IGS Network Coordinator Report - 2002

Angelyn Moore

IGS Central Bureau
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA

Network Composition Changes

The IGS network is a set of permanent, continuously-operating, dual-frequency GPS stations operated by over 100 worldwide agencies. The dataset is pooled at IGS Data Centers for routine use by IGS Analysis Centers in creating precise IGS products, as well as free access by other analysts around the world. The IGS Central Bureau hosts the IGS Network Coordinator, who assures adherence to standards and provides information regarding the IGS network via the Central Bureau Information System website at http://igscb.jpl.nasa.gov.

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 112 stations, listed in Table 1, during 2001 and 2002.

Table 1 - Network Composition Changes During 2001-2002

Additions	
AJAC	Ajaccio, Corsica, France
ALRT	Alert, Nunavut, Canada
ANTC	Los Angeles, Chile
BAN2	Bangalore, India
BOGI	Borowa Gora, Poland
BREW	Brewster, Washington, USA
BRST	Brest, France
CAGS	Gatineau, Quebec, Canada
CAGZ	Capoterra, Italy
CFAG	Caucete, Argentina
CHPI	Cachoeira Paulista, Brazil
CHUM	Chumysh, Kazakhstan
CONZ	Concepcion, Chile
COPO	Copiapo, Chile
COYQ	Coyhaique, Chile
DARR	Darwin, Australia
DAVR	Davis, Antarctica
DLFT	Delft, the Netherlands
DREJ	Dresden, Germany
DWH1	Woodinville, Washington, USA
FALE	Faleolo, Samoa
FFMJ	Frankfurt/Main, Germany
FREE	Freeport, the Bahamas
GMAS	Mas Palomas, Gran Canaria, Spain
GUAO	Urumqi, China

Table 1 - Network composition changes during 2001-2002 (continued)

Additions (cont'd)

HELJ	Helgoland Island, Germany	
HERP	Hailsham, England	
HILO	Hilo, Hawaii, USA	
HNLC	Honolulu, Hawaii, USA	
HOLM	Holman, Northwest Territories, Canada	
HUEG	Huegelheim, Germany	
HYDE	Hyderabad, India	
INVK	Inuvik, Northwest Territories, Canada	
IQQE	Iquique, Chile	
IRKJ	Irkutsk, Russia	
JOZ2	Josefoslaw, Poland	
KGN0	Koganei, Japan	
KGNI	Koganei, Japan	
KHAJ	Khabarovsk, Russia	
KOU1	Kourou, French Guyana	
KOUC	Koumac, New Caledonia	
KR0G	Kiruna, Sweden	
KSMV	Kashima, Japan	
LAE1	Lae, Papua New Guinea	
LEIJ	Leipzig, Germany	
LHAZ	Lhasa, Tibet, China	
LHUE	Lihue, Hawaii, USA	
LIND	Ellensburg, Washington, USA	
LROC	La Rochelle, France	
MALD	Male, Maldives	
MANZ	Manzanillo, Mexico	
MARS	Marseille, France	
MAT1	Matera, Italy	
MAUI	Haleakala, Hawaii, USA	
MBAR	Mbarara, Uganda	
MDVJ	Mendeleevo, Russia	
METZ	Kirkkonummi, Finland	
MIKL	Mykolaiv, Ukraine	
MIZU	Mizusawa, Japan	
MOBN	Obninsk, Russian Federation	
MORP	Morpeth, UK	
MR6G	Maartsbo, Sweden	
MSKU	Franceville, Gabon	
MTBG	Mattersburg, Austria	
MTKA	Mitaka, Japan	
NAIN	Nain, Newfoundland, Canada	
NNOR	New Norcia, Australia	
NPLD	Teddington, UK	
OBE2	Oberpfaffenhofen, Germany	Replacing OBER
OBET	Oberpfaffenhofen, Germany	
OHI2	O'Higgins, Antarctica	Replacing OHIG
OHIZ	O'Higgins, Antarctica	
OPMT	Paris, France	
OS0G	Onsala, Sweden	
OUS2	Dunedin, New Zealand	
PADO	Padova, Italy	Replacing UPAD

