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NETWORK AND STATION REPORTS

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GLOBAL, REGIONAL, AND LOCAL NETWORKS

Growth of the IGS Station Network in 2000

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Introduction

The IGS network of permanent dual-frequency GPS tracking stations formed by the cooperative efforts of the IGS site-operating agencies welcomed the addition of 25 sites in 2000:

- AMMN Amman, Jordan
- DRAG Metzogi Dragot, Israel
- DUBR Dubrovnik, Croatia
- DYR2 Diyarbakir, Turkey
- ESTI Esteli, Nicaragua
- GUAT Guatemala City, Guatemala
- HARB Pretoria, South Africa (Replacing HARK)
- KODK Kodiak, Alaska, USA
- MANA Managua, Nicaragua
- NKLG Libreville, Gabon
- NOT1 Noto, Italy (Replacing NOTO)
- NRIL Norilsk, Krasnoyarsk Region, Russian Federation
- NVSK Novosibirsk, Russia
- ORID Ohrid, Macedonia
- OSJE Osijek, Croatia
- RABT Rabat, Morocco (Replacing IAVH)
- RBAY Richardsbay, South Africa
- SFDM Piru, California, USA
- SLOR San Lorenzo, Honduras
- SPT0 Boras, Sweden
- SSIA San Salvador, El Salvador
- TEGU Tegucigalpa, Honduras
- UNSA Salta, Argentina
- YAR2 Dongara, Western Australia, Australia
- YEBE Yebes, Spain

This set includes sites which improve coverage in important areas such as Central America, Africa, northern Asia, and the Middle East, as well as desirable colocations with other geodetic techniques.

Figure 1 depicts stations added in 2000 emphasized by large circles, along with the complete network distribution at the end of 2000, which totalled 248 stations. Of these, 92 (shown in Figure 2) earned the "Global" classification for being regularly analyzed by at least three analysis centers (one on a continent other than that of the station). The Data Centers report in this volume notes that the number of sites participating in the hourly data subnetwork grew to more than 70.

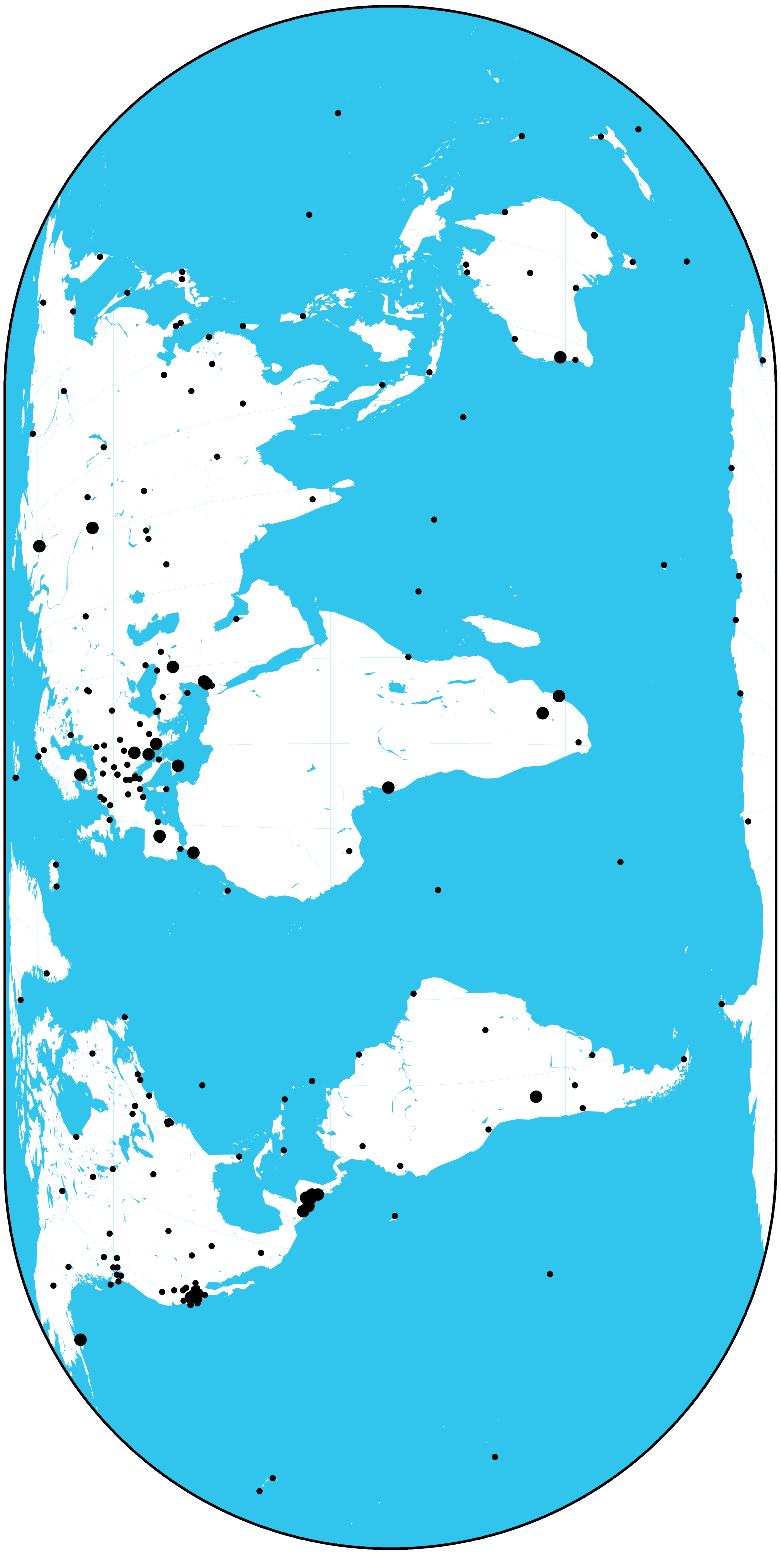

Figure 1. IGS Stations Added in 2000

Figure 2. IGS Stations Earning Global Classification

2000 Oslo Network Workshop and Proceedings

The workshop and its expert local organizers from the Norwegian Mapping Authority have already been lauded in the Central Bureau article in this Annual Report. Another highlight was the selection for "On Hourly Orbit Determination" by Jan Dousa and Leos Mervart of the Research Institute of Geodesy, Topography, and Cartography in the Czech Republic for the best poster of the joint meeting. A committee comprising representatives of the IGS and COST Action 716 considered all the posters and was pleased to see Dousa, as first author, presented with two Locus GPS receivers generously donated by Ashtech as a prize. The productivity of the entire event is apparent in the Proceedings, available as a special issue of Physics and Chemistry of the Earth, Part A, vol. 26, published by Elsevier Science. Coordinating editor Hans-Peter Plag, fellow IGS guest editors Mark Caissy and Ludwig Combrinck, the COST Action 716 team, and each author made the production of this document a pleasure and an education. This peer-reviewed, indexed journal probably represents the deepest penetration of a collection of IGS network articles into the world's libraries to date.

Network Coordination

As was suggested in the Network section of the 1999 Annual Report, the well-publicized Y2K rollover was readily handled by the IGS. Indeed, the new Central Bureau server installed to handle the rollover enabled enrichments such as self-service subscription management for the IGS email lists. Many users welcomed a noticeable improvement in response time.

Following the near-eradication of station metadata errors in calendar 1999, automatic quality audits of site logs and RINEX observation data file headers were increased to twice weekly. In this maintenance mode, station operators are notified by targeted email should a metadata error be inadvertently introduced by equipment or software changes. This system continues to maintain near-zero metadata error rates with minimal human effort and has enabled the long-envisioned SINEX combination and consistency of all products in the IGS realization of ITRF.

Looking Ahead

The expanding usage of the IGS network into new applications brings requirements for the collection and dissemination of such metadata. In late 2000, a revised site log template supporting GNSS equipment other than GPS was drafted, in anticipation of incorporating GLONASS stations into the IGS network. This provided an opportunity to also improve the collection of site eccentricity information, describing the spatial relation between a geodetic marker and a GPS antenna, and other geophysical information regarding each site. When reviewed and adopted, the new log format will allow the Central Bureau to provide increased and standardized station information to the user community.

