Federal Agency for
Cartography and Geodesy

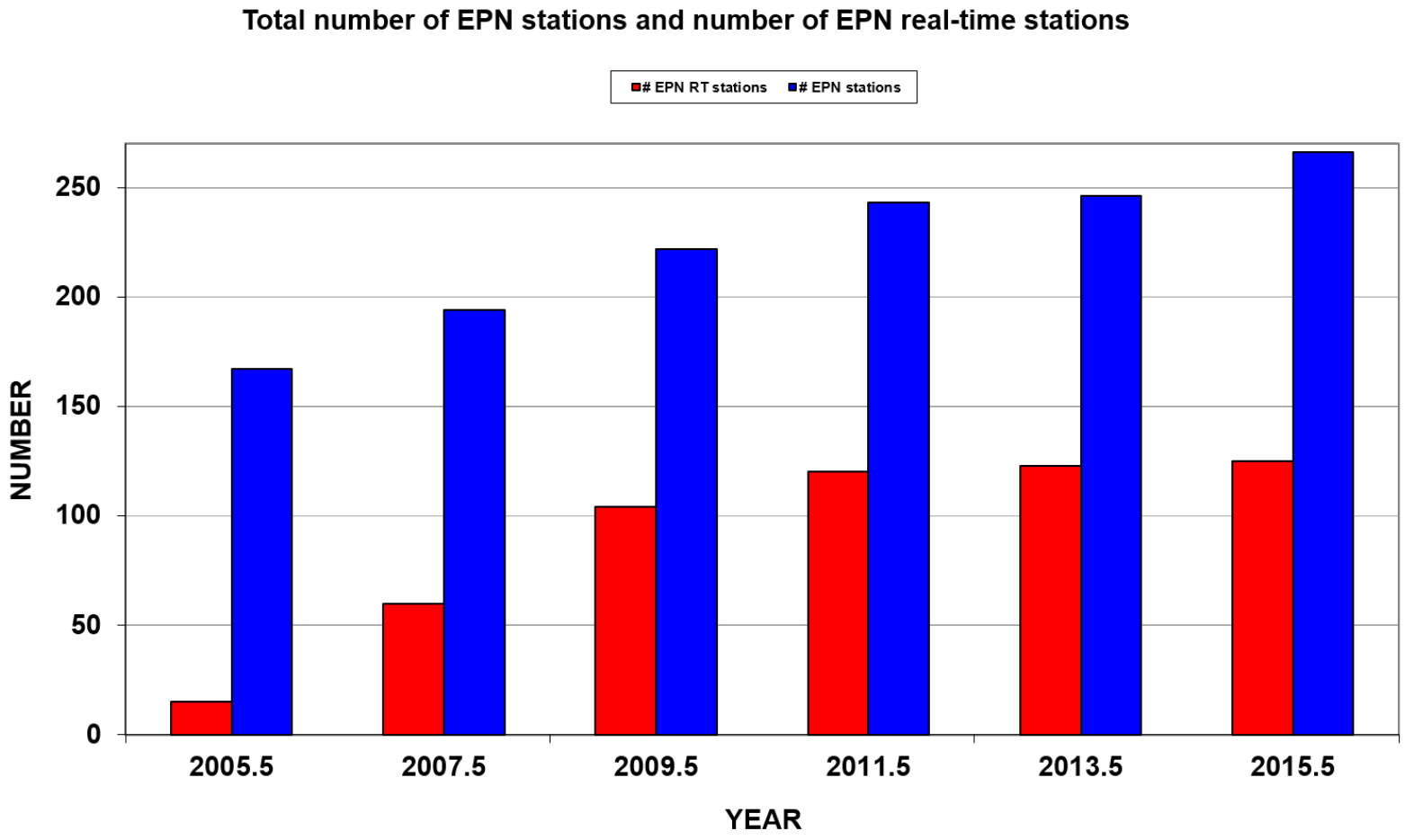
EPN Real-Time Analysis – Status Report

