CDDIS 1998 Global Data Center Report

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1 Introduction

The Crustal Dynamics Data Information System (CDDIS) has supported the International GPS Service (IGS) as a global data center since 1992. The CDDIS activities within the IGS during 1998 are summarized below; this report also includes any changes or enhancements made to the CDDIS during the past year. General CDDIS background and system information can be found in the CDDIS data center summary included in the *IGS 1994 Annual Report* (Noll, 1995) as well as the subsequent updates (Noll, 1996, Noll, 1997, and Noll, 1998).

2 System Description

The CDDIS archive of IGS data and products are now accessible worldwide through anonymous ftp. New users can contact the CDDIS staff to obtain general instructions on the host computer, directory structure, and data availability. The CDDIS is located at NASA's Goddard Space Flight Center (GSFC) and is accessible to users 24 hours per day, seven days per week. The system is available to users globally through the Internet and the World Wide Web (WWW).

2.1 Computer Architecture

During early 1998, CDDIS operations continued on the dedicated Digital Equipment Corporation (DEC) VAX 4000 Model 200 running the VMS operating system; in May, however, these operations, both data processing and data access, were transitioned to a new UNIX-based DEC AlphaServer 4000. The GPS data processing software was tested on this new computer during early 1998 with the help of the various IGS data and analysis centers that supply (and retrieve) data to the CDDIS. The directory structures supporting GPS data and products were consolidated under a single filesystem, thus simplifying the access to these data sets for the user community. All data and product files are now stored in UNIX compressed format, using lowercase filenames (with the exception of the .Z indicating a compressed file). At present, nearly 130 Gbytes of on-line magnetic disk space is devoted to the storage of the daily GPS tracking data and products.

The CDDIS staff began populating a 600-platter CD-ROM jukebox with CDs containing older GPS data not currently on-line. Thus far, most of the GPS data from 1997 have been archived to CD, one week per CD. These data are migrated from magneto-optical disks (in VAX/VMS format) to the UNIX system where a CD-ROM image is created. The CDs are written using a local CD recordable system consisting of a Macintosh computer and a CD-ROM tower with the capability of recording up to five copies of a CD. After mounting the resulting CDs in the jukebox, users can access the data contained on these CDs in a transparent fashion, i.e., the jukebox software creates a filesystem similar to on-line magnetic disk filesystems. A

dual-drive, rewriteable optical disk system connected to the VAX computer continues to be utilized for the off-line storage of older GPS data not yet recorded on CD.

3 Archive Content

As a global data center for the IGS, the CDDIS is responsible for archiving and providing access to both GPS data from the global IGS network as well as the products derived from the analyses of these data.

3.1 GPS Tracking Data

The GPS user community has access to the on-line and near-line archive of GPS data available through the global archives of the IGS. Operational and regional data centers provide the interface to the network of GPS receivers for the IGS global data centers. For the CDDIS, the following operational or regional data centers make data available to the CDDIS from selected receivers on a daily basis:

- Australian Survey and Land Information Group (AUSLIG) in Belconnen, Australia
- Alfred Wegener Institute (AWI) for Polar and Marine Research in Bremerhaven, Germany
- European Space Agency (ESA) in Darmstadt, Germany
- GeoforschungsZentrum (GFZ) in Potsdam, Germany
- Geographical Survey Institute (GSI) in Tsukuba, Japan
- NOAA's Geosciences Laboratory (GL/NOAA) Operational Data Center (GODC) in Rockville, Maryland
- Korean Astronomy Observatory (KAO) in Taejeon, Korea
- Jet Propulsion Laboratory (JPL) in Pasadena, California
- National Geography Institute (NGI) in Suwon-shi, Korea
- National Imagery and Mapping Agency (NIMA) in St. Louis, Missouri
- Natural Resources of Canada (NRCan) in Ottawa, Canada
- Regional GPS Data Acquisition and Analysis Center on Northern Eurasia (RDAAC) in Moscow, Russia
- University NAVSTAR Consortium (UNAVCO) in Boulder, Colorado
- United States Geological Survey (USGS) in Reston, Virginia

In addition, the CDDIS accesses the other two IGS global data centers, Scripps Institution of Oceanography (SIO) in La Jolla California and the Institut Géographique National (IGN) in Paris France, to retrieve (or receive) data holdings not routinely transmitted to the CDDIS by a regional data center. Table 1 lists the data sources and their respective sites that were transferred daily to the CDDIS in 1998. Nearly 54K station days from 185 distinct GPS receivers were archived at the CDDIS during 1998. A complete list of all archived sites can be found on the CDDIS web site (ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsdata/cddis_summary.1998).