The Australian Regional GPS Network - Report for 2000

Bob Twilley, Paul Digney
AUSLIG

Introduction

The Australian Regional GPS Network (ARGN) continued a period of consolidation during 2000, following the Y2K and GPS week rollover concerns of the previous year. All 15 sites across Australia, Antarctica, Macquarie Island in the Southern Ocean and Cocos Island in the Indian Ocean maintained a high level of output. All information is available at www.auslig.gov.au/geodesy/argn/argn.htm.

Performance

Figure 1 shows the quantity of data acquired on each day of the year, at each of the ARGN stations. The vertical bar in these diagrams indicates the relative size of the Rinex data file available and the line of joined dots shows the percentage of valid observations with respect to the total theoretically possible.

A number of significant events are apparent in Figure 1. The receivers at both Yarragadee & Tidbinbilla were relocated early in the year to maximize resources for the rollout of upgraded receivers at more remote sites, but JPL receivers continued to operate at these sites during this time. Improvement in performance is evident at sites where receivers were upgraded, as shown in Table 1. As expected, extreme weather conditions affected some sites, with lightning strikes taking Jabiru out of action for almost two months and causing communication problems at Darwin later in the year. A cyclone also caused severe disruptions at Karratha in early March and cyclone induced flooding in late November caused a loss of communications. Data loss at Davis late in the year was eventually traced to a faulty in-line amplifier, while also late in the year, decreased performance at Yarragadee was caused by problems with the external clock.

Improvements

In 1999 ARGN GPS receivers were upgraded at critical sites to cope with the GPS week rollover, the Y2K and increasing ionospheric disturbance. However, the remoteness of the Antarctic sites meant that some receivers were not upgraded until 2000. Some Australian mid-Latitude sites were also upgraded during the year as a lower priority. The effect of these receiver upgrades is apparent in Figure 1.

Table 1: GPS receiver upgrades during 2000

Site	Date Upgraded	Old Receiver	New receiver
Alice Springs	14 January 2000 24 January 2000	AOA ICS-4000Z AOA SNR-12 ACT	AOA SNR-12 ACT AOA ICS-4000Z ACT
Casey	6 February 2000	AOA ICS-4000Z	AOA ICS-4000Z ACT
Davis	8 February 2000	AOA ICS-4000Z	ASHTECH Z-XII3
Mawson	3 March 2000	AOA ICS-4000Z	AOA ICS-4000Z ACT
Yarragadee	8 March 2000	AOA SNR-12 RM	AOA ICS-4000Z ACT
Tidbinbilla	30 March 2000	AOA SNR-12 RM	AOA ICS-4000Z ACT
Ceduna	11 May 2000	AOA ICS-4000Z	AOA ICS-4000Z ACT
Karratha	13 June 2000	ASHTECH Z-II3	AOA ICS-4000Z ACT

A number of software amendments were made during 2000. These developments included refinement of receiver download programs and upgrading of data conversion and archiving processes. These changes were made to minimize data loss and increase the efficiency of the data transfer & conversion system

Local Monitoring Surveys

Although all ARGN sites were carefully selected for geological stability, they all include three stable reference marks, usually within about twenty metres of the main monument. Repeated accurate local surveys of these marks and the GPS monument allows any possible local movement to be detected. During 2000, local surveys were carried out at Ceduna and Mawson using a Leica TC2003 Total Station and Topcon DL-101C digital level to give sub-millimetre results. No significant local movement was found.