Wolfgang Söhne

Contents

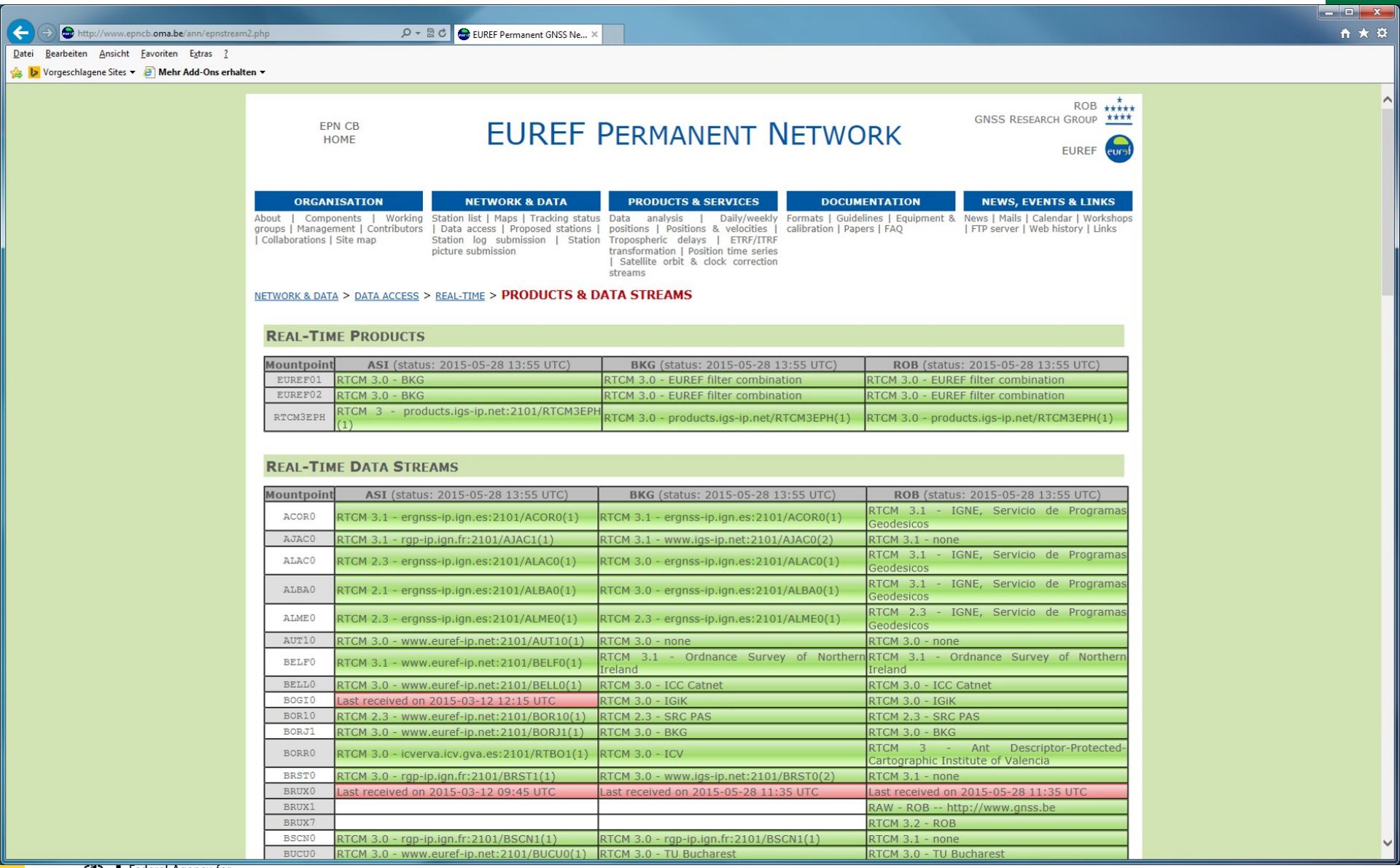
- Real-Time Data
- Real-Time Products
- RTCM
- Conclusions and Outlook

