PROGRESS AND IMPROVEMENTS IN REAL-TIME SERVICES AT NASA GSFC CDDIS

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Abstract
The Crustal DYNAMics Data Information System (CDDIS) is a NASA distributed active archive center (DAAC) and global distributor of real-time GNSS data and product streams in support of the International GNSS Service (IGS) Real-Time Service (RTS) which provides high-accuracy orbit and clock corrections to the GNSS community, enabling applications such as precise point positioning, time synchronization, and disaster monitoring. The CDDIS NTRIP (Networked Transport of RTCM via Internet Protocol) caster is operated by the NASA Goddard Space Flight Center (GSFC) and broadcasts over 400 GNSS data and 41 products streams provided by a variety of international caster sources.

Performance Metrics
An internal website has been developed to monitor caster and stream performance, containing plots of data and product stream mean latency and completeness. Mean latencies, logged every 15 minutes, are collected with the BNC Miscellaneous module, extracted, sorted, and plotted using CDDIS-developed Python scripts. The data are plotted as a bar chart with bar length signifying the mean latency in seconds, and bar color the percent completeness (Figure 3; darkest shade is 100% complete). The website will make the NTRIP caster accessible to users, is updated 3 times an hour, contains links to a page of precision latency plots for individual streams. The data are collected throughout this process and stored in a database, to be eventually released to the GNSS community. They include:
- Mean latencies with minimum and maximum values
- RMS uncertainties
- Observation interval epoch
- Date and time stamps
- Number of gaps observed in stream
- Qualitative data completeness (reported / expected epoch)

RTCM to RINEX V3 Conversion
The CDDIS has begun working to convert RTCM data streams into RINEX V3 high-rate (15-minute intervals with 1 second sampling rate) observation files using BNC. First (for testing purposes) RTCM-converted files, with RINEX V3 file names, will be generated for stations with high-rate files already existing at CDDIS. The new BNC-generated, and the corresponding receiver-generated files in the CDDIS archive, will be analyzed with CDDIS-developed scripts, to quantitatively compare their header and data content. After the files have been analyzed the RTCM-converted observation files will be named appropriately to differentiate them from receiver-generated observation files. Once data and header consistency is confidently established the process described here will be conducted for stations not currently using high-rate observation files to CDDIS, enabling CDDIS to expand the selection of high-rate observation files available to end-users. Lastly the RTCM-converted high-rate files will be processed, archived, and released to the community (see flow diagram below in Figure 4).

Real-Time Aspects
As of October 2018 the CDDIS NTRIP caster is configured to stream GNSS data from over 400 mount point sources (Figure 2), along with 41 products, from a variety of caster sources including IGS-Central Bureau, BKG, NASA JPL’s Global Differential GPS (GDGPS), Natural Resources Canada (NRCan), Land Information New Zealand (Linz) PoloisNZ, Geoscience Australia (GA), and the University of Chile. As recommended by the IGS Real Time Working Group (RTWG), CDDIS is replacing 5 character mount point names with 5-9 character names for streams relayed from IGS-Central Bureau and BKG casters. Currently the CDDIS offers 447 9-character name mount point data streams, along with the original 5-character name streams. The CDDIS is typically streaming at any one time about 70% of its current total available streams to its user base, and has the capacity to greatly expand both its total number of streams available and the number of users it serves.

NTRIP Caster Modifications
At CDDIS we are working to offer a custom update to the NTRIP caster system that will enable it to work with the newest version of the NASA Earth Observing System Data and Information System (EOSDIS) Earthdata Log. Earthdata Log provides a centralized and simplified mechanism for user registration and profile management for all EOSDIS system components. The updated NTRIP server running at CDDIS will allow users to continue to access CDDIS real-time data and products with their existing Earthdata credentials. This implementation connects CDDIS real-time users and NASA EOSDIS, allowing them to access data and documentation from both sources using the same credentials and keeps the data download process consistent across all methods.

Acknowledgements
3 Figure 1 icons: satellite by Pedro Ramalho, PT, the Noun Project; satellite dish by http://www.free-icons-download.net/database by Mister Floyd, the Noun Project; Australia and Chile by Nikita Kozin, RU, the Noun Project; kiwi by Mike Harding, the Noun Project; world map by Rofaj, Web Icons PNG, 2 CRX2RNX: Hatanaka, Y. (2008), A Compression Format and Tools for GNSS Observation Data, Bulletin of the Geospatial Information Authority of Japan, 55, 21-30

https://cddis.nasa.gov