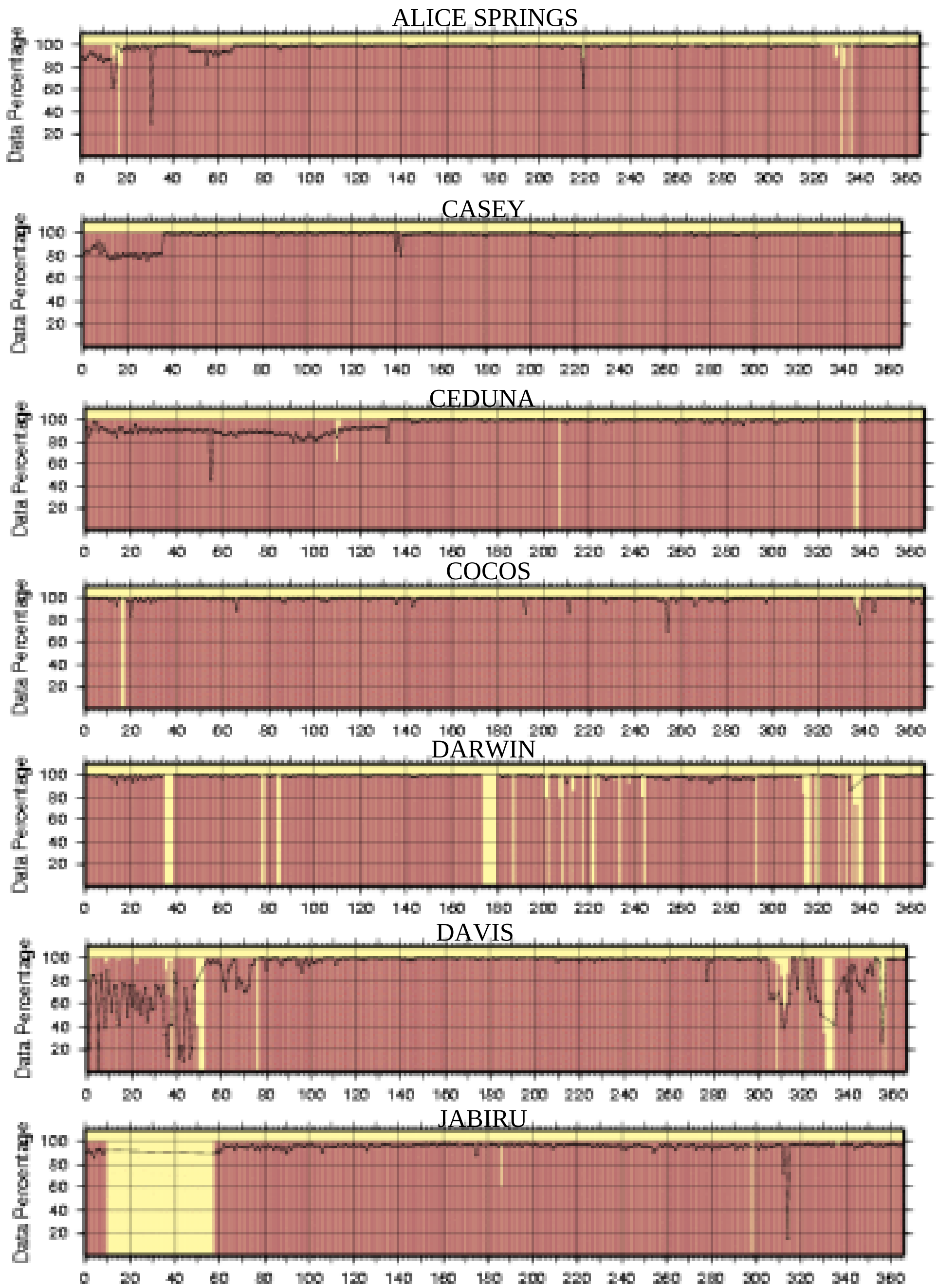

Figure 1 – Data availability at ARGN sites for 2000

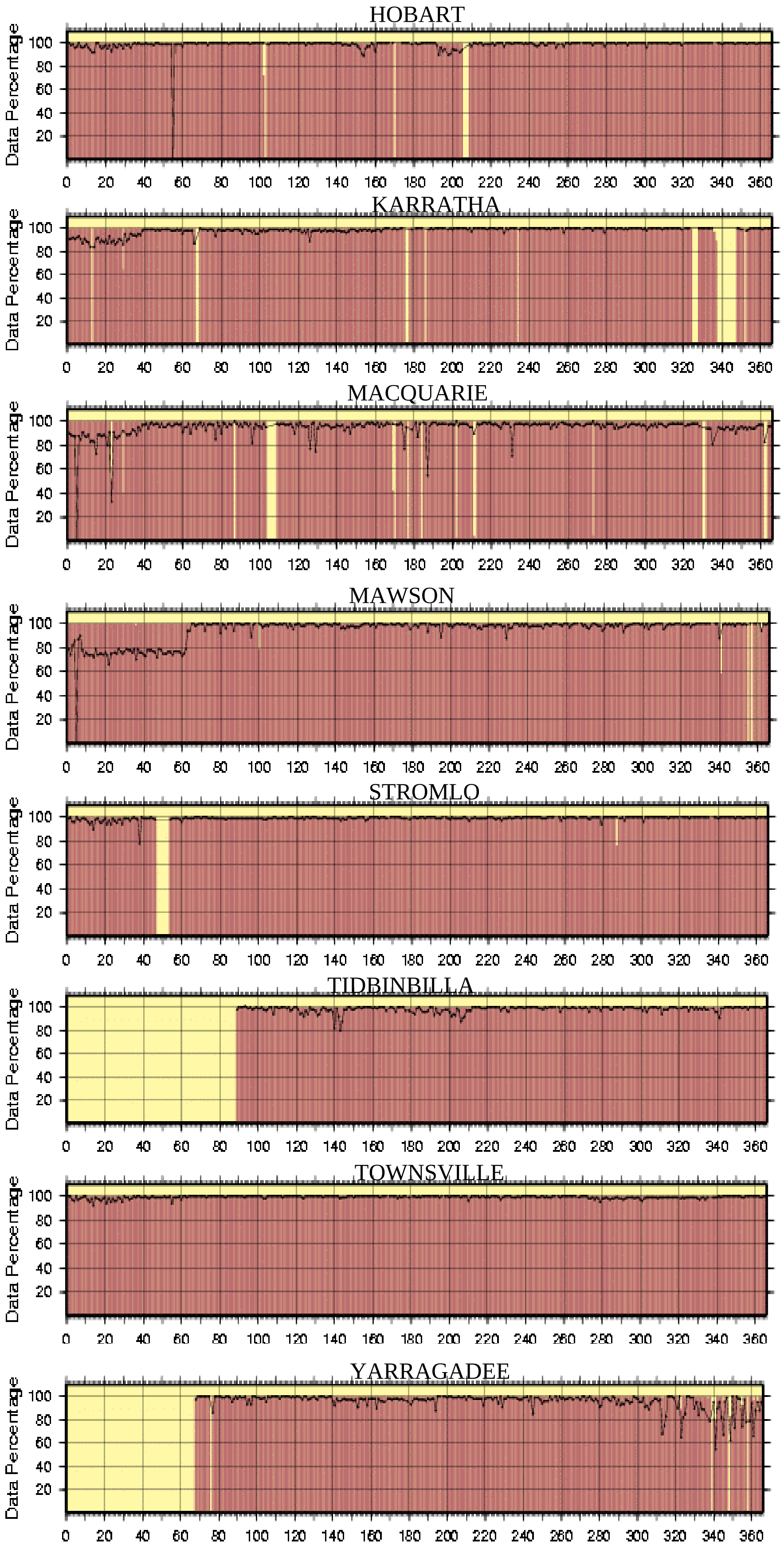

Figure 1 (cont.) – Data availability at ARGN sites for 2000

New Zealand Continuous GPS Network

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Introduction

It is timely to review the status of New Zealand's continuous GPS (CGPS) stations, because a major upgrade of CGPS monitoring is beginning in 2001/2002 and there will be a substantial increase in the data we will be providing to the IGS.

The CGPS array at December 2000 is shown in Figure 1, and the following paragraphs provide some notes on the stations.

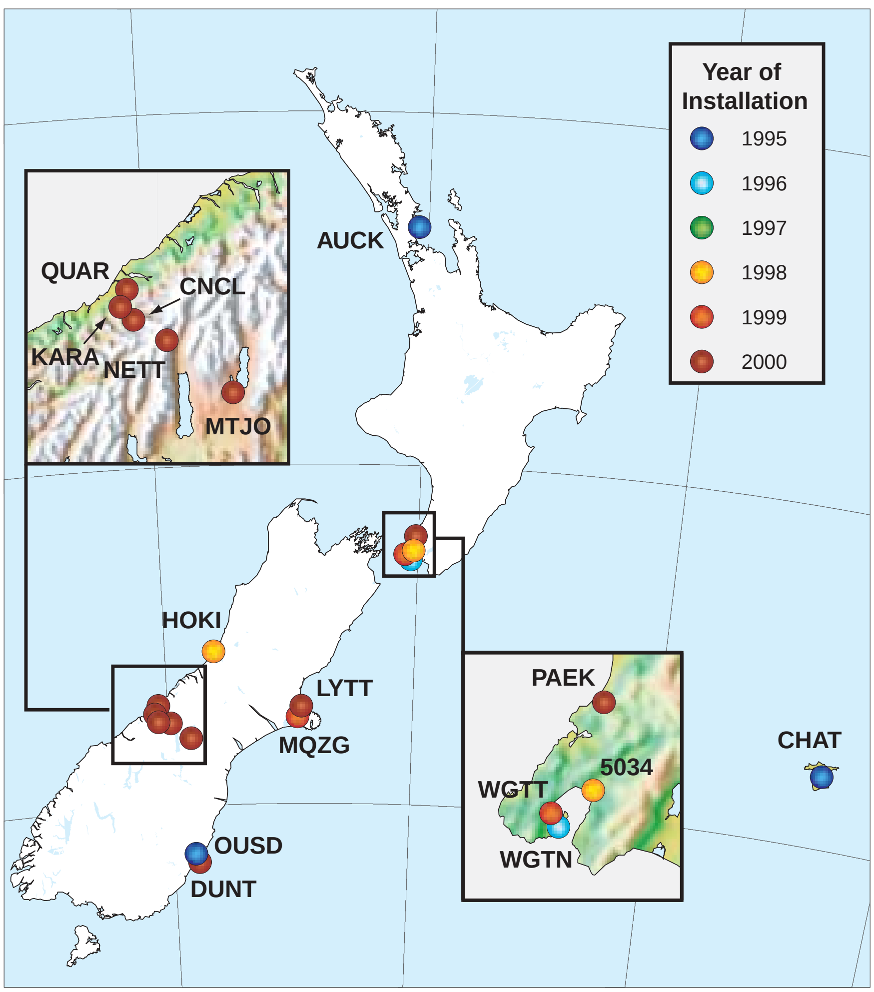

Figure 1. CGPS Array - December 2000

AUCK and CHAT

AUCK and CHAT are the original New Zealand IGS stations, installed in 1995 in partnership between the Institute of Geological and Nuclear Sciences (GNS), Land Information New Zealand (LINZ), JPL, and UNAVCO. These are the only New Zealand stations whose data are presently submitted to the IGS. Both stations have been operating with Turborogue SNR-8000 receivers since their inception, but we plan to upgrade both to Ashtech Z-12 CGRS receivers in 2001.

Sea Level Network

Since late 1999/early 2000, GNS and Otago University have operated CGPS receivers at three of New Zealand's longest-running tide gauges. These are stations DUNT, LYTT, and WGTT, and a fourth station will be established at the Auckland tide gauge in 2001. Funding for this network is from the New Zealand Foundation for Research, Science and Technology (FRST).

Southern Alps Network

The Southern Alps network (QUAR, KARA, CNCL, NETT, and MTJO) is primarily aimed at measuring the distribution of vertical motion across the Southern Alps in order to better understand processes of continental collision. The experiment started in February 2000 and will run at least 5 years. It is a joint project between MIT, the University of Colorado, Otago University, GNS, and UNAVCO. The primary funding is an NSF grant to Peter Molnar (with U.S. co-investigators Brad Hager and Tom Herring), with the New Zealand institutions funded by FRST and an Otago University Research Grant. As well as the continuous stations, a number of "semi-continuous" stations are operated for several months per year, mainly during the summer.