Real-Time Stations



EUREF Broadcaster

- Purpose: User should be able to get access to RT data (mountpoints) through different casters (redundancy concept)
- Goal: User should be able to switch between Regional Broadcasters (RB) without degradation of performance (e.g. availability, latency, …)
- Requirement: Identical setup at each broadcaster, e.g. identical mountpoint naming
- Valid for observations as well as for products
- Monitoring of general status done by ROB: http://www.epncb.oma.be/ann/epnstream2.php
- Monitoring of differences between broadcasters done by ROB: ftp://epncb.oma.be/pub/center/broadcasters/COMPARE_BRDC.txt
- Monitoring of differences between stream content and sourcetable or sitelog done by BKG:
  /home/rtmon/scripts/bin/checkSourcetable.pl
  → new tool available at the EPN CB



http://www.epncb.oma.be/ann/epnstream2.php

EUREF Permanent GNSS Ne...

Datei Bearbeiten Ansicht Favoriten Extras ?

Vorgeschlagene Sites | Mehr Add-Ons erhalten

EPN CB HOME

EUREF PERMANENT NETWORK

ROB GNSS RESEARCH GROUP

EUREF

ORGANISATION
About | Components | Working groups | Management | Contributors | Collaborations | Site map

NETWORK & DATA
Station list | Maps | Tracking status | Data access | Proposed stations | Station log submission | Station picture submission

PRODUCTS & SERVICES
Data analysis | Daily/weekly positions | Positions & velocities | Tropospheric delays | ETRF/ITRF transformation | Position time series | Satellite orbit & clock correction streams

DOCUMENTATION
Formats | Guidelines | Equipment & calibration | Papers | FAQ

NEWS, EVENTS & LINKS
News | Mails | Calendar | Workshops | FTP server | Web history | Links

