



Alberding-QC

a multi-purpose GNSS service performance monitoring tool

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Outline



Alberding GmbH

Alberding-QC

Displacement monitoring with low-cost GNSS receivers

Alberding GmbH



- German GNSS software and hardware development company
- Based in Wildau (near Berlin)
- 20 years of experience with high accuracy GNSS
- 10 employees (8 engineers)
- Independent from receiver manufacturers





Alberding GmbH

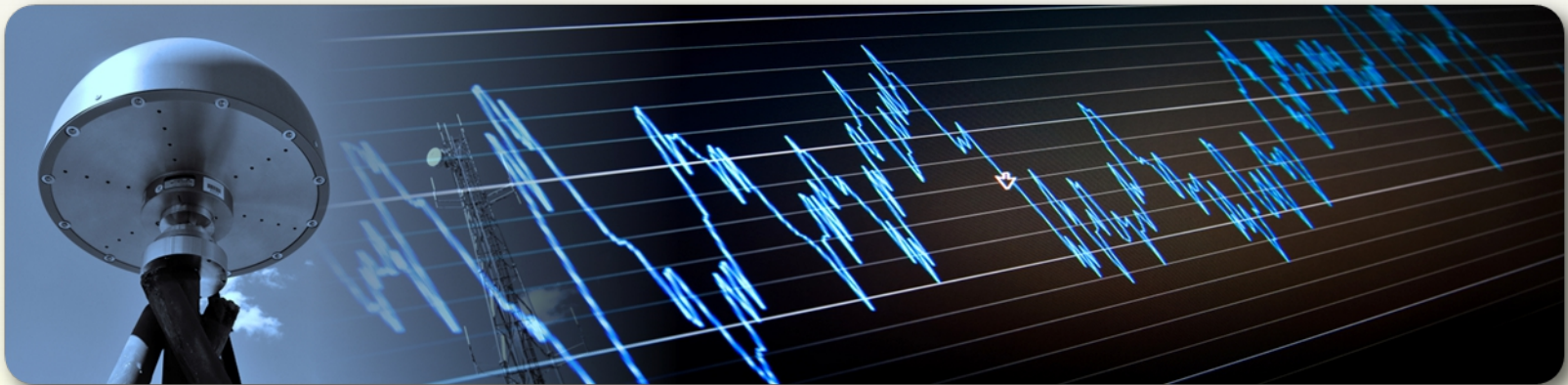
Alberding-QC

Displacement monitoring with low-cost GNSS receivers

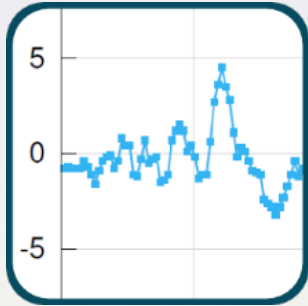
Alberding-QC



- Motivation: help operators improve service quality
= detect outages and performance degradations, generate warnings
- Developed for RTK/Network RTK, DGNSS, PPP service providers
- Monitors data availability, positioning accuracy and consistency
- Multi-purpose tool: 3 modules integrated into a single web interface
- Available for Linux and Windows
- Available for purchase or as a service by Alberding GmbH



Alberding-QC software modules



RTK-Check

- Positioning accuracy and RTK fixing time

Stream	
AMDS [0]	alberding
① LEIJ_RTK [0]	alberding
① SE001_TEST [0]	alberding
TITZ_CMR [0]	alberding
WALTB_D_RAW [0]	ntrip d