GNS Network

Five stations (WGTN, HOKI, 5034, MQZG, and PAEK) have been installed by GNS, sometimes in partnership with other institutions. HOKI was established in cooperation with Lamont-Doherty Earth Observatory of Columbia University, while PAEK was established in cooperation with the Geographical Survey Institute, Tsukuba, Japan. LINZ has contributed to the installation of several of the stations.

Otago University Station

OUSD is the longest-running CGPS station in New Zealand, dating from January 1995 some 8 months before AUCK and CHAT were established.

Near Real Time Precipitable Water

Most of the stations described above are downloaded hourly, and are processed to determine precipitable water with a delay of about 2 hours. These results may be found at www.gns.cri.nz/earthact/crustal/precip/gpspw.html.

References

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The GPS Receiver Network of ESOC: Maspalomas, Kourou, Kiruna, Perth, Villafranca and Malindi

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Overall Hardware Configuration

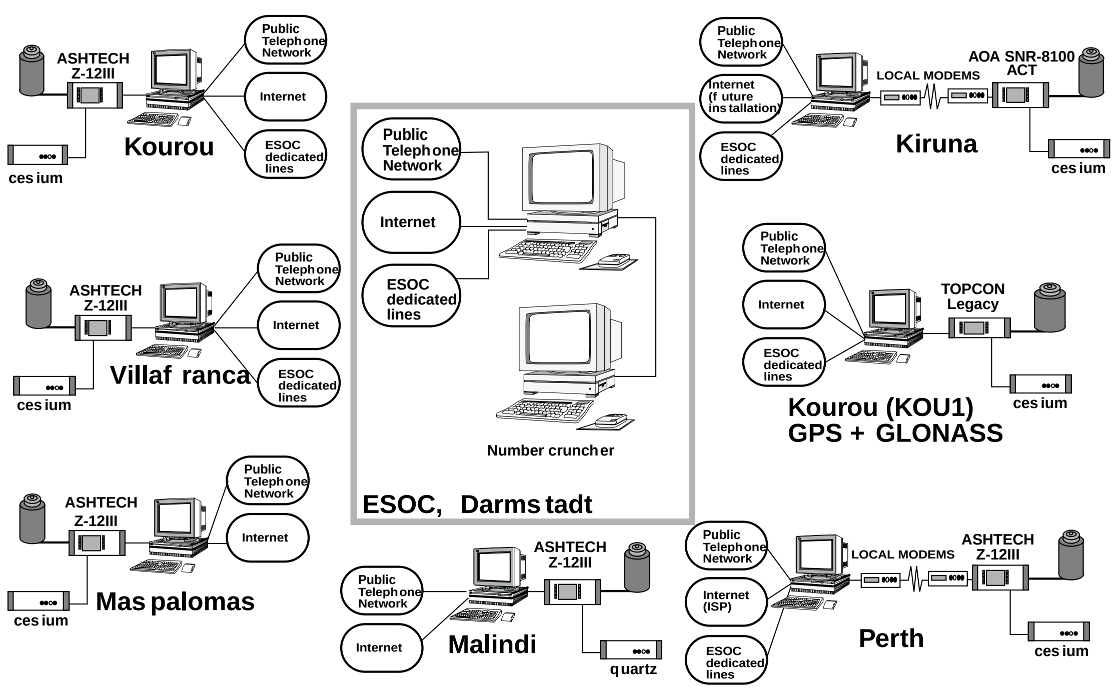

Figure 1 shows the configuration of the ESA stations by the end of 2000.

Receiver Performance

As it was reported in the IGS Network Systems Workshop, held in Annapolis 2-5 November 1998, the TurboRogues located at equatorial stations show many limitations in the cross correlation mode tracking during the solar maximum. The only solution is a replacement by new receivers.

Over the year 2000 ESOC has continued the plans to upgrade its network with receivers capable of tracking techniques with higher SNR than the cross correlation. ACT (AOA) and Z-tracking (Ashtech) receivers have been deployed to the tracking stations. It was a busy year with the following upgrades:

In Kiruna (KIRU) the receiver was upgraded to an AOA SNR-8100 ACT in September 2000.

In Kourou (KOUR) the TurboRogue was replaced by an ASHTECH Z-XII3 in March 2000.

In Malindi (MALI) the upgrade was delayed till April 2001 due to several problems with shipments arriving in bad condition to the African station.

Maspalomas (MAS1) was the first ACT upgrade in August 1999, but the upgraded receiver failed some months later and had to be replaced by an ASHTECH Z-XII3 in December 2000.

In Perth (PERT), due to the geographical location, the cross correlation receiver had an acceptable performance and the receiver was only replaced in 2001 after failure of the TurboRogue.

Villafranca (VILL) was upgraded to an AOA ACT receiver in July 2000. A similar situation to Maspalomas with a failure of the upgraded receiver some months later made necessary the replacement by an ASHTECH Z-XII3 by the beginning of 2001.

A Topcon Legacy combined GPS+GLONASS receiver was installed at Kourou (KOU1). A technical problem with the cable attenuation delayed the data distribution which is expected to start in 2001 to support IGS and IGLOS activities.

Communications

The communication from the ESA stations to the Control Centre at ESOC has been implemented based on the ESA permanent leased lines for those locations where they are available (Kiruna, Kourou, Perth and Villafranca) and based on dial-up modems where they are not. These lines are shared by other operational ESA projects and have a bandwidth limitation of 2400 baud. This rate is approximately twice the needed for 1 Hz receiver tracking and can be enough for data streaming but it is very tight if the data are packed in 15 minutes or 1 hour files.

To offer a better connectivity an effort has been undertaken to upgrade the stations with TCP/IP communications based on the Internet connectivity of the stations. The lines are not as reliable as the operational links, but accept higher throughput.

The new remote computers that support the receivers are Windows NT PCs with remote control for computer and receiver housekeeping. The operation is automatic and autonomous.

High Rate Data Capability

Thanks to the new Ashtech receivers and the new TCP/IP communications the ESA stations are able to produce 1 Hz data in subdaily downloads. It has been demonstrated in various high rate data collection campaigns like the HIRAC/Solarmax in April 2001.

The new Ashtech Z-XII receivers can internally store an download 1 HZ data. The AShtech receivers also do not present any problems in the second frequency tracking at equatorial stations caused by high ionospheric activity. The old TurboRogues where only capable of 0.33 Hz sampling by using the internal memory and CPU resources.

The Internet lines, developed for the bandwidth requirements of the web browsers, can download the 1 Hz data collected during one hour in a few minutes.

One-Hour Downloads

One-hour data of Kiruna, Kourou, Perth and Villafranca are available since September 1998. These stations have permanent leased data links to ESOC. The data flow has been continuos with only one hour latency during 1999 and 2000.

Maspalomas joined the hourly group in December 2000, at the beginning by using connectivity from a local Internet Service Provider and finally by using a 2 Mbits line of the station.

Malindi started the hourly downloads in 2001 using the Internet connection provided by the University of Rome at the San Marco station.

The hourly data are currently used for the computation of the ESA Rapid and Ultra Rapid products.

References

GPS-TDAF Stations Configuration Manual. Version 1.4, October 1999.

The GPS receiver Network of ESOC: Maspalomas, Kourou, Kiruna, Perth, Villafranca and Malindi. C. Garcia-Martinez, J.M. Dow, T. Martin-Mur, J. Feltens, P. Bernedo. 1998 Technical Reports. IGS Central Bureau.

ESA/ESOC IGS Analysis Centre Poster Summary. C. Garcia-Martinez, J.M. Dow, T. Martin-Mur, J. Feltens, P. Bernedo. 1998 IGS Network Systems Workshop.

Status Report of IGS Stations Monitored by GFZ

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Kinematics and Dynamics of the Earth

Introduction

The improving of the data availability is in fact the most important and a permanent task in monitoring the IGS GPS-sites. Some IGS sites operated by GFZ were extended to meet the requirements of the GFZ Champ mission, showing the possibilities and limitations of the current concept. Effort was taken to add new sites to the IGS net.