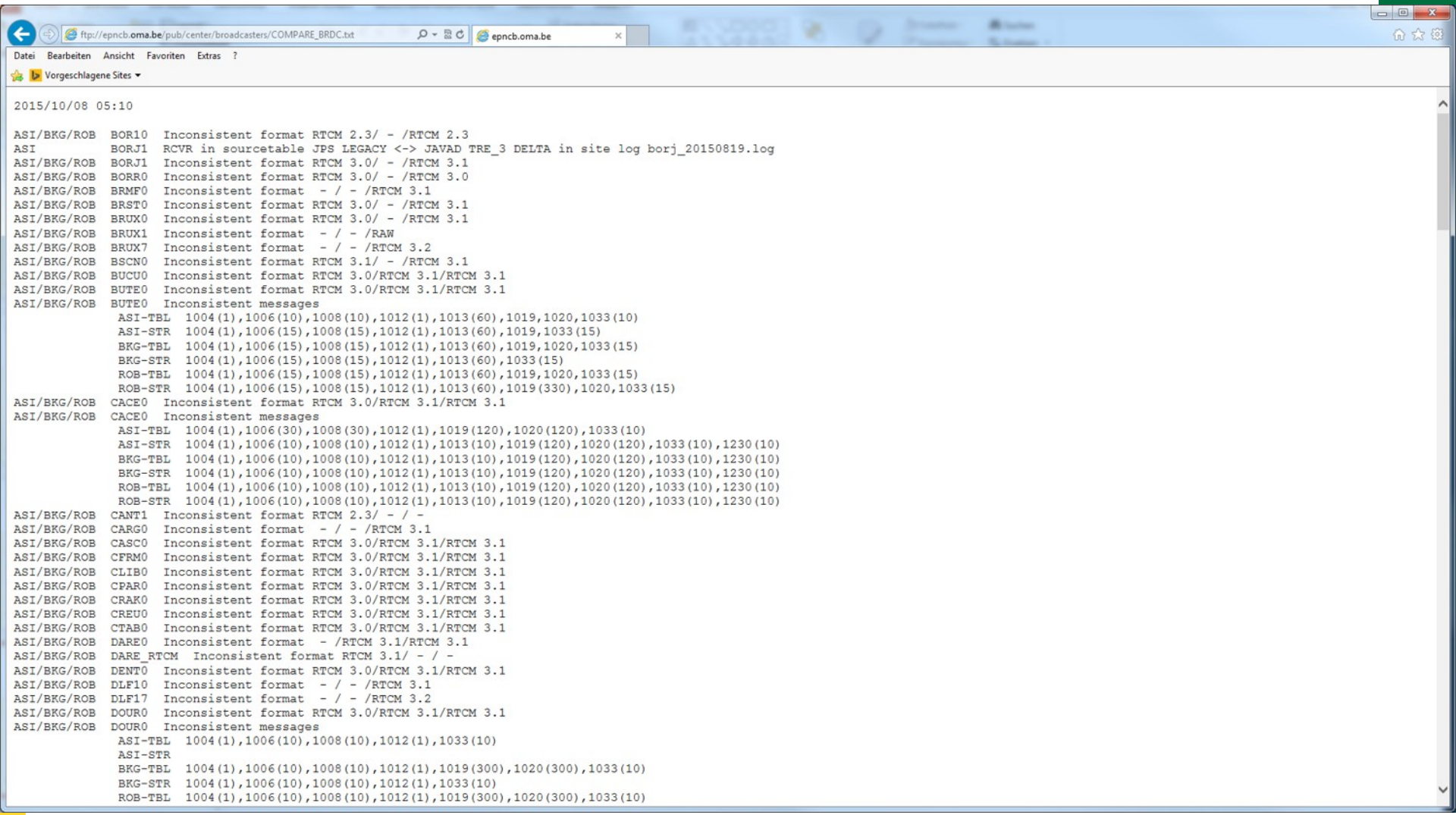
NETWORK & DATA > DATA ACCESS > REAL-TIME > **PRODUCTS & DATA STREAMS**

REAL-TIME PRODUCTS

Mountpoint	ASI (status: 2015-05-28 13:55 UTC)	BKG (status: 2015-05-28 13:55 UTC)	ROB (status: 2015-05-28 13:55 UTC)
EUREF01	RTCM 3.0 - BKG	RTCM 3.0 - EUREF filter combination	RTCM 3.0 - EUREF filter combination
EUREF02	RTCM 3.0 - BKG	RTCM 3.0 - EUREF filter combination	RTCM 3.0 - EUREF filter combination
RTCM3EPH	RTCM 3 - products.igs-ip.net:2101/RTCM3EPH(1)	RTCM 3.0 - products.igs-ip.net/RTCM3EPH(1)	RTCM 3.0 - products.igs-ip.net/RTCM3EPH(1)

