



The Role of EUREF in a Changing GNSS Landscape

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Evolution of the GNSS Landscape

- New navigation satellite constellations and signals, building the “System of Systems”
- The IGS Multi-GNSS Experiment (M-GEX) in practice
- Reference frames in real-time with PPP-RTK
- Development of Galileo



Axis/Directions of GNSS Satellite Deployment (1/2)

- Current GNSS satellite constellation (04/2012)
 - 31 GPS operational
 - 24 GLONASS operational
 - 2 Giove and 2 IOV Galileo operational
 - 1 QZSS (tracked by geodetic receiver)
 - 11 COMPASS (tracked by geodetic receiver)
- Frequencies
 - GPS: L1, L2, L5
 - GLONASS: L1, L2
 - Galileo: E1, E5a, E5b, E5
 - QZSS: L1, L2, L5, LEX(6)
 - Compass: E2, E5b, E6
- Tracking Mode (C/A, P, L1C, L2C, I, Q, X=I+Q, ...)



Axis/Directions of GNSS Satellite Deployment (2/2)

- A today's GNSS Observation file (RINEX v.3 Header)

```
3.02          OBSERVATION DATA      M (MIXED)          RINEX VERSION / TYPE
NetR9 4.48          Receiver Operator  26-APR-12 00:00:00  PGM / RUN BY / DATE
CUT0                                MARKER NAME
...
G   12 C1C L1C S1C C2W L2W S2W C2X L2X S2X L7I S7I C6I      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 L7I S7I C6I C7X L7X S7X C8X L8X S8X      SYS / # / OBS TYPES
J   15 C1C L1C S1C C1X L1X S1X C2X L2X S2X L7I S7I C6I C6X  SYS / # / OBS TYPES
      L6X S6X          SYS / # / OBS TYPES
C    9 C2I L2I S2I C7I L7I S7I C6I L6I S6I          SYS / # / OBS TYPES
...
```

- View on tracked signals asks for new tools, e.g., filtering of observation classes
→ New website at EPN-CB



Detailed View on EPN Tracking Status



HOME **EUREF Permanent Network** ROB GNSS Research Group EUREF

ORGANISATION	TRACKING NETWORK	DATA & PRODUCTS	NEWS & MAILS	FTP & WEB ACCESS
Creation, Management, Structure, Relation to IGS, Projects, Guidelines, FAQ	Site maps, Site list, Proposed sites, Equipment & calibration, Site coordinates, Site log submission, Site picture submission	Data access, Analysis centres, Products, Time series, ETRS89/ITRS transformation, Formats	News, Mails, Calendar, Papers, Workshops, Web site history	Anonymous FTP, Web site index, Related links

[DATA & PRODUCTS](#) > **TRACKING STATUS**

Details on the GNSS signals included in the daily RINEX v2.11 data files available from the EPN data centres are given below. The GPS L1 signal is mandatory included in all GNSS data files and cannot be de-activated. When GLONASS is selected, the GLONASS L1 signal is also considered as mandatory (and cannot be de-activated).

Status on

Locate site on map

Tracking criteria selection

GPS
 using the signals :
 code : C1 C2 C5 P1 P2 P5
 phase : L1 L2 L5
 not using the signals :
 code : C1 C2 C5 P1 P2 P5
 phase : L1 L2 L5

GLONASS
 using the signals :
 code : C1 C2 P1 P2
 phase : L1 L2
 not using the signals :
 code : C1 C2 P1 P2
 phase : L1 L2

Karte **Satellit**

Google 1000 km 500 Meilen

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EPN Tracking Status



Status on 2012-04-23

Locate site on map

- Select a station -

Tracking criteria selection

GPS
using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5
not using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5

GLONASS
using the signals :
code : C1 C2 P1 P2
phase : L1 L2
not using the signals :
code : C1 C2 P1 P2
phase : L1 L2

Update map

Karte Satellit

Google 1000 km 500 Meilen

Grafiken © 2012 NASA, TerraMetrics - Nutzungsbedingungen



EPN Tracking Status



Status on 2012-04-23

Locate site on map

- Select a station -

Tracking criteria selection

GPS
 using the signals :
 code : C1 C2 C5 P1 P2 P5
 phase : L1 L2 L5
 not using the signals :
 code : C1 C2 C5 P1 P2 P5
 phase : L1 L2 L5

GLONASS
 using the signals :
 code : C1 C2 P1 P2
 phase : L1 L2
 not using the signals :
 code : C1 C2 P1 P2
 phase : L1 L2

