



Challenges for Data Centers supporting the Multi-GNSS Experiment

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1) Federal Agency for Cartography and Geodesy

2) NASA Goddard Space Flight Center

3) IGN - Service de Géodésie et Nivellement



- Support new satellite constellations such as Galileo, COMPASS and QZSS
- Support new signal types and frequencies
- Consider new data formats

→ CDDIS, IGN and BKG emerged M-GEX DCs



- Assure continuity of operational IGS products during the M-GEX experiment
- Set up new tracking stations for M-GEX at the DCs, or assign/copy existing IGS stations to the M-GEX part of the DC
- Extend the DC functionality for RINEX version 3
- Allow submission of RINEX V2 and V3 files in parallel, while using identical file names for the two formats
- Extend the DC functionality for M-GEX products (to be ready, as soon as new M-GEX products will become available)
- Consider data and product streams of IGS-RT service, e.g., accumulated observation streams



Structure of M-GEX DCs - CDDIS -

- RINEX-v3, RINEX-v2 and RAW separated
- <ftp://cddis.gsfc.nasa.gov/>

Daily 30-second files:

- /gnss/data/campaign/mgex/daily/rinex3/YYYY/DDD/YYT
- /gnss/data/campaign/mgex/daily/rinex2/YYYY/DDD/YYT
- /gnss/data/campaign/mgex/daily/raw/YYYY/DDD/YYT

Hourly 30-second files:

- /gnss/data/campaign/mgex/hourly/rinex3/YYYY/DDD/HH
- /gnss/data/campaign/mgex/hourly/rinex2/YYYY/DDD/HH
- /gnss/data/campaign/mgex/hourly/raw/YYYY/DDD/HH

15-minute 1-second files:

- /gnss/data/campaign/mgex/highrate/rinex3/YYYY/DDD/HH/YYT
- /gnss/data/campaign/mgex/highrate/rinex2/YYYY/DDD/HH/YYT
- /gnss/data/campaign/mgex/highrate/raw/YYYY/DDD/HH/YYT





- RINEX-v3, RINEX-v2 and RAW separated
- <ftp://igs.ensg.ign.fr>

Daily 30-second files:

- /gnss/data/campaign/mgex/daily/rinex3/YYYY/DDD/YYT
- /gnss/data/campaign/mgex/daily/rinex2/YYYY/DDD/YYT
- /gnss/data/campaign/mgex/daily/raw/YYYY/DDD/YYT

Hourly 30-second files:

- /gnss/data/campaign/mgex/hourly/rinex3/YYYY/DDD/HH
- /gnss/data/campaign/mgex/hourly/rinex2/YYYY/DDD/HH
- /gnss/data/campaign/mgex/hourly/raw/YYYY/DDD/HH

15-minute 1-second files:

- /gnss/data/campaign/mgex/highrate/rinex3/YYYY/DDD/HH/YYT
- /gnss/data/campaign/mgex/highrate/rinex2/YYYY/DDD/HH/YYT
- /gnss/data/campaign/mgex/highrate/raw/YYYY/DDD/HH/YYT



- RINEX-v3 and RINEX-v2 separated
- <ftp://igs.bkg.bund.de>

Daily 30-
second files:

- /MGEX/obs/YYYY/DDD/
- /MGEX/obs_v3/YYYY/DDD/

Hourly 30-
second files:

- /MGEX/nrt/DDD/HH/
- /MGEX/nrt_v3/DDD/HH/

15-minute 1-
second files:

- /MGEX/highrate/YYYY/DDD/H
- /MGEX/highrate_v3/DDD/H





RINEX Creation - Daily -

4-Char	Name	Receiver	Firmware	RINEX PGM
ABMF	Aeroport du Raizet -LES ABYMES - France	TRIMBLE NETR9	4.60	BNC 2.6
BRST	Brest	TRIMBLE NETR9	4.60	BNC 2.6
LMMF	Aerop. Aime CESAIRE-LE LAMENTIN-France	TRIMBLE NETR9	4.60	BNC 2.6
NKLG	N' KOLTANG (GABON)	TRIMBLE NETR9	4.60	BNC 2.6
REUN	La Reunion - Observatoire Volcanologique	TRIMBLE NETR9	4.60	BNC 2.6
WARN	Warnemuende	JPS LEGACY	2.6.1 JAN,10,2008	BNC 2.6
DYNG	DIONYSOS	TRIMBLE NETR9	4.60	cnvtToRINEX 2.12.0
HARB	Hartebeesthoek	TRIMBLE NETR9	4.42	cnvtToRINEX 2.12.0
TLSE	Toulouse	TRIMBLE NETR9	4.6	cnvtToRINEX 2.12.0
USN5	U.S. Naval Obs. Time Service	NOV OEM6	OEM060000RN0000	convert10
MYVA	Reykjahlid / Iceland	LEICA GR10	6.110	GR10 V2.50
GOP6	Pecny, Ondrejov / CZ	LEICA GRX1200+GNSS	8.51/6.110	GRX1200&OBSRINEX
NURK	Kigali - National University of Rwanda, CGIS	JAVAD TRE_G3TH DELTA	3.4.4b0	MAKERINEX 2.0.10850
NYA2	Ny Alesund	JAVAD TRE_G3TH DELTA	3.3.5	MAKERINEX 2.0.10850
OBE3	Oberpfaffenhofen	JAVAD TRE_G3TH DELTA	3.3.5	MAKERINEX 2.0.10850
OUS2	Dunedin	JAVAD TRE_G3TH DELTA	3.4.4b0	MAKERINEX 2.0.10850
POTS	Potsdam, GeoForschungsZentrum	JAVAD TRE_G3TH DELTA	3.4.4b0	MAKERINEX 2.0.10850
SGOC	Surveyor General' s Office Colombo	JAVAD TRE_G3TH DELTA	3.3.5	MAKERINEX 2.0.10850
TASH	Tashkent	JAVAD TRE_G3TH DELTA	3.4.4b0	MAKERINEX 2.0.10850
ULAB	Ulaanbataar	JAVAD TRE_G3TH DELTA	3.4.1b3	MAKERINEX 2.0.10850
WUH2	WUHAN	JAVAD TRE_G3TH DELTA	3.3.5	MAKERINEX 2.0.10850
CUTO	Curtin University Bentley	TRIMBLE NETR9	4.60	NetR9 4.60
DLF1	Delft	TRIMBLE NETR9	4.60	NetR9 4.60
GRAC	GRASSE	TRIMBLE NETR9	4.42	NetR9 4.60
KIR8	Kiruna	TRIMBLE NETR9	4.43	NetR9 4.60
MAR7	Maartsbo	TRIMBLE NETR9	4.43	NetR9 4.60
ONS1	Onsala	TRIMBLE NETR9	4.43	NetR9 4.60
BRUX	Brussels	SEPT POLARX4TR	2.3-tst120216r34012	sbf2rin-8.1.0
USN4	U.S. Naval Observatory Time Service	SEPT POLARX4TR	2.3	sbf2rin-8.1.0
GRAB	Graz_B	IFEN SX_NSR_RT_800	2.4	SX-NSR
CONZ	Concepcion - TIGO	LEICA GRX1200+GNSS	8.51/6.110	ViewLB2 v1.3.7.0
OHIX	O' Higgins / Antarctica	LEICA GRX1200+GNSS	8.50/6.110	ViewLB2 v1.3.7.0

concatenation

utility

utility

firmware



RINEX Creation - Hourly -

4-Char	Name	Receiver	Firmware	RINEX PGM
DYNG	DIONYSOS	TRIMBLE NETR9	4.60	cnvtToRINEX 2.12.0
HARB	Hartebeesthoek	TRIMBLE NETR9	4.42	cnvtToRINEX 2.12.0
NKLG	N'KOLTANG (GABON)	TRIMBLE NETR9	4.60	cnvtToRINEX 2.12.0
TLSE	Toulouse	TRIMBLE NETR9	4.6	cnvtToRINEX 2.12.0
GOP6	Pecny, Ondrejov / CZ	LEICA GRX1200+GNSS	8.51/6.110	GRX1200&OBSRINEX
ABMF	Aeroport du Raizet -LES ABYMES - Météo France	TRIMBLE NETR9	4.60	NetR9 4.60
BRST	Brest	TRIMBLE NETR9	4.60	NetR9 4.60
DLF1	Delft	TRIMBLE NETR9	4.60	NetR9 4.60
GRAC	GRASSE	TRIMBLE NETR9	4.42	NetR9 4.60
KIR8	Kiruna	TRIMBLE NETR9	4.43	NetR9 4.60
LMMF	Aeroport Aime CESAIRE-LE LAMENTIN-Meteo Fra.	TRIMBLE NETR9	4.60	NetR9 4.60
MAR7	Maartsbo	TRIMBLE NETR9	4.43	NetR9 4.60
ONS1	Onsala	TRIMBLE NETR9	4.43	NetR9 4.60
REUN	La Reunion - Observatoire Volcanologique	TRIMBLE NETR9	4.60	NetR9 4.60
BRUX	Brussels	SEPT POLARX4TR	2.3-tst120216r34012	sbf2rin-8.1.0