Table 1 - Network composition changes during 2001-2002 (continued)

Additions (cont'd)		
PARC	Puntas Arenas, Chile	
POLV	Poltava, Ukraine	
PTBB	Braunschweig, Germany	
QAQ1	Qaqortoq, Greenland	
RESO	Resolute, Nunavut, Canada	
REYZ	Reykjavik, Iceland	
SACH	Sachs Harbour, Northwest Territories, Canada	
SCUB	Santiago de Cuba, Cuba	
SIMO	Simonstown, South Africa	
STR2	Stromlo, Australia	
SULP	Lviv, Ukraine	
SUNM	Brisbane, Australia	
SUTM	Sutherland, South Africa	
SUVA	Suva, Fiji	
TCMS	Hsinchu, Taiwan, Republic of China	
TGCV	Palmeira, Republic of Cape Verde	
THU2	Thule, Greenland	
THU3	Thule, Greenland	
TITZ	Titz, Germany	
TLSE	Toulouse, France	Replacing TOUL
TNML	Hsinchu, Taiwan, Republic of China	
TWTF	Taoyuan, Taiwan, Republic of China	
ULAB	Ulaanbataar, Mongolia	
UNB1	Fredericton, New Brunswick, Canada	
USN1	Washington, D.C., USA	
VALP	Valparaiso, Chile	
VS0G	Visby, Sweden	
WROC	Wroclaw, Poland	
WTZA	Koetzting, Germany	
WTZJ	Wettzell, Germany	
WTZZ	Koetzting, Germany	
YAKT	Yakutsk, Russian Federation	
YARR	Dongara, Australia	
ZAMB	Lusaka, Zambia	
ZIMJ	Zimmerwald, Switzerland	
ZIMZ	Zimmerwald, Switzerland	
Deletions		
BARB	Bridgetown, Barbados	
IGM0	Buenos Aires, Argentina	
MATH	Lake Mathews, California, USA	
PVEP	Palos Verdes, California, USA	
TAIW	Taipei, Taiwan, Republic of China	
TEGU	Tegucigalpa, Honduras	

While this number may initially seem alarmingly higher than recent rates of station addition (and indeed, equal to the total number of IGS stations at the close of 1995!), it reflects the wholesale incorporation of an entire new class of sites: those which receive both GPS and GLONASS signals and participate in the International GLONASS Service Pilot Project (IGLOS-PP). The new sites also include some participating in other IGS Working Groups and Pilot Projects, such as timing activities and Tide Gauge Benchmarks. Notable coverage improvements came to the Arctic and southern Africa, as is evident from the large circles in Figure 1.

Six stations (also listed in Table 1) exited the IGS network in 2001-2002, due to decommissioning or other permanent unavailability of tracking data, bringing the total number of stations to 348 at the close of 2002.

Typical IGS stations contribute data sampled at 30 seconds on a daily basis; a growing and increasingly well-distributed subset contributes similar data hourly or more frequently, as shown in Figure 2.

Network-Related developments: IGLOS Site Integration

In 2001-2002, the IGS station operators and other IGS participants collaborated with the Network Coordinator to realize several improvements to the network element. An overhaul of the station logs which record the history of each site (crucial to the maintenance of the IGS realization of the International Terrestrial Reference Frame and the consistency of IGS products) started with a proposal of a form allowing the structured collection of information on more types of ancillary and geophysical data. After review and revision by a small yet representative group, final suggestions were collected from the IGS at large in typical IGS collaborative fashion. The changeover was handled at the Central Bureau, with significant and timely assistance from site operators when apparent discrepancies arose, over a period of days leading up to the actual switch on 11 Jun 2002. Care was taken to ensure that the IGS SINEX template (the authoritative compilation of station configuration history) was not adversely affected by the site log maneuvers.