Checkstream

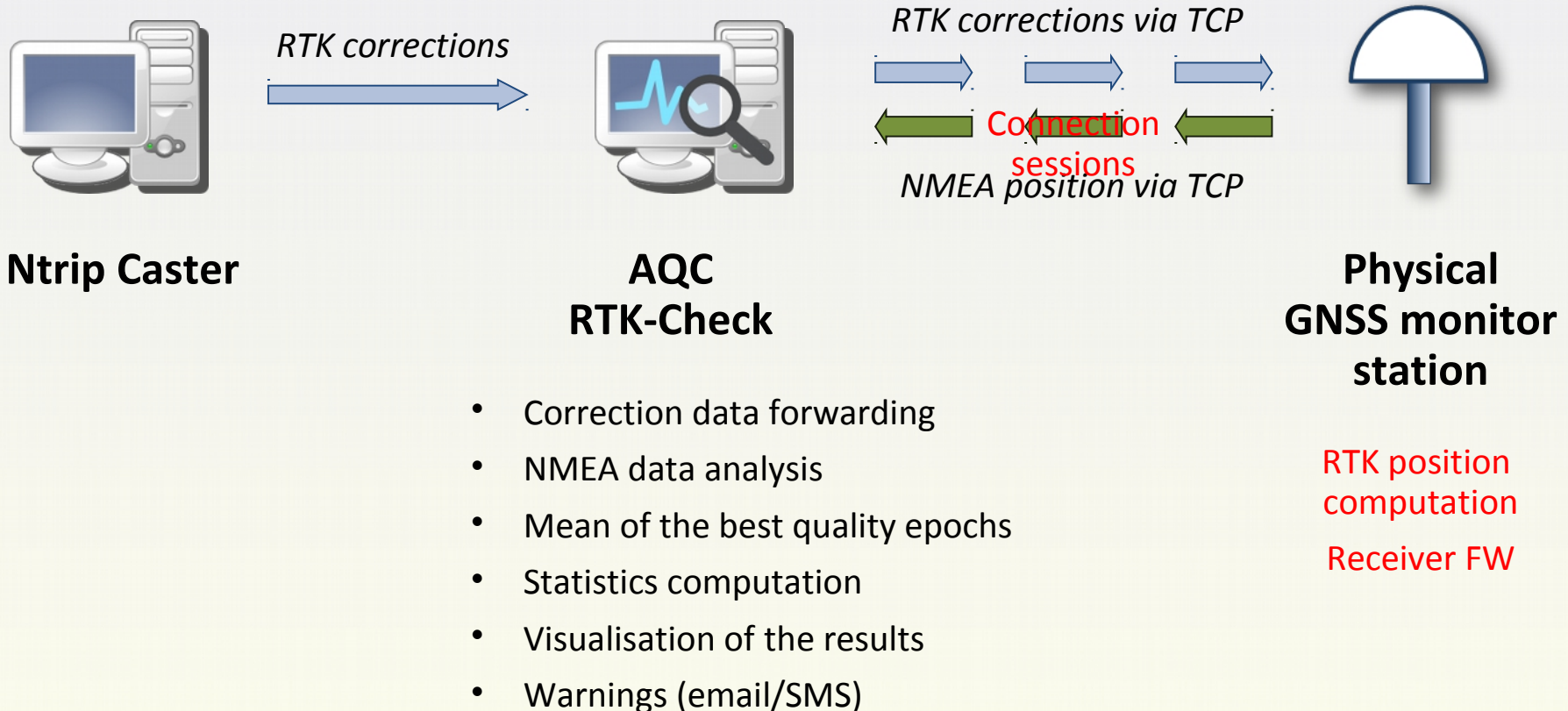
- Ntrip stream availability and consistency monitoring