Table 1: Sources of GPS data transferred to the CDDIS in 1998

Source	Sites								No. Sites
AUSLIG	*ALIC*	*CAS1*	*COCO*	*DAV1*	*DARW*	*HOB2*	*JAB1*	*KARR*	**12**
	MAC1	*MAW1*	*ORRO*	*TOW2*					
AWI	*GOUG*	*VESL*							**2**
NOAA/GL	*ACMT/2*	*AOML*[m]	*BARB*	*BARH*	*BRMU*	*EPRT*	*FORT*	*HNPT*	**15**
	KELY	*RCM6*	*SOL1*[m]	*USNA*	*USNO*[m]	*WES2*[m]	*WUHN*		
NRCan	*ALBH*[m]	*ALGO*[m]	*CHUR*	*DRAO*	*DUBO*	*FLIN*	*HOLB*	*NANO*	**16**
	NRC1[m]	*PRDS*[m]	*SCH2*	*STJO*[m]	*WHIT*	*WILL*	*WSLR*	*YELL*[m]	
ESA	*KIRU**	*KOUR**	*MALI*	*MAS1*	*PERT**	*VILL**			**6**
GFZ	*KIT3*[m]	*KSTU*	*LPGS*	*OBER*[m]	*POTS*[m]	*URUM*	*ZWEN*[m]		**7**
GSI	*TSKB*								**1**
IGN	*ANKR*	*BOR1*	*BRUS*[m]	*EBRE*	*GLSV*	*GRAS*	*GRAZ*[m]	*HARK*	**33**
	HERS[m]	*HOFN*	*IRKT*	*JOZE*	*KERG*	*(KIRU)*	*(KIT3)*	*KOSG*	**(40)**
	(KSTU)	*LHAS*[m]	*(LPGS)*	*(MAS1)*	*MATE*	*MDVO*	*METS*[m]	*NICO*	
	NOUM	*NTUS*	*NYA1*	*NYAL*	*OHIG*	*ONSA*	*(POTS)*	*REYK*[m]	
	TAHI/THTI	*TRO1*	*TROM*	*WSRT*	*WTZR*[m]	*ZECK*	*ZIMM*[m]	*(ZWEN*[m]*)*	
JPL	*AOA1**	*AREQ*	*ASC1*	*AUCK**[m]	*AZU1*	*BOGT**	*BRAZ*	*CARR*	**63**
	CASA	*CAT1*	*CHAT*[m]	*CICE**	*CIT1*	*CRO1**	*CSN1*	*DGAR*	
	*EISL**	*FAIR**[m]	*GALA*	*GODE**[m]	*GOL2**	*GOLD*	*GUAM**	*HARV*	
	*HRAO**	*IAVH*	*IISC*	*JPLF*	*JPLM**	*KOKB**[m]	*KRAK*	*KUNM*	
	*KWJ1**	*LBCH*	*MAD2*	*MADR**	*MCM4**	*MDO1**[m]	*MKEA*	*MOIN*	
	*NLIB**	*NSSP**	*OAT2**	*PIE1**	*POL2*	*QUIN**	*SANT**	*SELE*	
	SHAO	*SNI1*	*SPK1*	*SUTH**	*THU1*	*TID2**	*TIDB*	*UCLP**	
	UCLU	*USC1**	*USUD**	*WHC1*	*WLSN*	*XIAN*	*YAR1*		
KAO	*TAEJ*								**1**
NGI	*SUWN*								**1**
NIMA	*BAHR*[m]								**1**
RDAAC	*MAG0*	*PETR/1/P*	*TIXI*	*YAKA*	*YAKZ*				**5**
SIO	*BAKO*	*INEG*	*(MAG0)*	*MONP*	*(PETR/P)*	*PIN1*	*PVEP*	*RAMO*	**8**
	SIO3	*VNDP*	*(YAKA)*	*(YAKZ)*					**(12)**
UNAVCO	*CEDU*	*CHUM*	*KAYT*	*KUMT*	*(NSSP*)*	*(POL2)*	*RIOP*	*SHAS*	**8**
	SUMK	*TVST*							**(10)**
USGS	*AMUN*	*PALM*							**2**
Totals:	**181 sites from 16 data centers during 1998**								

Notes: Sites in () indicate backup delivery route
Sites in italics indicate sites new to the CDDIS in 1998
** Indicates site also providing hourly data to the CDDIS in 1998*
[m] Indicates site providing meteorological data to the CDDIS in 1998 (NRCan has ceased to provide met data as of late 1998)

3.1.1 Daily GPS Data Files

Once the daily RINEX data files arrive at the CDDIS, these data are quality-checked, summarized, and archived to public disk areas in daily subdirectories; the summary and inventory information are also loaded into an on-line data base. Typically, the archiving routines on the CDDIS are executed several times a day for each source in order to coincide with their automated delivery processes and to ensure timely arrival in the CDDIS public disk areas. In general, the procedures for archiving the GPS tracking data are fully automated, requiring occasional monitoring only, for replacement data sets or re-execution because of system or network problems.

The CDDIS daily GPS tracking archive consists of observation, navigation, and meteorological data, all in compressed (UNIX compression) RINEX format. Furthermore,

summaries of the observation files are generated by the UNAVCO quality-checking program TEQC (Estey 1999) and are used for data inventory and quality reporting purposes. During 1998, the CDDIS archived data on a daily basis from an average of 150 stations; toward the end of the year, this number increased to over 160 stations. Each site produces approximately 0.8 Mbytes of data per day (compressed RINEX, compressed compact RINEX, navigation, meteorological, and summary); thus, one day's worth of GPS tracking data totals nearly 130 Mbytes. For 1998, the CDDIS GPS data archive totaled over forty Gbytes in volume; this figure represents data from nearly 54K observation days. Of the 160 or more sites archived each day at the CDDIS, not all are of "global" interest; some, such as those in Southern California, are regionally oriented. The CDDIS receives data from these sites as part of its NASA archiving responsibilities.