This revised station metadata allowed stations participating in the International GLONASS Service Pilot Project (IGLOS-PP) to be fully integrated into the IGS network. Figure 3 shows an example of an IGLOS station co-located with a GPS-only IGS site. Combined GPS/GLONASS data and station configuration data now appear side by side with the GPS-only IGS stations. In addition to augmenting the IGS network and providing convenience for IGLOS-PP analysts, this serves as a significant demonstration of the IGS' capability to integrate data from other Global Navigation Satellite Systems (GNSS) into the IGS organization and information flow.

Notable New Web Features

Network maps

The IGS CBIS began to provide convenient clickable and downloadable maps of the IGS network and subnetworks, for the IGS community to use in preparing presentations, and to visualize the spatial distribution of the sets of sites.

Data quality plots

Detection of station anomalies has been a popular request in recent years. To that end, each station's web page at the Central Bureau was upgraded to include automatically-updated data quality plots representing the previous 45 days of daily RINEX data. The four quality figures (number of observations, cycle slips, and L1/L2 multipath) are obtained from teqc summary files (see http://www.unavco.ucar.edu/software/teqc/teqc.html for information on UNAVCO's teqc software) corresponding to each day of RINEX data. These are helpful in identifying sudden changes in data character which can identify a site disturbance or equipment failure.

The "spectrum" of all IGS stations' averages and standard deviations of these quality figures is also provided. This gives the viewer an idea how that particular station compares to the rest of the IGS network. See Figure 4 for an example of the L1 multipath graphs.

For IGS stations submitting hourly data, a graph of recent latency is also provided, alongside a graph depicting the recent latencies of all hourly data for comparison.

Network data table and access guide

Inquiries received at the CB made it clear that there was room for improvement in informing web visitors about the types of IGS data and how to acquire it. A table was developed to summarize the data types, including which Global Data Centers archive each kind. Links from the access column lead the visitor to all the needed information to acquire the data: file naming conventions, formats, and paths at the DCs. A portion of the table is shown in Figure 5. A similar access column was also added to the already-existing table of products. The complete tables are available at:
http://igscb.jpl.nasa.gov/components/data.html
http://igscb.jpl.nasa.gov/components/prods.html

Thanks to the Stations (and the People and Agencies That Make Them Possible)

These examples of network-wide improvements in themselves do not adequately reflect the complete picture of activity within the IGS network. All the while, the stations' operating agencies are planning new stations, arranging for equipment repair and upgrade, maintaining the integrity of station information, and improving communications and automation. It is this significant commitment to contribute to the global dataset that fundamentally makes the IGS possible.

