Alberding GNSS monitoring solutions

Tamás Horváth

Alberding GmbH

European Navigation Conference 2013, 23-25 April 2013, Vienna, Austria

Outline

Alberding GmbH

Why monitor?

What and how to monitor?

Example applications

Who is Alberding GmbH?

- Privately owned German GNSS software development company
- Founded in 1994
- Based in Schönefeld (Berlin)
- 9 engineers + external employees
- Independent from GNSS receiver manufacturers

Alberding GmbH experience

- GNSS data processing and analysis
- Internet based GNSS data communication
- Standardisation (Ntrip, RTCM MSM, SSR)
- Customised software and hardware development
- Complete system solutions
  - GNSS infrastructures
  - Monitoring systems

Alberding GmbH

Why monitor?

What and how to monitor?

Example applications

Why monitor?

- Prevent disasters and accidents
- Avoid loss of life and property
- Mitigate the effect of catastrophies
- Minimise the impact on the environment

- Ensure the safety of your investment
- Reduce operational cost and risk
- Reduce potential litigations and liabilities
- Increase productivity and efficiency
- Improve customer support

Alberding GmbH

Alberding GmbH

Why monitor?

What and how to monitor?

Example applications

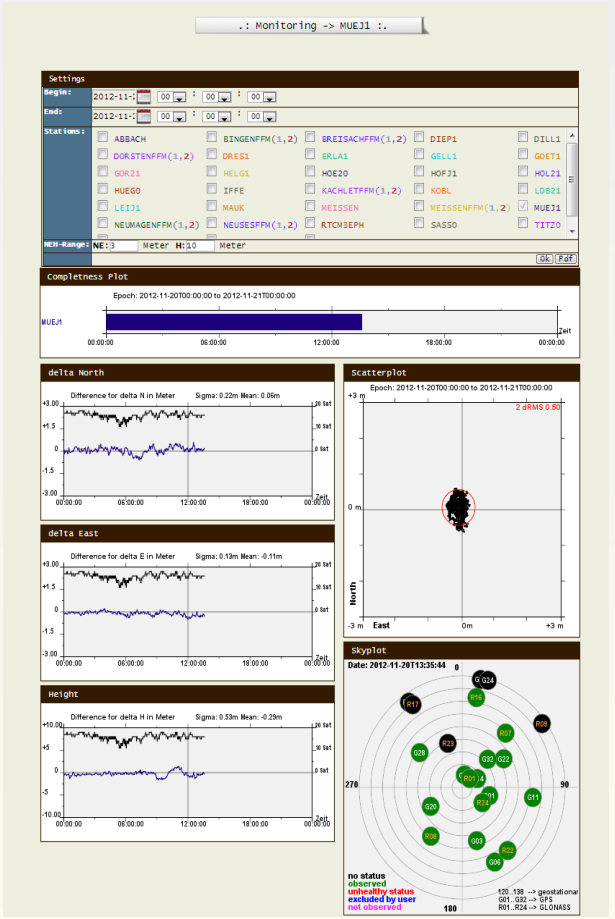
What and how to monitor?

- **What do we monitor:**
  - Data availability, age and content
  - Satellite tracking performance
  - Position
  - Accuracy
  - Object geometry
  - Motion and deformation
  - Operating status
- **How do we monitor:**
  - GNSS receivers (single- or dual-frequency, GPS-only or GPS+GLO), total stations, laser scanners, geotechnical and meteorological sensors
  - Single- or multi-station architectures
  - Centralised or decentralised configurations
  - Post-processed or real-time analysis
  - Various GNSS processing techniques (DGNSS, RTK, PPP)
  - Accuracies: sub-metre to <1 cm
  - Sampling rates: up to 10 Hz or more

Alberding GmbH

Alberding monitoring software features

- Scalable solution
- Modular architecture
- Web based graphical user interface
  - Comprehensive status tables
  - Time series and scatter plots
  - Availability bar graphs
  - Map display of stations and users
  - Statistical tables
  - Comparative performance evaluation
- Automated alert system (email/SMS)
- Status report generation



Alberding GmbH

Why monitor?

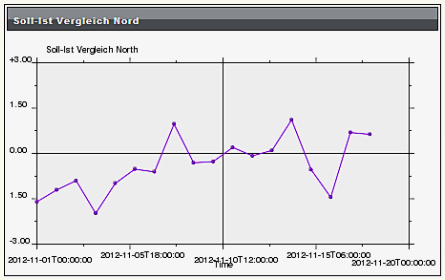
What and how to monitor?

