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CDDIS Real-Time Developments

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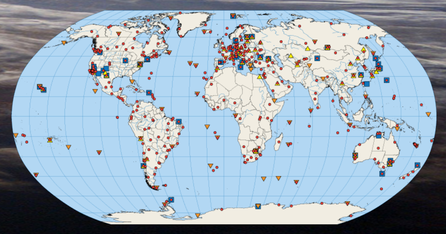
ABSTRACT: The Crustal Dynamics Data Information System (CDDIS) is one of NASA's Earth Observing System Data and Information System (EOSDIS) distributed data centers and as such is tasked to provide facilities for search and access of science data and products for a diverse user community. The archive consists of Global Navigation Satellite Systems (GNSS), laser ranging, Very Long Baseline Interferometry (VLBI), and Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) data sets and products derived from these data. With these data sets and products the CDDIS and its archive are a key component in several of the operational services within the International Association of Geodesy (IAG) and its project the Global Geodetic Observing System (GGOS), including the IGS, the International DORIS Service (IDS), the International Laser Ranging Service (ILRS), the International VLBI Service for Geodesy and Astrometry (IVS), and the International Earth Rotation Service (IERS). In the spring of 2013, the IGS officially launched its real-time service to provide support for applications requiring real-time access to IGS products. The real-time service (RTS) is a GNSS orbit and clock correction service that enables precise point positioning (PPP) and related applications, such as time synchronization and disaster monitoring. The service is based on a global infrastructure of network stations, data centers and analysis centers that provide high precision GNSS products and is operated as a public service. The CDDIS has decided to join the RTS infrastructure and take part in disseminating GNSS data and products through the RTS. This poster will include information about the CDDIS real-time implementation, how it fits into the RTS infrastructure, the user registration process, and future plans to accept data feeds and convert that data to high-rate data files.



Crustal Dynamics Data Information System

Background:

- The Crustal Dynamics Data Information System (CDDIS) is NASA's active archive of space geodesy data, products, an information (Global Navigation Satellite System/GNSS, Satellite Laser Ranging/SLR, Very Long Baseline Interferometry/VLBI, and Doppler Orbitography and Radio-positioning Integrated by Satellite/ DORIS).
- The system has provided data archiving and distribution support to a global research community for over thirty years.
- The system is supported through NASA's Earth Observing System Data and Information System (EOSDIS) and is one of its distributed data centers, serving a wide, diverse user community.
- The largest CDDIS user community comes from the services within the International Association of Geodesy (IAG).
- The CDDIS is now a regular member of the International Council for Science (ICSU) World Data System (WDS). The WDS strives to enable open and long-term access to multidisciplinary scientific data, data services, products and information. Membership in the WDS will promote the CDDIS to new user communities and show its commitment to the quality of our data and services.

Archive Contents:

- Data:
  - Stations in the GNSS, SLR/LLR, VLBI, and DORIS networks generate point data on a multi-day, daily, hourly, and/or sub hourly basis
  - GNSS: 500+ sites tracking GPS, GLONASS, and new GNSS (Galileo, QZSS, Beidou)
  - Laser Ranging (SLR and LLR): ~40 sites tracking 60+ satellites (including the Moon)
  - VLBI: 45 sites
  - DORIS: 58 sites tracking 5 satellites
- Products:
  - Precise network station positions (for ITRF)
  - Satellite orbits (for POD)
  - Station and satellite clocks (for timing)
  - Earth rotation parameters
  - Positions of celestial objects (for CRF)
  - Atmospheric parameters (Ionosphere TEC,
- Metadata information:
  - Non-standard metadata, data type specific
  - Extracted from incoming files
  - Internal access to metadata database

GNSS Antenna

SLR Satellite

VLBI Antenna

DORIS Beacon

Archive Statistics:

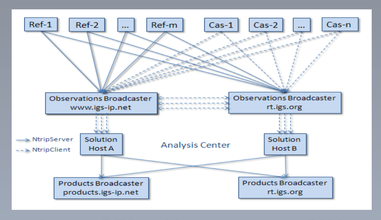
- File size is typically <2Mb/data "granule", <10Mb/derived product "granule"
- Archive size: ~9.7Tb
- Ingest rate: ~8.25Gb (75K files)/day
- Distribution rate: ~275Gb (~2.8M files)/day
- Data (L1, L1B), products (L2) derived from these data, and information about data and products
- Multi-day, daily, hourly, sub-hourly

CDDIS RTS Support:

- In the late Spring 2014 CDDIS installed a caster for broadcasting real-time GNSS data streams using the Network Transport of RTCM via internet Protocol (Ntrip) software
- System is currently undergoing internal testing and expected operational late summer 2014.
- User registration will not be handled through the IGS RTS but instead will be performed through the Earth Observing System Data and Information System (EOSDIS) registration system; CDDIS is one of twelve EOSDIS data centers.
- CDDIS developed the user authentication interface to the EOSDIS system and made this software available to the IGS community for possible future enhancements.
- CDDIS will carry all the streams of both the BKG and the IGS casters .