REAL-TIME DATA STREAMS

Mountpoint	ASI (status: 2015-05-28 13:55 UTC)	BKG (status: 2015-05-28 13:55 UTC)	ROB (status: 2015-05-28 13:55 UTC)
ACOR0	RTCM 3.1 - ergnss-ip.ign.es:2101/ACOR0(1)	RTCM 3.1 - ergnss-ip.ign.es:2101/ACOR0(1)	RTCM 3.1 - IGNE, Servicio de Programas Geodesicos
AJAC0	RTCM 3.1 - rgp-ip.ign.fr:2101/AJAC1(1)	RTCM 3.1 - www.igs-ip.net:2101/AJAC0(2)	RTCM 3.1 - none
ALAC0	RTCM 2.3 - ergnss-ip.ign.es:2101/ALAC0(1)	RTCM 3.0 - ergnss-ip.ign.es:2101/ALAC0(1)	RTCM 3.1 - IGNE, Servicio de Programas Geodesicos
ALBA0	RTCM 2.1 - ergnss-ip.ign.es:2101/ALBA0(1)	RTCM 3.0 - ergnss-ip.ign.es:2101/ALBA0(1)	RTCM 3.1 - IGNE, Servicio de Programas Geodesicos
ALME0	RTCM 2.3 - ergnss-ip.ign.es:2101/ALME0(1)	RTCM 2.3 - ergnss-ip.ign.es:2101/ALME0(1)	RTCM 2.3 - IGNE, Servicio de Programas Geodesicos
AUT10	RTCM 3.0 - www.euref-ip.net:2101/AUT10(1)	RTCM 3.0 - none	RTCM 3.0 - none
BELF0	RTCM 3.1 - www.euref-ip.net:2101/BELF0(1)	RTCM 3.1 - Ordnance Survey of Northern Ireland	RTCM 3.1 - Ordnance Survey of Northern Ireland
BELL0	RTCM 3.0 - www.euref-ip.net:2101/BELL0(1)	RTCM 3.0 - ICC Catnet	RTCM 3.0 - ICC Catnet
BOGI0	Last received on 2015-03-12 12:15 UTC	RTCM 3.0 - IGiK	RTCM 3.0 - IGiK
BOR10	RTCM 2.3 - www.euref-ip.net:2101/BOR10(1)	RTCM 2.3 - SRC PAS	RTCM 2.3 - SRC PAS
BORJ1	RTCM 3.0 - www.euref-ip.net:2101/BORJ1(1)	RTCM 3.0 - BKG	RTCM 3.0 - BKG
BORR0	RTCM 3.0 - icverva.icv.gva.es:2101/RTBO1(1)	RTCM 3.0 - ICV	RTCM 3 - Ant Descriptor-Protected-Cartographic Institute of Valencia
BRST0	RTCM 3.0 - rgp-ip.ign.fr:2101/BRST1(1)	RTCM 3.0 - www.igs-ip.net:2101/BRST0(2)	RTCM 3.1 - none
BRUX0	Last received on 2015-03-12 09:45 UTC	Last received on 2015-05-28 11:35 UTC	Last received on 2015-05-28 11:35 UTC
BRUX1			RAW - ROB -- http://www.gnss.be
BRUX7			RTCM 3.2 - ROB
BSCN0	RTCM 3.0 - rgp-ip.ign.fr:2101/BSCN1(1)	RTCM 3.0 - rgp-ip.ign.fr:2101/BSCN1(1)	RTCM 3.1 - none
BUCU0	RTCM 3.0 - www.euref-ip.net:2101/BUCU0(1)	RTCM 3.0 - TU Bucharest	RTCM 3.0 - TU Bucharest