During 1998, the "compact RINEX" data format became the operational format for exchange of GPS data between the IGS data and analysis centers. This software, developed by Hatanaka Yuki (GSI) and Werner Gurtner (AIUB), when used with UNIX compression, reduces the size of the RINEX data by approximately a factor of eight (as compared to approximately 2.5 with using UNIX compression alone). The CDDIS continues, however, to archive and make data available in the compressed RINEX format for the greater user community.

The majority of the data delivered to and archived in the CDDIS during 1998 was available to the user community within six hours after the observation day. As shown in Figure 1, over 35 percent of the data from all sites delivered to the CDDIS were available within three hours of the end of the observation day; over ten percent were available within one hour. These statistics were derived from the results of the daily archive report utilities developed by the IGS Central Bureau and executed several times each day on the CDDIS.

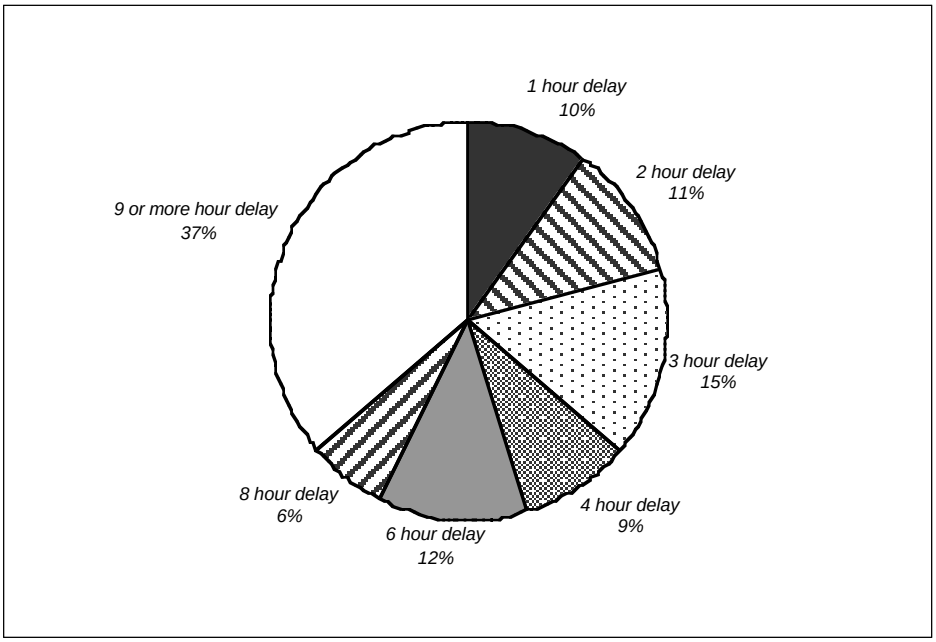

Figure 1: Average delay in GPS data delivery (all sites) to the CDDIS in 1998

3.1.2 Hourly GPS Data Files

In mid-1998, selected operational data centers (JPL and ESA) began transmission of hourly data files to the global data centers. Each file of observation (in compact RINEX format only), navigation, and meteorological data contains a single hour's worth of data. The individual hourly files are labeled by incrementing the sequence number digit in the RINEX file naming convention; e.g., the file *mmmmddd*a.*yy*o.Z contains the observation data for the first hour of day *ddd* in year *yy* for site *mmmm*. Within minutes of receipt, the files are archived to separate subdirectories (/gps/nrtdata) by day on the CDDIS. These data are retained on-line for three days. After three days, the hourly data files are deleted; the daily file, transmitted through normal channels with a typical delay of one to two hours, will have been received and archived already and thus the hourly data are of little use. Furthermore, to ensure the most rapid delivery of these data to the user community, no validation or checks on data quality are performed. On average, these hourly data files were available to the user community within thirty minutes of the end of the hour. GPS sites supplying hourly data to the CDDIS in 1998 are denoted by an * in Table 1.

3.2 Meteorological Data

The CDDIS currently receives meteorological data from nearly thirty sites, as noted in Table 1 below. The meteorological data provided are dry temperature, relative humidity, and barometric pressure at thirty minute sampling intervals. These data are stored on CDDIS with the daily GPS observation and navigation data files in parallel subdirectories.

3.3 IGS Products

The seven IGS data analysis centers (ACs) retrieve the GPS tracking data on a daily basis from the global data centers to produce daily orbit products and weekly Earth rotation parameters (ERPs) and station position solutions; the eight IGS associate analysis centers (AACs) also retrieve IGS data and products to produce station position solutions. The CDDIS archives the products generated by both types of IGS analysis centers. These files are delivered to the CDDIS by the IGS analysis centers to individual user accounts, copied to the central disk archive, and made available in compressed format on the CDDIS by automated routines that execute several times per day. The Analysis Coordinator for the IGS then accesses the CDDIS (or one of the other global analysis centers) on a regular basis to retrieve these products and derive the combined IGS orbits, clock corrections, and Earth rotation parameters as well as to generate reports on data quality and statistics on product comparisons. Users interested in obtaining precision orbits for use in general surveys and regional experiments can also download the IGS products. The CDDIS currently provides on-line access to all IGS products generated since the start of the IGS Test Campaign in June 1992. Access to the on-line archive of CDDIS products can also be performed through ftp or the WWW.

Regional Network Associate Analysis Centers (RNAACs) routinely generate station position solutions for regional networks in Software INdependent EXchange (SINEX) format. The three Global Network AACs (GNAACs) perform a comparison of these files and submit the resulting SINEX files to the CDDIS. The GNAACs also access the SINEX files from the IGS ACs and RNAACs and produced comparison and combined, polyhedron station position solutions.