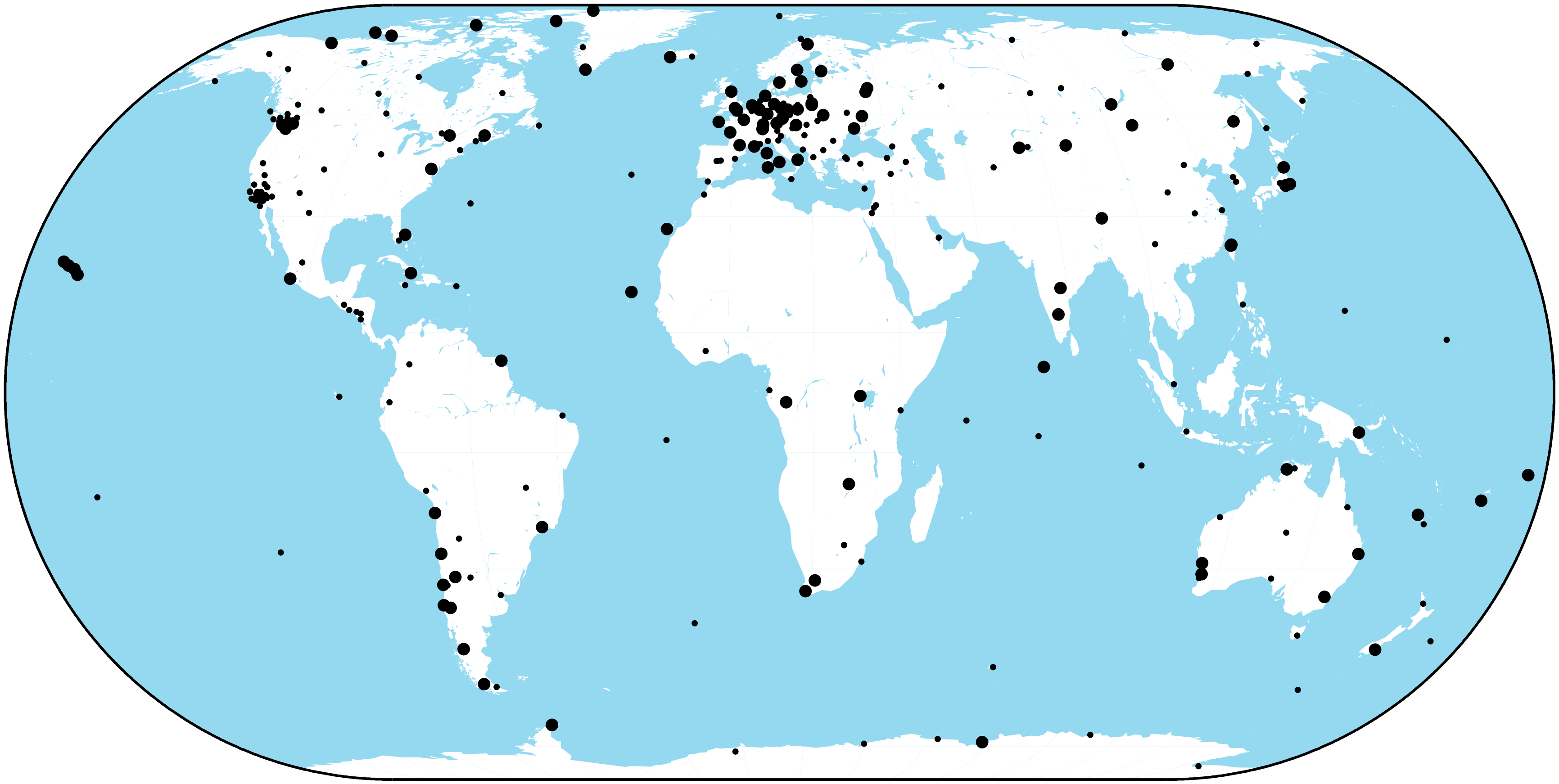


Figure 1. 112 stations (large circles) were added to the IGS network in 2001-2002, to form a total network of 242 stations (all circles).