RINEX Creation - High-Rate -

4-Char	Name	Receiver	Firmware	RINEX PGM
ABMF	Aeroport du Raizet -LES ABYMES - Météo France	TRIMBLE NETR9	4.60	BNC 2.7
BRST	Brest	TRIMBLE NETR9	4.60	BNC 2.7
CUT0	Curtin University Bentley	TRIMBLE NETR9	4.60	BNC 2.7
GMSD	GUTS Masda	TRIMBLE NETR9	4.60	BNC 2.7
GRAC	GRASSE	TRIMBLE NETR9	4.42	BNC 2.7
HARB	Hartebeesthoek	TRIMBLE NETR9	4.42	BNC 2.7
KIR8	Kiruna	TRIMBLE NETR9	4.43	BNC 2.7
KZN2	KAZAN	TRIMBLE NETR9	4.60	BNC 2.7
LMMF	Aerop. CESAIRE-LE LAMENTIN – France	TRIMBLE NETR9	4.60	BNC 2.7
MOSE	Rome - The 'Moses' of Michelangelo	LEICA GR25	2.50/6.110	BNC 2.7
MAR7	Maartsbo	TRIMBLE NETR9	4.43	BNC 2.7
MATG	MateraG	LEICA GRX1200+GNSS	8.51/6.110	BNC 2.7
MYVA	Reykjahlid / Iceland	LEICA GR10	6.110	BNC 2.7
NKLG	N'KOLTANG (GABON)	TRIMBLE NETR9	4.60	BNC 2.7
ONS1	Onsala	TRIMBLE NETR9	4.43	BNC 2.7
REUN	La Reunion	TRIMBLE NETR9	4.60	BNC 2.7
TLSE	Toulouse	TRIMBLE NETR9	4.6	BNC 2.7
WTZZ	Wetzell / Germany	JAVAD TRE_G3TH DELTA	3.3.8	BNC 2.7
DYNG	DIONYSOS	TRIMBLE NETR9	4.60	cnvtToRINEX 2.12.0
HARB	Hartebeesthoek	TRIMBLE NETR9	4.42	cnvtToRINEX 2.12.0
NKLG	N'KOLTANG (GABON)	TRIMBLE NETR9	4.60	cnvtToRINEX 2.12.0
TLSE	Toulouse	TRIMBLE NETR9	4.6	cnvtToRINEX 2.12.0
GOP6	Pecny, Ondrejov / CZ	LEICA GRX1200+GNSS	8.51/6.110	GRX1200&OBSRINEX
DLF1	Delft	TRIMBLE NETR9	4.60	NetR9 4.60
GRAB	Graz_B	IFEN SX_NSR_RT_800	2.4	SX-NSR

stream



- CDDIS generated own s/w to extract RINEX header information to create status/summary files
- CDDIS applies such meta information to maintain the data base

■ Link

<ftp://cddis.gsfc.nasa.gov/gnss/data/campaign/mgex/reports/2012/>

Author: Carey Noll/CDDIS

IGS M-GEX Daily RINEX V3 GNSS Data Holdings (as of 12-Jun-2012 09:24:31)

GPS Week 1691

3-Jun-2012 through 9-Jun-2012; Days 12155 through 12161

Site Name	Mon. Name Receiver	155 0603	156 0604	157 0605	158 0606	159 0607	160 0608	161 0609	No. Days
Brest	BRST Trimble NETR9	X	-	X	X	X	X	X	6
Brussels	BRUX SEPT POLARX4TR	X	X	X	X	X	X	X	7
Concepcion	CONZ Leica GRX1200+GN	X	-	X	X	X	X	-	5
Bentley	CUT0 Trimble NETR9	X	X	X	X	X	X	X	7
...									
Wuhan	WUH2 JAVAD TRE_G3TH D	X	X	X	X	X	X	X	7
Totals:	31 stations	27	24	28	27	27	27	24	184