InspectRTCM

- GNSS binary data decoding and visualisation

RTK-Check concept – physical station

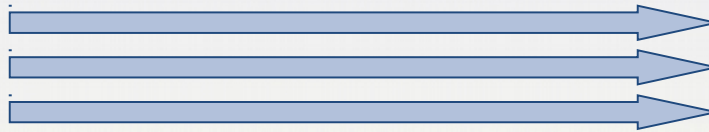


RTK-Check concept – internal processing



Ntrip Caster

GNSS raw data streams



Ephemeris data stream



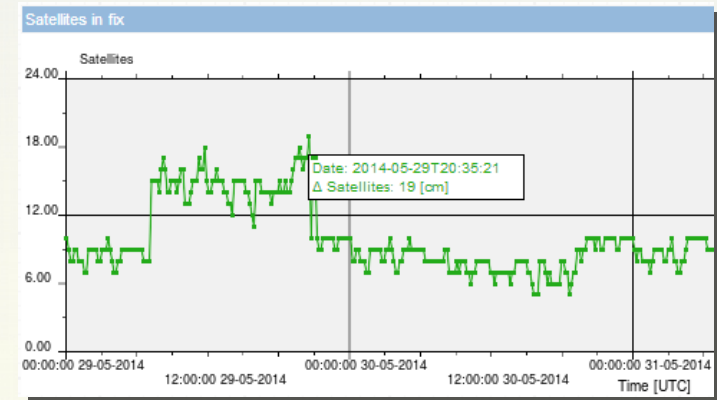
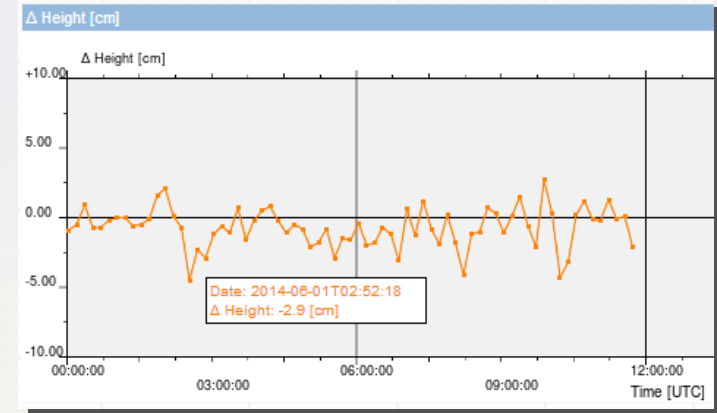
**AQC
RTK-Check**

- 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



Alberding-QC

RTK-Check InspectRTCM Checkstream Admin

RTK-Check >> Monitoring

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

Reload in: 00:00:47

Settings

Begin: 2014-05-30 0 : 0

End: 2014-05-31 0 : 0

Time frame: 1.0 [h]

Streams:

- ☐ WALTBD-POTS0_Real
- ☒ WALTBD-WILD_RTK_Real
- ☒ test_Real

Select all Invert selection Remove selection

NE: 10 [cm]

Height: 10 [cm]

Satellites: 24 [#]

Data-Age: 10 [s]

HDOP: 6

TTFA: 8 [s]

Peaks ☐

CSV PDF OK

Sessiondata - [WALTBD-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

Statistics

	RTKLIBTEST - 89 records				WALT-POTS_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



- Data stream availability analysis
- Data format check (RTCM, CMR, raw data)
- Data age analysis
- Monitoring multiple casters from a single website
- Monitoring hundreds of Ntrip mountpoints
- Colour-coded status tables and bar graphs
- Individual sampling rate and alarm thresholds for each mountpoint
- NMEA output for network RTK streams
- Availability statistics for 24/7 and normal working hours
- PDF reporting

