Real Time Pilot Project

Minutes of Teleconference

IGS RTPP Product Dissemination

25 February 2009

1   Meeting Summary

This teleconference was held on 25 February 2009 and was hosted by NRCan.
Participants were:

BKG: Georg Webber
CDDIS: Carey Noll
DLR: André Hauschild
ESOC: Loukis Agrotis, Pedro Alfaro
Geo++:   Gerhard Wuebbena, Martin Schmitz
GMV: Guillermo Tobías González
GFZ: Junping Chen, Jan Dousa
NRCan: Ken MacLeod
NGS: Jim Ray, Neil Weston

The meeting agenda items are listed below:
1. Briefing on RTCM meeting (Gerhard, Loukis, Georg)
2. Combination Solution (Loukis)
3. Real Time Product Dissemination
    a. Individual AC Solutions and Plans (All)
    b. Combination (Loukis)
    c. Hosting (Carey, Georg, Ken)
4. User Community Participation to RTPP (Ken)
5. Web Page (Ken)
6. Network Status (Ken, Georg)
7. AOB

2   Briefing on RTCM meeting

The meeting of RTCM SC104 took place on 4-5 February in Harwich UK. This special committee deals with differential GNSS and is chaired by Georg (who was absent from the Harwich meeting). It was attended by four of the telecon participants, Neil, Gerhard, Martin and Loukis. Loukis stated that he was impressed with the efficiency of the process in pushing new formats out to the receiver manufacturers.

Points of interest were:
➢ IGS has now applied for membership of RTCM
➢ Gerhard presented new formats for space state representation. These are formats for RT orbit and clock corrections.
➢ Galileo/Glonass messages
➢ L2C quarter cycle phase correction issue

Gerhard explained that messages for orbit and clock corrections have been available since the end of 2007 and are currently being disseminated. Several modifications were proposed at the end of 2008 including additional definitions for consistency. The new messages include GPS and Glonass orbit and clock corrections, code biases and URE. Clocks corrections are broken down into a low dynamic part and high rate clocks.

Georg explained the RTCM encoding and decoding capabilities within NTRIP. The software, which is open source, includes a server, BNS, for encoding and disseminating the RTCM messages. A client ,BNC, receives and decodes the real time streams (measurements and corrections). The latest proposed formats for the corrections have been implemented in BNC. BNS will be ready in 2-3 weeks. Anyone can use these tools over an IP connection.

Gerhard outlined the process for approval of the message formats through RTCM. Interoperability testing will now be performed. After this there will be a vote of the RTCM members, expected to take place at this year's September meeting. The precision of the messages is sub-mm. Manufacturers are also involved and we need to come up with an ongoing service to accelerate acceptance.

Jim requested that there should be more visibility in the activities of RTCM and the RTPP.

AI1: Mark and Loukis to summarise the main points of PP and RTCM as an IGS mail.

A short discussion on L2C phase corrections followed. Jim understands that there were objections from Werner Guertner on the proposal for uncorrected measurements. These were not in the papers submitted to RTCM by Gerhard. Loukis stated that since the IGS are members to the RTCM, we should be able to submit papers and to participate in the discussion. One problem is who should receive the RTCM documentation. Georg said that the RTCM links to documents should not be disseminated by email. An IGS liaison person should be appointed and he could forward relevant documents to the working group chairpersons.

AI2: Georg to request the appointment of an IGS liaison person from the IGS Governing Board and to formalise rules for communicating RTCM documentation.

3   Combination Solution

This is now being generated daily at ESOC from the sp3 and clock RINEX files submitted by the RT Analysis Centres. The combination is generally better than any of the individual contributors in RMS if 3 or more AC solutions are utilised. Clock sigma is in the middle of the range.

The combination summary and products are in:
    ftp://nng.esoc.esa.de/gps/products
    ftp://nng.esoc.esa.de/pub/gps_data/gps/products (IE users)

4   Real Time Product Dissemination

4.1   Individual AC Solutions and Plans

ESOC has 2 solutions now, one generated from the NTRIP and the other from the RTIGS caster data. The plan is to have a main solution using stations from both broadcasters and possibly 2 additional single-broadcaster solutions. The last two are to provide robustness for the combination if there are not enough ACs. ESOC are now ready to start development of the infrastructure to allow dissemination of the RT solution streams (individual ESOC and combination solutions) via NTRIP.

GFZ are currently working on their newly-designed software EPOS-RT and have nearly completed testing. They obtain better results in post processing (e.g., satellite clocks with RMS of

0.04ns compared to the IGS final; kinematic coordinates with RMS of 2-4 cm compared to IGS weekly solution). The RT satellite clocks are estimated based on the streams from the NTRIP caster at GFZ (a relay of the caster at BKG plus the streams of GFZ's network). RT satellite clocks are at the 0.13ns (4 cm) level. GFZ will try to move to routine operations with their software. There are 25 stations in the GFZ network with data from some of them to be disseminated.