Update map

Identification	Equipment	Tracking	Data flow
Receiver type: TRIMBLE NETR9			
Satellite system:	GPS	GLONASS	GALILEO
	yes	yes	yes
Antenna: TRM57971.00			
Radome: NONE			

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EPN Tracking Status



Status on 2012-04-23

Locate site on map
- Select a station -

Tracking criteria selection

GPS
using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5
not using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5

GLONASS
using the signals :
code : C1 C2 P1 P2
phase : L1 L2
not using the signals :
code : C1 C2 P1 P2
phase : L1 L2

Karte Satellit

Google 1000 km 500 Meilen

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EPN Tracking Status



Status on 2012-04-23

Locate site on map
- Select a station -

Tracking criteria selection

GPS
using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5
not using the signals :
code : C1 C2 C5 P1 P2 P5
phase : L1 L2 L5

GLONASS
using the signals :
code : C1 C2 P1 P2
phase : L1 L2
not using the signals :
code : C1 C2 P1 P2
phase : L1 L2

Update map

Karte Satellit

Google 1000 km 500 Meilen

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- Upgrade of GNSS tracking network, without compromising operational products
 - Careful equipment changes
 - Hold files of new data formats in separate archive directories
- Deliver new essential products to users (satellite orbits and clocks, inter-system biases,...)
- Quality check of new observations
 - run e.g. BNC tool
- Validate the reference frame from single system solutions
 - e.g., determine a GPS – GLONASS 3D-transition-vector



- The IGS Multi-GNSS Experiment (M-GEX) in practice



A Data Center for the IGS Multi-GNSS Experiment (M-GEX)



The screenshot shows the GDC (GNSS DATA CENTER) website interface. At the top, there is a navigation menu with links for Home, About Us, Data & Products, NTRIP, and Links. A search bar and a login section are also present. The main content area displays the 'Project Map: MGEX' with a world map showing various countries and red location pins. The map is powered by Google and includes a scale bar (2000 Meile/n, 2000 km). The footer contains links for '<impressum>', '<sitemap>', and '<contact>'.



IGS Multi-GNSS Experiment - Station List -



Show	FourCharacterId	Name	Country	Projects	stored in
Show	KIR8	Kiruna	Sweden	MGEX	MGEX
Show	KOUG	KOUROU	FRANCE (French Guian)	MGEX	MGEX
Show	KZN2	KAZAN	Russia	MGEX	MGEX
Show	LMMF	Aeroport Aime CESAIRE-LE LAMENTIN-Meteo Fra.	France	IGS MGEX	IGS
Show	MAR7	Maartsbo	Sweden	MGEX	MGEX
Show	MATG	MateraG	Italy	MGEX	MGEX
Show	MYVA	Reykjahlid / Iceland	Iceland	MGEX	MGEX
Show	NKLG	N'KOLTANG (GABON)	Gabon	IGS MGEX	IGS
Show	OHIX	O'Higgins / Antarctica	Antarctica	MGEX	MGEX
Show	ONS1	Onsala	Sweden	MGEX	MGEX
Show	REUN	La Reunion - Observatoire Volcanologique	France	IGS MGEX	IGS
Show	STK2	SHINTOTSUKAWA-A	Japan	IGS MGEX	IGS
Show	TLSE	Toulouse	France	IGS EUREF MGEX	IGS
Show	TSK2	TSUKUBA2-A	Japan	IGS MGEX	IGS
Show	USN4	U.S. Naval Observatory Time Service	USA	MGEX	MGEX

32 of 47 for M-GEX registered sites

Show	FourCharacterId	Name	Country	Projects	stored in
Show	KIR8	Kiruna	Sweden	MGEX	MGEX
Show	KOUG	KOUROU	FRANCE (French Guian)	MGEX	MGEX
Show	KZN2	KAZAN	Russia	MGEX	MGEX
Show	LMMF	Aeroport Aime CESAIRE-LE LAMENTIN-Meteo Fra.	France	IGS MGEX	IGS
Show	MAR7	Maartsbo	Sweden	MGEX	MGEX
Show	MATG	MateraG	Italy	MGEX	MGEX
Show	MYVA	Reykjahlid / Iceland	Iceland	MGEX	MGEX
Show	NKLG	N'KOLTANG (GABON)	Gabon	IGS MGEX	IGS
Show	OHIX	O'Higgins / Antarctica	Antarctica	MGEX	MGEX
Show	ONS1	Onsala	Sweden	MGEX	MGEX
Show	REUN	La Reunion - Observatoire Volcanologique	France	IGS MGEX	IGS
Show	STK2	SHINTOTSUKAWA-A	Japan	IGS MGEX	IGS
Show	TLSE	Toulouse	France	IGS EUREF MGEX	IGS
Show	TSK2	TSUKUBA2-A	Japan	IGS MGEX	IGS
Show	USN4	U.S. Naval Observatory Time Service	USA	MGEX	MGEX