BNC - E&QC RANGE OF SERVICES

Functionality	GNSS	Available	Remark
Concatenation RINEX-3 observation files	G R E J C M	X	Today's most significant added value
Concatenation RINEX-3 navigation files	G R M	X	
	E J C		
Edit RINEX Header	G R E J C M	X	Mandatory for routine operations
Multipath analysis L1 and L2	G	X	<i>Equations of approach missing, improve graph resolution</i>
	R E J C M		
Dual-frequency multipath analysis for specified frequencies and signal types	G R E J C M		Allow specification of two frequencies (from L1, L2, L5, E1...) and any signal type (I, Q, X, ...), <i>enables investigation of multipath for new signals</i>
Triple-frequency multipath analysis for specified frequencies and signal types			New approach (, ionosphere delay from three frequencies?)

E&QC Editing and quality control

GNSS systems G GPS
 R GLONASS
 E Galileo
 J QZSS
 C COMPASS
 M Mixed

ADDITIONAL REMARKS FOR FUTURE DEVELOPMENTS

Support Galileo PRS

Epoch-wise calculation of phase biases or ambiguities, respectively, from three carrier frequencies (apply "integer clocks"?, generate "phase ranges"?)



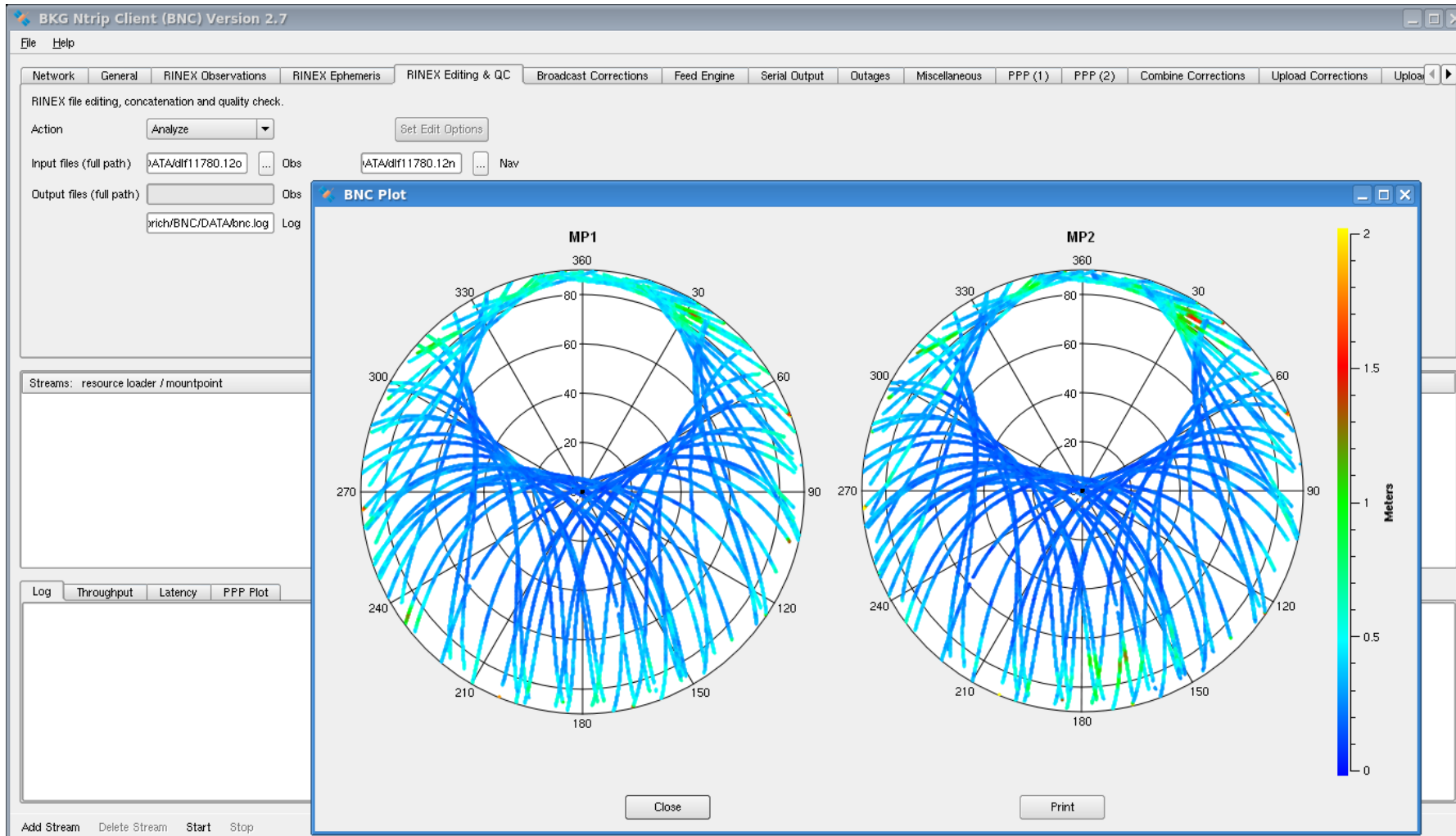
The screenshot displays the BKG Ntrip Client (BNC) Version 2.7 interface. The main window has a menu bar (File, Help) and a tabbed interface with the following tabs: Network, General, RINEX Observations, RINEX Ephemeris, RINEX Editing & QC (active), Broadcast Corrections, Feed Engine, Serial Output, Outages, Miscellaneous, and PPP (1). The RINEX Editing & QC tab contains the following elements:

- Text: "RINEX file editing, concatenation and quality check."
- Action: A dropdown menu set to "Edit/Concatenate" and a "Set Edit Options" button.
- Input files (full path): Two text boxes containing "ATA/dif11780a.12c" and "ATA/dif11780.12n", each followed by a "..." button and the label "Obs" or "Nav".
- Output files (full path): Two text boxes containing "NC/DATA/dif11780.120" and "NC/DATA/dif11780.12p", each followed by a "..." button and the label "Obs" or "Nav".
- Log: A text box containing "rich/BNC/DATA/bnc.log" followed by a "Log" button.

A modal dialog titled "RINEX Editing Options" is open in the foreground. It contains the following fields and controls:

- Run By: A text box containing "BKG".
- Comment(s): A text box containing "Concatenation with BNC 2.7".
- Table with two columns: "Old" and "New".
- Marker Name: Two text boxes.
- Antenna Name: Two text boxes.
- Receiver Name: Two text boxes.
- Buttons: "Help=Shift+F1", "OK / Save", and "Cancel".
- Other fields: "RNX Version" (dropdown set to "3"), "Sampling" (spin box set to "0 sec"), "Start" (date/time picker set to "1967-11-02 00:00:00"), and "End" (date/time picker set to "2099-01-01 00:00:00").


At the bottom of the main window, there is a "Log" section with tabs for "Log", "Throughput", "Latency", and "PPP Plot". The "Log" tab is active, showing an empty area. Below the log area are buttons for "Add Stream", "Delete Stream", "Start", and "Stop", along with a "Help ?=Shift+F1" button.