Data Transfer

The software for transferring the data via FTP was improved. Regarding the Windows based GPS sites new software was developed to increase the transfer reliability and speed. The station KIT3 shows still poor data availability due to the remote location. We are now working on an internet solution at this site.

Champ Support

Some GPS sites, e. g. LPGS, were extended to work at higher sample rates. Higher sample rates with increased file sizes could result in increased latencies depending on the strength of the data transfer routes. Compromises had to be taken to meet both requirements, low latency and high sample rates.

New Station

The station ULBA located at the Ulaanbaatar Astronomical Observatory in the Mongolia is about to obtain the IGS status. This station is equipped with an radio modem link type WIMAN **/1/**, connecting the GPS site over a distance of about 10 km to the internet. Efforts were taken to find new partners for building up new GPS sites in Africa and first contacts are very promising.

References

Neumeyer J., Nischan Th., Ramatschi M., Status Report of IGS Stations Monitored by GFZ, http://igscb.jpl.nasa.gov/overview/99_tech_reports.html

Table 1: Status of IGS stations operated by GFZ (07/2001)

Station	Receiver	Download Software	Receiver Format	Operating System	Compression	File Size	Data link	Latency	Meteo Station
KSTU (Russia)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Hourly	Internet	<15 min	Yes
KIT3 (Uzbekistan)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Daily	Internet (offline)	~ 10 days	Yes
LPGS (Argentina)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Hourly	Internet	<15 min	No
OBER (Germany)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp	Hourly	Internet	<15 min	Yes
POTS (Germany)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp	Hourly	Internet	<15 min	Yes
ULBA (Mongolia)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Hourly	Radio link + Internet	<15 min	No
UNSA (Argentina)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Hourly	Internet	<15 min	No
URUM (China)	AOA SNR 8000 ACT	TrMonitor	Conan Binary	LINUX	ZIP	Daily	Modem + Internet (offline)	<2 h	No
RIOG (Argentina)	Ashtech Z 12	GBSS	Binary	Win / NT4	ZIP	Hourly	Internet	<15 min	No
ZWEN (Russia)	AOA SNR 8000 ACT	TrMonitor	Turbo Binary	LINUX	Tcomp + ZIP	Hourly	Internet	<15 min	No

NASA-Sponsored GPS Global Network Activities

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Activities in 2000

NASA supported IGS sites established in 2000/2001, and partner agencies:

NRIL Norilsk, Russia - RDAAC/IRIS
MOBN Moscaw/Obninsk, Russia - RDAAC
CHPI Cachioera Paulista, Brazil - INPE
MBAR Mbarara, Uganda - IRIS/Geological Survey and Mines Dept. of Uganda
MSKU Franceville, Gabon - IRIS/Universite des Sciences et Techniques de Masuku
DYR2 Diyarbakir, Turkey - MIT/ERL
YAKT Yakutsk, Russia - RDAAC/IRIS
RBAY Richards Bay, South Africa - Hartebeesthoek Radio Astronomy Observatory
RABT Rabat, Morroco - MIT/ERL
CHUM Chumysh, Kazakhstan - IVTAN

NASA supported IGS sites upgraded with modern receivers:

AREQ, CRO1, IISC, GALA, GOLD, GUAM, HRAO, MADR, SANT, TIDB, USUD

High-rate data available with global distribution:

Partnered ground support commitment for the CHAMP LEO mission, the IGS call for support for LEO missions in general, and real-time GPS data applications provided the impetus to expand the high-rate subnetwork to 25 (and growing) sites. In most cases, these sites provide both 1s data and what are now typical hourly and daily 30s RINEX file products.

Formats of data publicly available from ftp://bodhi.jpl.nasa.gov/pub/

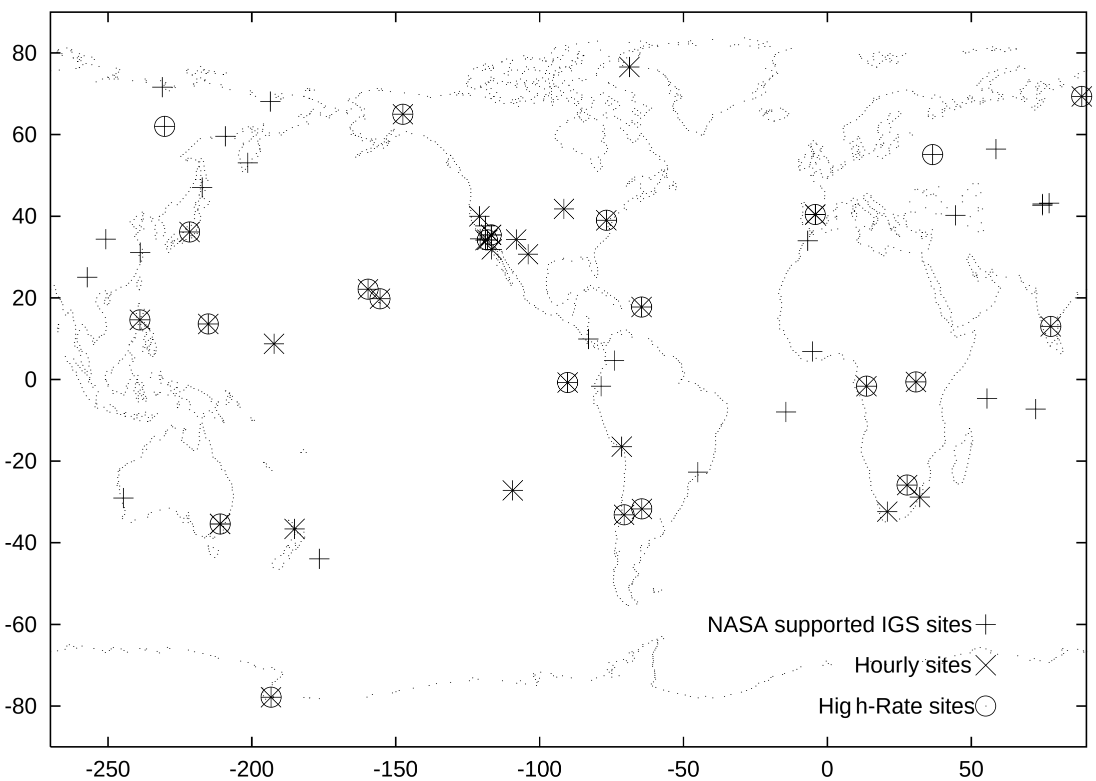
Daily 30s-samplerate RINEX
Hourly 30s-samplerate RINEX
15m 1s-samplerate compressed TurboBinary (GFZ tcomp utility);
CHAMP LEO support
15m 1s-samplerate CompactRINEX (Hatanaka/unix compressed);
IGS LEO Pilot Project format

Continued L2 troubles:

TurboRogues continue to have problems w/L2 tracking during solar maximum. A firmware fix did not materialize. An external fix running the TurboRogue receiver at 1s provides some improvement, but is not feasible at many locations. Receiver replacement has provided the best solution.

Y2K and other issues:

Other than some minor date formatting issues that were resolved almost immediately, and bit of a flurry to continue to provide continuous IGS support with a reduced number of Global Data Centers and an unusual number of key facility electrical power outages (unrelated to Y2K issues), this particular date rollover was largely uneventful.