Show	FourCharacterId	Name	Country	Projects	stored in
Show	USN5	U.S. Naval Observatory Time Service	USA	MGEX	MGEX
Show	WTZZ	Wetzell / Germany	Germany	IGS MGEX	IGS



IGS Multi-GNSS Experiment - Data Availability -



GDC GNSS DATA CENTER

User: Password:

Home About Us Data & Products NTRIP Links Help Project Filter: MGEX

Data & Products > Project Information > Data Availability > daily RINEX

Data Availability - daily

DOY: Year: RINEX Type: RINEX Version: Stations:

Stations	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114
ABMF - Aeroport du Raizet -LES ABYMES - Météo ...	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
AIRA - AIRA	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
BRST - Brest	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
BRUX - Brussels	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
CCJ2 - CHICHIJIMA-A	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
CONZ - Concepcion - TIGO	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
CUT0 - Curtin University Bentley	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
DYNG - DIONYSOS	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GMSD - GUTS Masda	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GOP6 - Pecny, Ondrejov / CZ	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GRA1 - Graz_B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GRA2 - Graz_B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GRAB - Graz_B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
GRAC - GRASSE	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
HARB - Hartebeesthoek	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
KIR8 - Kiruna	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
KOUG - KOUROU	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
KZN2 - KAZAN	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
LMMF - Aeroport Aime CESAIRE-LE LAMENTIN-Meteo...	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
MAR7 - Maartsbo	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
MATG - MateraG	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
MYVA - Reykjahlid / Iceland	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
NKLG - N'KOLTANG (GABON)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
OHIX - O'Higgins / Antarctica	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
ONS1 - Onsala	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
REUN - La Reunion - Observatoire Volcanologique	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
STK2 - SHINTOTSUKAWA-A	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
TLSE - Toulouse	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
TSK2 - TSUKUBA2-A	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
USN4 - U.S. Naval Observatory Time Service	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
USN5 - U.S. Naval Observatory Time Service	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
WTZZ - Wettzell / Germany	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

<impressum> <sitemap> <contact>

Info

In here you can see the data availability of daily rinex-files for stations of the selected project.

A coloured box shows you that the RINEX file is available for the day and you can download by clicking on the box. The colour of the box shows you the latency of the RINEX file, that is the time between the last epoch of the RINEX file and the arrival of the file at our DataCenter.


The **latencies** are:

- <= 6 hours
- <= 12 hours
- <= 24 hours
- <= 2 days
- <= 4 days
- > 4 days



IGS Multi-GNSS Experiment - Data Availability -




User:
Password:

[Home](#) | [About Us](#) | [Data & Products](#) | [NTRIP](#) | [Links](#) | | [Project Filter: MGEX](#)

Data & Products > Project Information > Data Availability > hourly RINEX

Data Availability - hourly

Hour: DOY: Year: Rinex Type: RINEX Version: Stations:

Stations	113 14 o	113 15 p	113 16 q	113 17 r	113 18 s	113 19 t	113 20 u	113 21 v	113 22 w	113 23 x	114 00 a	114 01 b	114 02 c	114 03 d	114 04 e	114 05 f	114 06 g	114 07 h	114 08 i
ABMF - Aeroport du Raizet -LES ABYMES - Météo ...																			
AIRA - AIRA																			
BRST - Brest																			
BRUX - Brussels																			
CCJ2 - CHICHIJIMA-A																			
CONZ - Concepcion - TIGO																			
CUT0 - Curtin University Bentley																			
DYNG - DIONYSOS																			
GMSD - GUTS Masda																			
GOP6 - Pecny, Ondrejov / CZ																			
GRA1 - Graz_B																			
GRA2 - Graz_B																			
GRAB - Graz_B																			
GRAC - GRASSE																			
HARB - Hartebeesthoek																			
KIR8 - Kiruna																			
KOUG - KOUROU																			
KZN2 - KAZAN																			
LMMF - Aeroport Aime CESAIRE-LE LAMENTIN-Meteo...																			
MAR7 - Maartsbo																			
MATG - MateraG																			
MYVA - Reykjavik / Iceland																			
NKLG - N'KOLTANG (GABON)																			
OHIX - O'Higgins / Antarctica																			
ONS1 - Onsala																			
REUN - La Reunion - Observatoire Volcanologique																			
STK2 - SHINTOTSUKAWA-A																			
TLSE - Toulouse																			
TSK2 - TSUKUBA2-A																			
USN4 - U.S. Naval Observatory Time Service																			
USN5 - U.S. Naval Observatory Time Service																			
WTZZ - Wettzell / Germany																			

[<impressum>](#) [<sitemap>](#) [<contact>](#)

Info ✕

In here you can see the data availability of hourly rinex-files for stations of the selected project.

