



## Alberding solutions for GNSS infrastructure operators

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Alberding GmbH

3<sup>rd</sup> EUPOS Council and Technical Meeting

14-15 November 2016, Prague, Czech Republic

# Outline



**About us**

**Alberding GNSS Status Software**

**Alberding-QC**

**Alberding DataConv**

# Alberding GmbH



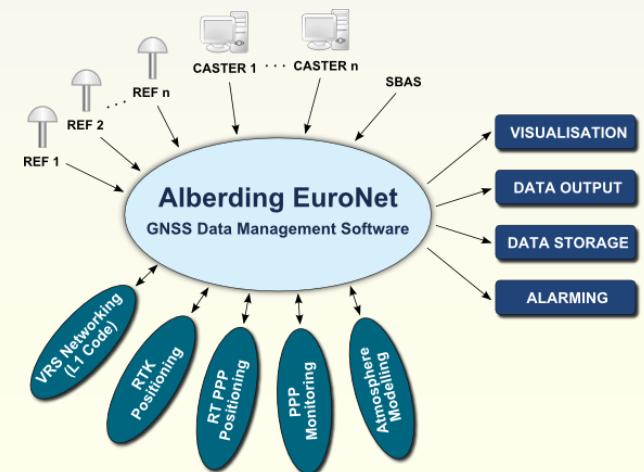
- German GNSS software and hardware development company
- Based in Wildau (near Berlin)
- More than 20 years of experience in high-accuracy GNSS positioning
- Specialised in GNSS data communication, management, processing and monitoring
- Customised solutions for GNSS infrastructure operators
- Independent from GNSS receiver manufacturers



# Alberding GNSS Status Software



- **Central GNSS data management**
  - Real-time data collection
  - RINEX logging (v 2.11, v 3.0x)
  - Real-time data redirection (TCP, Ntrip)
- **Data processing modules**
  - Real-time positioning (DGNSS, RTK, PPP)
  - Post-processed PPP positioning
  - DGNSS VRS networking
  - Atmosphere modelling
- **Web interface**
  - Visualisation
  - Alarming
  - Reporting



# Alberding GNSS Status Software



- **Application areas:**

- GNSS observation data quality monitoring
- External sensor data monitoring
- GNSS reference station antenna position stability monitoring (post-processed PPP)
- DGNSS/RTK/PPP service quality control
- Monitoring of atmospheric processes

# Alberding GNSS Status Software



- **GNSS observation data quality**
  - Raw data availability, latency, completeness
  - Number of satellites
  - DOP values, skyplot
  - Multipath
  - Cycle slips
  - Signal quality ( $C/N_0$ )
- **Position quality**
  - Accuracy (N,E,H)
  - Statistical values
- **External sensor data**
  - Weather station
  - Tilt sensor
  - Geotechnical sensors
- **Troposphere**
  - Zenith Total Delay
  - Integrated Water Vapour

# Observation data monitoring



Alberding GNSS Status Software

● EuroNet Process  
● EuroNet Cron  
● HD Used 62%

SUMMARY
MONITORING
SETUP - SYSTEM
GET EURONET.CFG
SETUP - INTERFACE
LOG & RINEX FILES
RINEX CONFIGURATION
DATA OUTPUT

Summary

00:00:41

Map

Raw Data Inputs

KRA2	KGA1	KOPE
KRA2	PRA1	PRA2
STAL	STA2	

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# Observation data monitoring



Alberding GNSS Status Software

SUMMARY MONITORING SETUP - SYSTEM GET EUROMET.CFG SETUP - INTERFACE LOG & RINEX FILES RINEX CONFIGURATION DATA OUTPUT

EuroNet Process EuroNet Cron HD Used 62%

Status with station information

00:00:13 Stop

Status Information --- System Time: 11-11-2016 08:36:01 (UTC)

Name	Availability	HDOOP	VOOP	PDOOP	Delay [s]	Number of Satellites		
Raw Data Inputs Display all								
ARA2	2016-11-11T08:35:49	0.8	1.0	1.2	0.1	G08 G10 G11 G14 G16 G18 G21 G27 G32 R06 R07 R08 R14 R21 R22 R23		
KGA1	2016-11-11T08:35:49	0.7	0.9	1.2	0.1	G01 G08 G10 G11 G14 G16 G18 G21 G27 G32 R06 R07 R08 R13 R21 R22 R23		
KOPE	2016-11-11T08:35:49	0.6	0.8	1.0	0.1	G01 G08 G10 G11 G14 G16 G18 G21 G27 G32 R06 R07 R08 R13 R14 R21 R22 R23		
KRA2	2016-11-11T08:35:49	0.7	0.8	1.1	0.7	G01 G08 G10 G11 G14 G16 G18 G21 G27 G32 R06 R07 R08 R13 R14 R21 R22 R23		
PRA1	2016-11-11T08:35:49	0.7	0.9	1.2	0.1	G01 G08 G10 G11 G14 G16 G18 G21 G27 G32 R06 R07 R08 R13 R14 R21 R22 R23		
PRA2	2016-11-11T08:35:49	1.0	1.3	1.6	0.1	G08 G10 G11 G14 G16 G18 G21 G27 G32		
STA1	2016-11-11T08:35:49	0.9	1.2	1.5	0.1	G01 G08 G10 G11 G16 G18 G21 G27 G32		
STA2	2016-11-11T08:35:49	0.8	1.0	1.2	0.1	G01 G08 G10 G11 G16 G18 G21 G27 G32 R06 R07 R08 R13 R21 R22 R23		
Name	Availability	Temperature [°C]	Pressure [hPa]	Humidity [%]	Wind azimuth	Wind speed [m/s]	Rain increment [0.1mm]	Hail indicator [L/0]
Meteorological Data Display all								
ARA2	2016-11-11T07:59:30	1.2	868.5	89.8	119.0	1.0	0.0	0
KGA1	-	-	-	-	-	-	-	-
KOPE	-	-	-	-	-	-	-	-
KRA2	2016-11-11T07:59:30	5.8	917.4	77.4	306.0	0.2	0.0	0
PRA1	2016-11-11T07:59:54	1.9	992.8	92.9	53.0	0.1	0.1	0
PRA2	-	-	-	-	-	-	-	-
STA1	-	-	-	-	-	-	-	-
STA2	2016-11-11T07:59:30	4.2	971.3	84.5	103.0	0.4	0.0	0
Name	Availability	Tilt north [°]	Tilt east [°]					
Tilt Data Display all								
ARA2	2016-11-11T07:59:30	0.17400	0.72100					
KGA1	2016-11-11T07:59:55	-0.20800	-0.33800					
KOPE	-	-	-					
KRA2	2016-11-11T07:59:30	0.77600	0.59800					
PRA1	2016-11-11T07:59:45	-0.03500	-0.04300					
PRA2	-	-	-					
STA1	-	-	-					
STA2	2016-11-11T07:59:30	0.08100	-0.02300					

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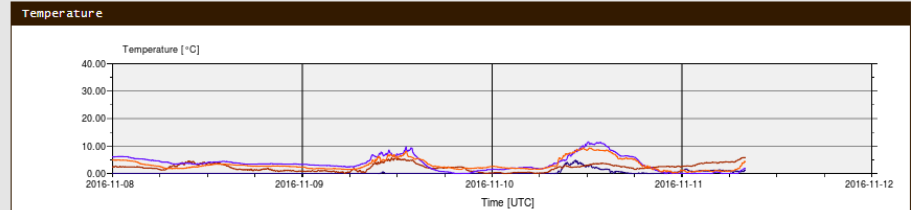
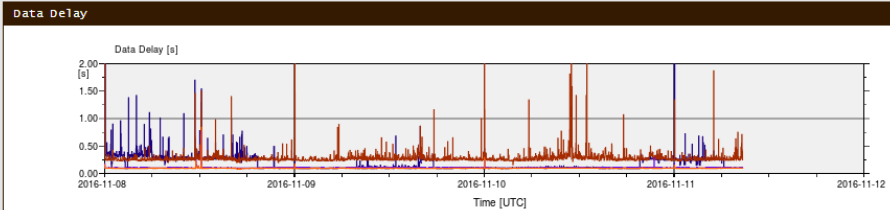
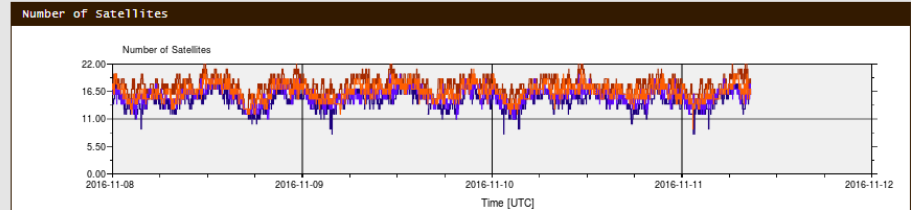
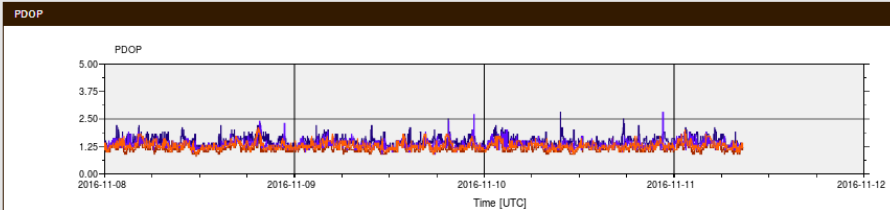
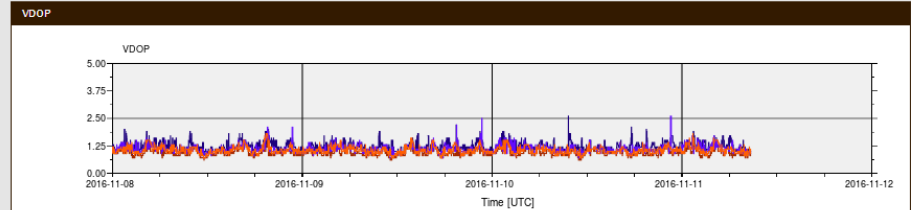
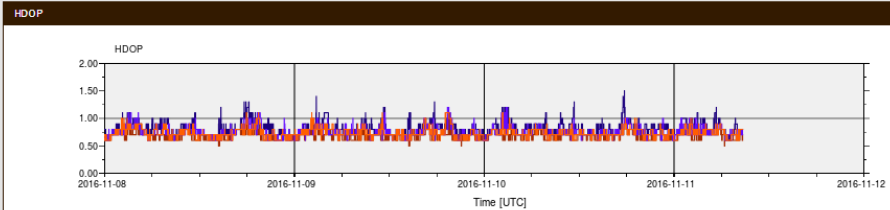
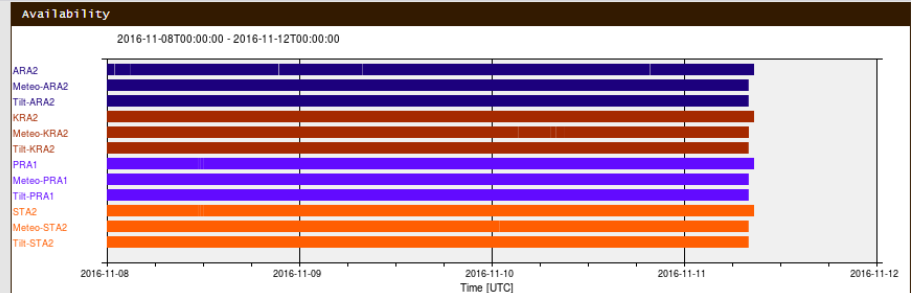




