IGS DATA CENTER REPORT
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Carey E. Noll
NASA Goddard Space Flight Center
Greenbelt, MD 20771 USA

Background

The IGS collects, archives, and distributes GPS observation data sets of sufficient accuracy to meet the objectives of a wide range of scientific and engineering applications and studies. During the IGS design phases, it was realized that a distributed data flow and archive scheme would be vital to the success of the IGS. Thus, the IGS has established a hierarchy of data centers to distribute data from the network of tracking stations: operational, regional, and global data centers. This scheme provides an efficient access and storage of GPS data, thus reducing traffic on the Internet, as well as a level of redundancy allowing for security of the data holdings.

Operational data centers (ODCs) are responsible for the direct interface to the GPS receiver, connecting to the remote site daily and downloading and archiving the raw receiver data. The quality of these data are validated by checking the number of observations, number of observed satellites, date and time of the first and last record in the file. The data are then translated from raw receiver format to a common format (RINEX) and compressed. Both the observation and navigation files (and sometimes meteorological data) are then transmitted to a regional or global data center ideally within an hour following the end of the observation day.

Regional data centers (RDCs) gather data from various operational data centers and maintain an archive for users interested in stations of a particular region. Furthermore, to reduce electronic network traffic, the regional data centers are used to collect data from several operational data centers before transmitting them to the global data centers. Typically data not used for global analyses are archived and available for on-line access at the RDCs. IGS regional data centers have been established in several areas, including Europe and Australia.

The IGS global data centers (GDCs) are ideally the principle GPS data source for the IGS analysis centers and the general user community. These on-line data are employed by the IGS analysis centers to create a range of products, which are then transmitted to the global data centers for public use. The GPS observation data available through the global data centers consists of observation, navigation, and sometimes meteorological files, all in RINEX format. GDCs are tasked to provide an on-line archive of at least 100 days of GPS data in the common data format, including, at a minimum, the data from all global IGS sites. The GDCs are also required to provide an on-line archive of derived products, generated by the IGS analysis centers and associate analysis centers. These data centers equalize holdings of global sites and derived products on a daily basis (at minimum). The three GDCs provide the IGS with a level of redundancy, thus preventing a single point of failure should a data center become unavailable. Users can continue to reliably access data on a daily basis from one of the other two data centers. Furthermore, three centers reduce the network traffic that could occur to a single geographical location. The table below lists the data centers currently supporting the IGS; information on how and who to contact for these data centers is available through the IGS web site.

Highlights for 1997 and Plans for 1998

IGS Data

The number of stations archived by the IGS data centers increased by approximately twenty percent in 1997. On a daily basis during the past year, nearly 300 stations were archived at SIO (supporting both the IGS and southern California research activities), over 140 at CDDIS (supporting both the IGS and NASA activities), and over 100 at IGN. Both CDDIS and SIO experienced usage figures of several hundred users downloading 2K to 3K files per day from their archives (approximately one to two Gbytes per day).

The latency of the data arrival at the global data centers improved some during 1997. On average, fifty percent of the data arrived at the global data centers within six hours. Several operational data centers (e.g., NRCan and CIGNET) significantly improved their turnaround time, providing the RINEX data to the global data centers within one to two hours of the end of the UTC day. Efforts to reduce the time delay, particularly for global IGS stations, will continue during 1998.

The IGS is a co-sponsor of a new activity to establish an international campaign for GLONASS observations during the fall of 1998. The main purpose of the International GLONASS Experiment, IGEX-98, is to conduct the first global GLONASS observation campaign for geodetic and geodynamics applications and to evaluate the results in an international workshop in 1999. Many of the existing IGS data centers will propose to participate in IGEX-98, thereby increasing the diversity of their archives with the addition of GLONASS data and products.

A second enhancement to the global data center archives will be the inclusion of hourly data received in a rapid fashion. These data are primarily utilized by scientists involved in atmospheric research. Plans are for a subset of the global network (twenty to thirty stations) to provide RINEX data through the IGS data flow in hourly files. At the end of the 24-hour period, the daily file would be generated and archived as usual. It is envisioned that these hourly files need only be retained at the global data centers for a few weeks.