A coloured box shows you that the RINEX file is available for the hour and you can download by clicking on the box. The colour of the box shows you the latency of the RINEX file, that is the time between the last epoch of the RINEX file and the arrival of the file at our DataCenter.

The **latencies** are:

- <= 5 min
- <= 10 min
- <= 30 min
- <= 1 hour
- <= 4 hours
- > 4 hours



IGS Multi-GNSS Experiment - File Browser -



GDC
GNSS DATA CENTER

User:
Password:

Home About Us Data & Products NTRIP Links Help Project Filter: MGEX

Data & Products > File Archives > File Browser

File tree:
highrate
highrate_v3
nrt
nrt_v3
obs
obs_v3
2012
051
gop60510.12d.Z
gop60510.12g.Z
gop60510.12m.Z
gop60510.12n.Z
grac0510.12d.Z
myva0510.12d.Z
myva0510.12g.Z
myva0510.12n.Z
ohix0510.12d.Z
ohix0510.12g.Z
ohix0510.12n.Z
050
049
048
047
046
045
044
043
042
041
040
039
038
037
036
035
034
033
032

File-Information of ohix0510.12d.Z

Station:	D'Higgins / Antarctica
Receiver:	LEICA GRX1200+GNSS
Antenna:	LEIAR25.R3 LEIT
Received:	2012-02-21 08:46:03
Filename:	ohix0510.12d.Z
Filepath:	archive/MGEX/obs_v3/2012/051/
Filesize:	1.16 MB
Number of Observations:	
Maximal Observations:	

[<impressum>](#) [<sitemap>](#) [<contact>](#)