# Observation data monitoring

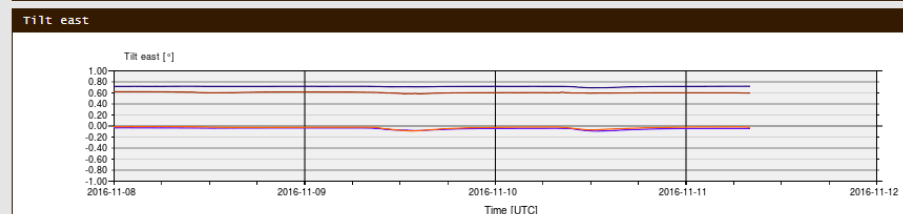
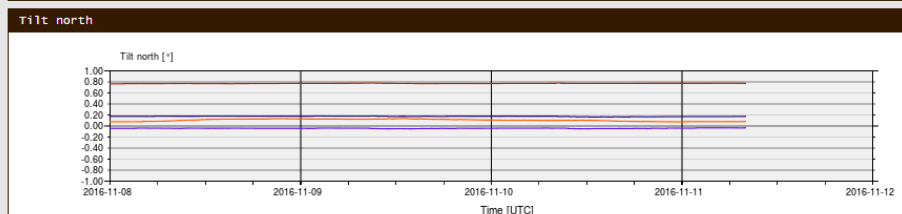
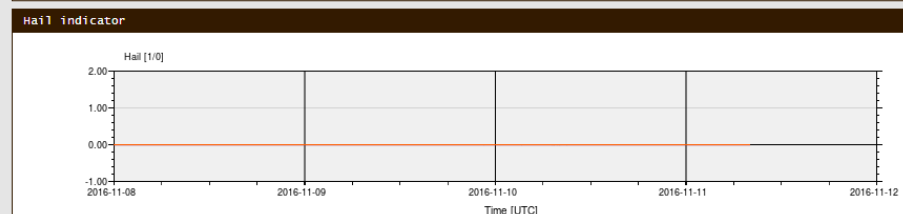
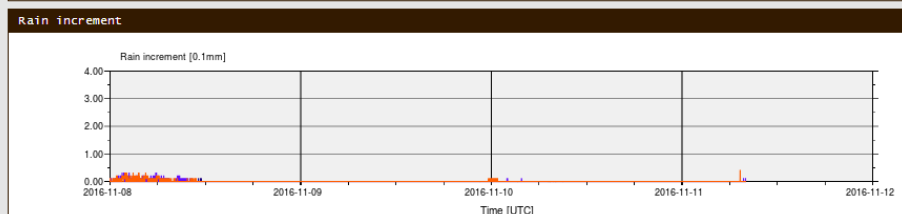
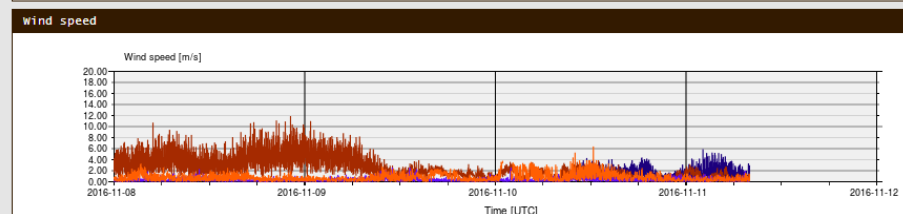
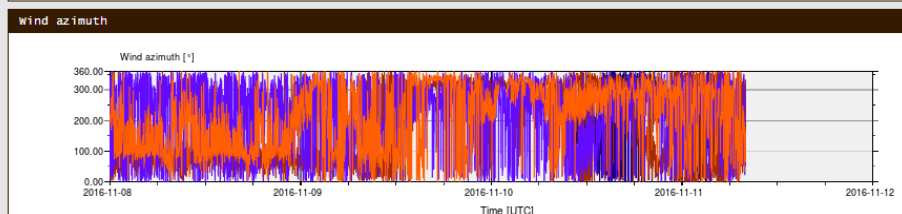
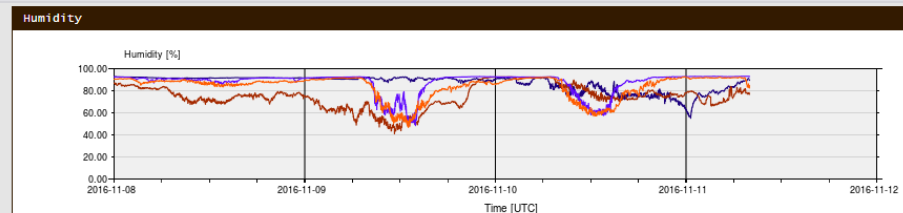
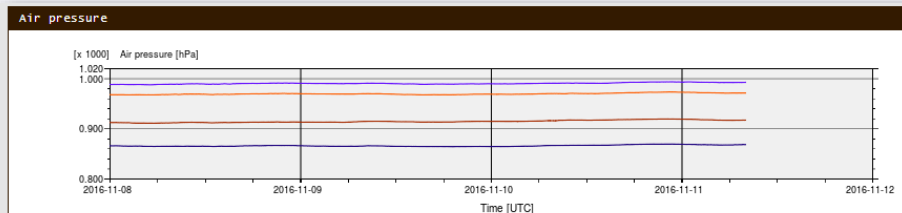


Statistics	ARA2			KRA2			PRA1			STA2
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min
Number of SVs	8.0	19.0	14.8	12.0	22.0	17.9	11.0	20.0	15.8	9.0
Data Delay	0.09	6.42	0.18	0.16	141.34	0.31	0.09	0.76	0.11	0.08
Temperature	-5.70	4.80	-1.77	0.00	5.80	2.22	-0.70	11.50	3.54	0.20
Pressure	864.30	869.80	866.34	911.30	919.80	915.00	987.80	993.90	990.65	967.70
Humidity	55.10	92.90	86.94	41.20	92.60	74.63	48.40	93.00	87.55	46.90
Wind azimuth	0.00	359.00	207.05	0.00	359.00	167.75	0.00	359.00	231.84	0.00
Wind speed	0.10	5.80	1.41	0.00	11.80	2.40	0.00	2.70	0.39	0.00
Rain	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.30	0.01	0.00
Tilt north	0.17	0.18	0.18	0.76	0.78	0.77	-0.05	-0.03	-0.04	0.07
Tilt east	0.69	0.72	0.72	0.58	0.62	0.61	-0.09	-0.03	-0.05	-0.09
Availability [%]	G:99.27 M:99.16 T:99.16			G:99.99 M:98.49 T:99.16			G:99.68 M:99.16 T:99.16			G:99.69



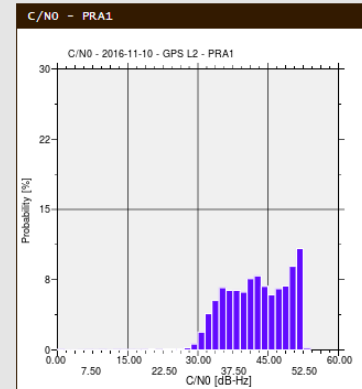
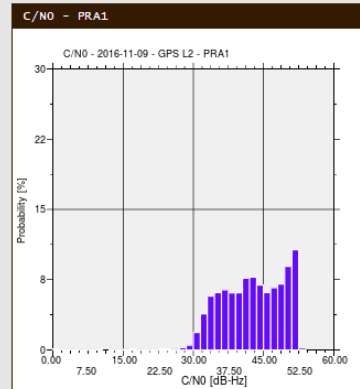
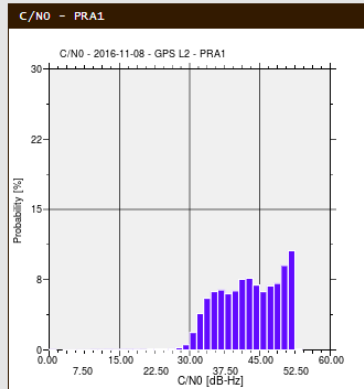
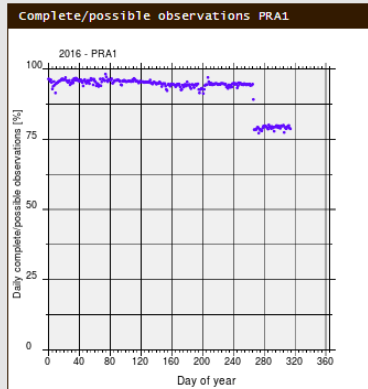
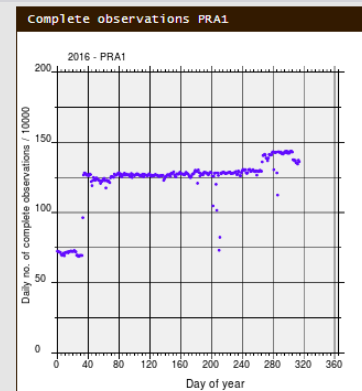
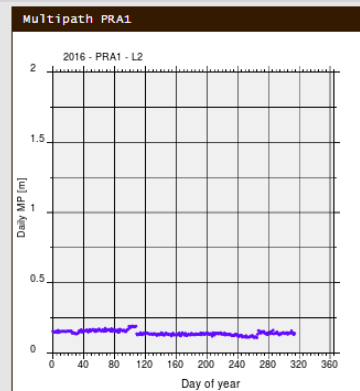
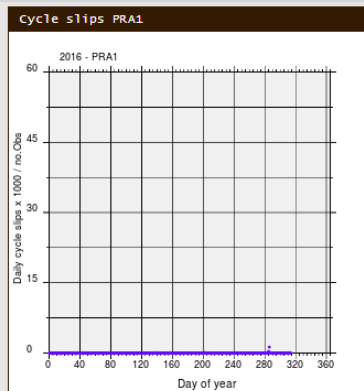
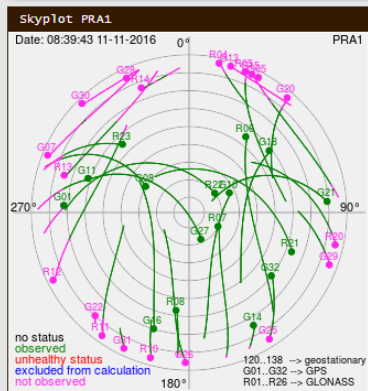
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# Observation data monitoring



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# Observation data monitoring



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# Observation data monitoring



Alberding GNSS Status Software

SUMMARY MONITORING **SETUP - SYSTEM** GET EURONET.CFG SETUP - INTERFACE LOG & RINEX FILES RINEX CONFIGURATION DATA OUTPUT

EuroNet Process  
EuroNet Cron  
HD Used 62%

Edit -> ARA2  
Created: 2016-01-28T11:02:16

Delete	User Name	[active] Mail	[active] SMS	No Data [s]	No Data Wezeo [s]	No Data Tilt [s]	Satellites (Time)	Data Delay (Time)	HDOP (Time)	VDOP (Time)	PDOP (Time)	Temp. (Time)	Press. (Time)	Hum. (Time)	wind speed (Time)	Rain (Time)	Hail (Time)	Tilt north (Time)	Tilt east (Time)
<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	120 [s]	7500 [s]	7500 [s]	4 [#] (60 [s])	5 [s] (60 [s])	7 (60 [s])	7 (60 [s])	7 (60 [s])	-10 35 [°C] (60 [s])	800 110 [hPa] (60 [s])	20 95 [%] (60 [s])	10 [m/s] (60 [s])	5 [0.1mm] (60 [s])	(60 [s])	-5 5 (60 [s])	-5 5 (60 [s])
<input type="checkbox"/>	katja	<input checked="" type="checkbox"/>	<input type="checkbox"/>	120 [s]	7500 [s]	7500 [s]	4 [#] (60 [s])	5 [s] (60 [s])	7 (60 [s])	7 (60 [s])	7 (60 [s])	-10 35 [°C] (60 [s])	800 110 [hPa] (60 [s])	20 95 [%] (60 [s])	10 [m/s] (60 [s])	5 [0.1mm] (60 [s])	(120 [s])	-1 1 (600 [s])	-1 1 (600 [s])
<input type="checkbox"/>	nfabiani	<input checked="" type="checkbox"/>	<input type="checkbox"/>	120 [s]	7500 [s]	7500 [s]	4 [#] (60 [s])	5 [s] (60 [s])	7 (60 [s])	7 (60 [s])	7 (60 [s])	-10 35 [°C] (60 [s])	800 110 [hPa] (60 [s])	20 95 [%] (60 [s])	10 [m/s] (60 [s])	5 [0.1mm] (60 [s])	(120 [s])	-1 1 (600 [s])	-1 1 (600 [s])

Edit default values by no input for new user in mail and user name!