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2015/10/08 05:10

ASI/BKG/ROB  BOR10  Inconsistent format RTCM 2.3/ - /RTCM 2.3
ASI          BORJ1  RCVR in sourcetable JPS LEGACY <-> JAVAD TRE_3 DELTA in site log borj_20150819.log
ASI/BKG/ROB  BORJ1  Inconsistent format RTCM 3.0/ - /RTCM 3.1
ASI/BKG/ROB  BORR0  Inconsistent format RTCM 3.0/ - /RTCM 3.0
ASI/BKG/ROB  BRMF0  Inconsistent format  - / - /RTCM 3.1
ASI/BKG/ROB  BRST0  Inconsistent format RTCM 3.0/ - /RTCM 3.1
ASI/BKG/ROB  BRUX0  Inconsistent format RTCM 3.0/ - /RTCM 3.1
ASI/BKG/ROB  BRUX1  Inconsistent format  - / - /RAW
ASI/BKG/ROB  BRUX7  Inconsistent format  - / - /RTCM 3.2
ASI/BKG/ROB  BSCN0  Inconsistent format RTCM 3.1/ - /RTCM 3.1
ASI/BKG/ROB  BUCU0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  BUTE0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  BUTE0  Inconsistent messages
              ASI-TBL  1004(1),1006(10),1008(10),1012(1),1013(60),1019,1020,1033(10)
              ASI-STR  1004(1),1006(15),1008(15),1012(1),1013(60),1019,1033(15)
              BKG-TBL  1004(1),1006(15),1008(15),1012(1),1013(60),1019,1020,1033(15)
              BKG-STR  1004(1),1006(15),1008(15),1012(1),1013(60),1033(15)
              ROB-TBL  1004(1),1006(15),1008(15),1012(1),1013(60),1019,1020,1033(15)
              ROB-STR  1004(1),1006(15),1008(15),1012(1),1013(60),1019(330),1020,1033(15)
ASI/BKG/ROB  CACE0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  CACE0  Inconsistent messages
              ASI-TBL  1004(1),1006(30),1008(30),1012(1),1019(120),1020(120),1033(10)
              ASI-STR  1004(1),1006(10),1008(10),1012(1),1013(10),1019(120),1020(120),1033(10),1230(10)
              BKG-TBL  1004(1),1006(10),1008(10),1012(1),1013(10),1019(120),1020(120),1033(10),1230(10)
              BKG-STR  1004(1),1006(10),1008(10),1012(1),1013(10),1019(120),1020(120),1033(10),1230(10)
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              ROB-STR  1004(1),1006(10),1008(10),1012(1),1013(10),1019(120),1020(120),1033(10),1230(10)
ASI/BKG/ROB  CANT1  Inconsistent format RTCM 2.3/ - / -
ASI/BKG/ROB  CARG0  Inconsistent format  - / - /RTCM 3.1
ASI/BKG/ROB  CASC0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  CFRM0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  CLIB0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
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ASI/BKG/ROB  CRAK0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  CREU0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  CTAB0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  DARE0  Inconsistent format  - /RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  DARE_RTCM  Inconsistent format RTCM 3.1/ - / -
ASI/BKG/ROB  DENT0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  DLF10  Inconsistent format  - / - /RTCM 3.1
ASI/BKG/ROB  DLF17  Inconsistent format  - / - /RTCM 3.2
ASI/BKG/ROB  DOUR0  Inconsistent format RTCM 3.0/RTCM 3.1/RTCM 3.1
ASI/BKG/ROB  DOUR0  Inconsistent messages
              ASI-TBL  1004(1),1006(10),1008(10),1012(1),1033(10)
              ASI-STR
              BKG-TBL  1004(1),1006(10),1008(10),1012(1),1019(300),1020(300),1033(10)
              BKG-STR  1004(1),1006(10),1008(10),1012(1),1033(10)
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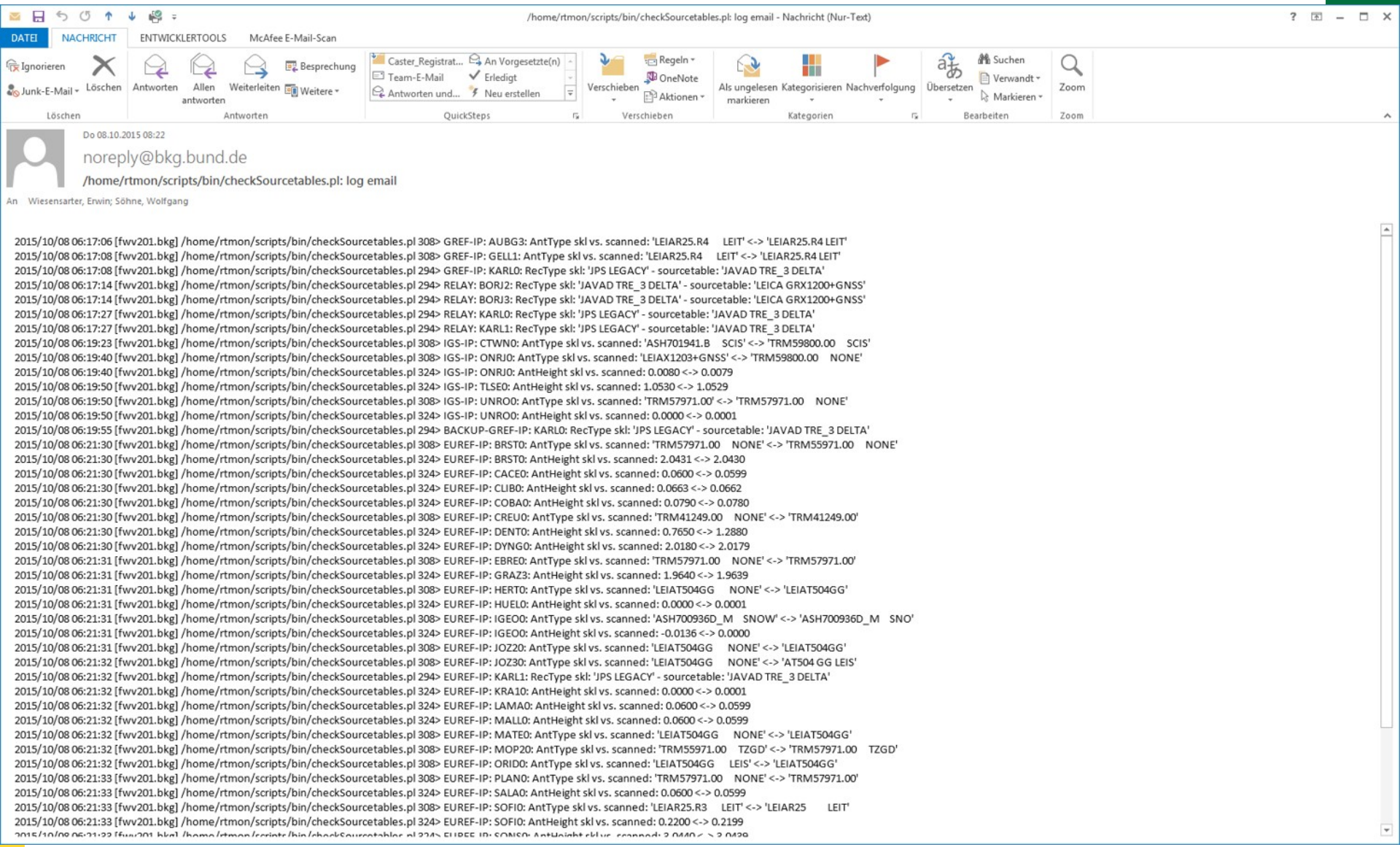

