Enhancing the IGS Data and Products Infrastructure - A Data Center Perspective

M. Scharber, C. Noll

Over the past decade challenges facing IGS Data Centers (DCs) have typically involved: reducing data file latency, improving the quality of service to the community, increasing the amount of data available to the public, maintaining high-availability servers, managing a systems infrastructure to support local analysts, and provide backup mechanisms for archive data, etc. The data and product archive and distribution requirements of the IGS DCs have expanded over the last ten years in answer to new applications, pilot projects, and working groups established within the service.

As the window of tolerance lessens the strain on Data Centers tends to increase. This position paper is an attempt to highlight some of the challenges facing GPS data centers, in particular those associated with the IGS, as GPS data becomes: a) more popular, b) more voluminous, and c) more frequently produced/sampled. Most importantly, we outline a coordinated effort to streamline the IGS Data Center infrastructure of inter-archive, GPS data publication, retrieval, storage, and resubmission.

Addition of Real-Time Capability to the Japanese Dense GPS Network

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Geographical Survey Institute (GSI) has been operating the nationwide GPS array of Japan, named GEONET (GPS Earth Observation Network System), to monitor crustal deformations and to provide reference stations for users of land surveying by GPS. GSI has modified and upgraded the most of the 1200 stations and system to add real-time capabilities. The upgrade covered most of the components including receivers, antennas, data communication, data archive, analysis systems, etc. The 1-Hz data are acquired at the observation sites, and transferred to GSI in Tsukuba through Internet Protocol - Virtual Private Network (IP-VPN) in real-time. IP-VPN is a communication network provided by communication companies, and realizes IP-connection to the sites with closing the communication within limited users ("virtually private") for high security. In case of emergency, the 1-Hz data are analyzed by RTK-type software for selected baselines. The data are converted to RINEX format, decimated to 30-second interval and archived for routine analyses. Currently, the 1-Hz data are discarded 2 week after the observation. Three types of routine analysis are carried out; final and rapid analysis in daily, and near-realtime analysis every 3 hour with sliding data-window of 6 hours. The 1-Hz data are also provided to commercial users (positioning service companies) in real-time through a non-profit organization with charging the cost.

The Role of IGS Data Centers and Real-Time Data

R. Muellerschoen, M. Caissy

IGS Data Centers have traditionally serviced the GNSS community through acquisition of raw GPS and GLONASS observable and navigation files, and various meteorological data products. Although methods vary, in general files are cataloged, quality checked, compressed and efficiently archived, and made available for distribution. Coordinated and dedicated efforts of the three Global Data Centers (CDDIS, IGN, SIO) along with the six Regional Data Centers (AUSLIG, BKG, NGS/NOAA, HRAO, JPL, RDACC-IRIS) and the many contributing Operation Data Centers have resulted in a tremendous and highly organized data base of GPS/GLONASS, and assorted meteorological observables and products. Most remarkable is that these data files are made freely available to scientific, commercial, governmental and military organizations. In fact tremendous efforts and ingenious methods have been constructed to assist user access, such as UCAR's LDM (Local Data Manager) and Scripp's GSAC (GPS Seamless Archive).

Numerous applications now require data to be made available in a timelier manner. As latency decreases to the realm of real-time, packet technologies, and in particular the Internet, are replacing the notion of "data files" with "data streams". The natural question arises as to what role IGS Data Centers will have with regards to real-time data streams.

As latency decreases, the value of data increases. And real-time data streams have significant value over file-based data. In this presentation we will assess the role of IGS Data Centers in the context of real-time data streams. The 4 traditional roles (cataloging, quality monitoring, archiving, and distribution) that IGS Data Centers serve now will be discussed from the standpoint of what value they may add to a real-time data stream.

New and Adapted Technologies for the Plate Boundary Observatory

G. Anderson, K. Bohnenstiehl, D. Mencin, M. Jackson

The Plate Boundary Observatory (PBO), part of the EarthScope project, will study active plate boundary deformation across the western United States (US) using 875 continuous GPS sites, 175 borehole strainmeter stations, and five laser strainmeters, all installed over the next five years. To build PBO, UNAVCO is using several new technologies, some of which we describe here.

Installing such a large network is difficult. We use ArcIMS (Internet Map Server), which provides geospatial data sets and can be accessed from any web browser, to ease this burden. PBO engineers use ArcIMS to see problems with proposed sites, identify alternatives, and plan infrastructure, all before leaving the office.

PBO GPS receivers use an embedded Linux operating system and Internet protocol communications, and can collect and stream data at multiple sample rates simultaneously. This allows (1) rapid development of receiver software, (2) real-time data streams with automatic rebroadcast of missing data, and (3) distributed backup with data stored in large ring buffers on each receiver.

PBO data collection and distribution also use new developments. For example, cellular modem network growth in the western US means 3G modems may be used for many PBO sites, reducing the need for

more expensive systems. Also, we will distribute PBO data products to end users through the GPS Seamless Archive System (GSAC) and help support GSAC development to handle derived products and non-file-based data.