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# RINEX and raw data logging



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SUMMARY MONITORING SETUP - SYSTEM GET EURONET.CFG SETUP - INTERFACE LOG & RINEX FILES RINEX CONFIGURATION DATA OUTPUT

EuroNet Process  
EuroNet Cron  
HD Used 44%

RINEX Setup

Number	Stations	Duration	Data rate	Lock
10	ARA2			
11	ARA2			
12	KG1			
13	KG1			
14	KOPE			
15	KOPE			
16	KRA2			
17	KRA2			
18	PRA1			
19	PRA1			
20	ARA2			
21	PRA2			
22	STA1			
23	STA1			
24	STA2			
25	STA2			
26	ARA2			
27	KG1			
28	KOPE			
29	KRA2			
30	KOPE			
31	PRA1			
31	PRA2			

Alberding GNSS Status Software

SUMMARY MONITORING SETUP - SYSTEM GET EURONET.CFG SETUP - INTERFACE LOG & RINEX FILES RINEX CONFIGURATION DATA OUTPUT

EuroNet Process  
EuroNet Cron  
HD Used 44%

RINEX Setup

1 day Duration of data  
30 s Data rate  
ARA2 Marker  
 Hatanaka (CRX)  
gz1p .gz Compression  
move Upload  
User  
Password  
Server  
Path  
5 minutes Upload timeout  
Upload bandwidth restriction in kB/s  
Phase alignment specification  
Don't output these types (like L2, C1C, GC15)  
 Generate almanac file  
 Use RINEX 2.12  
 Use RINEX 3  
2.11 Set RINEX version (override above settings)  
 Use raw data instead of RINEX  
 Use old naming convention for RINEX 3  
 Use one mixed navigation file  
 Sort satellites by PRN  
 Add observation count in header  
RINEX 3 info part of name (e.g. 0000CU)  
 Activate GPS  
 Activate GLONASS  
 Activate Galileo  
 Activate QZSS  
 Activate SBAS  
 Activate Beidou  
ARA2 RINEX header: Marker name  
Aren 2 RINEX header: Marker number  
1110 PAB101 RINEX header: Observer  
Geodetic uplink RS RINEX header: Agency  
Geodetic uplink RS RINEX header: Run-By  
1831178 RINEX header: Receiver number  
LEICA GR25 RINEX header: Receiver type  
3.22.1818 RINEX header: Receiver version  
LEIAR20 LEIM RINEX header: Antenna type  
RINEX header: Antenna number  
4239308.7454 RINEX header: Position X  
1176563.8551 RINEX header: Position Y  
4604205.1655 RINEX header: Position Z  
-0.0006 RINEX header: Antenna Delta E  
0.0007 RINEX header: Antenna Delta N  
0.0800 RINEX header: Antenna Delta H  
RINEX header: Comment

1 day Duration of data  
30 s Data rate  
default Marker  
20Hz Hatanaka (CRX)  
10 Hz  
5 Hz Compression  
2 Hz Upload  
1 s User  
5 s Password  
10 s  
15 s Server  
30 s Path  
1 m  
5 minutes Upload timeout

2.11 Set RINEX version (override above settings)  
2.11 Use raw data instead of RINEX  
2.12 Use old naming convention for RINEX 3  
3.00 Use one mixed navigation file  
3.01 Sort satellites by PRN  
3.02  
3.03 Add observation count in header

hatanaka (CRX)  
gz1p .gz Compression  
none Upload  
gz1p .gz User  
b21p2 .b22 Password  
xz .xz Server  
zip .zip Server  
7zip .7z Path  
compress .Z Upload timeout  
zip archive .zip Upload bandwidth

move Upload  
no User  
scp Password  
ftp Server  
lftp Server  
copy Path  
ng Upload timeout

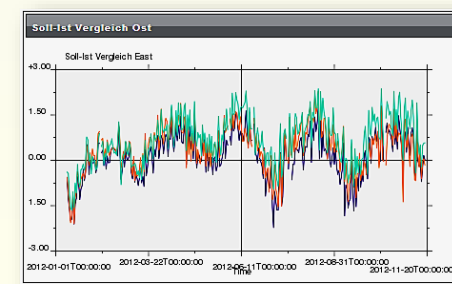
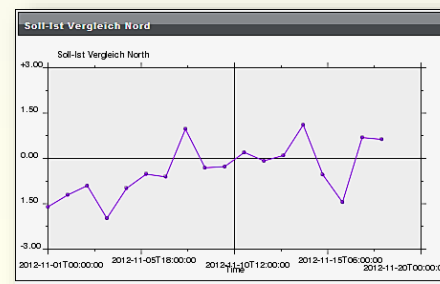
Activate changes

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# Post-processed PPP monitoring



- Reference station coordinates
- Independent from the RTK networking algorithms
- Post processing of 24h RINEX files
- Web based status monitoring
- History data on time series plots
- Comparative analysis, differential plots
- Customisable alarm generation



# PPP monitoring results



PPP-Monitoring SAPOS R1 x

saposmonitoring.dgpsonline.eu/pppmonitoring.cgi-bin/pppmonitoring.cgi?

STATUSÜBERSICHT | DIAGRAMME | WARNUNG | ZUSAMMENFASSUNG | BERECHNUNGSABLAUF

Reload in: 0 Tage 08:01:32

**Soll-Ist Vergleich Nord**

**Soll-Ist Vergleich Ost**

**Soll-Ist Vergleich Höhe**

**Einstellungen**

Beginn: 01-01-2012

Ende: 20-11-2012

Station:

- Atzey2
- Birkenfeld
- Koblenz
- Mayen
- Pirmasens
- Simmern
- Bernkastel-Kues
- Daun
- Landau
- Meisenheim
- Pruem
- Trier
- Bingen2
- Kaiserslautern
- Ludwigshafen
- Montabaur2
- Rodershausen
- Wissen

Auswahl:

Basisstation:

- Atzey2
- Birkenfeld
- Koblenz
- Mayen
- Pirmasens
- Simmern
- Bernkastel-Kues
- Daun
- Landau
- Meisenheim
- Pruem
- Trier
- Bingen2
- Kaiserslautern
- Ludwigshafen
- Montabaur2
- Rodershausen
- Wissen
- absolut

Peaks:

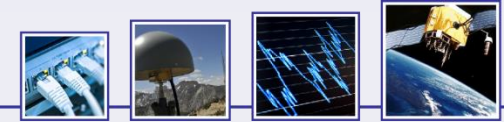
Download:

**Details der PPP-Lösung - Atzey2**

Datum	2012-11-18
Zeitspanne	24:00 h
Fehlende Epochen (Datenrate 30 s)	0
Soll-Ist (N   E   H)	-0.88 cm   -0.02 cm   -0.65 cm
Sigma (N   E   H)	0.05 cm   0.08 cm   0.16 cm
Navigationssystem	GPS GLOIASS
GPS Beobachtungstypen (Sigma)	C1/P2 (0.87 cm)
GLOIASS Beobachtungstypen (Sigma)	C1/P2 (0.77 cm)
Auswertezentrum	ESOC
Antennenkorrekturen des Satelliten	igs08.atx
Antennenkorrekturen des Empfängers	0529.atx
Antennenbezeichnung	LEIAT504GG LEIS 201025
Empfängerbezeichnung	LEICA GRX1200+GNSS



# Troposphere monitoring



- Real-time Precise Point Positioning (PPP) based troposphere estimation
- Tropospheric Zenith Total Delay (ZTD)
- Integrated Water Vapour (IWV)

Status with station information

00:00:38 Stop

Status Information			
Name	Availability	ZTD	IWV
<b>Raw Data Inputs</b>			
CLK91	2016-05-18T13:00:43		
RTCM3EPH	2016-05-18T13:00:43		
<b>Troposphere Monitoring Inputs</b>			
BAIA	2016-05-18T13:01:15	2.32	12.74
BAIA_Meteo	2016-05-18T13:00:43		
BEIU	2016-05-18T13:01:16	2.33	14.58
BIST	2016-05-18T13:01:16	2.28	12.31
CHTK	2016-05-18T12:59:43	2.32	13.73
CLUJ	2016-05-18T13:01:16	2.28	16.90
DEBR	2016-05-18T13:01:16	2.35	14.69
DORO	2016-05-18T13:01:16	2.33	12.46
FRAN	2016-05-18T13:01:16	2.31	13.66
FUZE	2016-05-18T13:01:16	2.35	14.43
HUST	2016-05-18T13:01:16	2.35	8.26
KOLS	2016-05-18T13:01:16	2.26	14.94
KOLS_Meteo	2016-05-18T13:00:43		
KOSE	2016-05-18T13:01:16	2.34	20.79
MISC	2016-05-18T13:01:16	2.34	15.86
MIZG	2016-05-18T13:00:22	2.27	18.81
MUKA	2016-05-18T13:01:16	2.34	13.09
MUKA_Meteo	2016-05-18T13:00:43		
MYKO	2016-05-18T13:01:16	2.30	10.97
NYLZ	2016-05-18T13:01:16	2.37	17.50
ORAD	2016-05-18T13:01:16	2.35	14.85
PRES	2016-05-18T13:01:16	-	-
PUSP	2016-05-18T13:01:16	2.36	14.27
RAHI	2016-05-18T13:01:16	2.26	13.05
RISA	2016-05-18T13:01:16	2.32	13.57
RJNT	2016-03-30T12:05:43	-	-
SALG	2016-05-18T13:01:16	2.31	14.17
SAMB	2016-05-18T13:01:16	2.29	11.81
SATU	2016-05-18T13:01:16	2.36	15.88
SKOL	2016-05-18T13:01:16	2.24	4.33
SKRV	2016-05-18T13:01:16	2.31	13.96
SKSK	2016-05-18T13:01:15	2.31	14.43
SKSV	2016-05-18T13:01:16	2.32	18.60