Checkstream web interface



Alberding-QC

RTK-Check
InspectRTCM
Checkstream
Admin

Checkstream >> Checkstream-Monitoring

Time Zone: 2014-05-30T12:22:16 UTC

Reload in: 00:00:30 Stop

Statistics

Stream	Caster	Subnet	Activation	Last Accessed	Σ	Connection		Message		Data Age	
						Last Error(24h),(NWH)		Last Error(24h)		Last Error(24h)	
AMDS [0]	alberdingcaster.dgpsonline.eu	-	2013-08-29T16:36:59	00:01:51	0	3 day(s) 03:29:31 (100.00 %),(100.00 %)	0	00:00:00 (100.00%)	0	00:00:00 (100.00%)	
BORJO_DGNSS [0]	alberdingcaster.dgpsonline.eu	-	2013-08-29T16:33:44	-	0	273 day(s) 19:47:31 (0.00 %),(0.00 %)	0	00:00:00 (100.00%)	0	00:00:00 (100.00%)	
EBERCMR [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	1	11:03:31 (51.75 %),(60.88 %)	1	11:05:31 (51.22%)	0	153 day(s) 18:39:31 (100.00%)	
EBERH [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	1	11:03:31 (52.02 %),(51.25 %)	1	11:05:31 (51.48%)	0	00:00:00 (100.00%)	
EBERRTCM [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	1	11:03:31 (51.75 %),(60.88 %)	1	11:05:31 (51.22%)	0	38 day(s) 08:01:31 (100.00%)	
ENSICMR [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	0	9 day(s) 16:27:30 (100.00 %),(100.00 %)	0	9 day(s) 16:29:31 (100.00%)	0	95 day(s) 23:57:31 (100.00%)	
ENSIRAW [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	-	0	16 day(s) 19:05:30 (100.00 %),(100.00 %)	0	242 day(s) 09:23:31 (100.00%)	0	00:00:00 (100.00%)	
ENSIRTCM [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	0	9 day(s) 16:27:31 (100.00 %),(100.00 %)	0	15 day(s) 19:37:31 (100.00%)	0	39 day(s) 08:01:31 (100.00%)	
FLEPOSCMRGLO [0]	ntrip.flepos.be	-	-	-	-	-	-	inactive!	-	-	
FLEPOSVRS31 [0]	ntrip.flepos.be	-	-	-	-	-	-	inactive!	-	-	
FLEPOSVRS31GLO [0]	ntrip.flepos.be	-	-	-	-	-	-	inactive!	-	-	
HOZD_RTCM_3_1 [0]	system.asgeupos.pl	-	-	-	-	-	-	inactive!	-	-	
HUEQCMR [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	0	13:17:31 (100.00 %),(100.00 %)	0	1 day(s) 13:17:31 (100.00%)	0	146 day(s) 12:43:31 (100.00%)	
HUEQTCM [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:01:46	0	13:17:31 (100.00 %),(100.00 %)	0	24 day(s) 11:43:31 (100.00%)	0	146 day(s) 12:49:31 (100.00%)	
KARLSICMR [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	0	1 day(s) 22:17:31 (100.00 %),(100.00 %)	0	1 day(s) 00:45:31 (100.00%)	0	39 day(s) 07:57:30 (100.00%)	
KARLSRTC [0]	aka.dgpsonline.eu	-	2013-08-27T13:52:46	00:00:14	0	1 day(s) 00:45:31 (100.00 %),(100.00 %)	0	15 day(s) 08:03:31 (100.00%)	0	243 day(s) 09:33:30 (100.00%)	
TITZ_CMR [0]	alberdingcaster.dgpsonline.eu	-	2013-10-14T05:43:01	00:00:46	0	3 day(s) 03:30:31 (100.00 %),(100.00 %)	0	4 day(s) 10:25:31 (100.00%)	0	12 day(s) 15:11:31 (100.00%)	
WILD_RTK [0]	alberdingcaster.dgpsonline.eu	-	2013-08-30T09:15:27	00:01:46	0	3 day(s) 03:29:31 (100.00 %),(100.00 %)	0	27 day(s) 04:23:31 (100.00%)	0	14 day(s) 13:35:31 (100.00%)	
test [0]	test.dgpsonline.eu	-	2013-10-24T08:51:52	-	0	231 day(s) 02:41:01 (0.00 %),(0.00 %)	0	00:00:00 (100.00%)	0	00:00:00 (100.00%)	

Settings

Begin: 2014-05-30 00:00:00

End: 2014-05-31 00:00:00

Time Interval: 2013 2014

Streams:

- ☒ AMDS@alberdingcaster.dgpsonline.eu
- ☒ BORJO_DGNSS@alberdingcaster.dgpsonline.eu
- ☒ EBERCMR@aka.dgpsonline.eu
- ☒ EBERH@aka.dgpsonline.eu
- ☒ EBERRTCM@aka.dgpsonline.eu
- ☒ ENSICMR@aka.dgpsonline.eu
- ☒ ENSIRAW@aka.dgpsonline.eu
- ☒ ENSIRTCM@aka.dgpsonline.eu
- ☒ FLEPOSCMRGLO@ntrip.flepos.be