New Server Concept at the BKG Data Centre

H. Habrich

The Federal Agency of Cartography and Geodesy (BKG) decided in 2002 to develop and realize a new server concept for the data centre. The objective is to make the access to the data centre more comfortable for the users as well as for the administrator. It should be possible to get all information by usage of the http protocol. Also the administration of the data centre should easily be possible by the generation of helpful status overviews and the execution of predefined repair batches. For that purpose the LAMP (Linux operation system, Apache web server, MySQL data bank and PHP script language) server concept will be used. The new server will not change the disk file structure and thus batch programs for ftp downloads may still be used. LAMP enables to show dynamic web pages for the current content of the data base. A beta-version of the new server has been installed at the end of 2003 and is currently running in parallel to the existing server. It will replace the current server as soon as the full functionality has been confirmed. In 2002 about 10 new GPS/GLONASS stations has been established in Germany by BKG and provide observations in a real-time data stream using the NTRIP protocol. These data streams are compiled to hourly files and copied to the data centre. High-rate data are currently not archived at the data centre, but corresponding procedures may be implemented if requested by a certain number of users.

SOPAC IT Developments

Y. Bock, P. Fang, B. Gilmore, P. Jamason, D. Malveaux, R. Nikolaidis,
L. Prawirodirdjo, M. Scharber

Over the past decade the Scripps Orbit and Permanent Array Center (SOPAC) has developed an extensive array of valuable scientific data and analysis tools and products, which are available through publicly accessible interfaces including HTTP and FTP. In the past year SOPAC has made significant strides toward enhancing and supplementing these resources using modern IT methods such as XML. Work in this area has necessitated substantial improvements in our computing resources architecture, strategies for exchanging information, and scientific collaborations in a variety of projects (IGS, CSRC, SCIGN, GSAC, NGS, NOAA/FSL, etc). In this presentation we will present a brief tour of SOPAC's primary website, highlighting topics of interest to IGS Data Centers as they pertain to the points presented in the position paper for this session.

Availability and Completeness of IGS/IGLOS Tracking Data

S. Schaer, M. Meindl

Timely availability of GNSS tracking data is a basic condition for generation of best possible analysis products. Data availability problems are highlighted, with the main focus on the data flow of hourly observation files. CODE provides high-quality analysis products with regard to all transmitting GNSS satellites. This includes all satellites marked unusable, or unhealthy, brand new satellites, and, since recently, GPS satellites being repositioned. In all mentioned cases, GNSS tracking data without interruption is desired.

ESA/ESOC IGS Activities

J. Dow, C. Garcia, I. Romero, J. Feltens, R. Gautschi, J. Perez, E. Rojo, H. Boomkamp

ESA/ESOC has been providing GPS data and processed products from the inception of the IGS service. This poster will cover the current state of the IGS activities within ESOC, the advances over the past year, the level of the ESA products and the future expected developments.

Proposing to Host the Fourth Global Data Center at Korea Astronomy Observatory

P.-H. Park, K.-D. Park, J.-U. Park, H.-C. Lim, J.-H. Joh

We are proposing to host the fourth Global Data Center (GDC) at Korea Astronomy Observatory (KAO). KAO has a long history of active researches in GPS geodesy in Korea and has been operating a global IGS site (TAEJ, which was moved to DAEJ in 1999) since 1994. KAO is building three VLBI sites, which are to be completed by 2008, and proposing to have a SLR system. By adding VBLI and SLR, we will have three most important tools in space geodesy. We are aware that there are three GDCs in operation: two in USA and another in France. We regret that there is no GDC in Asia, even though there are ~1000 permanent GPS sites in Japan and ~400 in China. Korea itself has more than 70 as of January 2004. Considering the fact that Korea is geographically located between Japan and China and the eastern Asia is an important area in geophysical studies, we firmly believe that the IGS needs to have a new GDC in Korea. Starting early 2003, we have been contacting IGS Governing Board members including the chairman Dr. John Dow, Network Coordinator Dr. Angie Moore and Central Bureau Director Ruth Neilan. They are positive about our proposal to build a GDC in Korea. Our plan to host a GDC was recently funded by our government, which is eager to act as a R&D hub country connecting all east Asian countries. In this presentation, we will outline our plan to how to organize our efforts in terms of required computing resources and manpower. First of all, we will talk about our

history of IGS activities and projects we successfully finished. Then, we will highlight state-of-the-art IT (Information Technology) of Korea and explain how we can utilize it. Finally, we will show a preliminary plan of the fourth GDC and have a chance to discuss our plan.

The CERGOP2 Database - Information for Geodynamics in Central Europe

G. Stangl, P. Pesec, E. Cristea

The new EU-project CERGOP2 serves as a platform for investigations concerning the geodynamics of Central Europe. The database should make available information about collected observations and generated products. The historical and future data since 1994 will be structured into categories and a relational database will be constructed. The database contains the necessary metadata to access the data distributed at several data centers together with extracted information from data and products. Queries and access to the distributed data holdings will be web-based.

The IGS Global Data Center at the CDDIS - An Update

C. Noll, M. Dube

The Crustal Dynamics Data Information System (CDDIS) has served as a global data center for the International GPS Service (IGS) since its start in June 1992, providing on-line access to data from nearly 300 sites on a daily basis. The CDDIS provides easy and ready access to a variety of data sets, products, and information about these data. The specialized nature of the CDDIS lends itself well to enhancement and thus can accommodate diverse data sets and user requirements. This poster paper will present information about the GPS and GLONASS data and products archive at the CDDIS. General information about the system, the computer architecture, archive contents, and future plans, and its support of other international space geodesy services (the ILRS, IVS, and IDS) will be discussed.