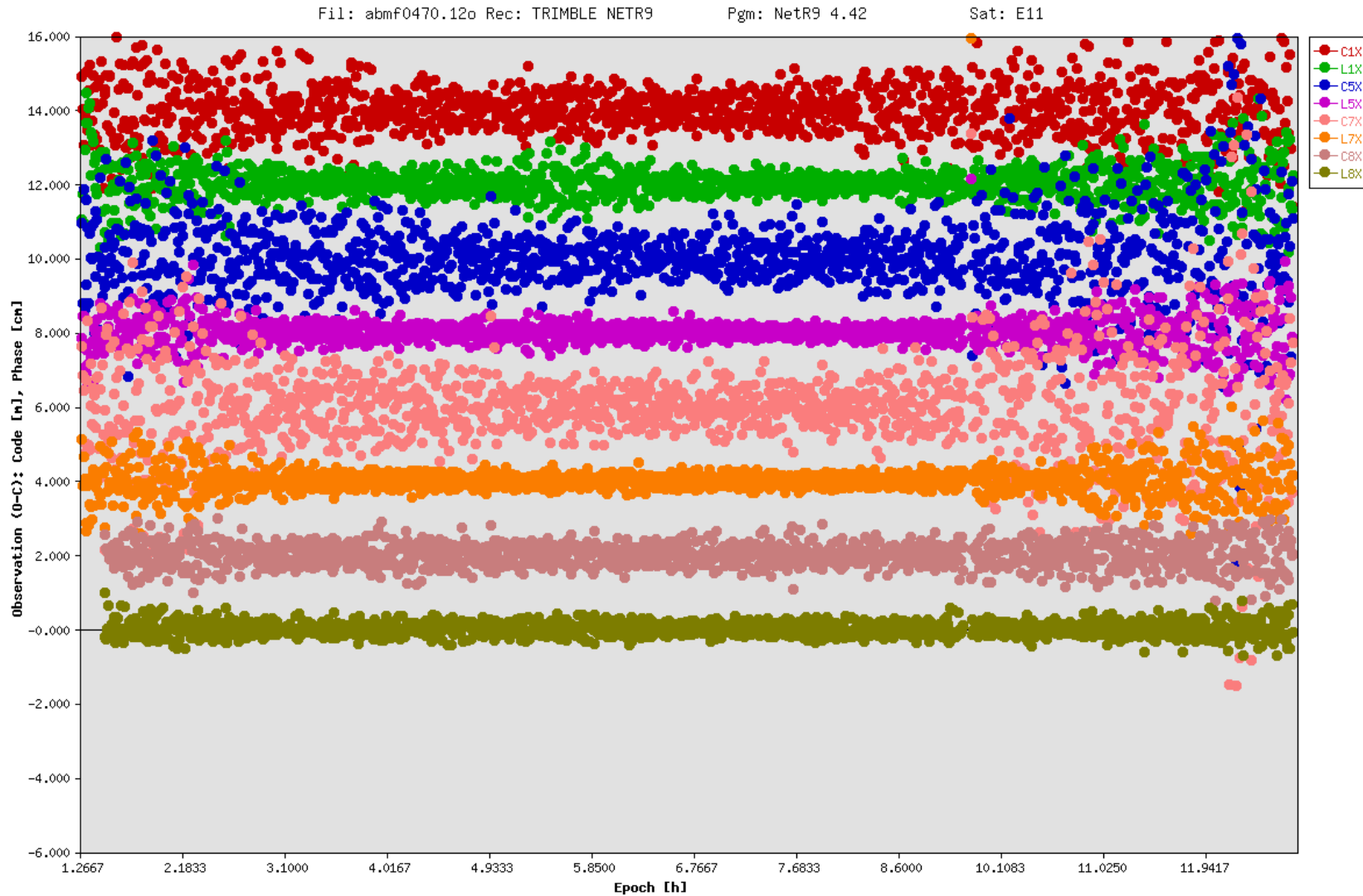


M-GEX Receiver Types (32 Sites)

Site	Project	ReceiverType ▼	SatteliteSystem	FirmwareVersion
GRA1	MGEX	TRIMBLE NETR5	GPS	1.1-3 28 Apr 2005
TLSE	IGS	TRIMBLE NETR9	GPS+GLONASS	4.42
MAR7	MGEX	TRIMBLE NETR9	not defined	4.43
ONS1	MGEX	TRIMBLE NETR9	not defined	4.43
KIR8	MGEX	TRIMBLE NETR9	not defined	4.43
KZN2	MGEX	TRIMBLE NETR9	not defined	4.43
REUN	IGS	TRIMBLE NETR9	GPS+GLONASS+GALILEO	4.42
BRST	IGS	TRIMBLE NETR9	GPS+GLONASS+GALILEO	4.42
LMMF	IGS	TRIMBLE NETR9	GPS+GLONASS+GALILEO	4.42
ABMF	IGS	TRIMBLE NETR9	GPS+GLONASS+GALILEO	4.42
STK2	IGS	TRIMBLE NETR9	GPS	4.45
GMSD	IGS	TRIMBLE NETR9	GPS	4.48
CCJ2	IGS	TRIMBLE NETR9	GPS	4.45
DYNG	EUREF	TRIMBLE NETR9	GPS+GLONASS	4.42
CUT0	MGEX	TRIMBLE NETR9	GPS+GLONASS+GALILEO+QZSS+COMPASS	4.48
NKLG	IGS	TRIMBLE NETR9	GPS+GLONASS	4.42
HARB	IGS	TRIMBLE NETR9	GPS+GLONASS	4.42
GRAC	MGEX	TRIMBLE NETR9	GPS+GLONASS	4.42
AIRA	IGS	TRIMBLE 5700	GPS	1.24
USN4	MGEX	SEPT POLARX4TR	not defined	2.3
BRUX	IGS	SEPT POLARX4TR	GPS+GLONASS	2.3-tst120216r34012
USN5	MGEX	NOV OEM6	not defined	OEM060000RN0000
GOP6	MGEX	LEICA GRX1200+GNSS	GPS+GLONASS+GALILEO+SBAS	8.51/6.110
OHIX	MGEX	LEICA GRX1200+GNSS	GPS+GLONASS+GALILEO	8.50/6.110
CONZ	IGS	LEICA GRX1200+GNSS	GPS+GLONASS	8.51/6.110
GRA2	MGEX	LEICA GRX1200+GNSS	GPS+GLONASS	8.50 / 6.110
MATG	MGEX	LEICA GRX1200+GNSS	GPS+GLONASS+GALILEO	8.51/6.110
KOUG	MGEX	LEICA GR10	GPS+GLONASS	4.010.S9
MYVA	MGEX	LEICA GR10	GPS+GLONASS+GALILEO	6.110
WTZZ	IGS	JAVAD TRE_G3TH DELTA	GPS+GLONASS	3.3.8 MAR,20,2012
TSK2	IGS	JAVAD TRE_G3TH DELTA	GPS	3.4.0a3_qzs
GRAB	IGLOS	IFEN SX_NSR_RT_400	not defined	phase 3



- C8Q and L8X: (E5=E5a+E5b)
- C8X smallest code-noise
- L8X smallest phase-noise (e.g. for low elevation)





New Tool for Editing and Quality Control - Concatenation of Hourly RINEX v3 Files -



BKG Ntrip Client (BNC) Version 2.6

File Help

Network General RINEX Observations RINEX Ephemeris RINEX Editing & QC Broadcast Corrections Feed Engine Serial Output Outag

RINEX file editing, concatenation and quality check.