Select all Invert selection Remove selection Ok PDF

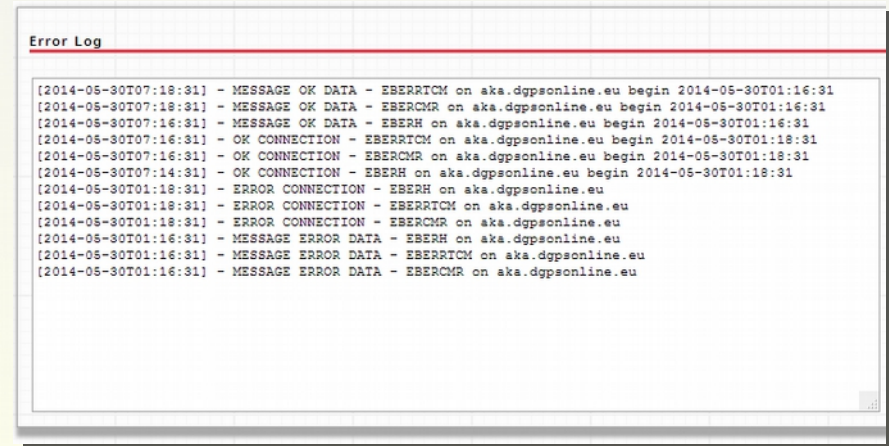
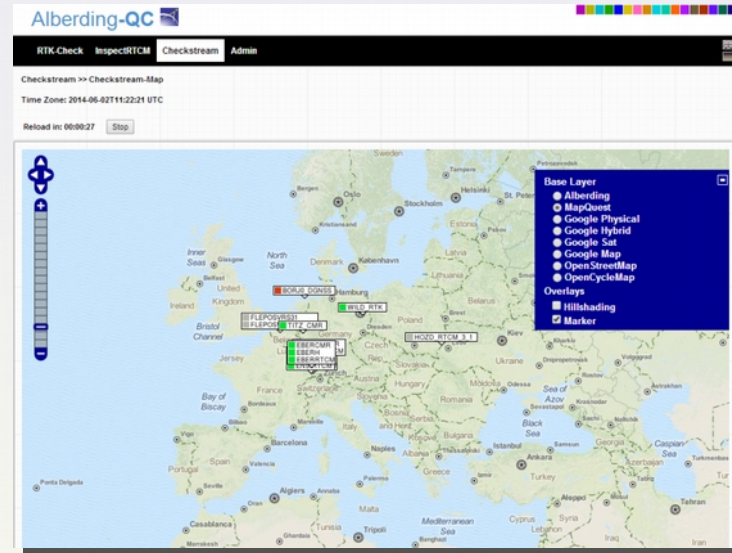
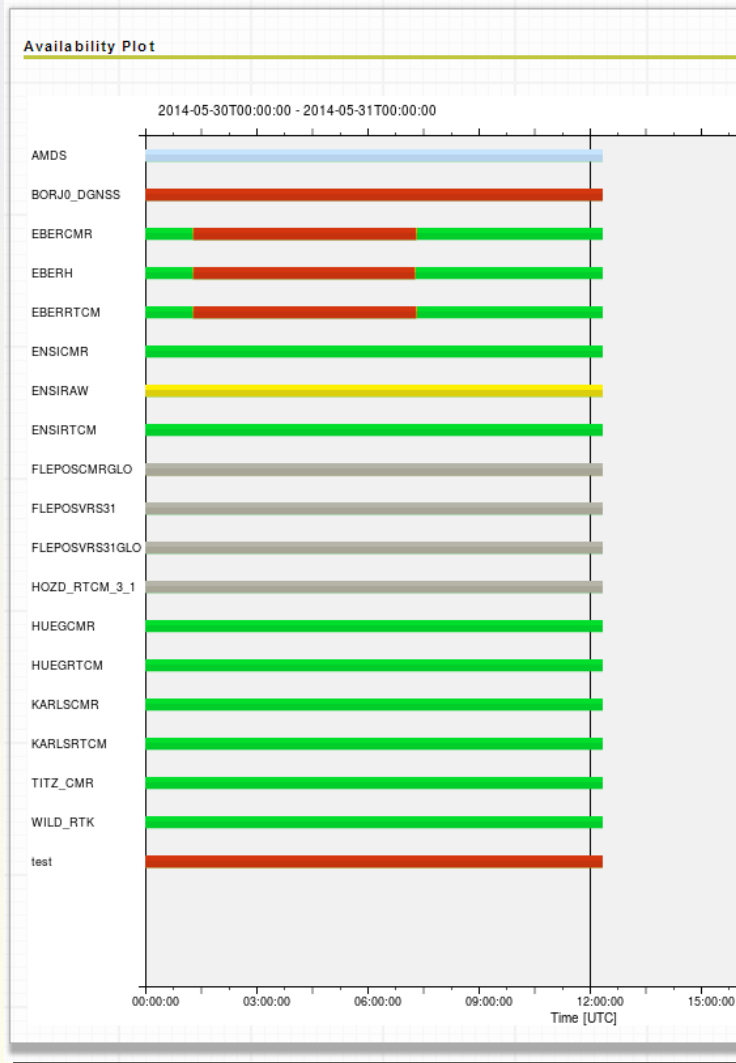
Legend