The derived products from the IGS ACs are typically delivered to the CDDIS within seven days of the end of the observation week; delivery times for AAC products vary, but average thirty days for regional solutions. Figure 2 presents the median delay during 1998, in days and by source, of AC and AAC products delivered to the CDDIS. The statistics were computed based upon the arrival date of the solution summary file for the week. The time delay of the IGS products and the combined SINEX solutions are dependent upon the timeliness of the individual IGS analysis centers; on average, the combined orbit is generated within one to two days of receipt of data from all analysis centers and is typically available to the user community within ten days.

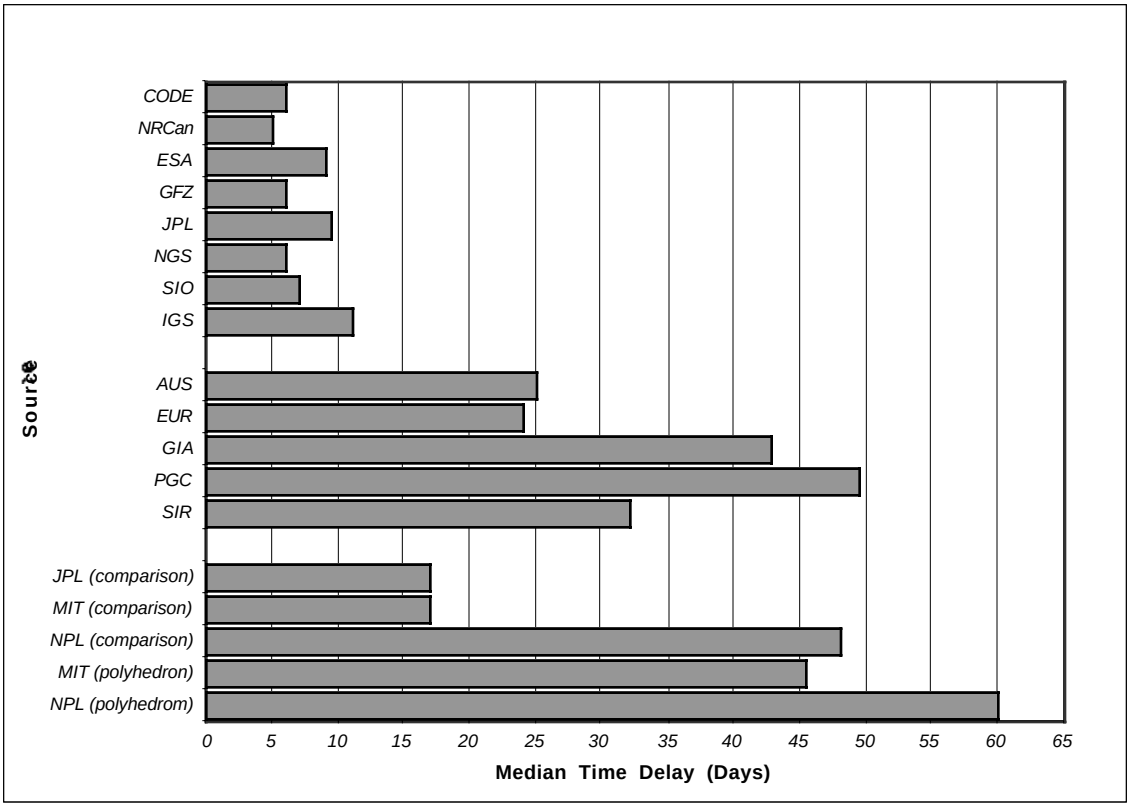

Figure 2: Median delay in GPS product delivery to the CDDIS (by source) in 1998

The rapid orbit and ERP products generated by the IGS Analysis Coordinator, designated IGR, were also made available to the IGS global data centers starting in June 1996. These products are produced daily, by 17:00 hours UTC; automated procedures at the CDDIS download these files from the Analysis Coordinator in a timely fashion.

Starting in early 1998, the IGS Analysis Center Coordinator began generating predicted orbit, clock, and Earth rotation parameter combinations based upon the individual ACs' predicted solutions. These solutions, designated IGP, are available by 23:30 UTC. The IGS global data centers, including the CDDIS, have made these products available in a timely fashion to ensure their usefulness to the user community.

Also early in 1998, the IGS Analysis Center Coordinator began generating accumulated IGR and IGS ERP files on a daily and weekly basis; these data are used with either the final or the rapid orbits. These files will be produced at the same time as the IGS rapid and final products

are generated and downloaded by the IGS global data centers. The files are designated igs95p02.erp (to be used with the IGS final orbits) and igs96p02.erp (to be used with IGS rapid orbits).

The CDDIS began generating "short-SINEX" files, designated with an .ssc extension, from all AC and AAC SINEX files in early 1998. These files contain the site information from the SINEX file but no matrices. The files are stored in the weekly IGS product subdirectories.

Since January 1997, the IGS has conducted a pilot experiment on the combination of troposphere estimates. Using a sampling rate of two hours, the zenith path delay (ZPD) estimates generated by the IGS analysis centers were combined by GFZ to form weekly ZPD files for approximately 100 IGS sites. As of early 1998, these troposphere products are available through the IGS global data centers; at the CDDIS the files are in a subdirectory of each weekly GPS products directories (i.e., /gps/products/*wwww*/trop).