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Tamás Horváth

Alberding solutions for GNSS infrastructure operators

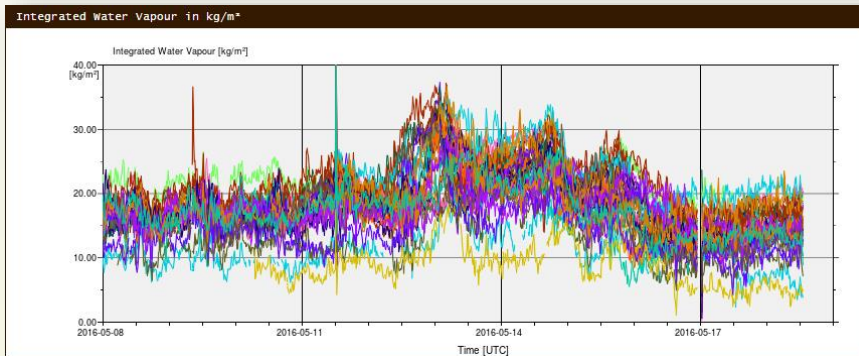
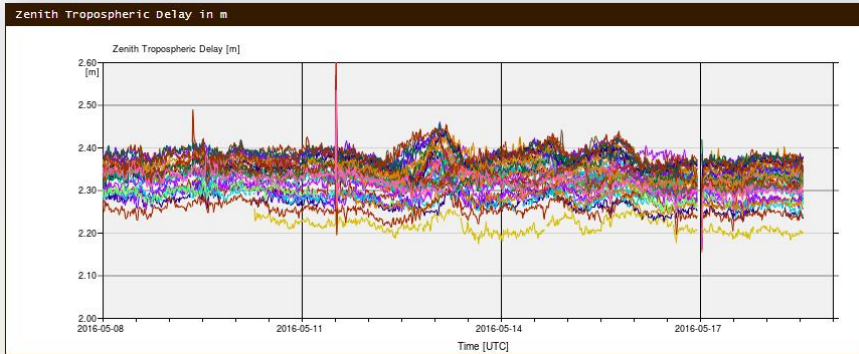
15.11.2016 16/38



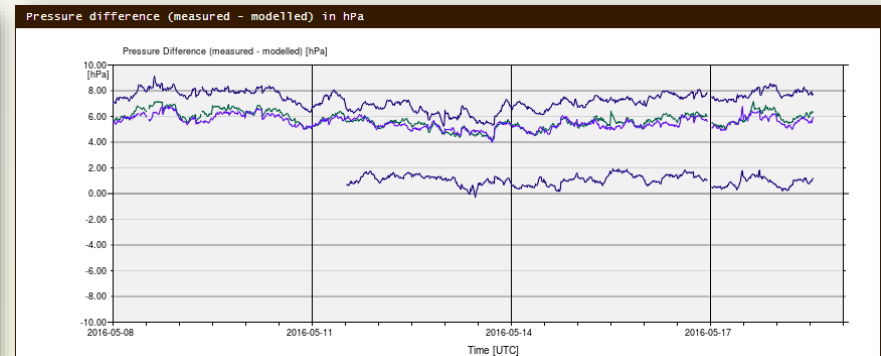
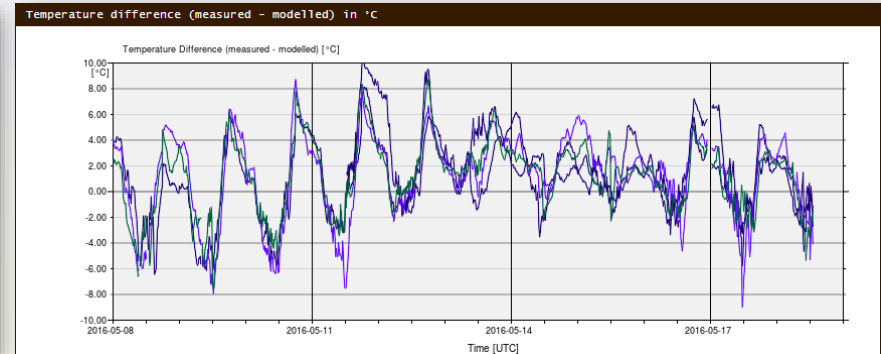
# Troposphere monitoring



- ZTD and IWV time series plots



- Temperature and pressure differences

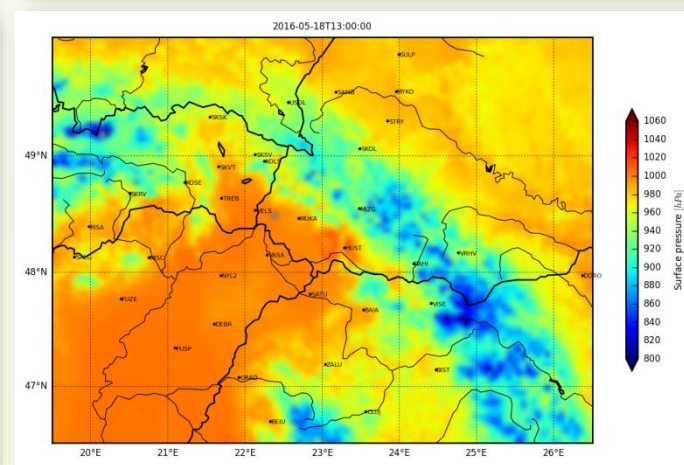
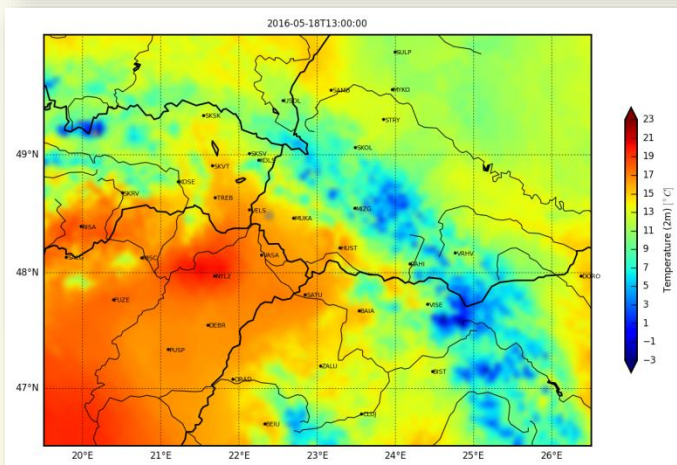
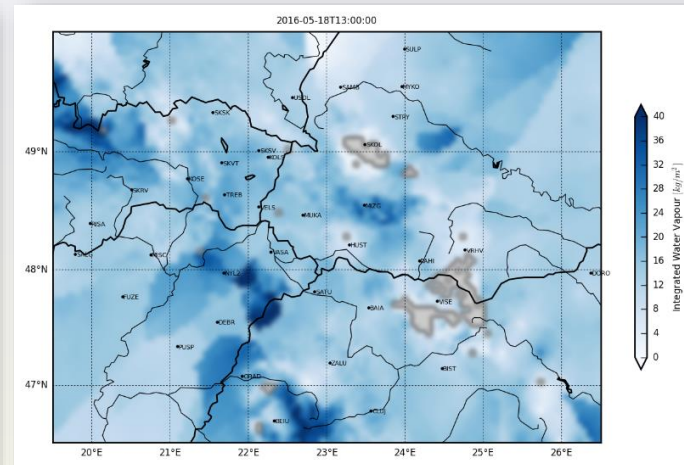
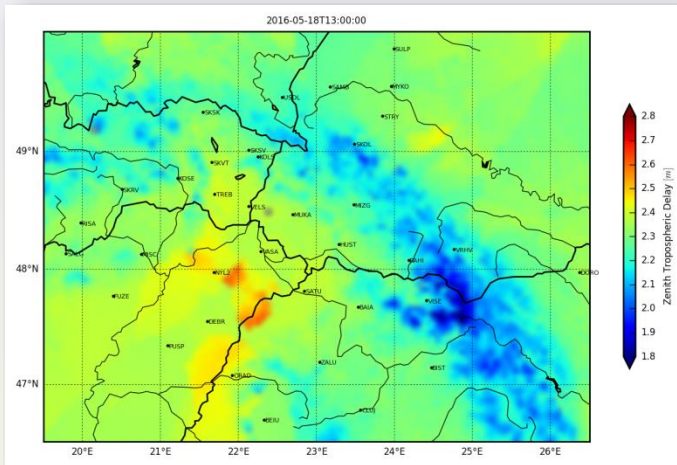


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# Troposphere monitoring

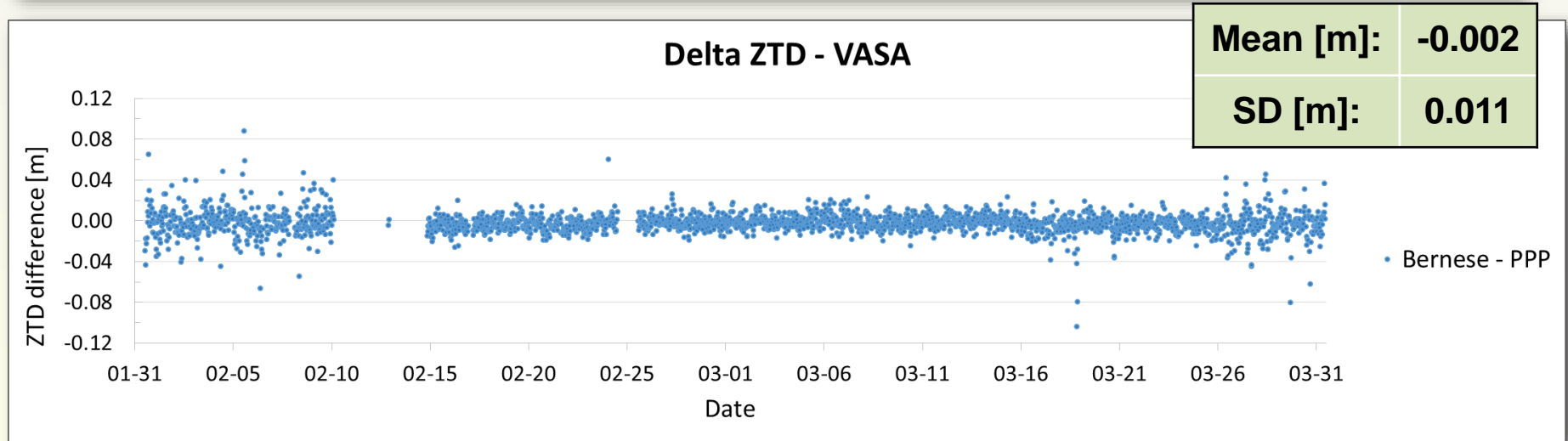
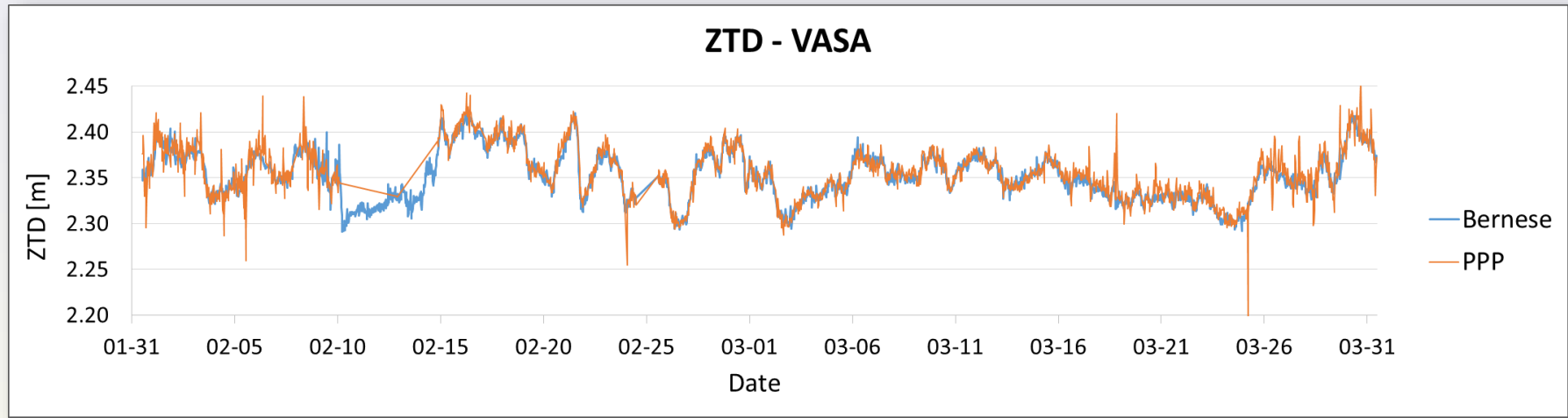