Action Edit/Concatenate Set Edit Options

Input files (full path) dyng108?.12o Obs Nav

Output files (full path) dyng1080.12o Obs Nav

Log

Streams: resource loader / mountpoint

Log Throughput Latency PPP Plot

Add Stream Delete Stream Start Stop Help ?=Shift+F1

RINEX Editing Options

RNX Version 3 Sampling 0 sec

Start 1967-11-02 00:00:00 End 2099-01-01 00:00:00

Old New

Marker Name

Antenna Name

Receiver Name

Help=Shift+F1 OK / Save Cancel



- Reference frames in real-time with PPP-RTK



- Local RTK networks
 - a few cm accuracy within a few observation epochs
 - local reference stations and reference frames realization
 - no activity from EUREF in this domain
- PPP-RTK
 - PPP is global approach
 - provide and apply precise SSR information
 - concept doesn't request local reference stations
 - global reference frame realization; if needed transformed to regional or local reference frames
 - EUREF real-time product and data streams



PPP-RTK & Open Standards Symposium Frankfurt am Main, 2012



PPP - RTK & Open Standards - Symposium and Workshop - March 12-14, 2012 - Frankfurt am Main - Germany



RTCM – SSR Working Group



- **Primary goal:**
 - Development of messages to exchange information about **GNSS error states (SSR)** for **precise positioning** applications **including RTK**
 -
- Working Group established in 2007
 - ~15 members
- 3 Stage Development Plan
 1. **Satellite Orbits, Clocks, Satellite Code Biases**
 - **Code Based DF-RT-PPP**
 2. **Vertical Ionosphere (VTEC), Satellite Phase Biases**
 - **Code Based SF-RT-PPP, Carrier based DF-RT-PPP with AR**
 3. **Slant Ionosphere (STEC) and Troposphere**
 - **RTK**