As of June 1, 1998, several IGS Analysis Centers began supplying daily, global ionosphere maps of total electron content (TEC) in the form of IONEX (an official format for the exchange of ionosphere maps) files. These products are also available from the IGS global data centers. At the CDDIS, the IONEX files are located in daily subdirectories of the main product area (e.g., /gps/products/ionex), rather than under the weekly subdirectory structure, since the files are produced daily.

3.4 Supporting Information

Daily status files of GPS data holdings, reflecting timeliness of the data delivered as well as statistics on number of data points, cycle slips, and multipath continue to be generated by the CDDIS. By accessing these files, the user community can receive a quick look at a day's data availability and quality by downloading a single file. Furthermore, monthly summaries of the data quality for the IGS sites are also generated. Both the daily and monthly status files are available through the WWW at URL ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsstatus/. The daily status files are also archived in the daily GPS data directories. An example of this daily status file, for day 98200, is shown in Figure 3.

Ancillary information to aid in the use of GPS data and products are also accessible through the CDDIS. Weekly and yearly summaries of IGS tracking data archived at the CDDIS are generated on a routine basis and distributed to the IGS user community through IGS Report mailings. These summaries are now accessible through the WWW at URL ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsdata. The CDDIS also maintains an archive of and indices to IGS Mail, Report, and Network messages.

4 System Usage

Figures 4 through 6 summarize the monthly usage of the CDDIS for the deposit and retrieval of GPS data during 1998. These figures were produced daily by automated routines that peruse the log files created by each network access of the CDDIS. Data for January through May reflect access to the CDDIS VAX system; data for the remainder of 1998 are for accesses to the AlphaServer computer. Figure 4 illustrates the amount of data retrieved by the user community during 1998. Nearly two million files were transferred in 1998, totaling approximately 380 Gbytes in volume. Averaging these figures, users transferred 150K files per month, totaling

nearly 30 Gbytes in size. The chart in Figure 5 details the total number of host accesses per month with the number of distinct (i.e., unique) hosts per month shown as an overlay. Here, a host access is defined as an initiation of an ftp session; this session may transfer a single file, or many files. Figure 6 illustrates the profile of users accessing the UNIX system during 1998; these figures represent the number of distinct hosts in a particular country, geographic area, or organization. This year, less that one half of the users of GPS data available from the CDDIS come from U.S. government agencies, universities, or corporations.