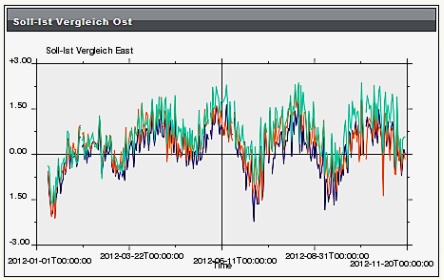
Example applications

Reference station coordinates

- Precise Point Positioning (PPP)
- 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

Koblenz	Ok
Landau	Ok
Ludwigshafen	Warning
Mayen	Ok
Meisenheim	Ok
Montabaur2	Ok
Pirmasens	Ok
Pruem	Ok
Rodershausen	Ok
Simmern	Ok
Trier	Ok



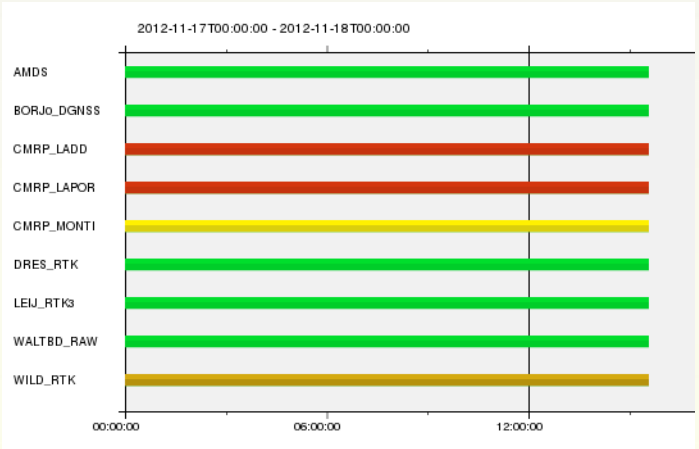


Ntrip Caster

- Data stream availability and content analysis (RTCM, CMR, raw data)
- Data age analysis
- Monitoring third party casters
- Monitoring multiple casters from a single website
- Colour-coded status tables and bar graphs
- User-defined sampling rate and alarm thresholds

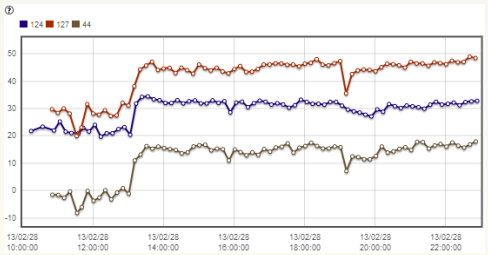
Statistics

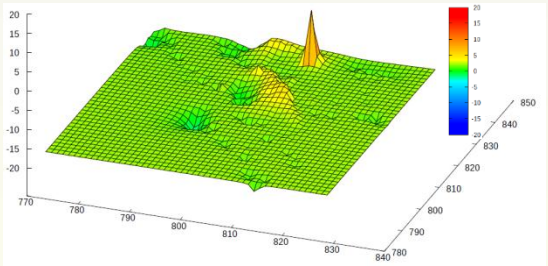
Stream	Caster	Activation	Last Accessed	Connection Error Σ	Connection Error Last (%)	Message Error Σ (Empty, Wrong)	Message Error Last (%)	Data Age Error Σ	Data Age Error Last (%)
AMDS	alberdingcaster.dgpsonline.eu	2012-10-22T15:40:05	00:01:33	0	3 day(s) 04:56:28 (0.00 %)	0 (0, 0)	3 day(s) 00:04:21 (0.00%)	disabled	
BORJ0_DGNSS	alberdingcaster.dgpsonline.eu	2012-10-22T15:40:05	00:01:32	0	3 day(s) 04:56:28 (0.00 %)	0 (0, 0)	3 day(s) 00:04:21 (0.00%)	0	00:00:00 (0.00%)
CMRP_LADD	199.102.46.67	2012-11-05T10:09:10	12 day(s) 05:10:31	no connection!					
CMRP_LAPOR	199.102.46.67	2012-11-05T10:07:40	12 day(s) 05:10:31	no connection!					
CMRP_MONTI	199.102.46.67	2012-11-05T10:30:23	3 day(s) 22:29:29	0	3 day(s) 22:29:29 (0.00 %)	0 (0, 0)	10 day(s) 23:39:31 (0.00%)	0	00:00:00 (0.00%)
DRES_RTK	alberdingcaster.dgpsonline.eu	-	10 day(s) 02:37:32	inactive!					
LEIJ_RTK3	alberdingcaster.dgpsonline.eu	2012-10-22T16:04:47	00:01:33	0	3 day(s) 04:56:28 (0.00 %)	0 (0, 0)	3 day(s) 00:04:21 (0.00%)	0	00:00:00 (0.00%)
WALTBD_RAW	alberdingcaster.dgpsonline.eu	2012-10-22T15:40:05	00:01:33	0	3 day(s) 03:20:29 (0.00 %)	0 (0, 0)	12 day(s) 05:10:31 (0.00%)	0	00:00:00 (0.00%)
WILD_RTK	ntrip.dgpsonline.eu	2012-10-22T14:40:51	00:01:33	no data!					