EUREF Real-Time Data Streams



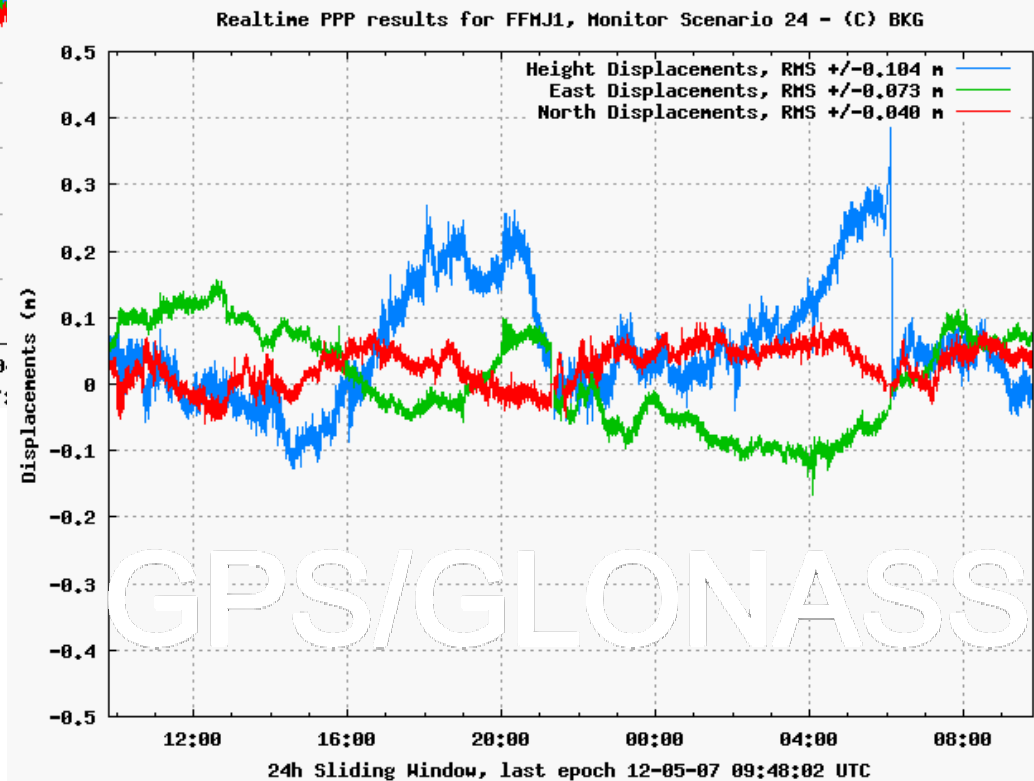
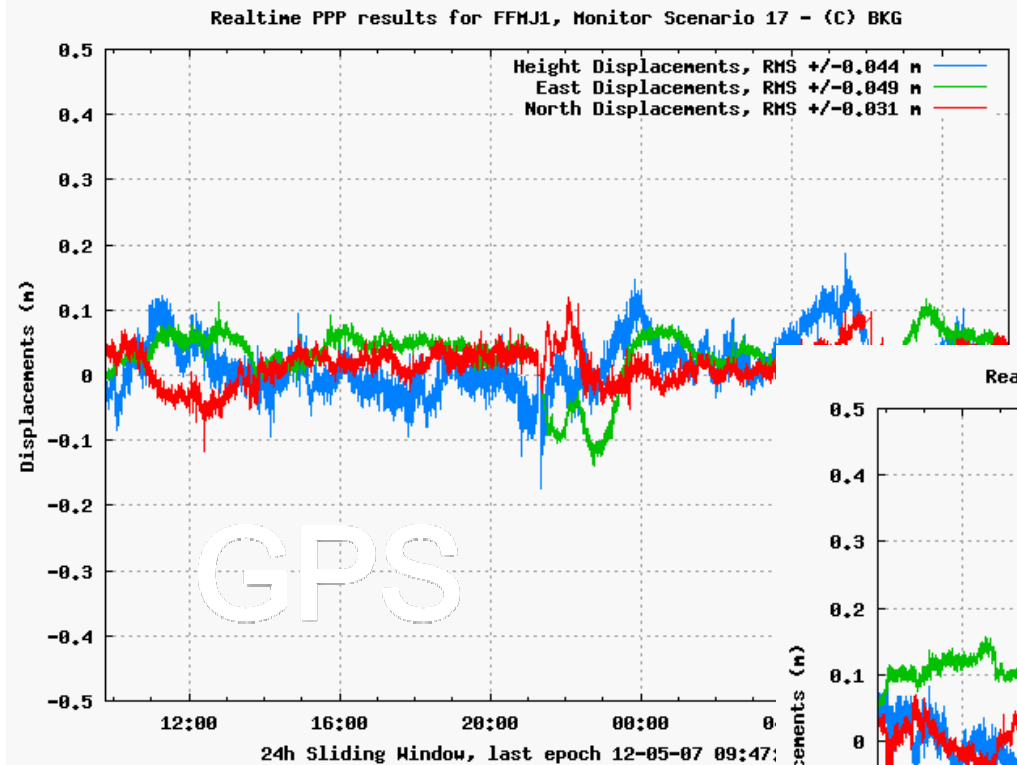