The figures referenced above present statistics for routine access of the on-line CDDIS GPS data archives. However, a significant amount of staff time is expended on fielding inquiries about the IGS and the CDDIS data archives as well as identifying and making data available from the off-line archives. Table 2 summarizes the type and amount of special requests directed to the CDDIS staff during 1998. To satisfy requests for off-line data, the CDDIS staff must copy data from the optical disk archive to an on-line magnetic disk area, or for larger requests, mount the optical disks in a scheduled fashion, coordinating with the user as data are downloaded. It is hoped that as CD-ROMs of older data become available through the on-line jukebox this figure can be greatly reduced in the coming years.

```
IGS Tracking Network Status for 19-Jul-98 980719 98200    GPS Week 0967 Day 1          As of date:  Aug 19 1998 09:40:35

     Dly  No.   No.   Pts.     Avg. Avg. Pos.  No.                                                    Ant.                        Marker
Site (H)  Exp.  Obs.  Del.  %  MP1  MP2  Diff Slps V    Receiver Type         Antenna Type     Height      Marker Name      Number
---- --- ----- ----- ----- --- ---- ---- ---- ---- - -------------------- -------------------- ------ -------------------- ---------
albh   4 21927 21244     0  96 0.37 0.66 0.03   30 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.10 albh  WCDA-ACP   927 40129M003
algo   4 21853 20332    12  93 0.41 1.13 0.04   17 1 ROGUE SNR-8000       DORNE MARGOLIN T        .10 algo CACS-ACP   8831 40104M002
alic  28 21988 20495     0  93 0.43 1.33 0.03  453 1 ROGUE SNR-8100       DORNE MARGOLIN T       0.00 ALIC                 AU012-501
amct  12 22127 20504  1080  92 0.33 0.98 0.41  129 1 ROGUE SNR-12         DORNE MARGOLIN T        .00 AMCT                 40472S003
amun 714 26214 25924    13  98 0.60 0.45 0.00    4 1 ASHTECH Z-XII3       DORNE MARGOLIN ASH     0.07 AMUN
ankr  24 21545 18008  1939  83 0.22 0.86 0.08  132 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.06 ANKARA               20805M002
aoa1   1 21862 19745   468  90 0.44 0.81 0.00   40 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.00 AOA1                 40483S001
aoml   1 22524 19944   501  88 0.36 0.80 0.04   48 1 ROGUE SNR-8000       DORNE MARGOLIN T        .00 ATLANTIC OCEANOGRAPH 49914S001
areq   6 23089 19913   545  86 0.26 0.88 0.00   47 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.06 AREQ                 42202M005
asc1   1 25549 19283  1123  75 0.47 0.79 0.00  109 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.06 ASC1                 30602M001
auck  37 22211 20076    72  90 0.23 0.65 0.00   21 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.00 AUCK                 50209M001
azu1
bahr  18 21990 21807    16  99 0.17 0.19 0.07    3 1 ASHTECH Z-12         DORNE MARGOLIN ASH     3.12 BAHR                 249010M02
bako  18 24741 21411   312  86 0.55 0.67 0.04  105 1 TRIMBLE 4000SSE     4000ST L1/L2 GEOD      1.67 BAKO                 TTG.01
barb
bogt   2 25262 18405  1547  72 0.41 0.88 0.00   81 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.06 BOGT                 41901M001
bor1  10  2254  1737     0  77 0.23 1.98 0.03   12 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.06 BOR1                 12205M002
braz
                                                                                                .
                                                                                                .
                                                                                                .
yar1   1 21874 20388    55  93 0.24 0.59 0.00   38 1 ROGUE SNR-8100       DORNE MARGOLIN T       0.08 YAR1                 50107M004
yell   4 24480 23588     3  96 0.51 0.75 0.04   10 1 ROGUE SNR-12 RM      DORNE MARGOLIN T        .10 yell CACS-ACP   8892 40127M003
