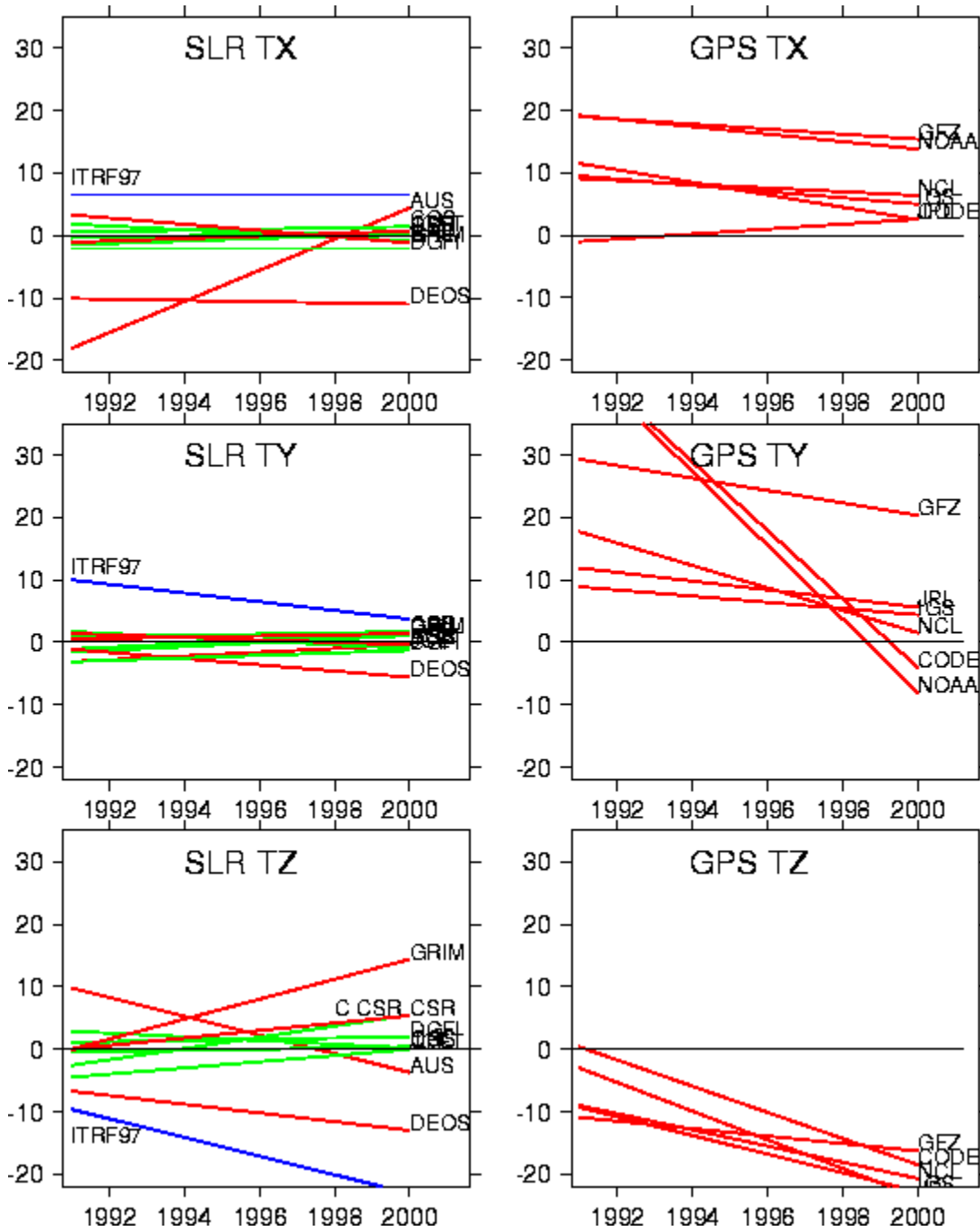


NAZCA plate direction

58 cm. station shift



ITRF2000 SCALE VARIATIONS



ITRF2000 TRANSLATION VARIATIONS