* 1s data available + hourly 30s data available

NASA Supported IGS Sites

AOA1 ROGUE SNR-8000
+AREQ AOA SNR-8000 ACT
ARTU ASHTECH Z-XII3
ASC1 AOA SNR-8000 ACT
+AUCK ROGUE SNR-8000
BILI ASHTECH Z-XII3
BOGT non-operational
CASA ROGUE SNR-8000
CHAT ROGUE SNR-8000
CHPI ROGUE SNR-8000
CHUM ROGUE SNR-8000
+CIC1 ROGUE SNR-8000
*+CORD ROGUE SNR-8000
*+CRO1 ASHTECH Z-XII3
DGAR AOA SNR-8000 ACT
DYR2 ROGUE SNR-8000
+EISL ROGUE SNR-8000
*+FAIR AOA SNR-8100 ACT
*+GALA ASHTECH Z-XII3
*+GODE AOA SNR-12 ACT
+GOL2 ROGUE SNR-12 RM
*+GOLD ASHTECH Z-XII3
*+GUAM ASHTECH Z-XII3
HARV AOA SNR-8000 ACT
*+HRAO ASHTECH Z-XII3
IAVH (replaced by RABT)
*+IISC ASHTECH Z-XII3
+JPLM ROGUE SNR-8000
*+KOKB AOA SNR-8100 ACT
KUNM ROGUE SNR-8000
+KWJ1 AOA SNR-8100 ACT
+MAD2 ROGUE SNR-12 RM
*+MADR ASHTECH Z-XII3
MAGO ASHTECH Z-XII3
*+MBAR ASHTECH Z-XII3
MCM4 ROGUE SNR-8000
+MDO1 ROGUE SNR-8000
*+MKEA ASHTECH Z-XII3
*MOBN ASHTECH Z-XII3
MOIN non-operational
*+MSKU ASHTECH Z-XII3
+NLIB ROGUE SNR-8000
*+NRIL ASHTECH Z-XII3
NSSP ROGUE SNR-8000
PETP ASHTECH Z-XII3
+PIE1 ROGUE SNR-8000
*+PIMO ROGUE SNR-8000
POL2 ROGUE SNR-8000
+QUIN ROGUE SNR-8000
RABT ROGUE SNR-8000
+RBAY ROGUE SNR-8000
RIOP ROGUE SNR-8000
*+SANT ASHTECH Z-XII3
SELE ROGUE SNR-8000
SEY1 ROGUE SNR-8000
SHAO ROGUE SNR-8100
+SUTH ROGUE SNR-8100
THU1 ROGUE SNR-12 RM
+TID2 ROGUE SNR-12 RM
*+TIDB ASHTECH Z-XII3
TIXI ASHTECH Z-XII3
*+USUD ASHTECH Z-XII3
XIAN ROGUE SNR-8100
*YAKT ASHTECH Z-XII3
YAR1 ROGUE SNR-8100
YKRO ROGUE SNR-8000
YSSK ASHTECH Z-XII3

*Auxiliary Z-12 receiver (GODF) providing 1s data from GODE antenna/monument.
*Auxiliary Z-12 receiver (MCMZ) providing 1s data from MCM4 antenna/monument.
*Auxiliary Z-12 receiver (JPLT) providing 1s data from JPL Frequency Standard Test Lab
*Auxiliary Z-12 receiver (OKC2) providing 1s data from ARM Facility in Oklahoma

NRCan – GSC
Western Canada Deformation Array GPS Network
2000 Report

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Introduction

The Western Canada Deformation Array (WCDA) is a regional network of continuous GPS stations operated by the Geological Survey (GSC) of Canada primarily for the study of crustal deformation in the Cascadia Subduction Zone. In addition two sites, DUBO and FLIN, (supported under a joint GSC – NASA/JPL research agreement), are operated as part of a continental postglacial rebound study involving the analysis of GPS data from various agencies. Absolute gravity measurements are carried out at a subset of eight of these sites. In 2000, the operation of station WHIT was transferred to the Geodetic Survey Division (GSD) of NRCan. The WCDA network grew by a number of new stations bringing the total number of sites up to 14. Of these, 10 are posted to the IGS. Data from all sites are available from the WCDA ftp server.

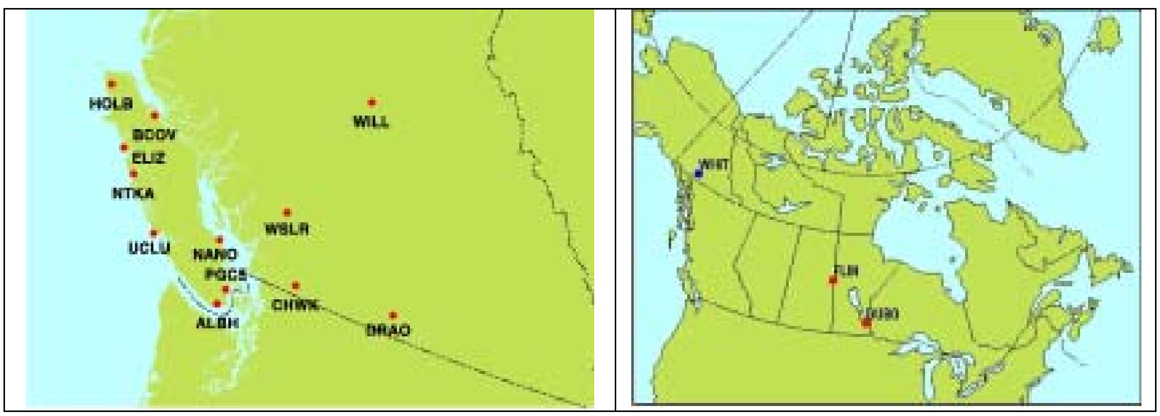


Figure 1: WCDA GPS Network

Data Retrieval, Validation and Distribution

No significant changes were made to the GPS data retrieval, validation and distribution systems in 2000. Data are retrieved on an ongoing automated basis. Data from the two IGS global sites, ALBH and DRAO are forwarded hourly to CDDIS. The remaining sites' data are distributed to the IGS in 24-hour files. All file distribution and posting on the WCDA server is in the compressed Hatanaka RINEX format. Data validation process continues to use three separate programs: GIMP, GPSPACE (both GSD/NRCan) and TEQC (UNAVCO).

GIMP provides arc-by-arc statistics including number of observations, data gaps, cycle slips, ionospheric and multipath parameters. GPSPACE uses either broadcast orbits or 'SP3' format orbits to calculate single point position, clock offset and clock drift. TEQC, in addition to providing data quality control, is also used to RINEX all WCDA data. Summary statistics from all three validation programs are tabulated in summary files used for evaluating site performance, generating plots, etc..

Metadata contained in the RINEX observation file headers are generated at the time of RINEX conversion based on time-stamped entries in station log files. UNIX-Hatanaka compressed RINEX files are posted on the WCDA FTP server and forwarded to CDDIS immediately after automated data retrieval and validation is complete. Data files and IGS site logs are available via the web (http://www.pgc.nrcan.gc.ca/geodyn) or via anonymous FTP from WCDA server: ftp://sikanni.pgc.nrcan.gc.ca

WCDA Site Upgrades:

The summary of site upgrades includes receiver, receiver firmware, antenna and dome changes carried out in 2000 and in effect as of Dec 31, 2000. Changes made subsequent to Dec 31. 2000 are not reflected in these tables.

Receiver Upgrades 2000

Three stations were upgraded to the AOA BenchMark ACT technology.

Site	Date Installed	Firmware Version
ALBH	15-MAR-2000	3.3.32.2N
WHIT*	11-JUL-2000	3.3.32.4
WSLR	AOA SNR-8000 ACT	3.3.32.3

Table 1: AOA BENCHMARK ACT GPS receiver installation
as of Dec. 31, 2000
* WHIT: operation transferred to GSD, NRCan Oct. 4, 2000

Firmware Upgrades 2000

Table 2 lists the receiver type and firmware changes carried out prior to December 31, 2000.

Site	Receiver Type	Date Installed	Firmware Version
ALBH	AOA BENCHMARK ACT	15-MAR-2000 18:18 UT	3.3.32.2N
DRAO	AOA BENCHMARK ACT	06-DEC-2000 22:36 UT	3.3.32.4
WHIT*	AOA SNR-8000 ACT	04-OCT-2000 00:00 UT	3.3.32.2N
WSLR	AOA SNR-8000 ACT	29-MAR-2000 21:53 UT	3.3.32.3

Table 2: Receiver Firmware: Date of Upgrade and Version Number
as of December 31, 2000
* WHIT: operation transferred to GSD, NRCan Oct. 4, 2000

Antenna / Dome Upgrades 2000

All WCDA sites are equipped with AOAD/M_T antennas. Several models of this antenna are used. Table 3 summarizes antenna changes and Table 4 dome changes made at WCDA sites.