Points of Discussion

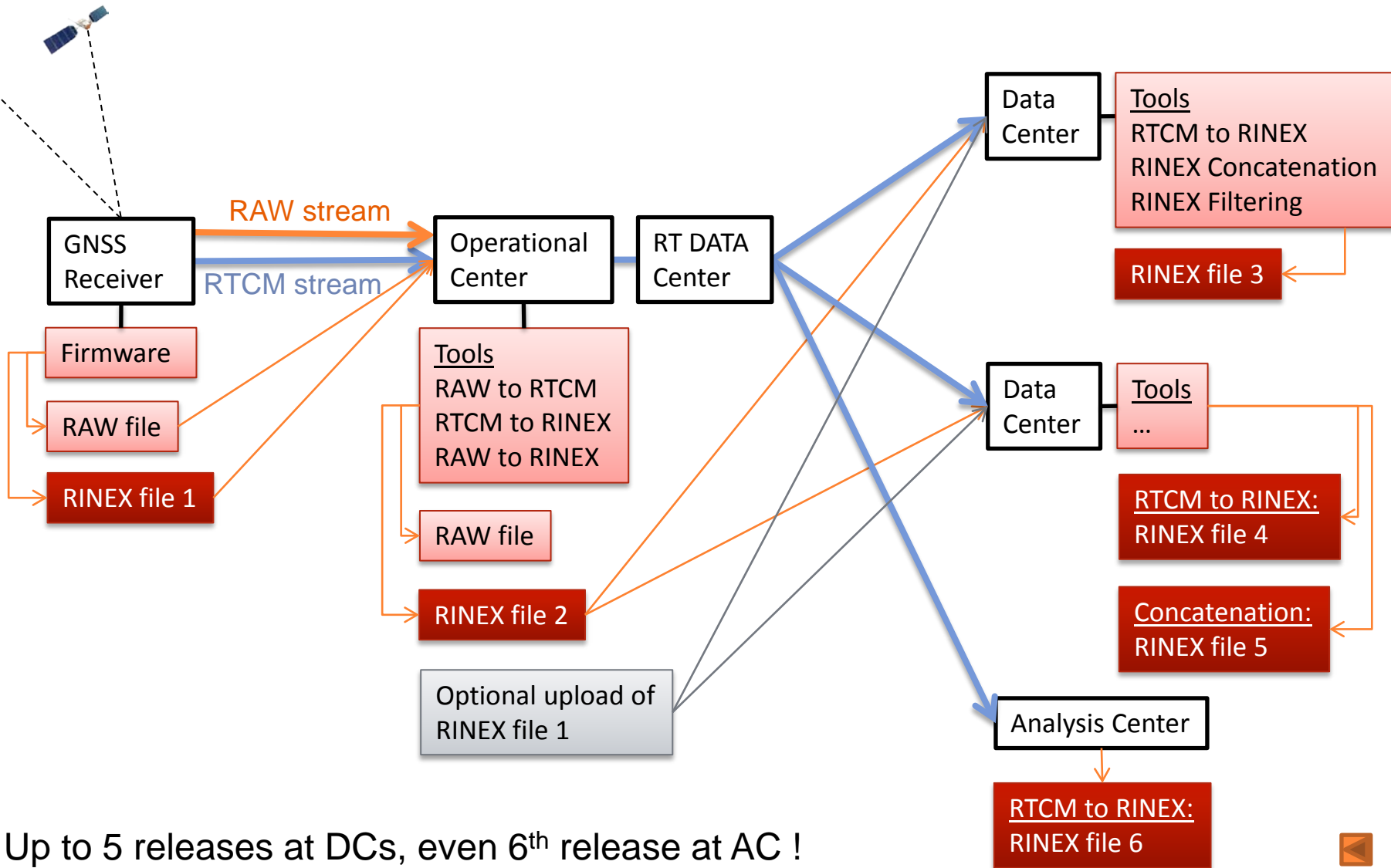
- Multiple Releases of RINEX Files -

- Creation of RINEX at different places 
- Creation of RINEX by different approaches
 - e.g., conversion of RAW files vs. accumulation of data streams
- How to identify particular releases?
- Rules for data holding
 - Storage of a single release vs. multiple releases in parallel
 - Any priority of releases?
 - Overwrite low priority with high priority files?
 - Completeness of file synchronization between DCs? Is the minimum of one release at a DC accepted?