- Real-time ZTD, IWV, temperature and pressure surface maps



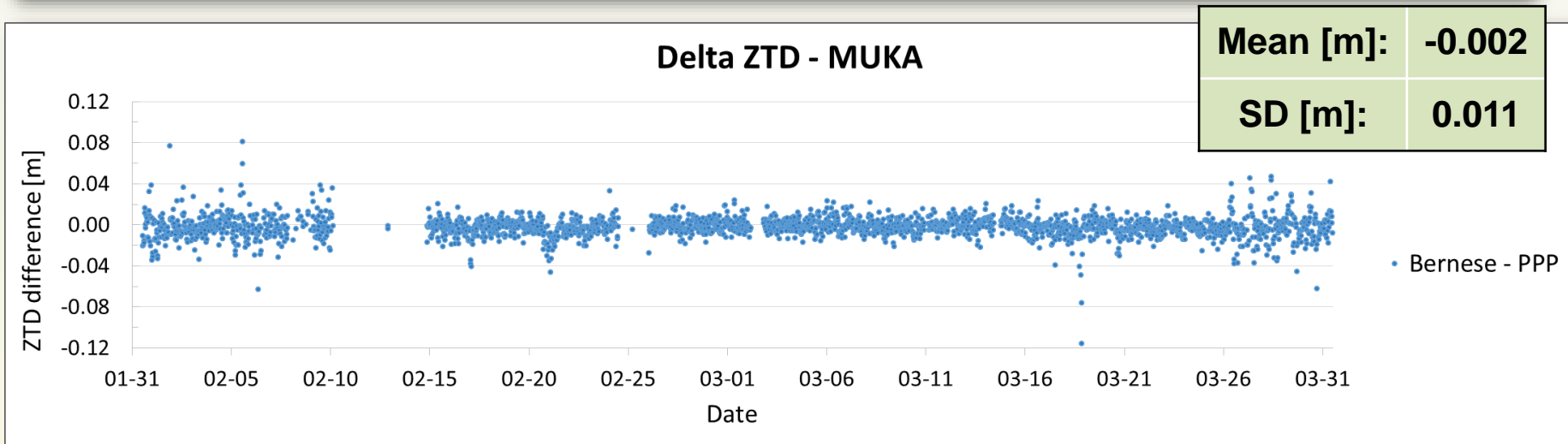
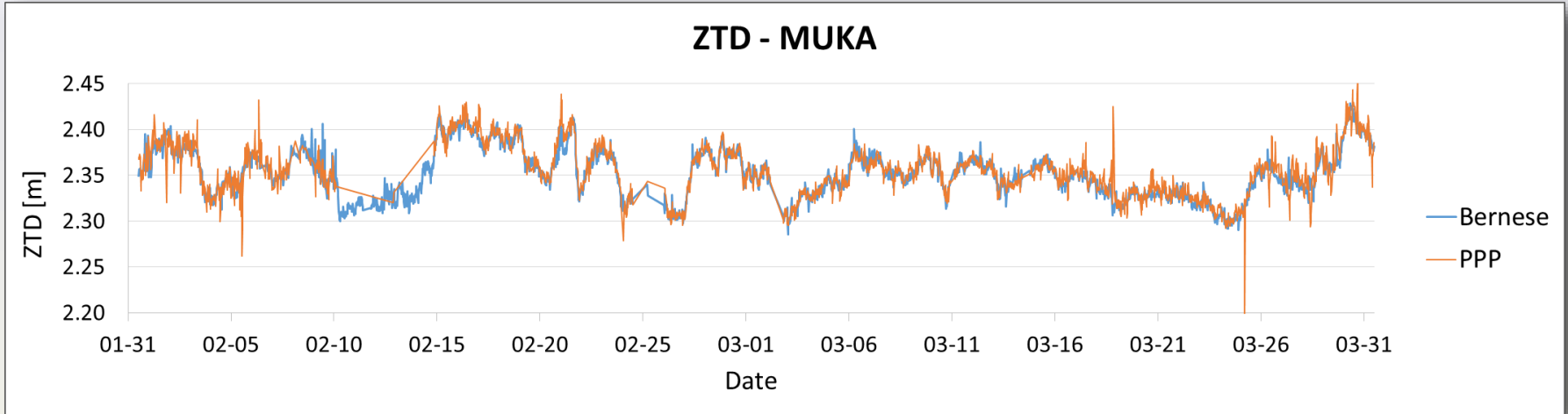
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# ZTD validation with Bernese V5.2



Bernese ZTD data provided by FÖMI SGO, Hungary

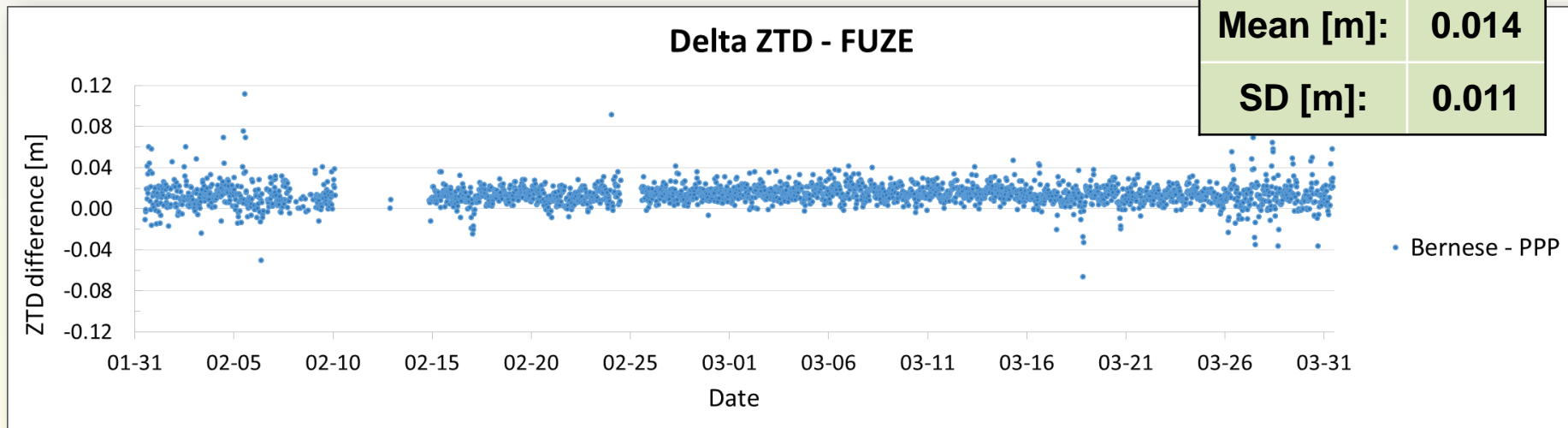
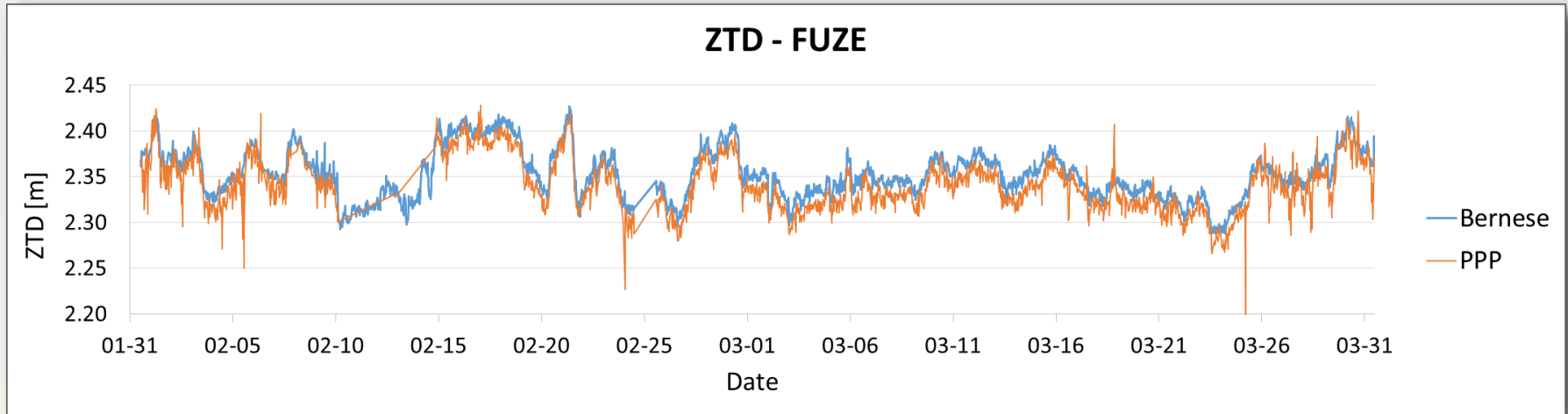
# ZTD validation with Bernese V5.2



Bernese ZTD data provided by FÖMI SGO, Hungary



# ZTD validation with Bernese V5.2



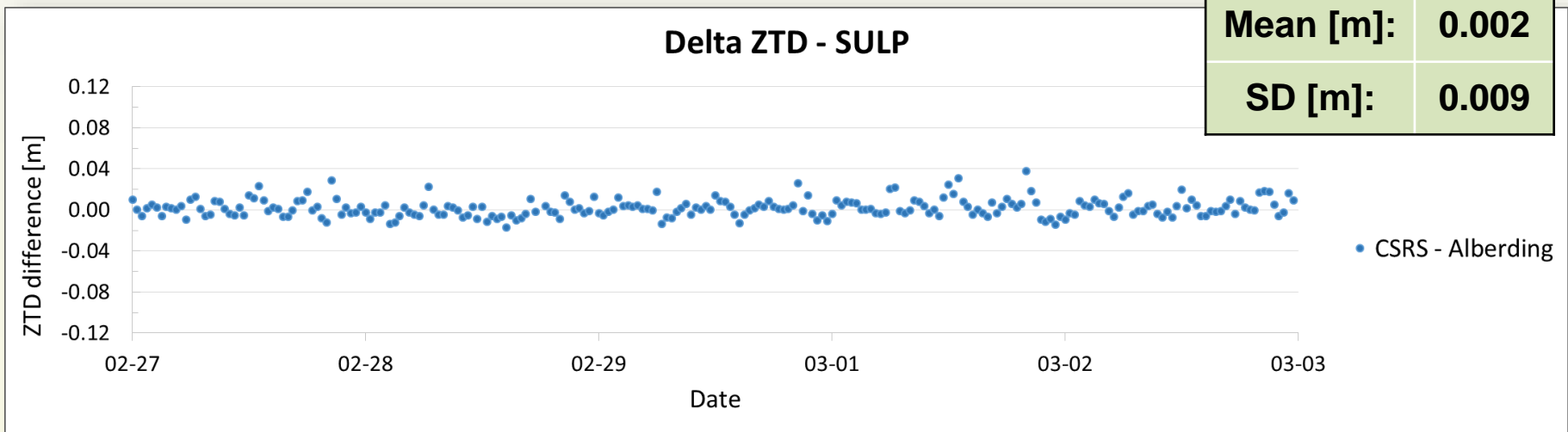
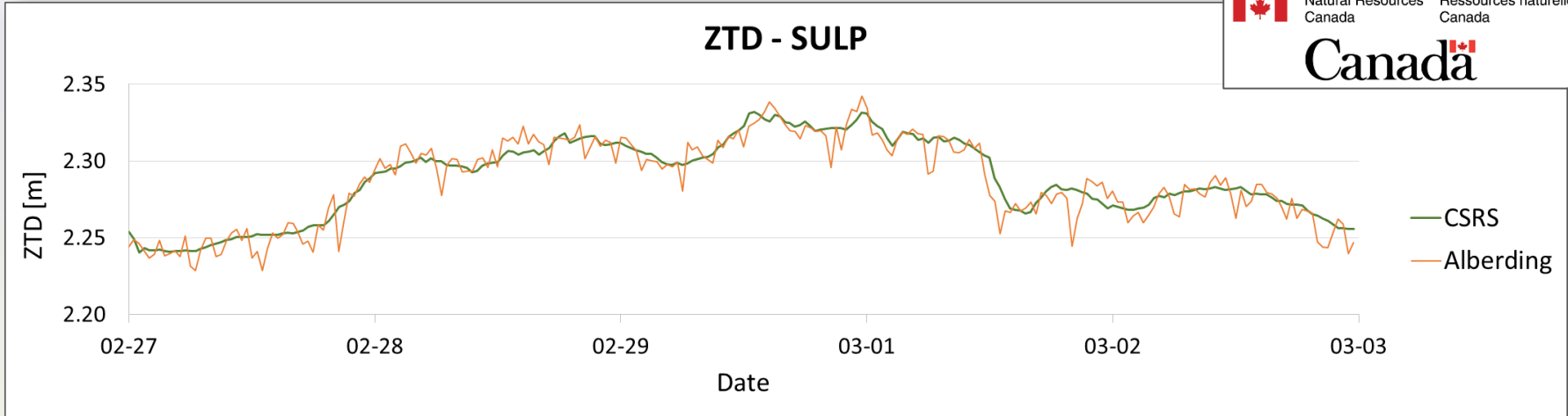
Bernese ZTD data provided by FÖMI SGO, Hungary