Surface deformation

- Landslides, open pit mines
- Short baseline RTK positioning
- Total stations, laser scanners
- Statistical analysis
- Visual warnings on web interface
- Flashing alert at local sites





Mining machine position

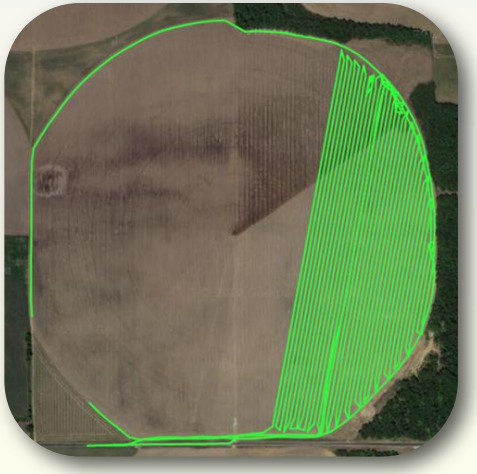
- Mining excavator positioning
- Short baseline RTK
- Multiple GNSS receivers installed
- Tilt sensors
- Position + heading/pitch/roll determination
- Warnings for out-of-tolerance values

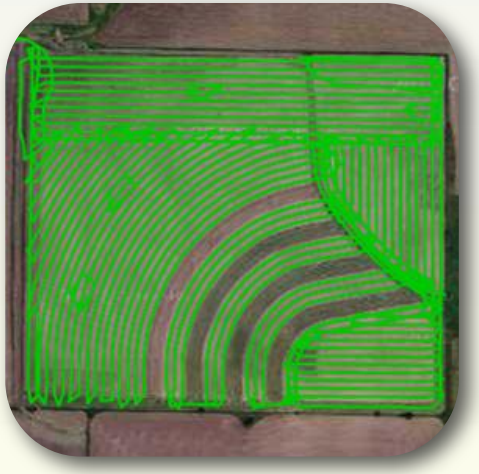
Agricultural machine position

- Agricultural machinery
- Ntrip based RTK positioning
- User NMEA GGA messages
- Real-time position information and quality indicators
- Fleet management

Agricultural machine position cont'd

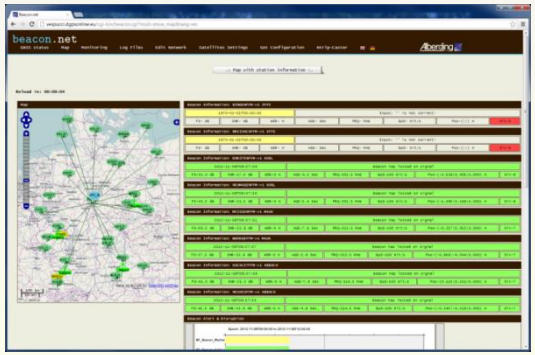
- History data analysis
- KML file generation – map display
- Colour-coded RTK fixing status indicator
- Troubleshooting assistance (e.g., correction reception issues)

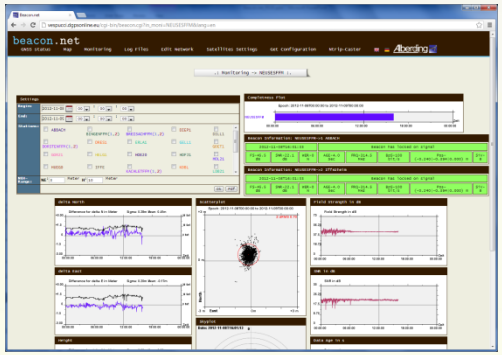


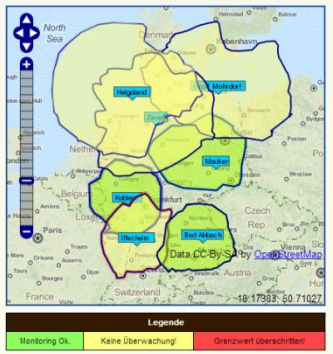


Service integrity

- Maritime and inland waterway DGPS positioning
- Pre-Broadcast Monitoring
  - Satellite range domain analysis
  - Position domain analysis
- Far Field Monitoring
  - Dedicated monitoring stations
  - Position accuracy and beacon signal quality
- User information service







Under development

- Displacement monitoring with low-cost, single-frequency GPS+GLO+Galileo receivers

  Alberding A07

- Ambiguity-fixed PPP positioning with regional augmentation

  Goal: instantaneous cm accuracy using state space algorithms

Thank you for your attention!

Contact:

Tamás Horváth

Alberding GmbH
Lilienthalstr. 25
D-12529 Schönefeld
Tel.: +49 30 6782 6060
Fax: +49 30 6782 6066
Web: www.alberding.eu

Office in Hungary
1139 Budapest, Petneházy u. 50-52.
Tel.: +36 1 7843 813
Mobile: +49 151 188 048 99
E-Mail: horvath@alberding.eu