DATA CENTER ACTIVITIES
2000

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Background

Since the inception of the IGS, the archives of the data centers have become increasingly important to a wide range of scientific and research applications. The distributed nature of the data flow supporting the IGS has been key to the successful archive and availability of both IGS data and products. The IGS utilizes a hierarchy of data centers to distribute data from the network of tracking stations: operational, regional, and global data centers. This scheme provides for efficient access and storage of GPS data, thus reducing network traffic, as well as a level of redundancy allowing for security of the data holdings.

GPS data, in both daily and hourly observation, navigation, and meteorological data files, are available from the IGS regional and global data centers in compressed RINEX format. IGS products, such as precise orbits, station positions, and atmospheric parameters are also accessible through these data centers. Table 1 lists the data centers supporting the IGS in the year 2000; information on how to contact these data centers is available through the IGS Central Bureau web site.

Highlights for 2000 and Plans for 2001

General

The past year was once again a busy time for the IGS data centers. The increased size of the network, both of sites producing daily data sets as well as those capable of generating hourly data sets challenged the capacities of global and regional data centers. The timeliness of the hourly data product continued to improve as various levels of the IGS infrastructure reviewed data transmission methods and implemented improvements. However, as the IGS moves more toward supporting near real-time activities, it has become clear that the data centers must take further steps to ensure the reliability of hourly data operations. To achieve this goal, the data centers, particularly the global data centers, will implement schema during early 2001 to ensure timely and redundant availability of the hourly data.

Unfortunately, due to personnel re-assignments, the global data center at IGN was not able to fully support IGS activities during 2000; management at the institute have announced that routine operations, as well as improvements to the data center, can be expected in late 2001.

At the IGS Network Workshop, held in July 2000 in Oslo Norway, the development and implementation of backup data flow paths were discussed. This workshop focused on identifying areas of improvement in the IGS infrastructure needed to support near real-time operations. Installation of an effective data flow redundancy plan is essential to the current and

future directions of the IGS. These plans have yet to be realized within the current IGS infrastructure, but it is hoped these plans will be reviewed once IGN is again fully operational.

IGS Data

The IGS data centers continued to expand their archives of data from the IGS network. During the past year, nearly 700 stations were archived daily at SIO (supporting both the IGS and other global research activities), nearly 200 at CDDIS (supporting both the IGS and NASA activities), and over 100 at IGN.

The global network of IGS sites producing 30-second data on an hourly basis expanded to over seventy sites during 2000 as shown in Figure 1. These hourly files are archived in compressed, compact RINEX format and are retained at the global data centers for three days. No validation or checking of data quality is performed on these data in order to provide the files in a timely fashion to the user community. The daily observation and navigation files from these hourly sites, containing all 24 hours of data, are then transmitted through established data flow paths and archived indefinitely at the data centers. The timeliness of the hourly data improved during 2000 with fifty percent of the data available within fifteen minutes after the end of the previous hour and 85 percent available within thirty minutes. Efforts to further reduce the time delay of both daily and hourly data sets will continue during the coming months.

Unfortunately, not all IGS global data centers provided a timely archive of hourly, 30-second data during 2000. Efforts will begin in 2001 to ensure that these hourly data are available at all IGS global data centers, thus permitting analysts redundant sources for these critical data sets.

By mid-2001, the International GLONASS Service – Pilot Project (IGLOS-PP) will commence operations. The pilot project is a continuation of the successful 1998-99 International GLONASS Experiment, IGEX-98, the first global GLONASS observation campaign for geodetic and geodynamics applications. IGLOS-PP will see the integration of GLONASS data into the IGS data flow and in the generation of IGS products. Data centers will provide a single point of access for both GPS and GLONASS data sets.