# ZTD validation with Bernese V5.2



Station ID	Mean [m]	SD [m]
BAIA	0.013	0.012
DEBR	0.016	0.012
FUZE	0.014	0.011
MISC	0.019	0.012
MUKA	-0.002	0.011
NYL2	-0.002	0.010
ORAD	0.022	0.018
PUSP	0.017	0.011
RJNT	0.006	0.013
SALG	0.017	0.013
SAMB	0.001	0.013
SATU	0.014	0.012
SKOL	0.003	0.014
STRY	0.001	0.011
SULP	-0.001	0.013
VASA	-0.002	0.011
VRHV	0.001	0.014
<b>Average</b>	<b>0.008</b>	<b>0.012</b>

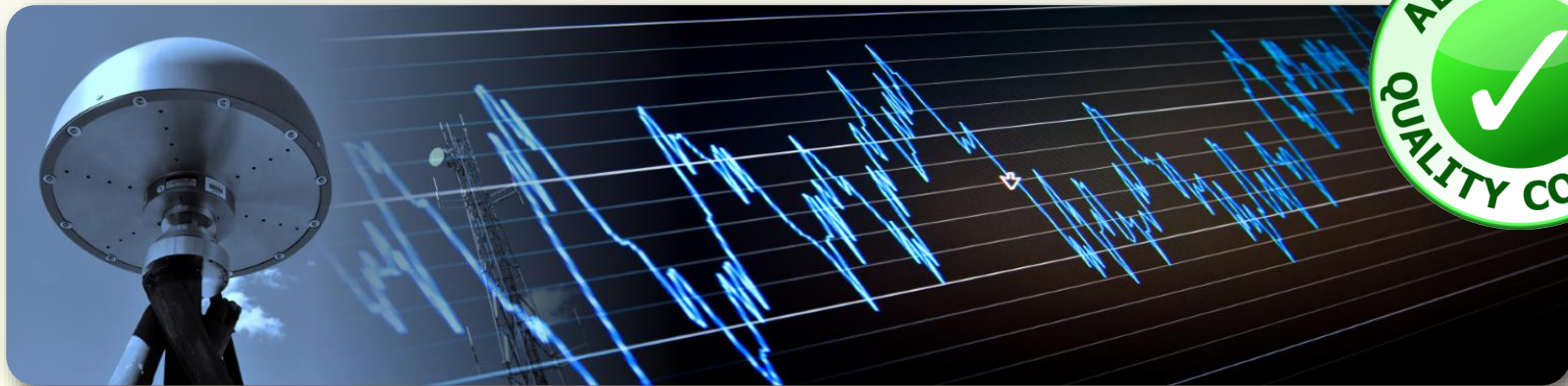
# ZTD validation with CSRS-PPP



# Alberding-QC – service monitoring

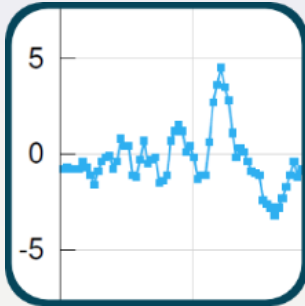


- Quality control software for DGNSS, RTK and PPP service providers
- Multi-purpose tool: 3 modules integrated into a single web interface
- Monitors service availability, accuracy and data contents
- Software licence or service provided by Alberding GmbH





# Alberding-QC software modules



## RTK-Check

- Positioning accuracy and ambiguity fixing time

Stream	
AMDS [0]	alberding
❗ LEIJ_RTK [0]	alberding
❗ SE001_TEST [0]	alberding
TITZ_CMR [0]	alberding
WALTBD_RAW [0]	ntrip d

## Checkstream

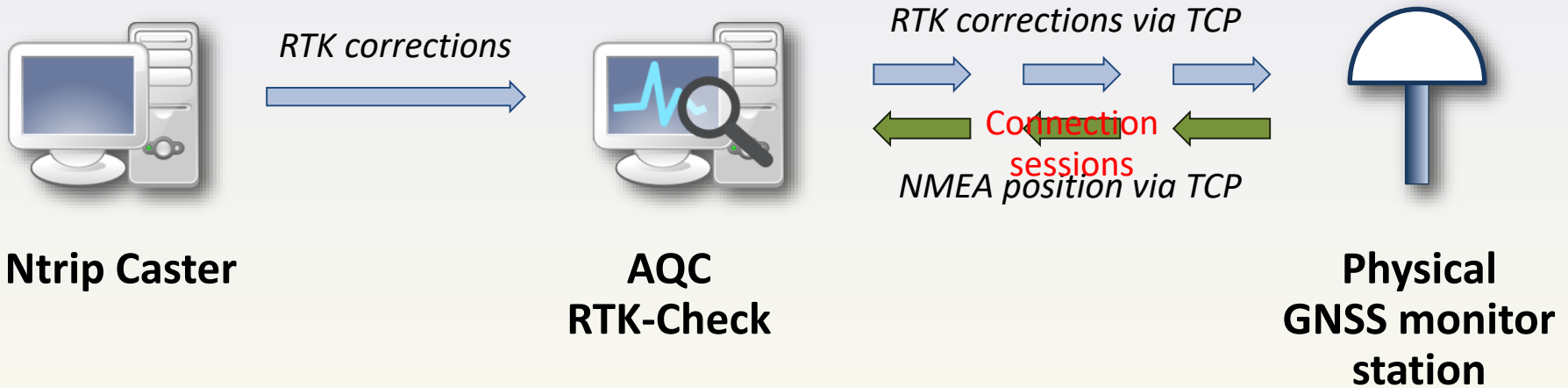
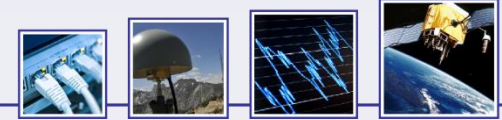
- Ntrip stream availability and data consistency



## InspectRTCM

- GNSS binary data decoding and visualisation

# RTK-Check concept – physical station



**Ntrip Caster**

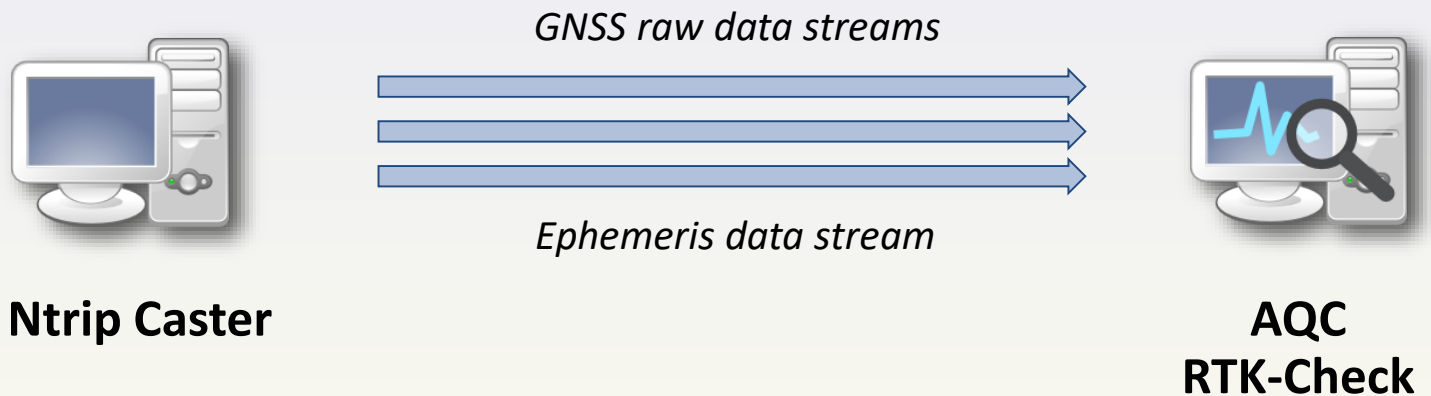
**AQC  
RTK-Check**


**Physical  
GNSS monitor  
station**

- Correction data forwarding
- NMEA data analysis
- Mean of the best quality epochs
- Statistics computation
- Visualisation of the results
- Warnings (email/SMS)

RTK position  
computation  
Receiver FW

# RTK-Check concept – internal process.

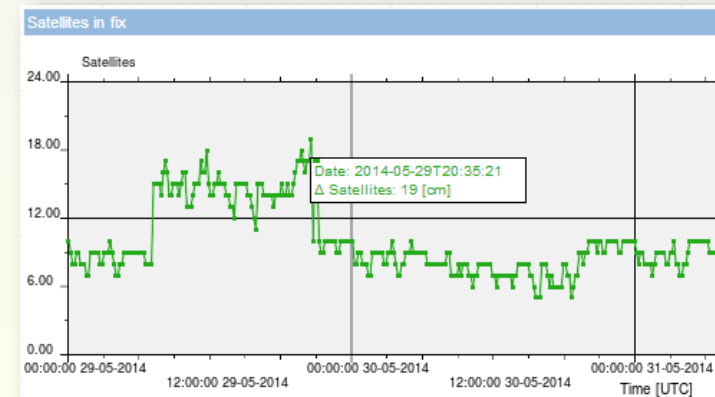
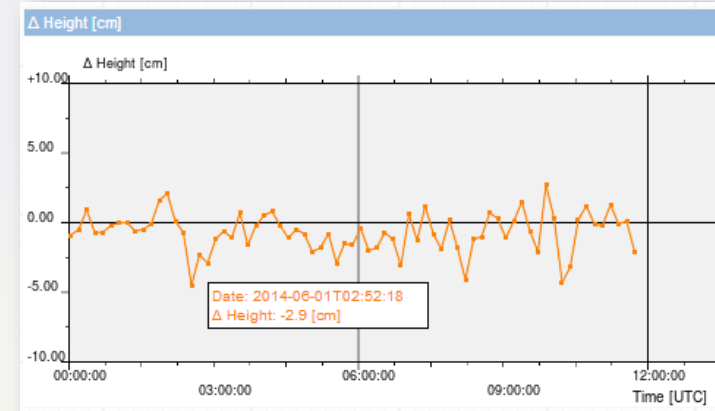