DLR will continue with their participation to the RTPP. They will move to a professionally hosted server to reduce network outages. The DLR products are provided on the BKG caster as an NTRIP-stream using the BNS software.

BKG have been disseminating their solution in the form of double difference clock corrections. This makes it difficult to make comparisons with the other ACs. BKG have decided to switch to absolute clocks and expect to have this product available in 2 weeks. In addition, more computer power is to be procured. Two solution streams will be available using ITRF2005 and European Terrestrial System 2000 coordinates.

Geo++ are processing GPS/Glonass data from a 60 station network (NTRIP) generating RTCM streams. There are currently some problems with the stability of the solution and they are not yet generating SP3 and clock files. Their products are not so easy to compare because of the use of kinematic orbits. They are prepared to disseminate a solution stream at short notice.

GMV are trying to improve their products. At the moment they are not able to use NTRIP because of network security issues, so their solution is based on batch download of Rinex files, They are working on increasing their budget in order to develop their system to use NTRIP. Currently they are trying to improve the batch results, reduce latency and improve the quality of the clock and orbit predictions.

NRCan have not been working on the RTPP solution recently. They will resume work on it this week. They are currently working to include the NTRIP RTCM3 stations in the RTIGS stream with the objective that all NTRIP data can be available in RTIGS. They will be ready for RT dissemination of their solution by late spring – summer.

Loukis asked which ACs will be able to start streaming their solution immediately. BKG, DLR and Geo++ have offered to start providing their solution via NTRIP in the next two weeks.

AI3: BKG, DLR and Geo++ to publish their RT streams on NTRIP and provide details on how to receive those streams.

4.2   Combination

Loukis stated that the algorithm for making the current combination is suitable for real time, as the combination is processed on an epoch-by-epoch basis.

Jim stated that in the IGS rapids there are enough solutions of sufficiently good quality to ensure that the combination is better than the individual solutions. He was not sure that this will be the case in the early stages of the RTPP, and he would like to also see the individual solutions being published.

Loukis added that some ACs may not want their solutions to be made available. Also, all solutions suffer from occasional outliers and this is where the combination will be valuable.

4.3 Hosting

Carey said that CDDIS are ready to start hosting the comparison report and RT-derived batch products. They could in the future also host the RT products.

AI4: Pedro to provide the directory structure for the RT products (report and combination solution)

AI5: Mark to approach the remaining Data Centres to ask for contributions in hosting the RT products.

Ken said that NRCan are in the process of a network transition. Frame relay is being phased out and they are moving to a new network with a more robust double stream so that one failure is seamless. The tools for delivery are also being improved. They are developing a new IP relay (with the option of either UDP or TCP protocols) and are adding the NTRIP(RTCM) protocol. They will next work on standardising next generation RTCM (RTCM4) and corrections.

Georg said that hosting the product is no problem. The data rate and number of users is small. The problem is in the hosting of data where there are 150-200 streams for IGS plus 150 streams from the European network. More broadcasting capacity is needed and Georg recommends that a separate server should be procured for the RTPP.

5   User Community Participation to RTPP

In Mark's absence it was decided to record the following action:

AI6: Mark to develop plan to involve the user community in processing the RTPP products.

6   Web Page

Ken has updated the station map to include the stations from GFZ and the NTRIP planned stations. Mark is doing some work on the web site and will send something for review. Ken would like to see more people participating.

AI7: Loukis to discuss with Mark about contributing to the effort for updating the web site.

Georg listed the number of sites dealing with RTIGS. He would like to see links to these pages from RTIGS.net.

AI8: Georg to provide the links he would like to include in the RTPP web page.

Jim asked for a concise and complete IGS mail report to summarise the main points of the PP (see AI1).

7   Network Status

Ken said that there have been some issues with the data from GSA (Australia) after the leap second. GSA stations are being upgraded with new generation Leica receivers and the data management is in transition. All data transfers will be in RTCM format.
New stations from Taiwan and GFZ will be included soon in the RTIGS data stream.

Georg discussed the issue of problems in the data quality. GFZ has also found that some stations have bad quality (1-2 cycle slips). There is a clear need for a mechanism for solving these problems. The procedure suggested by Georg requires that ACs should inform a limited number of people when they observe a problem. Georg has compiled an initial mailing list and has already distributed problem reports raised by ESOC and DLR. For the time being, the mailing list comprises:
Andre (DLR)
Georg (BKG)
Jim (IGS)
Junping (GFZ)
Ken (NRCan)
Loukis (ESA)
Martin (Geo++)

Jim highlighted the need for a receiver working group within the IGS. He identified a position paper that was presented at the Miami workshop on future receiver development, with recommendations for the IGS
(http://igscb.jpl.nasa.gov/overview/pubs/IGSWorkshop2008/docs/recDev-positionpaper.pdf). The IGS Infrastructure Committee would need to follow this up.

8   AOB

Georg stated that there are around 25 stations on NTRIP that are not IGS stations and asked what can be done to push for them to become IGS sites. Jim suggested that the Infrastructure Committee should deal with this, as presently there is nobody to handle the "official IGS" assignment. The main problem for the RT community is that there are no accurate station coordinates for receivers that are not processed by the IGS.