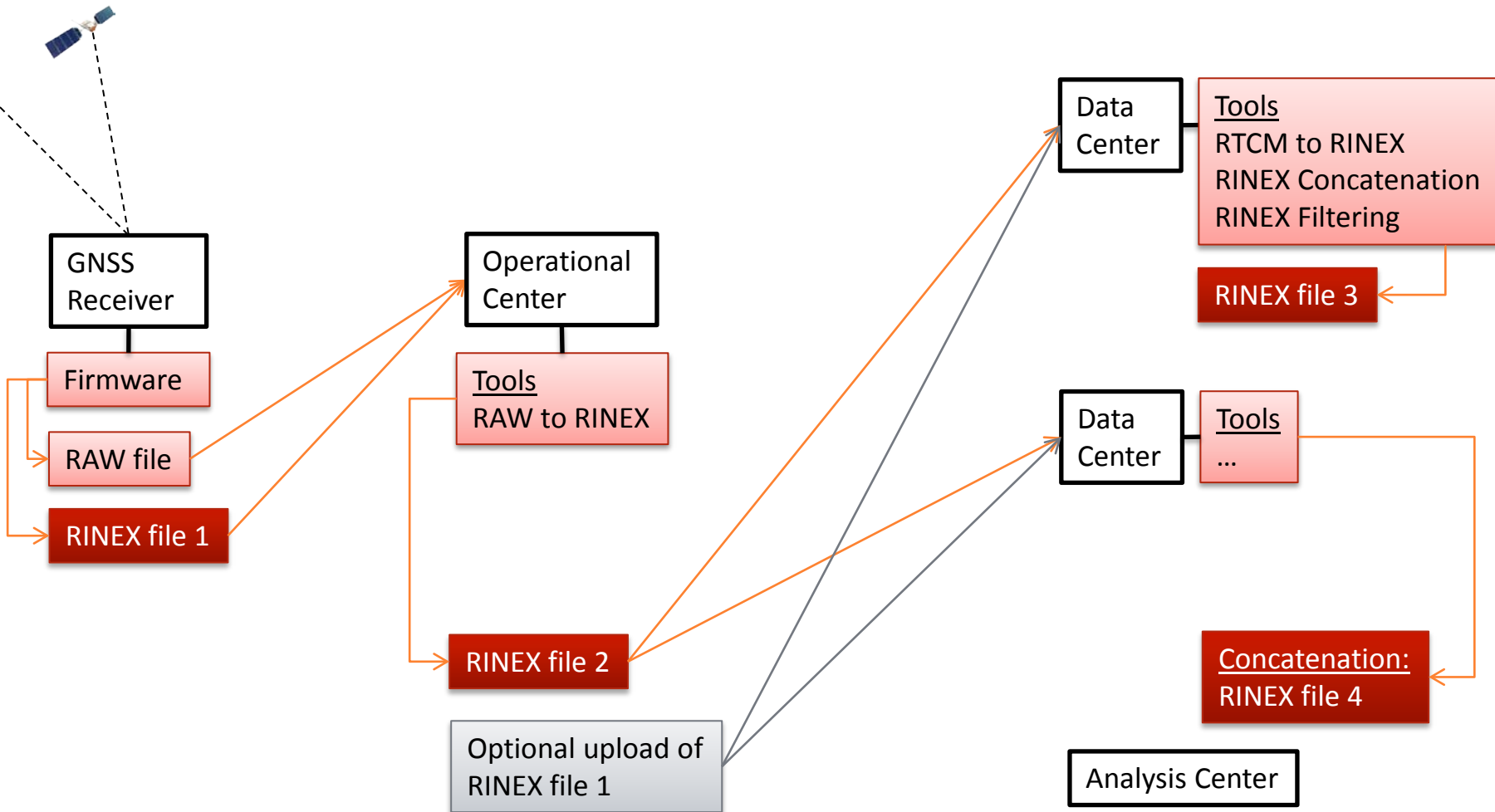
RINEX Creation at Different Places



Up to 5 releases at DCs, even 6th release at AC !



RINEX Creation at Different Places - No Data Streams -



Up to 4 RINEX files based on identical RAW file !