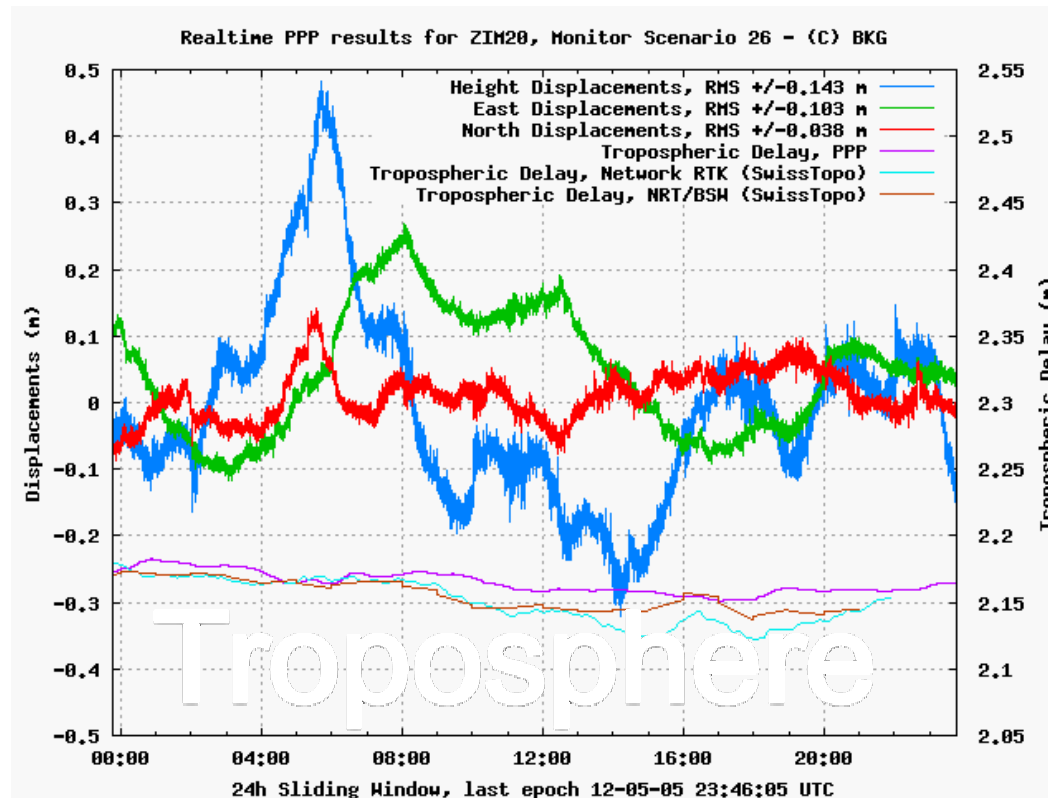
Message	Contents
1057	GPS orbit corrections to Broadcast Ephemeris
1058	GPS clock corrections to Broadcast Ephemeris
1059	GPS code biases
1060	Combined orbit and clock corrections to GPS Broadcast Ephemeris
1061	GPS User Range Accuracy
1062	High-rate GPS clock corrections to Broadcast Ephemeris
1063	GLONASS orbit corrections to Broadcast Ephemeris
1064	GLONASS clock corrections to Broadcast Ephemeris
1065	GLONASS code biases
1066	Combined orbit and clock corrections to GLONASS Broadcast Ephemeris

Caster IP:Port	Mountpoint & Input Streams	Ref. Point	GNSS	Messages	Orbits	Reference System	Analysis Center & SW	Register for access
www.euref-ip.net:2101	EUREF01	APC	GPS	1059, 1060	IGS Ultra Rapid	ETRF2000	KF Combination BNC	Registration
www.euref-ip.net:2101	EUREF02	APC	GPS GLO	1057,1058,1059 1063,1064,1065	CODE Ultra Rapid	ETRF2000	KF Combination BNC	Registration

Helmert Transformation Parameters for Transformation to Regional Systems

Regional System	Tx, Ty, Tz (m)	dTx, dTy, dTz (m/y)	Rx, Ry, Rz (mas)	dRx, dRy, dRz (mas/y)	S (10 ^{**} -9) dS (10 ^{**} -9/y)	T0 for Rates
ETRF2000	0.0541 0.0502 -0.0538	-0.0002 0.0001 -0.0018	0.891 5.390 -8.712	0.081 0.490 -0.792	0.40 0.08	2000.0







Ambiguity resolution turns PPP into PPP-RTK



	PPP	PPP-RTK
Ambiguity fixing (zero-diff., real-time)	no	yes
Convergence time	~ 30 min	a few epochs (sec.)
Phase bias correction	no	yes
Inonosphere modeling	yes	yes
Throposphere information	no	yes

- Commercial services for PPP and PPP-RTK available
- Big market in “precision farming”
- Open standard (here RTCM) will foster more applications



Galileo Geodetic Reference Interface (GGRI) Working Group



- Established by EC/ESA with European experts from geodesy (some experts from EUREF organizations)
- Kickoff October 2010
- Goal: Create conditions for transition from the “Service Provider” prototype to a permanent geodetic service
- Content
 - Review of baseline “Galileo Reference Service Provider” (GRSP) – a EU 6th framework project – and of the “Time and Geodetic Validation Facility” (TGVF/OVF) – industrial project led by ThalesAleniaSpace-France
 - User Types and Applications
 - Requirements for additional GRSP Products and Services
- Final report June 2012 (tbd); publication not yet decided



- EUREF supports all satellite navigation systems
 - data archive extended by RINEX version 3
 - GLONASS recommended in analysis guidelines
 - website at EPN central bureau ready for multi-GNSS
- EUREF established real-time services
 - data and product streams
 - permanent PPP monitoring
 - development of tools, e.g., BNC
- EUREF organizations take part in Galileo developments
 - Galileo reference frame
 - Galileo geodetic working group