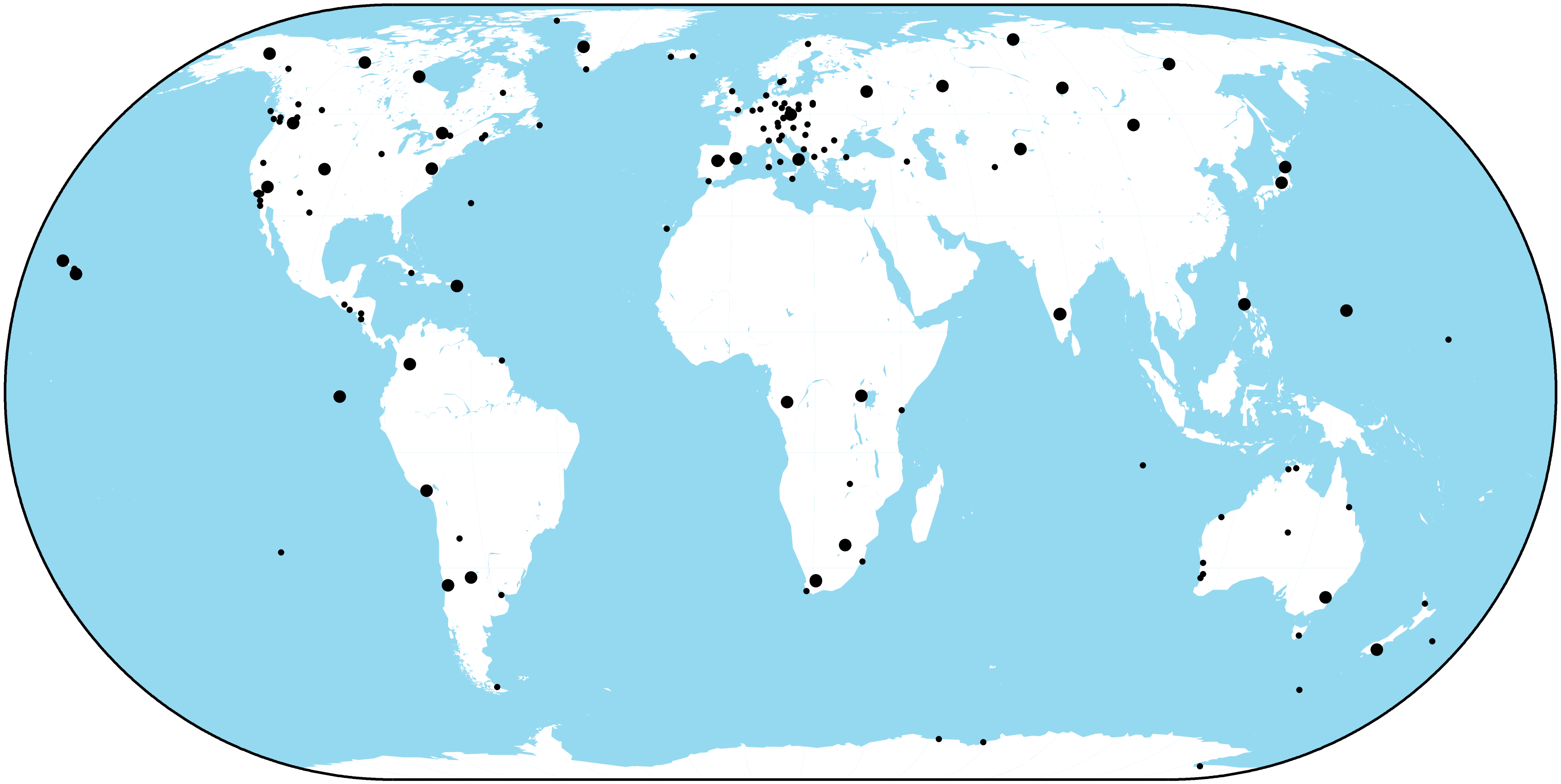


Figure 2. IGS stations contributing hourly (small circles) and sub-hourly (large circles) data during 2001-2002.