The IGS Pilot Project for Low Earth Orbiters (LEO) will also begin in mid-2001. Data centers supporting the pilot project will archive data from a network of thirty to forty high-rate (one-second) sites. These data will be archived in files containing fifteen minutes of data. Furthermore, data from GPS flight receivers, particularly SAC-C and CHAMP, will be made available through IGS data centers supporting the pilot project. An enhanced version of RINEX (version 2.20) will be utilized for the flight receiver data; RINEX version 2.10 will continue to be used for GPS data from the high-rate ground network. Analysis centers participating in the LEO-PP will utilize these various data sets to produce orbits for the LEO missions and study the impact on the "classic" IGS products. This pilot project will also help assess the issues involved in future IGS support of occultation analysis.

IGS Products

The products generated by the IGS analysis centers, associate analysis centers, and various pilot projects continued to be archived at the IGS data centers in 2000. These products include the

weekly, standard orbit, clock, station position, and Earth rotation parameters (ERPs) from the seven IGS Analysis Centers and the combined product from the IGS Analysis Coordinator. The accumulated IGR (rapid orbit) and IGP (predicted orbit) products were distributed and archived on a daily basis as well. The analysis centers began producing a new "ultra-rapid" analysis product in 2000; the combined product, generated twice daily, is now archived at the IGS data centers. IGS station coordinate and reference frame solutions were routinely provided by seven IGS Associate Analysis Centers as well as a combined solution by the IGS Reference Frame Coordinator. The IGS troposphere product, in the form of combined zenith path delay (ZPD) estimates for over 160 sites, was generated by GFZ and archived on a weekly basis at the global data centers. Individual ionosphere maps of total electron content (TEC) were derived on a daily basis by five IGS Associate Analysis Centers and were also archived at the global data centers. A daily file of these data in IONEX format includes twelve two-hour snapshots of the TEC and optional corresponding RMS information.

Table 1. Data Centers Supporting the IGS in 2000

Operational Data Centers	
ASI	Italian Space Agency*
AUSLIG	Australian Surveying and Land Information Group
AWI	Alfred Wegener Institute for Polar and Marine Research, Germany
BKG	Bundesamt für Kartographie und Geodäsie, Germany*
CASM	Chinese Academy of Surveying and Mapping
CNES	Centre National d'Etudes Spatiales, France
DGFI	Deutsches Geodätisches ForschungsInstitut, Germany
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 Imagery and Mapping Agency, USA
NMA	Norwegian Mapping Authority
NOAA	National Oceanic and Atmospheric Administration, USA*
NRCan	Natural Resources of Canada*
PGC	Pacific Geoscience Centre, NRCan, Canada*
RDAAC	Regional GPS Data Acquisition and Analysis Center on Northern Eurasia, Russia
SIO	Scripps Institution of Oceanography, USA
UNAVCO	University NAVSTAR Consortium, USA
USGS	United States Geological Survey
Regional Data Centers	
AUSLIG	Australian Surveying and Land Information Group
BKG	Bundesamt für Kartographie und Geodäsie, Germany
JPL	Jet Propulsion Laboratory, USA
NOAA	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

Notes: * indicates operational data center forwarding hourly 30-second data to the IGS

Figure 1. Subnetwork distribution of IGS stations delivering hourly RINEX data files.
(map consistent with other maps in the annual report and with following sites: ALBH, ALGO, AOA1, AREQ, AUCK, BARH, BOR1, BRUS, CAGL, CHUR, CIC1, CORD, CRO1, DRAO, EISL, EPRT, ESTI, FAIR, GALA, GODE, GOL2, GOLD, GUAM, GUAT, HARV, HERS, HFLK, HRAO, JPLM, KIRU, KOKB, KOUR, KWJ1, MAD2, MADR, MANA, MAS1, MATE, MCM4, MDO1, MEDI, MKEA, NLIB, NRC1, NRC2, NSSP, OBER, ONSA, PENC, PERT, PIE1, PIMO, POTS, PRDS, QUIN, RBAY, REYK, RIOG, SANT, SCH2, SSIA, STJO, SUTH, TEGU, TID2, TIDB, UNSA, UPAD, USUD, VILL, WHIT, WTZR, YEBE, YELL, ZIMM, ZWEN)