zeck  23 21592 19903    96  92 0.36 0.65 0.03   28 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.04 ZECK                 12351M001
zimm   2 21756 21316    86  97 0.28 0.71 0.05   22 1 TRIMBLE 4000SSE      4000ST L1/L2 GEOD      0.00 ZIMM                 14001M004
zwen  22 22726 20412     0  89 0.49 0.93 0.05   56 1 ROGUE SNR-8000       DORNE MARGOLIN T       0.04 zwen                 12330M001

Program:  QC V3 by UNAVCO run with elevation angle cutoff of 10 degrees
    Field      Size   Type                          Explanation
-------------  ----  ------  ------------------------------------------------------------
Site              4   char    Site name
Dly (H)           3   number  Delivery delay in hours
No. Exp.          5   number  Total number of observations expected
No. Obs.          5   number  Total number of observations in file
Pts. Del.         5   number  Total number of points deleted
%                 3   number  Data collection percentage
Avg. MP1          4   number  Average L1 multipath (rounded to two decimal places)
Avg. MP2          4   number  Average L2 multipath (rounded to two decimal places)
Pos. Diff         4   number  RINEX vs QC point position difference (Km)
No. Slps          4   number  Number of detected slips
V                 1   number  Version of the data file (set to 1 for initial delivery)
Receiver Type    20   char    Type of GPS receiver from RINEX header
Antenna Type     20   char    Type of GPS antenna from RINEX header
Ant. Height       6   number  Height of antenna from RINEX header
Marker Name      20   char    Marker name from RINEX header
Marker Number    10   char    Marker DOMES number from RINEX header
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Figure 3. Daily Status File Produced by CDDIS

Table 2: Summary of special requests for GPS data and information in 1998

Type of Request	Totals
General IGS/CDDIS information	*~350 requests (phone, fax, e-mail)*
Off-line GPS data	*~75 requests (phone, fax, e-mail)*
Amount of off-line data requested	*~10,000 station days†*
Volume of off-line data requested	*~9 Gbytes*

Notes: †In this context, a station day is defined as one day's worth of GPS data (observation and navigation file in RINEX format)

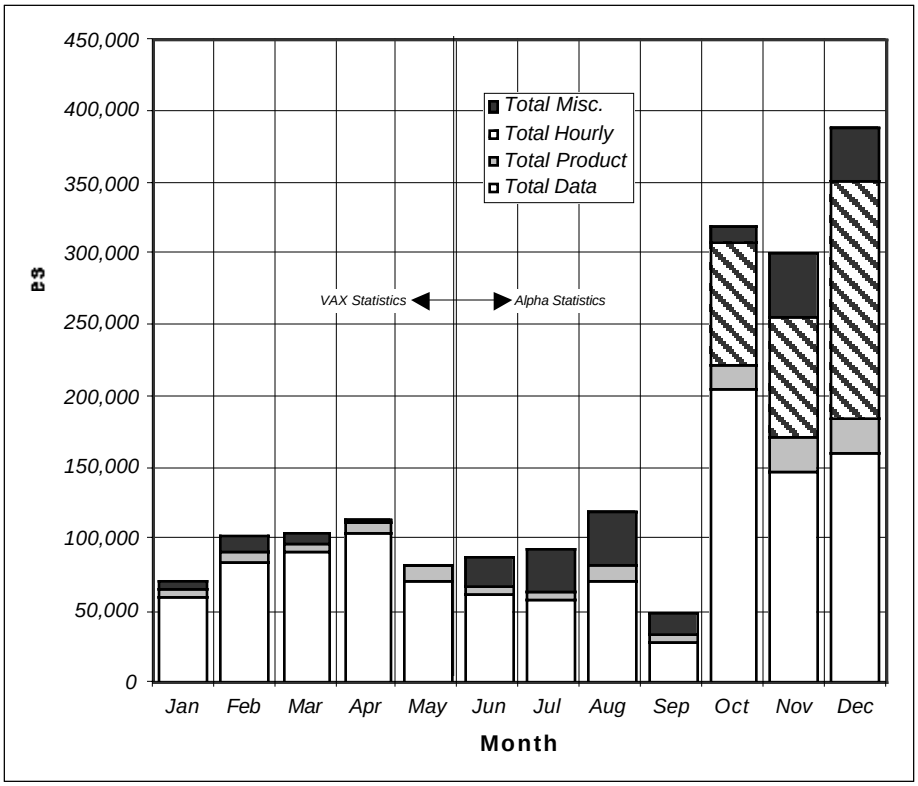

Figure 4: Number of GPS related files transferred from the CDDIS in 1998

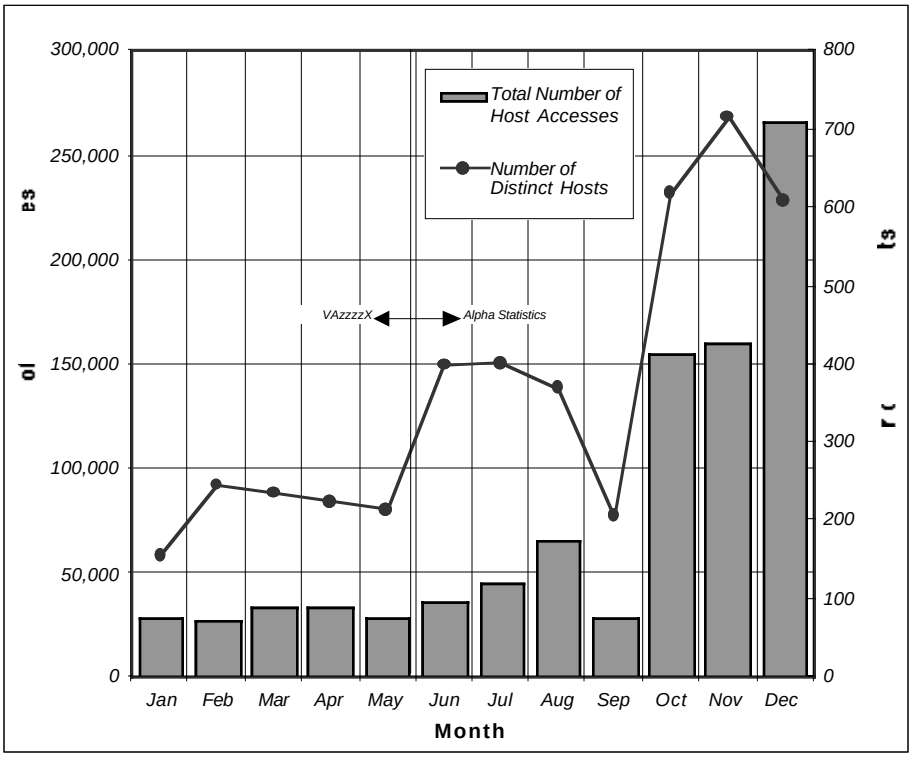

Figure 5: Number of hosts accessing GPS data and products on the CDDIS in 1998

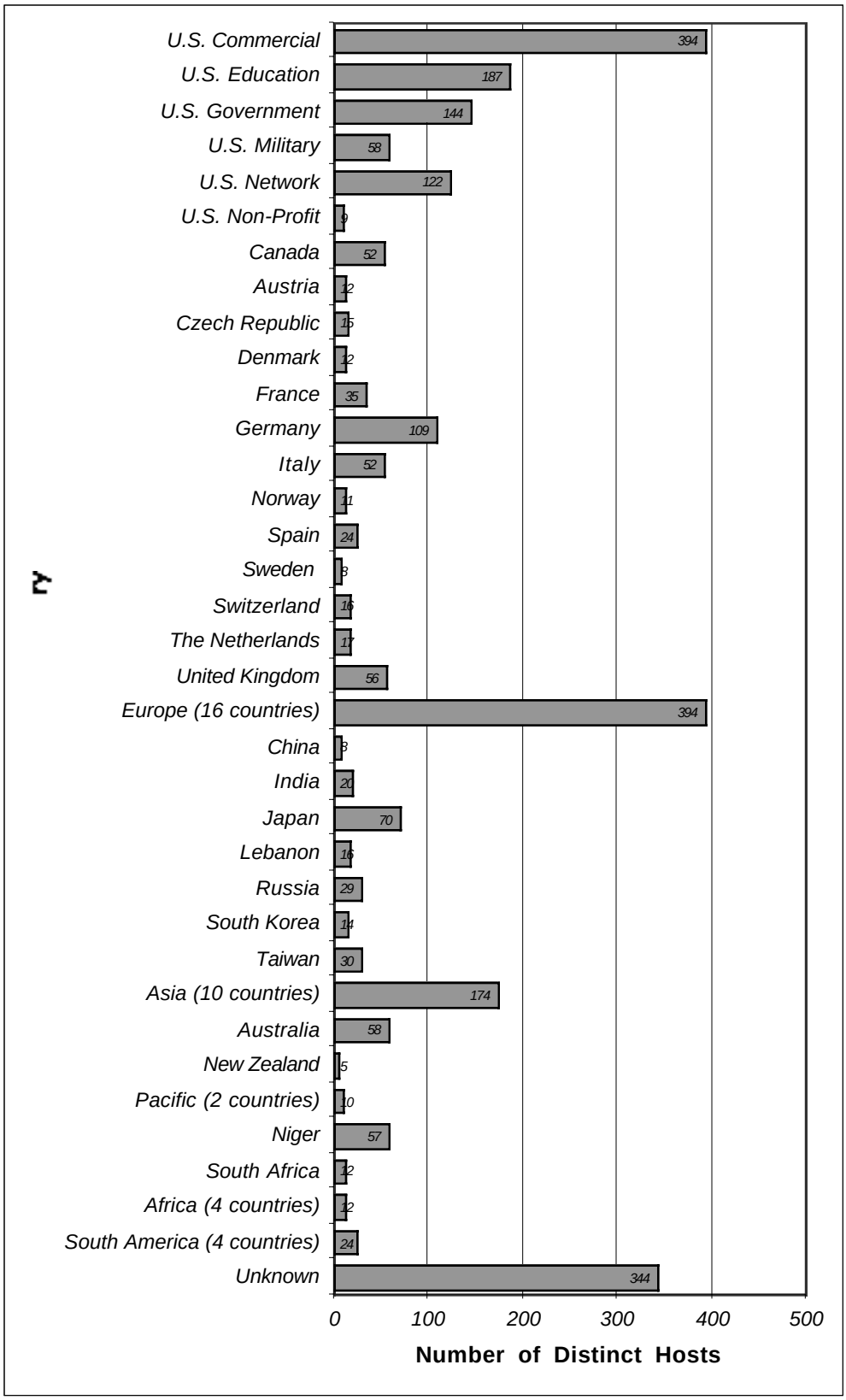

Figure 6: Distribution of IGS users of the CDDIS in 1998

5 Other Activities

The CDDIS (and NASA) as well as the IGS were sponsors and co-conveners of the IGS Network Systems Workshop, held in Annapolis Maryland in November 1998. This was the first workshop of its type, focusing on the network and infrastructure issues and how future plans for the IGS affect the components of the service. Over eighty people attended this workshop which provided a venue for the various network components of the IGS to meet and discuss current configurations, problems and their resolutions, incorporation of the many future requirements into the existing infrastructure of the IGS, and the identification of emerging technologies. The proceedings from this very successful workshop, including recommendations generated during the event, will be published in mid-1999.

In early 1998, a Call for Participation in the International GLONASS EXperiment (IGEX-98) was issued. IGEX-98, sponsored by several organizations, including the IGS, and requested participation by stations, data centers, and analysis centers. The CDDIS responded to this call and was selected to serve as a global data center for GLONASS data and products. The staff took advantage of the data archiving and processing procedures developed for the IGS in the support of IGEX. The campaign started in October of 1998 and continues into 1999. The CDDIS archived GLONASS data from 66 sites totaling nearly 3500 station days of data. GLONASS products from six analysis centers were also made available to the public. IGEX data and products are accessible via anonymous ftp to host cddisa.gsfc.nasa.gov, in the filesystem /igex.