Hatanaka compression

During 1997, a new RINEX compression procedure, developed by Yuki Hatanaka (GSI), was tested within the IGS community in the hopes of adopting it as a new standard for distribution of the GPS observation data. This compression is performed in two steps:, first the RINEX observation file is compacted using the new software (an ASCII to ASCII compression); second the compact RINEX observation file is compressed using standard UNIX compression (ASCII to binary format). The original RINEX observation file is compressed by a factor of eight using this software combined with UNIX compression as compared to about 2.9 with UNIX compression alone. By the end of 1997, many of the operational and regional data centers were using this compression software in their processing and data transmission procedures. The global data centers started archiving data in this format, in addition to the previous, UNIX-compressed-only files. Software to decompress and un-compact the files are available through the IGS Central Bureau Information System (CBIS). Plans for 1998 include operational use of this data format within the IGS community, both for exchange of data between the data centers themselves and with the analysis centers.

IGS Products

Starting with GPS week 0895, the IGS Analysis Coordinator began the operational generation of IGS combined orbit predictions. The predicted orbit files (orbit, ERP, and summary) are available at the global data centers ideally thirty minutes prior to the start of the day of the orbit. This new data set is now available from all IGS global data centers as well as the CBIS.

At the December 1996 IGS Workshop in Pasadena, the Analysis Center representatives discussed the generation of a “short” SINEX file containing site information but no matrices. This product could be produced either by the analysis centers themselves or by the global data centers. A conversion program was written by Gerd Gendt (GFZ) and has been utilized at the

GDCs to convert historic as well as incoming SINEX files into these “new” products, denoted with an extension of SSC.

Since January 1997, the IGS has conducted a pilot experiment, headed by Gerd Gendt at GFZ, 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. At the February 1998 IGS Workshop in Darmstadt Germany, the IGS Governing Board recommended that the pilot phase of this experiment be terminated and that these ZPD estimates become an official product of the IGS. The combination is performed by GFZ on a weekly basis. The troposphere products will be available at all IGS global data centers. Future plans include conversion of the ZPD values into precipitable water vapor, ideally when a sufficient number of collocated GPS-meteorological instruments are available in the IGS network. Users can convert ZPD into precipitable water vapor by utilizing existing meteorological files as well as interpolation within global or regional meteorological fields.

The IGS Analysis Coordinator will soon supply users with two new products, accumulated IGR (rapid orbit) and IGS (final orbit) ERP files on a daily and weekly basis, respectively. The files, igs96p02.erp (to be used with IGS rapid orbits) and igs95p02.erp (to be used with IGS final orbits) will be available through the GDCs and the CBIS.

Table. Data Centers Supporting the IGS

Operational Data Centers	
ASI	Italian Space Agency
AUSLIG	Australian Land Information Group
CNES	Centre National d’Etudes Spatiales, France
DSN	Deep Space Network, USA
DUT	Delft University of Technology, The Netherlands
ESOC	European Space Agency (ESA) Space Operations Center, Germany
GFZ	GeoForschungsZentrum Germany
GSI	Geographical Survey Institute, Japan
ISR	Institute for Space Research, Austria
JPL	Jet Propulsion Laboratory, USA
KAO	Korean Astronomical Observatory
NGI	National Geography Institute, Korea
NIMA	National Image and Mapping Agency (formerly DMA), USA
NOAA	National Oceanic and Atmospheric Administration, USA
NRCan	Natural Resources of Canada
SIO	Scripps Institution of Oceanography, USA
SK	Statens Kartverk, Norwegian Mapping Authority, Norway
Regional Data Centers	
AUSLIG	Australian Land Information Group
BKG	Bundesamt fuer Kartographie und Geodaesie (formerly IfAG), Germany
JPL	Jet Propulsion Laboratory, USA
NOAA/GODC	National Oceanic and Atmospheric Administration, USA
NRCan	Natural Resources of Canada
Global Data Centers	
CDDIS	Crustal Dynamics Data Information System, NASA GSFC, USA
IGN	Institut Géographique National, France
SIO	Scripps Institution of Oceanography, USA