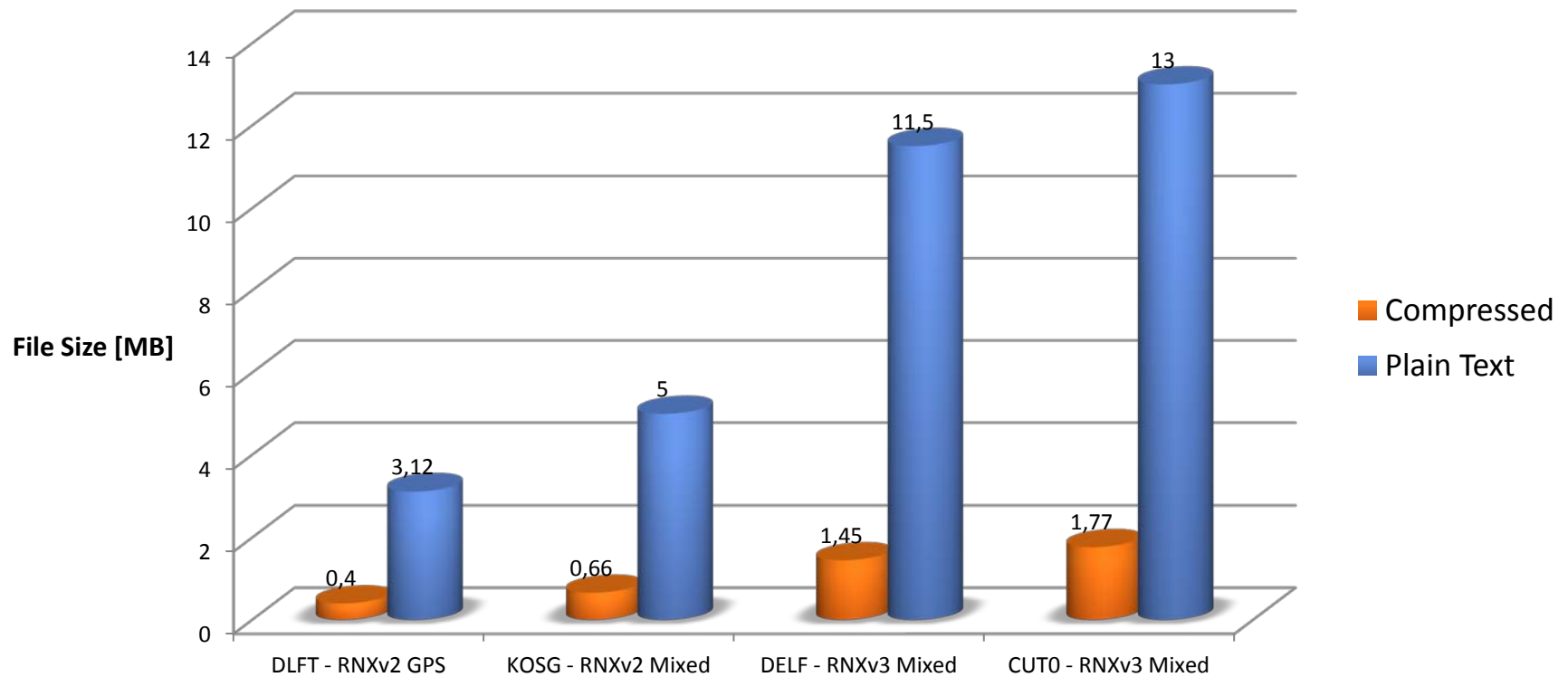


- RINEX file name convention
 - apply <agency> field to file name to identify place of file creation and RINEX creation approach
 - use “REC” as agency identification for creation “by receiver”?
 - handling of legacy file names (e.g., use “links”)
 - ... ongoing discussion in several WGs
- Two format versions of RINEX
 - RINEX 2.xx and 3.xx
 - long-term goal ?
 - strategies for transition to new formats, while ensuring continuity of IGS operations
 - conversion RINEX 2.xx to 3.xx and vice versa, is it an issue?



RINEX File Content and Size

DLFT: 2.10	OBSERVATION DATA	G (GPS)	RINEX VERSION / TYPE
•7 L1 L2 C1 P2 P1 S1 S2			# / TYPES OF OBSERV
KOSG: 2.11	OBSERVATION DATA	M (MIXED)	RINEX VERSION / TYPE
•6 L1 L2 C1 P2 S1 S2			# / TYPES OF OBSERV
DLF1: 3.02	OBSERVATION DATA	M (MIXED)	RINEX VERSION / TYPE
•G 12 C1C L1C S1C C2W L2W S2W C2X L2X S2X C5X L5X S5X			SYS / # / OBS TYPES
•S 3 C1C L1C S1C			SYS / # / OBS TYPES
•R 12 C1C L1C S1C C1P L1P S1P C2C L2C S2C C2P L2P S2P			SYS / # / OBS TYPES
•E 12 C1X L1X S1X C5X L5X S5X C7X L7X S7X C8X L8X S8X			SYS / # / OBS TYPES
•J 15 C1C L1C S1C C1X L1X S1X C2X L2X S2X C5X L5X S5X C6X			SYS / # / OBS TYPES
• L6X S6X			SYS / # / OBS TYPES
•C 9 C2I L2I S2I C7I L7I S7I C6I L6I S6I			SYS / # / OBS TYPES





User Registration Thoughts - Arrangement Worthwhile? -

■ PROs:

- identification of problems caused by corruptive downloads, e.g., too many parallel jobs or mistake in scripting
- enables generation of user information/statistics
- already realized for upload, after misuse of IGS archives
- registration already requested for RT-data streams, nobody complains about that
- maintain “guest account” without registration

■ CONSs:

- implication for users who use automated scripting
- implementation of user registration mechanism requested at DCs
- may discourage users from using IGS products

■ Remark

→ registration must not be a restriction of the service



- Several new tasks for data centers supporting Multi-GNSS
- Some issues need to be discussed (RINEX-WG, Infrastructure WG,...)

→ Join the Data Center WG meeting on Wednesday, July 5, afternoon !!