6 Publications

The CDDIS staff attended several conferences during 1998 and presented papers on or conducted demos of their activities within the IGS, including:

- "1997 IGS Data Center Reports" (Carey Noll) for 1997 IGS Annual Report
- "Data Center Issues" (Loic Daniel, Jeffrey Dean, Myron McCallum, Carey Noll) was presented at the IGS Network Systems Workshop in November 1998
- "Recent Enhancements to the CDDIS" (Carey Noll) was presented at the IGS Network Systems Workshop in November 1998
- "The Space Geodesy Data Archive and Distribution Facility of the CDDIS (Carey Noll and Maurice Dube) was presented at the American Geophysical Union in December 1998

Hypertext versions of this and other publications can be accessed through the CDDIS on-line documentation page on the WWW at URL http://cddisa.gsfc.nasa.gov/documents.html.

7 Future Plans

7.1 Computer System Enhancements

The AlphaServer 4000 computer supporting the CDDIS has been operational for nearly one year. Additional disk space may be procured in the near future, as well as a dedicated tape backup system. CDDIS staff will continue the migration of older off-line GPS data from VAX/VMS formatted magneto-optical disks to CD-ROM.

7.2 Changes in the Data Archive

The IGS sponsored a workshop in March 1999 focusing on data and analysis requirements of low Earth orbiting (LEO) missions. The GPS products required by these missions will need one second GPS data, probably on an hourly basis. The CDDIS, as well as other IGS data centers, will begin the archive and distribution of one second data files, probably utilizing a new, more efficient binary exchange format, during the later part of 1999. It is also possible that the data centers will become involved in the archive of space-borne GPS receiver data. A pilot program for the use of this flight data may begin in 1999.

One area under investigation within the IGS is a common directory structure for data and products among all data centers. This system would aid IGS analysis centers and users in navigation of multiple data centers. An extension of this plan is the participation of IGS data centers in the GPS Seamless Archive Center (GSAC) activity (McCallum et. al., 1998), sponsored by UNAVCO, and designed to allow easy navigation of multiple GPS archives for data of interest. Both activities will be investigated further to ascertain how best to implement the concepts within the CDDIS.

7.3 Changes in the Product Archive

Many of the seven IGS ACs will soon supply GPS and ground station clock values on a weekly basis. A new format has been developed for these data. The daily files will be made available through the IGS global data centers; the CDDIS will store the files in the weekly products directories (subdirectories of /gps/products).

The IGS Reference Frame Coordinator, currently located at NRCan, has begun generating the official IGS combined weekly SINEX solutions and Earth rotation parameters. These files will also be made available to the user community through the global data centers.

The 1999 LEO Workshop also recommended that the IGS Analysis Centers should develop a new ultra-rapid analysis product (orbit, clock, EOP, and predictions) with a latency of less than three hours. These new products will most likely be developed and generated through a pilot program in late 1999.

8 Contact Information

To obtain more information about the CDDIS IGS archive of data and products, contact:

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