Site	Antenna Type	Antenna Part Number	Change Effective
UCLU	AOAD/M_T	7490582-B	01-JUN-2000 23:00 UT
WSLR	AOAD/M_T	7490582-2	29-MAR-2000 21:53 UT

Table 3: Antenna and Changes, 2000
as of December 31, 2000

Site	Dome Type + RF screen	Change Effective
UCLU	SCIS + RF screen	SCIS Dome installed 01-JUN-2000 23:00 UT
WSLR	SCIS	SCIS Dome installed 29-MAR-2000 21:53 UT

Table 4: Antenna Dome changes, 2000
as of December 31, 2000

External Frequency (Clock) Changes 2000

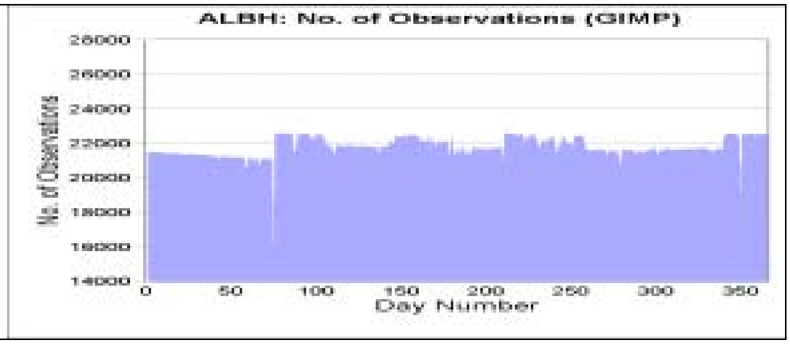
Site	Clock Change	Change Effective
ALBH	Rubidium to Hydrogen Maser	06-OCT-2000 19:45 UT
NANO	Rubidium to Clock Steering	07-NOV-2000 17:08 UT
WSLR	Rubidium to Clock Steering	31-MAR-2000 17:20 UT

Table 5: External Frequency (clock) changes, 2000
as of December 31, 2000

WCDA IGS Global Sites

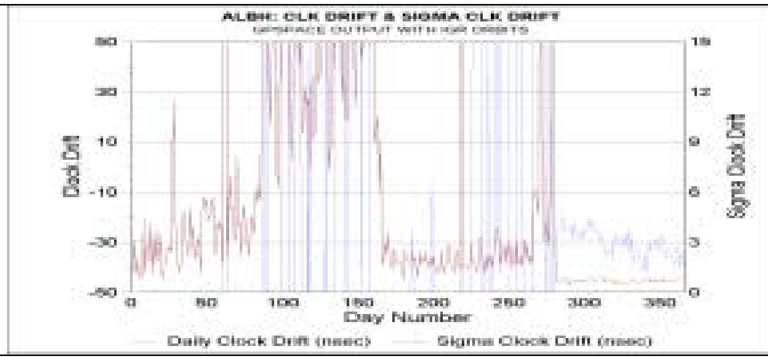
The following tables summarize the data collection status of WCDA IGS Global sites (ALBH, DRAO) as indicated by the total number of daily observations. The clock performance as derived from GPSPACE with IGS Rapid orbits is also indicated.

ALBH
- upgrade to AOA BenchMark ACT D075 (8 ch to 12 ch)
- difference(s) in daily No. of data points due to changes in constellation;

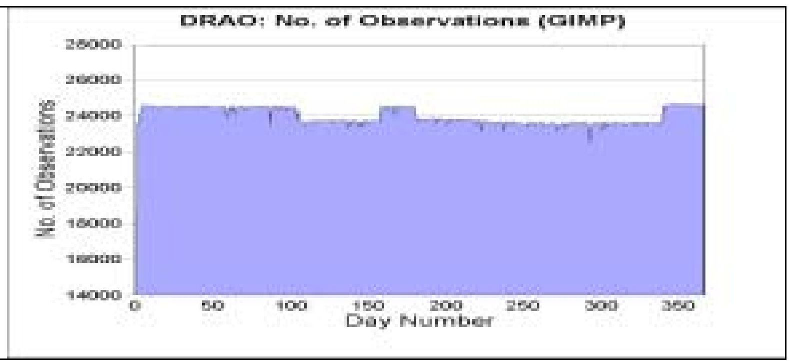


ALBH
- Rubidium clock used until Oct. 6 (D280);
- Hydrogen Maser installed D280;

> Output from GPSPACE with Rapid Orbits;

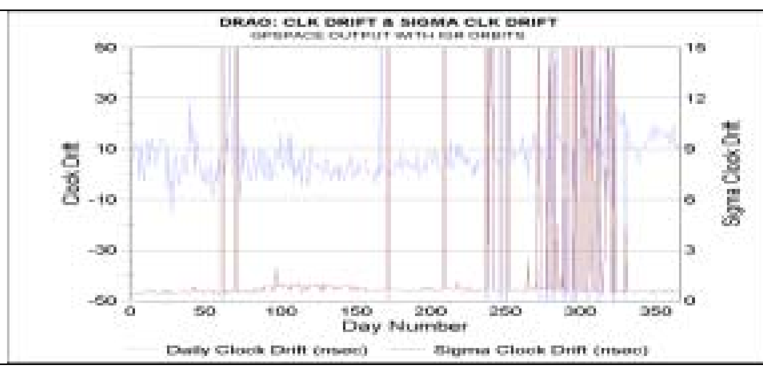


DRAO
- difference(s) in daily No. of data points due to changes in constellation;



DRAO
- large number of apparent clock resets due to problem with receiver offloads causing receiver resets;
- problem resolved by firmware upgrade D341

> Output from GPSPACE with Rapid Orbits;



Complete site information is available at: http://www.pgc.nrcan.gc.ca/geodyn

Permanent GPS Tracking Station UPAD

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Presentation

The GPS station UPAD of the University of Padova operates since 1994 as a permanent installation in support of the International GPS Service for Geodynamics (IGS), of EUREF (European Reference Frame) and the project CERGOP of the Central Europe Inititative. In 1997 our University joined the University Navstar Consortium UNAVCO. The UPAD station serves the scientific and tutorial needs of the Department of Geology, Paleontology and Geophysics, as to the application of GPS data to Earth Sciences, and of the Interdipartimental Center for Space Activities (CISAS), as to the application of GPS techniques to Space Engineering, Space Communication and Navigation. The station is located downtown Padova, on the roof of the University Main Building, near a Geodetic Dome formerly used for astrolabe observations.

Instrumentation

In 1997 the station operated with the TRIMBLE 4000SSE receiver and geodetic antenna with ground plane. In September 1997 new equipment included a TRIMBLE 4000 Ssi, choke ring antenna and the control software URS, under OS2. The local PC is configured as a FTP and WEB server. Since September 1999 the URS operates under the Operating system Windows NT4.

Data

Data production consists of :

- Real time differential corrections RTCM/RTK obtainable at free of charge at the phone number 049 8273442 (modem)
- Hourly files in compressed RINEX format. Compression is according to IGS standards (Unix+Hatanaka). Observation and Navigation files are available. Sampling time is 5 seconds.
- Hourly files in compressed RINEX format. Compression is according to IGS standards (Unix+Hatanaka). Observation and Navigation files are available. Sampling time is 30 seconds.
- Daily files in compressed RINEX format. Compression is according to IGS standards (Unix+Hatanaka). Observation and Navigation files are available. Sampling time is 30 seconds.