CDDIS Caster and RTS Infrastructure:

- Will eventually serve as the third primary IGS RTS dissemination center
- Will increase the robustness and reliability of the RTS
- Will combine it's role as a global data center with the RTS to capture the real-time streams and convert them to data files in real-time.



Current RTS architecture courtesy BKG

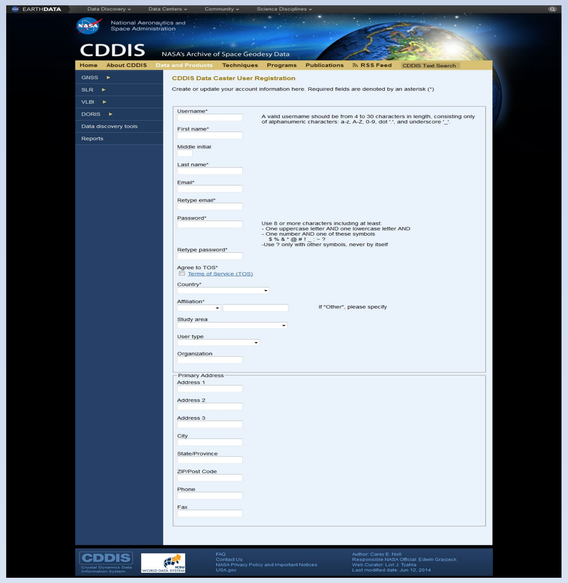
Caster User Registration

Background:

- The current IGS real-time user registration process is not compatible with NASA policies and procedures. *Current users of IGS & BKG casters will be required to register through this process in order to use the CDDIS caster.*
- CDDIS already has access to a world class user registration process from EOSDIS – which currently has over 100,000+ users in the system.
- CDDIS developed the software to interface the Ntrip caster with the EOSDIS user registration system (URS).
- The software "glue" between the Ntrip caster and the URS was developed within a generic Lightweight Directory Access Protocol (LDAP) framework and given back to the IAG community for possible future.

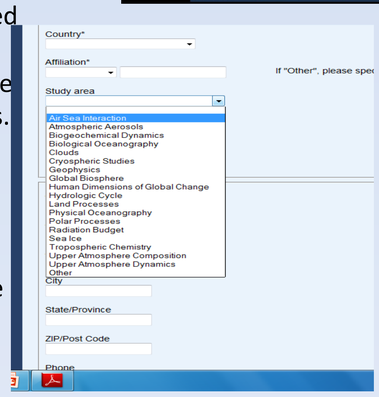
Advantages:

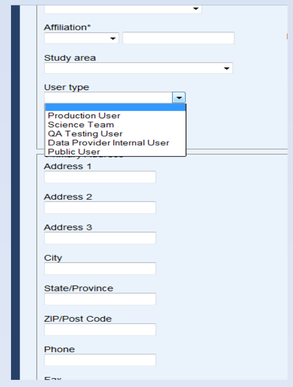
- The registration process is accomplished in real-time.
- Once registered within the EOSDIS system, the user has access to the entire suit of EOSDIS products across all 12 EOSDIS DAACs.
- With the 4th generation URS (expected early 2015) the User will have "single sign on" capability to all the DAACs within the EOSDIS community – which includes CDDIS.



Process:

- User will access the registration form on the CDDIS website and fill out the required information. An example is to the right.
- Categories marked with an asterisk are required
- Several categories have drop down boxes for common study areas or for user access type. Examples are below.
- All users NOT associated with CDDIS or EOSDIS would pick the "public user" type.
- User submits the form and an email is generated with a validation link. User clicks on the link within the email and the URS system validates the form data. Total time is typically a minute or less.
- User now has access to the caster & EOSDIS





Future Improvements:

- URS's next generation with incorporate "single sign on" capability sometime in 2015.
- Automate the process of adding the user to the caster configuration files. Currently can take up to 12 hours to accomplish this task.

Conversion of Real-Time Streams into Data Files:

CDDIS has already started the process of incorporating the existing software into our operations process to capture real-time data feeds and convert the data into high-rate data files. Once the system goes production in late summer 2014 we hope to bring this capability online within a short time frame.

More Information/Feedback:

- Data and products are acquired as part of NASA's Earth Science Data Systems and archived and distributed by the Crustal Dynamics Data Information System (CDDIS): C. Noll, The Crustal Dynamics Data Information System: A resource to support scientific analysis using space geodesy, Advances in Space Research, Volume 45, Issue 12, 15 June 2010, Pages 1421-1440, ISSN 0273-1177, DOI:10.1016/j.asr.2010.01.018.
- The staff welcomes feedback on the CDDIS and in particular the ideas expressed in this poster; contact Patrick Michael (Patrick.Michael@nasa.gov).