Jim proposed that the log files and hourly and daily files for these stations could be uploaded to the data centres. The ACs would then use those files as a matter of course. Carey agreed to store the data for the additional stations.

Junping asked if there were any plans to disseminate ERPs in the RT data streams. Jim said that ERPs could be disseminated to allow people to make rotational corrections to compensate between the values used and the actual values. However, he did not feel that the IGU products could be improved by such corrections.

Loukis thanked the participants for a very constructive teleconference and emphasised the important milestone of having 3 ACs ready to start disseminating products in Real Time.

9   Action Item List[1]

Action Item	Status	Submit Date	Due/Close Date	Title	Description	Actionee	Response
M4-1	Open	25/02/09	14/03/09	PP Status	Summarise the main points of PP and RTCM as an IGS mail.	Mark Caissy, Loukis Agrotis	First draft written by Loukis and sent to Mark to finalise.
M4-2	Open	25/02/09	14/03/09	RTCM Liaison	Request the appointment of an IGS liaison person from the IGS Governing Board and formalise rules for communicating RTCM documentation.	Georg Weber	
M4-3	Open	25/02/09	14/03/09	RT product dissemination	BKG, DLR and Geo++ to publish their RT streams on NTRIP and provide details on how to receive those streams.	Georg Weber, André Hauschild, Gerhard Wuebbena	Broadcaster: www.igs-ip.net Port: 2101 or 80 Mountpoint: CLK10 Reference System: ITRS2005 Authorization: none Engine: RTNet, TU Prague Encoder: BNS, v1.0 Decoder: BNC, V1.7 Format: Premature, RTCM 026-2008-SC104-429 Broadcaster: www.igs-ip.net Port: 2101 or 80 Mountpoint: CLK00 Reference System: ITRS2005 Authorization: none Engine: RETICLE, DLR/GSOC Encoder: BNS, v1.0 Decoder: BNC, V1.7 (used for BCEs only!) Format: Premature, RTCM 026-2008-SC104-429
M4-4	Closed	25/02/09	14/03/09	RT Product Directories	Provide the directory structure for the RT products (report and combination solution) to be stored at CDDIS	Pedro Alfaro	Carey and Pedro have now set this up in ftp://cddis.nasa.gov/gps/products/rtpp/
M4-5	Open	25/02/09	14/03/09	Data Centres	Approach the remaining Data Centres to	Mark	

---
[1] Greyed-out entries have been confirmed as closed

Action Item	Status	Submit Date	Due/Close Date	Title	Description	Actionee	Response
					ask for contributions in hosting the RT products.	Caissy	
M4-6	Open	25/02/09	14/03/09	User Community	Develop plan to involve the user community in processing the RTPP products	Mark Caissy, Loukis Agrotis	IGSmail from M4-1 will be the starting point for this.
M4-7	Open	25/02/09	14/03/09	RTPP Web Site	Discuss with Mark about contributing to the effort for updating the web site	Loukis Agrotis	Agreed for Loukis to provide a description of the products and the AC and Data Centre data sheets for inclusion in the new web site.
M4-8	Closed	25/02/09	14/03/09	NTRIP links for Web Site	Provide the links to be included in the RTPP web page	Georg Weber	On top of www.rtigs.net we currently have a table of links to the UDP topics "Stations, Protocol, Products, Architecture, Software, Network, FAQ". For a quick solution my suggestion would be to turn this table of links into a pull-down-menue offering equivalent links to both, the UDP and the NTRIP approach. Best regards, Georg == List of links with RTIGS contents not included in www.rtigs.net == Monitoring: http://www.igs.oma.be/real_time/ Operation: http://www.igs.oma.be/real_time/station_operation_details.php RTIGS, FAQ: http://www.igs.oma.be/real_time/ntripfaq.php Highrate RINEX: http://www.igs.oma.be/highrate/ NTRIP Broadcast: http://www.igs-ip.net/home NTRIP Streams, Map: http://igs.bkg.bund.de/root_ftp/NTRIP/maps/casters/IGS-IP.png NTRIP Stream Table: http://igs.bkg.bund.de/root_ftp/NTRIP/streams/streamlist_igs-ip.htm NTRIP Contributors: http://igs.bkg.bund.de/ntrip/contributors.htm NTRIP User Registration: http://igs.bkg.bund.de/ntrip/ntrip_register.htm NTRIP Provider Registration:

Action Item	Status	Submit Date	Due/Close Date	Title	Description	Actionee	Response
							http://igs.bkg.bund.de/ntrip/ntrip_register_provider.htm NTRIP Streams, Notice Advisories: http://igs.bkg.bund.de/root_ftp/NTRIP/nabu/igs NTRIP Streams, Outages: http://igs.bkg.bund.de/root_ftp/NTRIP/outages/igs NTRIP Software: http://igs.bkg.bund.de/ntrip/ntrip_down.htm