- **Internal data processing in sessions (RTKLIB)** 
- NMEA data analysis
- Statistics computation
- Visualisation of the results
- Warnings (email/SMS)

# RTK-Check features






- Compare different solutions
  - Different baseline lengths
  - Different processing techniques
  - Different receiver/software settings
- User defined connection intervals
- Real-time, epoch-by-epoch analysis
- Customised warning thresholds
  - No NMEA data
  - No RTK Fix
  - High position error
  - Low number of SVs
  - High data age
- PDF reports , CSV export



# RTK-Check web interface



RTK-Check
InspectRTCM
Checkstream
Admin


RTK-Check >> Monitoring

Time Zone: 2014-05-30T12:57:33 UTC

Reload in: 00:00:47

Settings

Begin:   :

End:   :

Time frame:  [h]

Streams:  WALTBD-POTS0\_Real  
 WALTBD-WILD\_RTK\_Real  
 test\_Real

NE:  [cm]

Height:  [cm]

Satellites:  [#]

Data-Age:  [s]

HDOP:

TTFA:  [s]

Peaks

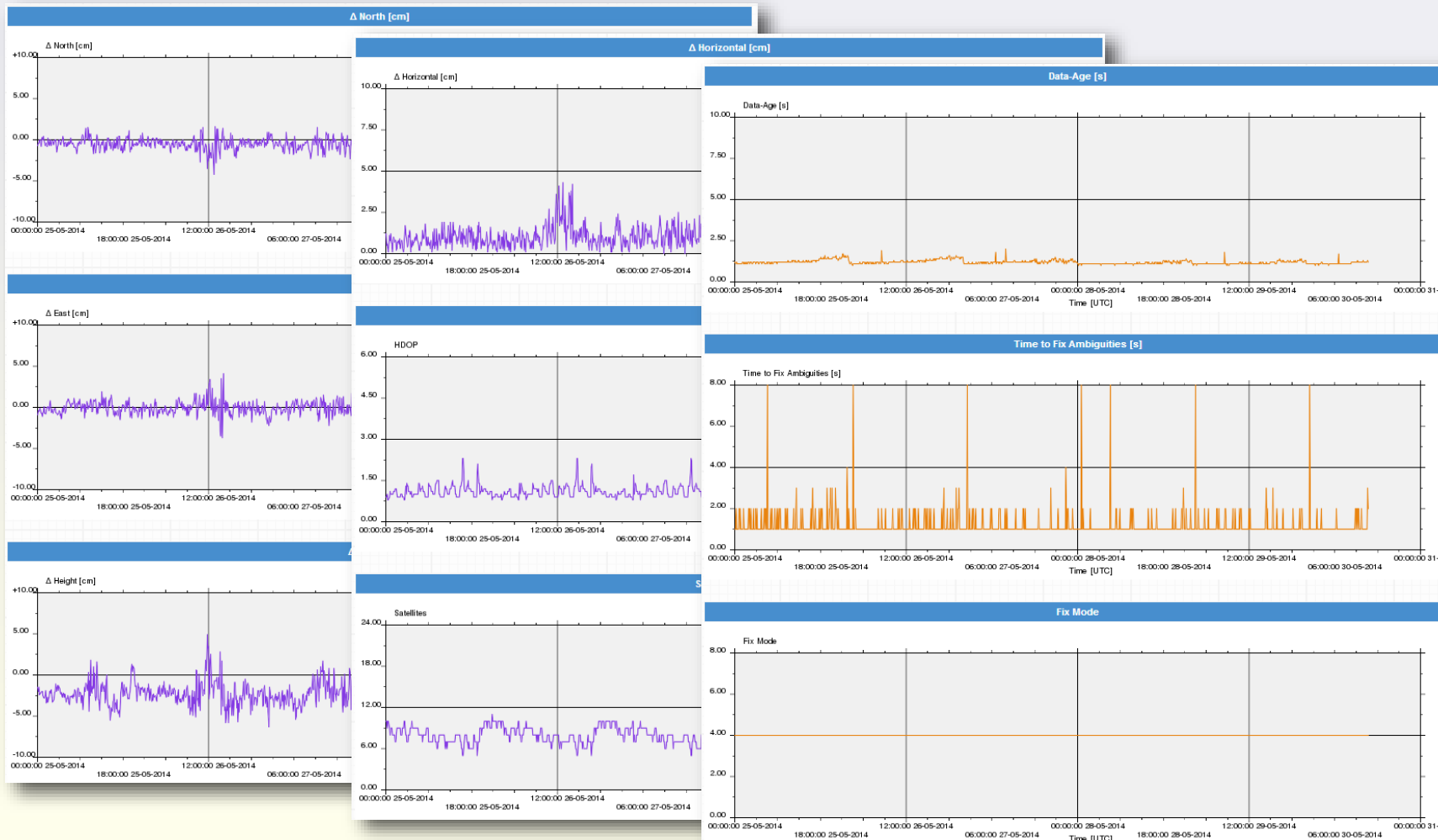
Sessiondata - [WALTB-D-WILD\_RTK]

Event Time [UTC]	Solution	Epochs	ΔN [cm]	ΔE [cm]	ΔH [cm]	ΔNE [cm]	TTFA [s]	# of Sat.	HDOP	Data-Age [s]	Checktype
2014-05-30 12:53:16	RTK Fixed	298 / 300	0.2	-2.3	-2.7	2.3	3	7	1.0	1.3	Interval Check
2014-05-30 12:46:15	RTK Fixed	299 / 300	0.4	-1.2	-0.7	1.3	1	7	1.0	1.2	Interval Check
2014-05-30 12:39:14	RTK Fixed	300 / 300	0.3	-1.8	-2.3	1.8	1	7	1.0	1.2	Interval Check
2014-05-30 12:32:13	RTK Fixed	300 / 300	-0.8	-2.1	-2.1	2.3	1	7	1.0	1.2	Interval Check
2014-05-30 12:25:12	RTK Fixed	300 / 300	-0.7	-2.5	-1.6	2.6	1	7	1.2	1.2	Interval Check
2014-05-30 12:18:11	RTK Fixed	300 / 300	-1.8	-1.3	-4.7	2.2	1	7	1.2	1.2	Interval Check
2014-05-30 12:11:10	RTK Fixed	300 / 300	-0.9	-0.4	-1.2	0.9	1	7	1.2	1.2	Interval Check
2014-05-30 12:04:09	RTK Fixed	300 / 300	-0.7	1.1	-3.3	1.4	1	7	1.3	1.2	Interval Check
2014-05-30 11:57:08	RTK Fixed	300 / 300	0.1	3.0	-5.6	3.0	1	8	1.0	1.3	Interval Check
2014-05-30 11:50:07	RTK Fixed	300 / 300	0.5	-0.1	-4.1	0.5	1	8	0.9	1.2	Interval Check
2014-05-30 11:43:06	RTK Fixed	300 / 300	-0.8	0.5	-3.3	0.9	1	8	0.9	1.2	Interval Check
2014-05-30 11:36:05											
2014-05-30 11:29:04											
2014-05-30 11:22:03											
2014-05-30 11:15:02											

Statistics

	RTKLIBTEST - 89 records				WALTBD-WILD_RTKLIB - 89 records			
	Min.	Max.	Mean	σ	Min.	Max.	Mean	σ
Δ North [cm]	-43.3	22.2	-0.9	6.8	-18.0	22.4	1.0	7.4
Δ East [cm]	-71.1	18.2	-1.7	11.1	-80.2	76.3	4.2	17.1
Δ Height [cm]	-51.1	48.0	-0.7	11.3	-61.2	41.9	-8.1	15.0
Δ Horizontal [cm]	0.1	71.2	4.7	12.3	1.1	82.9	11.0	15.6
TTFA [s]	1.0	540.0	134.9	226.9	-	540.0	98.0	188.4
# of Sat.	6.0	10.0	8.3	1.1	6.0	10.0	8.3	1.1
HDOP	-	1.5	1.0	0.3	-	1.5	0.9	0.4
Data-Age [s]	0.0	1.8	1.0	0.2	1.0	4.0	2.5	0.6

# RTK-Check history data analysis

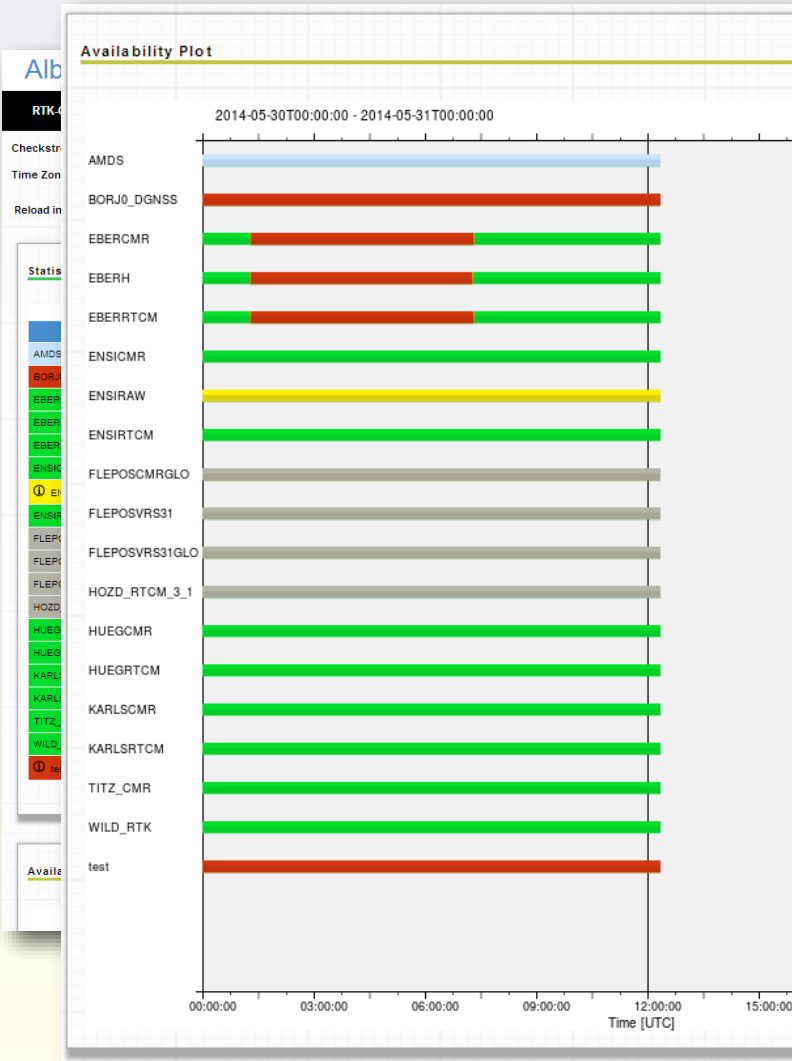


# Checkstream – Ntrip monitoring



- Ntrip Caster server and Ntrip stream availability monitoring
- Periodical data sampling
- Data decoding - format verification (RTCM, CMR, raw data)
- Data content analysis – message types and update rates
- Data age analysis
- Monitoring multiple casters from a single website
- Monitoring hundreds of Ntrip mountpoints
- NMEA output for network RTK streams
- Availability statistics for 24/7 and normal working hours
- Automatic email/SMS warnings with flexible settings
- PDF reporting