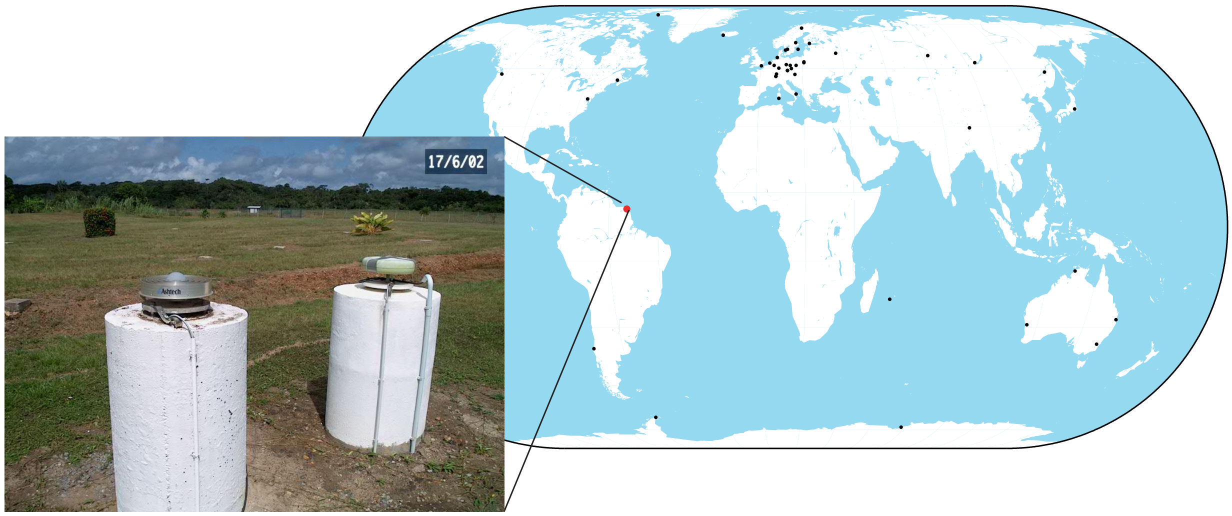


Figure 3. GPS/GLONASS tracking stations in the IGS (black circles) include the Kourou, French Guyana station, which features GPS/GLONASS tracking equipment alongside a long-standing GPS-only IGS site. Photo courtesy of ESA/ESOC.

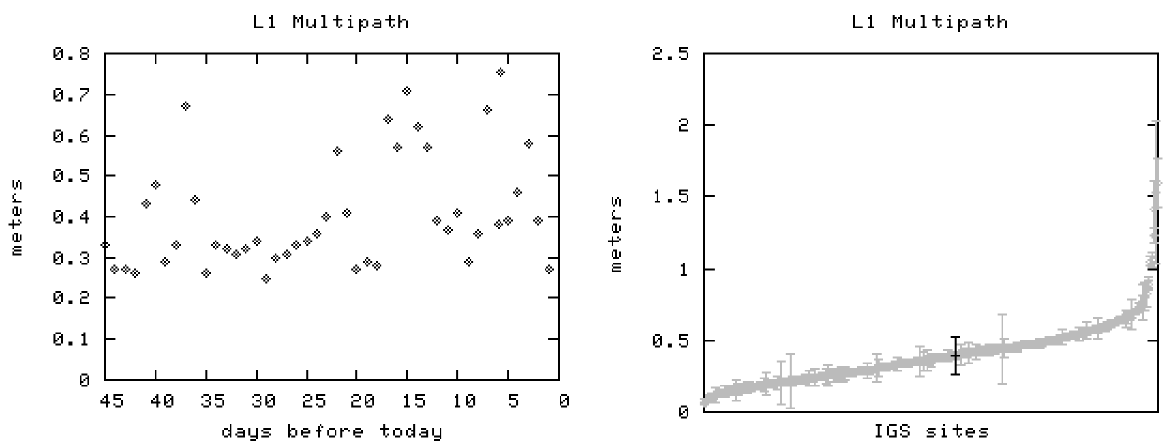
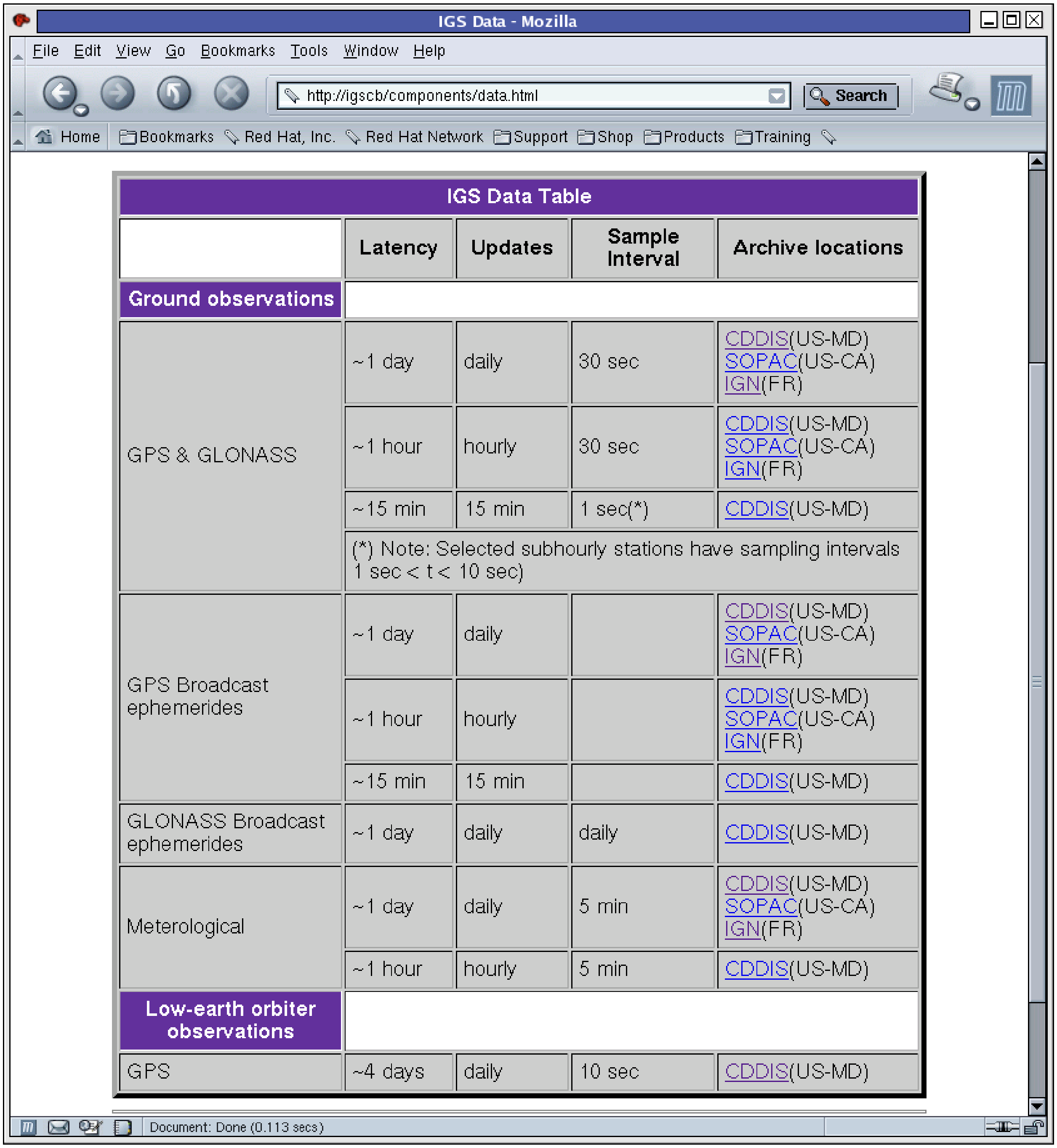