- Connection Error
- Login Error
- NMEA Error
- Message Error
- Nullframe
- Data-Age High
- Ok
- Inactive

Availability Plot

2014-05-30T00:00:00 - 2014-05-31T00:00:00

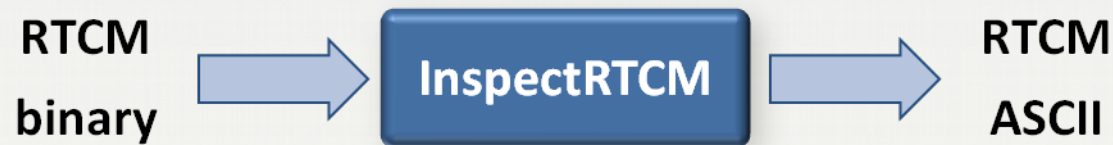
Checkstream – history data analysis



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]]]
 tcp:server[:port]
 serial:[baud][[:bits:parity:stop:protocol]][@device]

Correction-Inputs:

Data-Rate: ☐

Check Start Stop

Inspect-File

Inspect File Choose File No file chosen Start Inspect-File

Output

```

RTCM (2014-05-30T12:38:54.61 delay 1.0s) Type 18: ID=560, xcnt=2349.6, SeqNr=6, blocks=19,