# Checkstream – web interface



### Alberding-QC

RTK-Check InspectRTCM Checkstream Admin

Checkstream >> Checkstream-Map

Time Zone: 2014-06-02T11:22:21 UTC

Reload in: 06:00:27

#### Error Log

```

[2014-05-30T07:18:31] - MESSAGE OK DATA - EBERRTCM on aka.dgpsonline.eu begin 2014-05-30T01:16:31
[2014-05-30T07:18:31] - MESSAGE OK DATA - EBERCMR on aka.dgpsonline.eu begin 2014-05-30T01:16:31
[2014-05-30T07:16:31] - MESSAGE OK DATA - EBERH on aka.dgpsonline.eu begin 2014-05-30T01:16:31
[2014-05-30T07:16:31] - OK CONNECTION - EBERRTCM on aka.dgpsonline.eu begin 2014-05-30T01:18:31
[2014-05-30T07:16:31] - OK CONNECTION - EBERCMR on aka.dgpsonline.eu begin 2014-05-30T01:18:31
[2014-05-30T07:14:31] - OK CONNECTION - EBERH on aka.dgpsonline.eu begin 2014-05-30T01:18:31
[2014-05-30T01:18:31] - ERROR CONNECTION - EBERH on aka.dgpsonline.eu
[2014-05-30T01:18:31] - ERROR CONNECTION - EBERRTCM on aka.dgpsonline.eu
[2014-05-30T01:18:31] - ERROR CONNECTION - EBERCMR on aka.dgpsonline.eu
[2014-05-30T01:16:31] - MESSAGE ERROR DATA - EBERH on aka.dgpsonline.eu
[2014-05-30T01:16:31] - MESSAGE ERROR DATA - EBERRTCM on aka.dgpsonline.eu
    
```

#### Ping Server

2014-10-01T00:00:00 - 2014-10-02T00:00:00

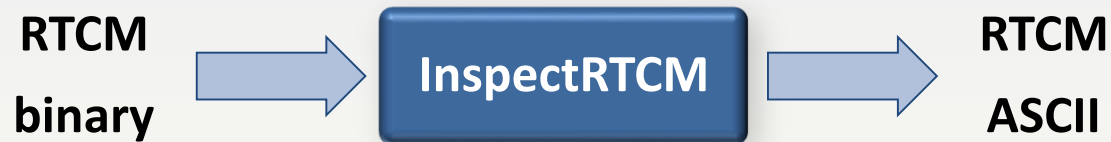
Time [UTC]



# InspectRTCM



- GNSS binary data decoder software for detailed data content analysis



- Real-time visualisation
- RTCM, CMR, RTCA, raw binary input
- NMEA GGA output for network RTK streams
- Transmission delay analysis
- Data rate analysis of individual message types
- **Real-time streams (TCP/UDP/Ntrip/serial) and file input**

# InspectRTCM web interface



**Alberding-QC**

RTK-Check
InspectRTCM
Checkstream
Admin

InspectRTCM  
Time Zone: 2014-05-30T12:38:51 UTC

Check successful!

Inspect-Stream

**Connection-String**

ntrip:mountpoint[/username[:password]][@server[:port]][[:nmea[:sec]]]  
 top:server[:port]  
 serial[:baud][[:bits;parity;stop;protocol]][@device]

**Correction-Inputs**

**Data-Rate**

Inspect-File

**Inspect File**  No file chosen

Output

```

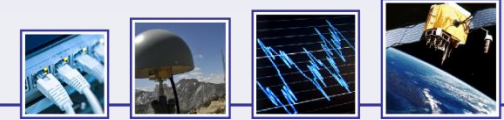
RTCM (2014-05-30T12:38:54.61 delay 1.0s) Type 18: ID=560, zcnt=2349.6, SeqNr=6, blocks=19,
Health='UDRE Scale Factor 1', discontinuity detected
  Frequency=L1, Time of measurement=2350.00000000
SV= 4, Multi= yes, Code=C/A, Type=GPS, Qual=4 (<= 0.03933c), Loss=13, cp= 7414663.465c
SV=12, Multi= yes, Code=C/A, Type=GPS, Qual=0 (<= 0.00391c), Loss=10, cp=-7912195.121c
SV=14, Multi= yes, Code=C/A, Type=GPS, Qual=1 (<= 0.00696c), Loss=20, cp=-3929313.266c
SV=15, Multi= yes, Code=C/A, Type=GPS, Qual=3 (<= 0.02208c), Loss=26, cp= 8300132.441c
SV=17, Multi= yes, Code=C/A, Type=GPS, Qual=1 (<= 0.00696c), Loss=13, cp=-3140950.336c
SV=22, Multi= yes, Code=C/A, Type=GPS, Qual=5 (<= 0.07006c), Loss=13, cp= 3016321.824c
SV=24, Multi= yes, Code=C/A, Type=GPS, Qual=0 (<= 0.00391c), Loss= 8, cp=-5906300.203c
SV=25, Multi= yes, Code=C/A, Type=GPS, Qual=2 (<= 0.01239c), Loss=10, cp=-5369131.031c
RTCM (2014-05-30T12:38:54.61 delay 1.0s) Type 18: ID=560, zcnt=2349.6, SeqNr=7, blocks=19,
Health='UDRE Scale Factor 1'
  Frequency=L2, Time of measurement=2350.00000000
SV= 4, Multi= yes, Code= P, Type=GPS, Qual=4 (<= 0.03933c), Loss=13, cp= 1855661.840c
SV=12, Multi= yes, Code= P, Type=GPS, Qual=0 (<= 0.00391c), Loss=10, cp= -718256.027c
SV=14, Multi= yes, Code= P, Type=GPS, Qual=1 (<= 0.00696c), Loss=23, cp= 6089356.977c
SV=15, Multi= yes, Code= P, Type=GPS, Qual=3 (<= 0.02208c), Loss= 0, cp= 2545657.238c
SV=17, Multi= yes, Code= P, Type=GPS, Qual=1 (<= 0.00696c), Loss=13, cp= 6703653.461c
SV=22, Multi= yes, Code= P, Type=GPS, Qual=5 (<= 0.07006c), Loss=13, cp=-1571588.727c
SV=24, Multi= yes, Code= P, Type=GPS, Qual=0 (<= 0.00391c), Loss=14, cp= 844774.281c
                    
```

# Alberding-QC – references

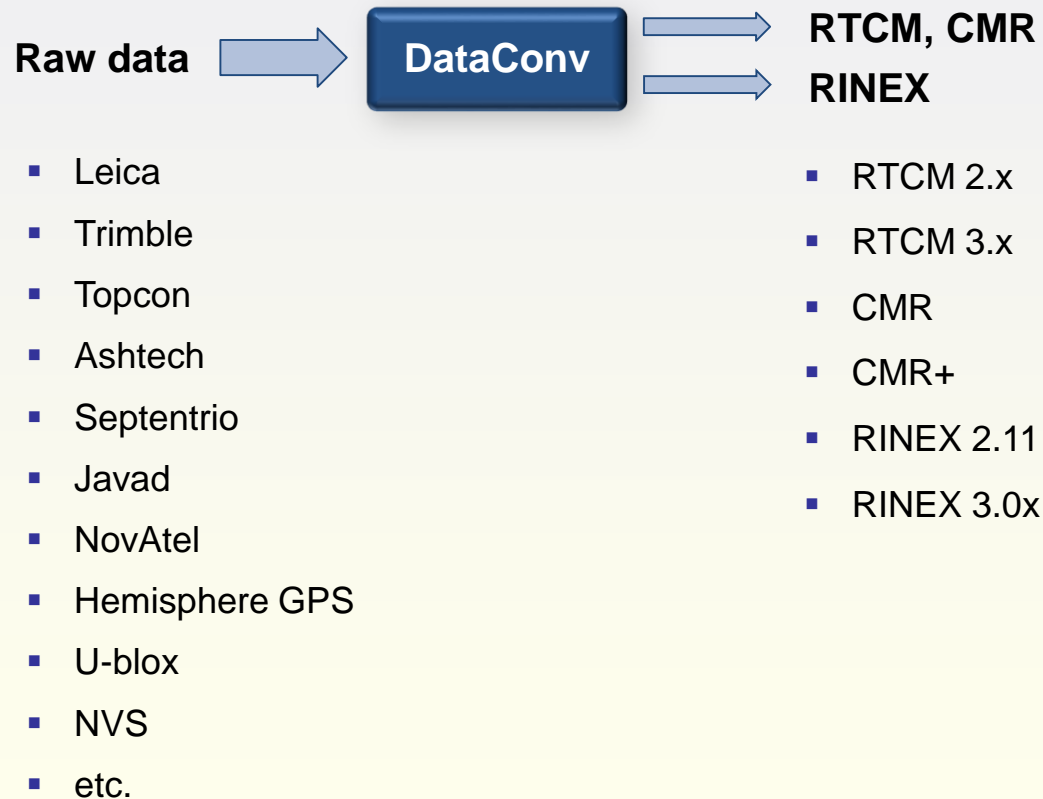


- AXIO-NET (Germany)
- SWEPOS (Lantmäteriet, Sweden)
- AllDayRTK (Position Partners, Australia)
- FLEPOS (Agiv, Belgium)
- SWIPOS (swisstopo, Switzerland)
- mAXI-NET (Axiál, Hungary)
- ASG-EUPOS (GUGIK, Poland)
- SKPOS (GKÚ, Slovakia)
- SIGNAL (GURS/GIS, Slovenia)
- IGN (IGN, France)

# Alberding DataConv



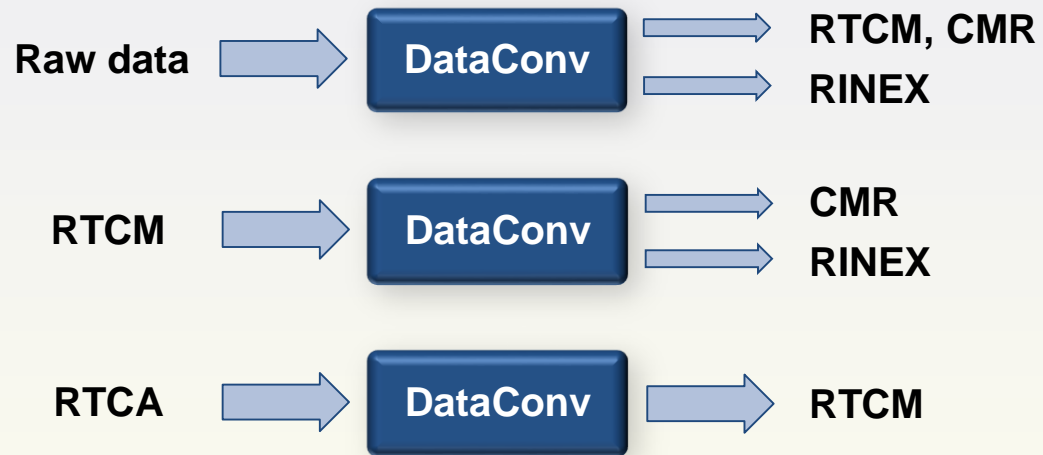
## • Real-time GNSS data translation



# Alberding DataConv

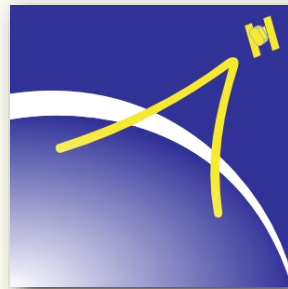


- Real-time GNSS data translation





# Thank you for your attention!



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