Figure 4. Graphs, updated daily at the Central Bureau website, show recent data characteristics of each sitevarying with time, and in comparison to other GPS sites.



IGS Data Table

	Latency	Updates	Sample Interval	Archive locations
Ground observations				
GPS & GLONASS	~1 day	daily	30 sec	CDDIS(US-MD) SOPAC(US-CA) IGN(FR)
	~1 hour	hourly	30 sec	CDDIS(US-MD) SOPAC(US-CA) IGN(FR)
	~15 min	15 min	1 sec(*)	CDDIS(US-MD)
	(*) Note: Selected subhourly stations have sampling intervals 1 sec < t < 10 sec)			
GPS Broadcast ephemerides	~1 day	daily		CDDIS(US-MD) SOPAC(US-CA) IGN(FR)
	~1 hour	hourly		CDDIS(US-MD) SOPAC(US-CA) IGN(FR)
	~15 min	15 min		CDDIS(US-MD)
GLONASS Broadcast ephemerides	~1 day	daily	daily	CDDIS(US-MD)
Meterological	~1 day	daily	5 min	CDDIS(US-MD) SOPAC(US-CA) IGN(FR)
	~1 hour	hourly	5 min	CDDIS(US-MD)
Low-earth orbiter observations				
GPS	~4 days	daily	10 sec	CDDIS(US-MD)

Figure 5. The data types table now available at the Central Bureau website, including access instructions for obtaining data from each Global Data Center.