Health='UDRE Scale Factor 1', incontinuity 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, xcnt=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 GmbH

Alberding-QC

Displacement monitoring with low-cost GNSS receivers

Monitoring with low-cost GNSS receivers



- Can we use low-cost receivers for high-accuracy displacement monitoring?
- Is it possible to overcome power supply and communication limitations?



An integrated L1 GNSS receiver is required with telemetry and power supply modules



Alberding A07-MON

Low-cost GNSS system Alberding A07

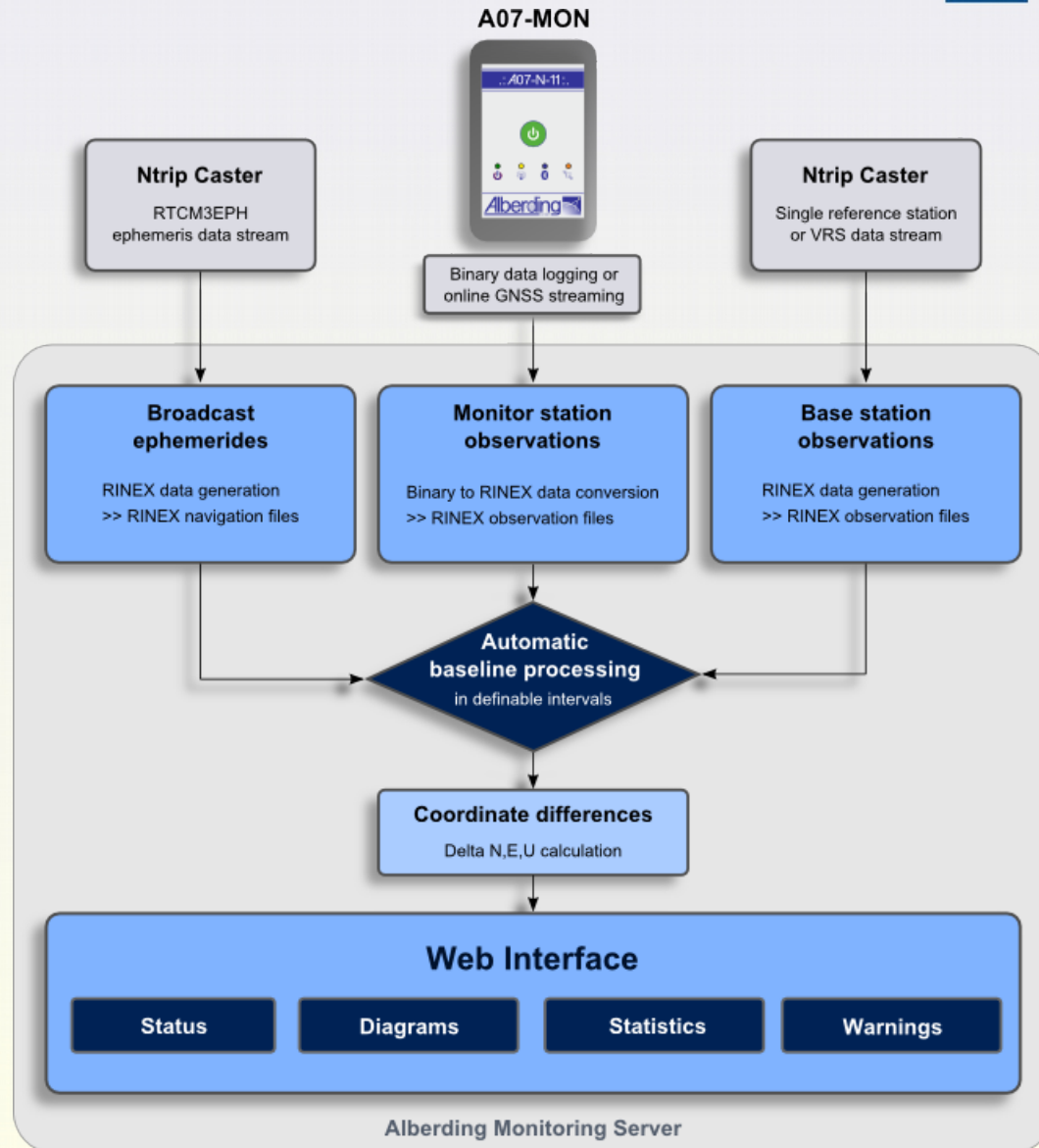