The FTP target hosts are, at this time:

1. University of Padova
2. Observatory Graz Lustbuehl, Austria
3. BKG, Frankfurt, Germany
4. GFZ, Potsdam, Germany
5. Italian Space Agency, Matera Space Geodesy Center, Italy

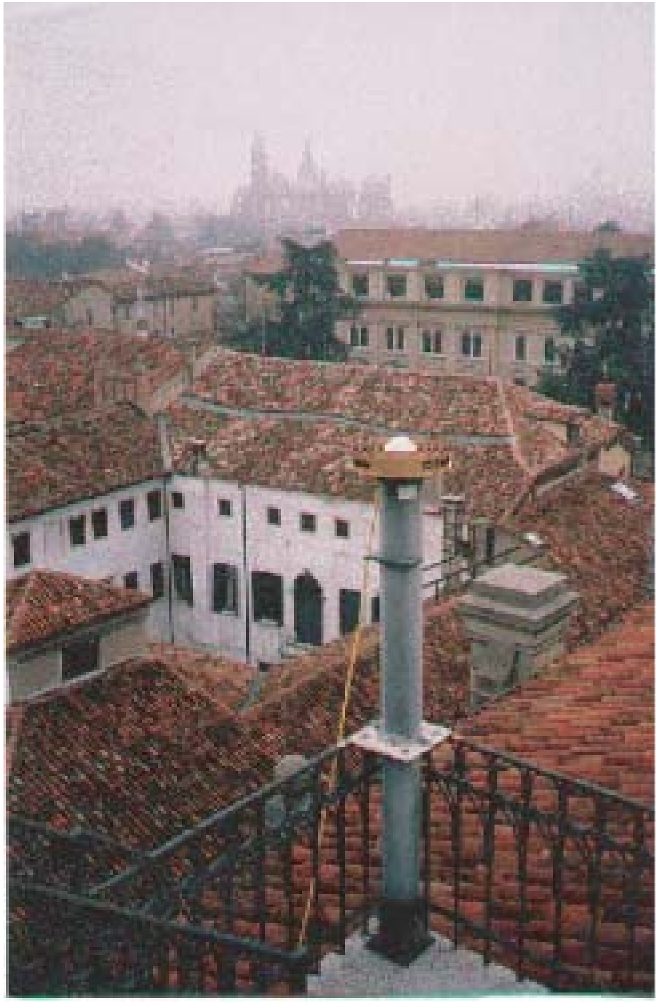

Figure 1: the antenna of UPAD

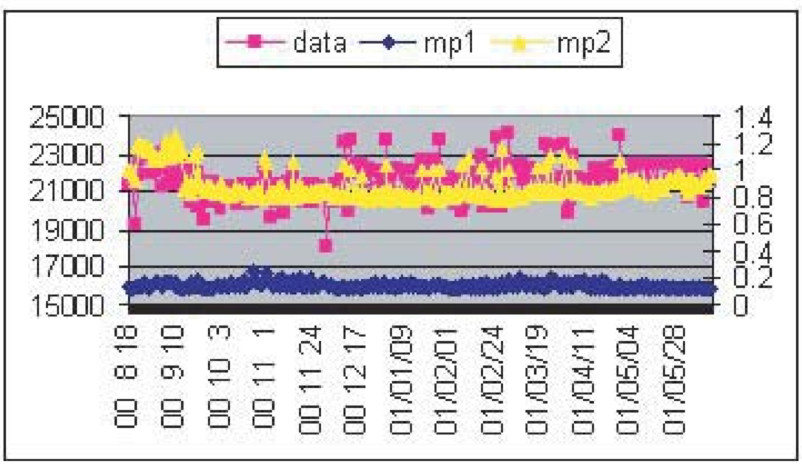

Figure 2: plot of total acquired data since August 2000, and code multipath (right y –scale, in meters)

Technical Report on LAMA IGS Station for Year 2000

L.W. Baran, J. Kapcia, P. Wielgosz

The IGS permanent station LAMA is located in Poland, 25 kilometres northwards from Olsztyn and 200 kilometres northwards from Warsaw, the capital city of Poland. It is maintained by the Institute of Geodesy of the University of Warmia and Mazury in Olsztyn. The station has carried out GPS observation within IGS since 1994 and also within EPN (EUREF Permanent Network). It is equipped (nowadays) with ASHTECH Z-XII-3 receiver, ASH700936F_C antenna, rubidium frequency standard and LAB EL meteo station.

In year 2000 the station experienced problem with its GPS antenna AOAD/M_T. The problem started about April 9, 2000. We got known about this situation when our station was excluded from EUREF weekly solutions due to large residuals on May 16, 2000. We were informed about the problem with over one month of delay, because of the availability of the EUREF combined solution. We did not get any information about low quality of LAMA observations from IGS. We know also that EPN management works to improve this situation in order to nearly real-time data quality checking (Takacs and Bruyninx, 2001). Anyway, we checked this problem and found out, that our antenna was tracking very few satellites (2-4 satellites less than nearby IGS/EPN stations). So we sent our AOAD/M_T antenna to repair and replaced it by ASH700936F_C antenna (with Ashtech radome) on October 6, 2000. Since then the station has operated without major problems. It is a pity we could not use the new antenna until October 2000. The change of the antenna caused a few millimetres shift in station coordinates.

On the basis of GPS observations collected at LAMA and other IGS/EPN stations we conduct studies, primarily on ionospheric TEC behaviour during geomagnetic storms and also on monitoring vectors connecting LAMA with several EPN stations for geodynamics purposes (Baran et al., 2000; Chenyakov et al., 1999).

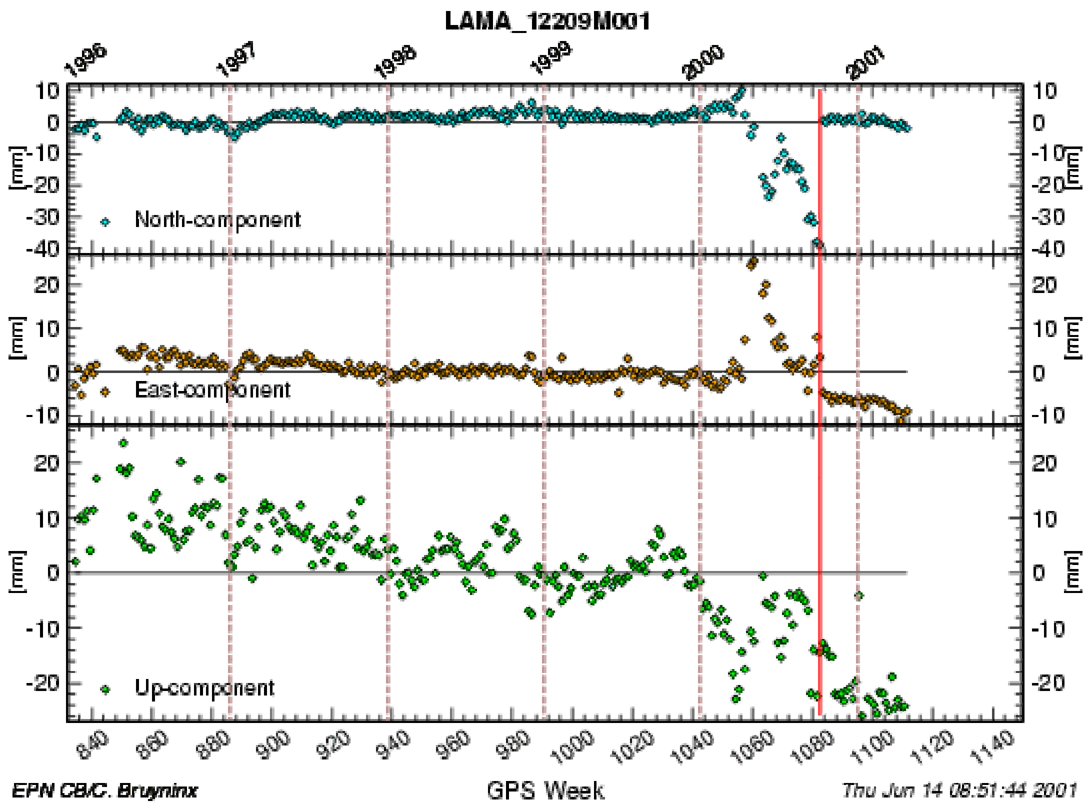

Fig.1 Changes in coordinate time series of LAMA station caused by malfunction and next replacement of GPS antenna (by www.epncb.oma.be/series/lama.html, C. Bruyninx).

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