- **L1 multi-constellation (GPS/GLONASS/Galileo/SBAS) receiver**
 - Raw code and carrier phase output
 - **GPRS modem with antenna**
 - Integrated Cortex M3 processor with Alberding sw
 - **MicroSD card**
 - Central processing option (A07-MON)
- PP, RTK → centimetre accuracy
- Flexible external antenna options
 - **Integrated Li-Ion battery,**
- low power consumption**
- Bluetooth modules and additional sensors

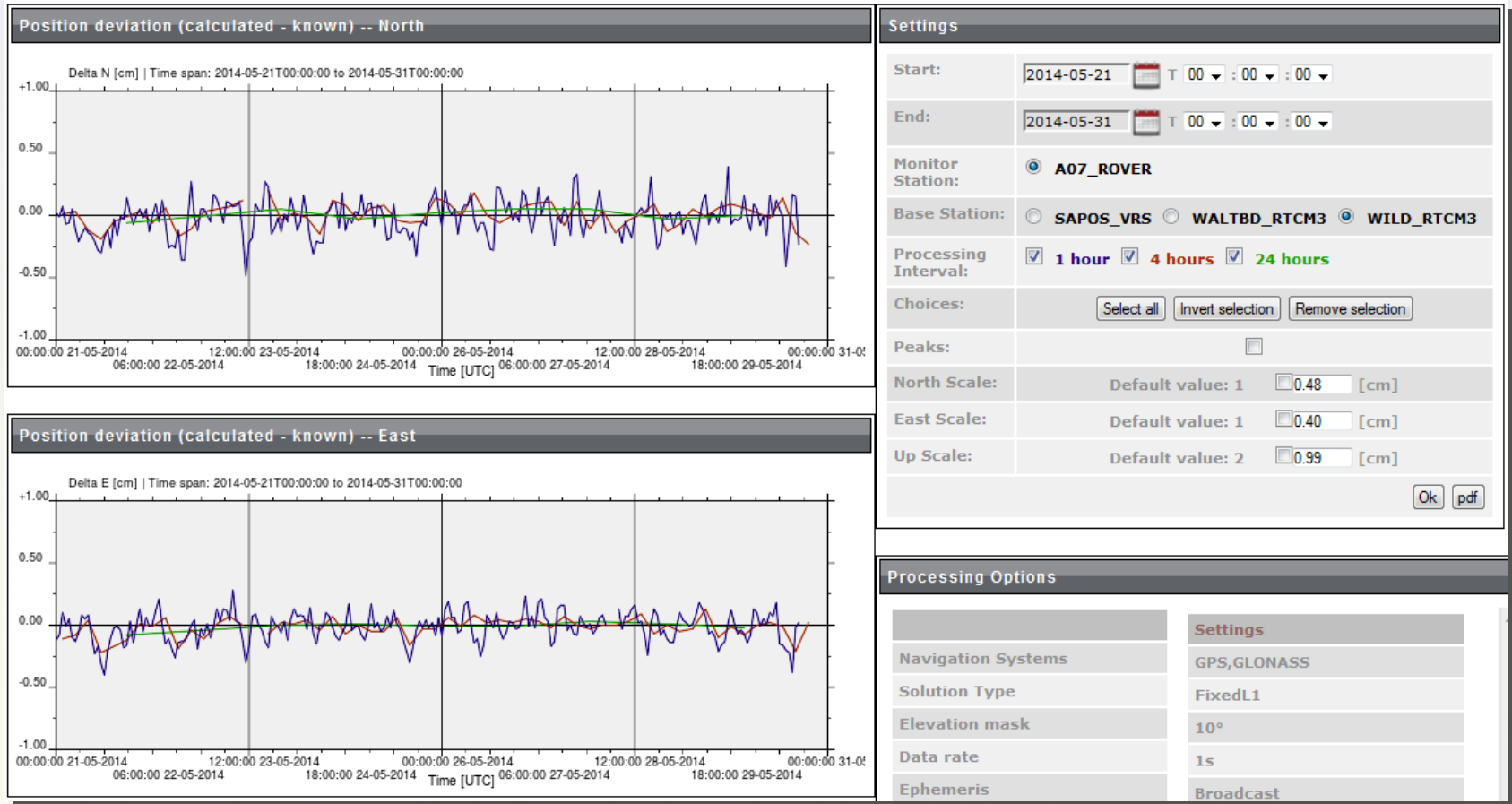


Alberding A07-N-11

A07-MON processing data flow



Alberding Monitoring web interface





Thank you for your attention!

Contact:

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