2015/10/08 06:17:06 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> GREF-IP: AUBG3: AntType skl vs. scanned: 'LEIAR25.R4 LEIT' <-> 'LEIAR25.R4 LEIT'
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2015/10/08 06:17:14 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 294> RELAY: BORJ2: RecType skl: 'JAVAD TRE_3 DELTA' - sourcetable: 'LEICA GRX1200+GNSS'
2015/10/08 06:17:14 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 294> RELAY: BORJ3: RecType skl: 'JAVAD TRE_3 DELTA' - sourcetable: 'LEICA GRX1200+GNSS'
2015/10/08 06:17:27 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 294> RELAY: KARL0: RecType skl: 'JPS LEGACY' - sourcetable: 'JAVAD TRE_3 DELTA'
2015/10/08 06:17:27 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 294> RELAY: KARL1: RecType skl: 'JPS LEGACY' - sourcetable: 'JAVAD TRE_3 DELTA'
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2015/10/08 06:19:50 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> IGS-IP: TLSE0: AntHeight skl vs. scanned: 1.0530 <-> 1.0529
2015/10/08 06:19:50 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> IGS-IP: UNRO0: AntType skl vs. scanned: 'TRM57971.00' <-> 'TRM57971.00 NONE'
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2015/10/08 06:21:30 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: BRST0: AntType skl vs. scanned: 'TRM57971.00 NONE' <-> 'TRM55971.00 NONE'
2015/10/08 06:21:30 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: BRST0: AntHeight skl vs. scanned: 2.0431 <-> 2.0430
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2015/10/08 06:21:30 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: CREU0: AntType skl vs. scanned: 'TRM41249.00 NONE' <-> 'TRM41249.00'
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2015/10/08 06:21:30 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: DYNG0: AntHeight skl vs. scanned: 2.0180 <-> 2.0179
2015/10/08 06:21:31 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: EBRE0: AntType skl vs. scanned: 'TRM57971.00 NONE' <-> 'TRM57971.00'
2015/10/08 06:21:31 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: GRAZ3: AntHeight skl vs. scanned: 1.9640 <-> 1.9639
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2015/10/08 06:21:31 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: HUEL0: AntHeight skl vs. scanned: 0.0000 <-> 0.0001
2015/10/08 06:21:31 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: IGEO0: AntType skl vs. scanned: 'ASH700936D_M SNOW' <-> 'ASH700936D_M SNO'
2015/10/08 06:21:31 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: IGEO0: AntHeight skl vs. scanned: -0.0136 <-> 0.0000
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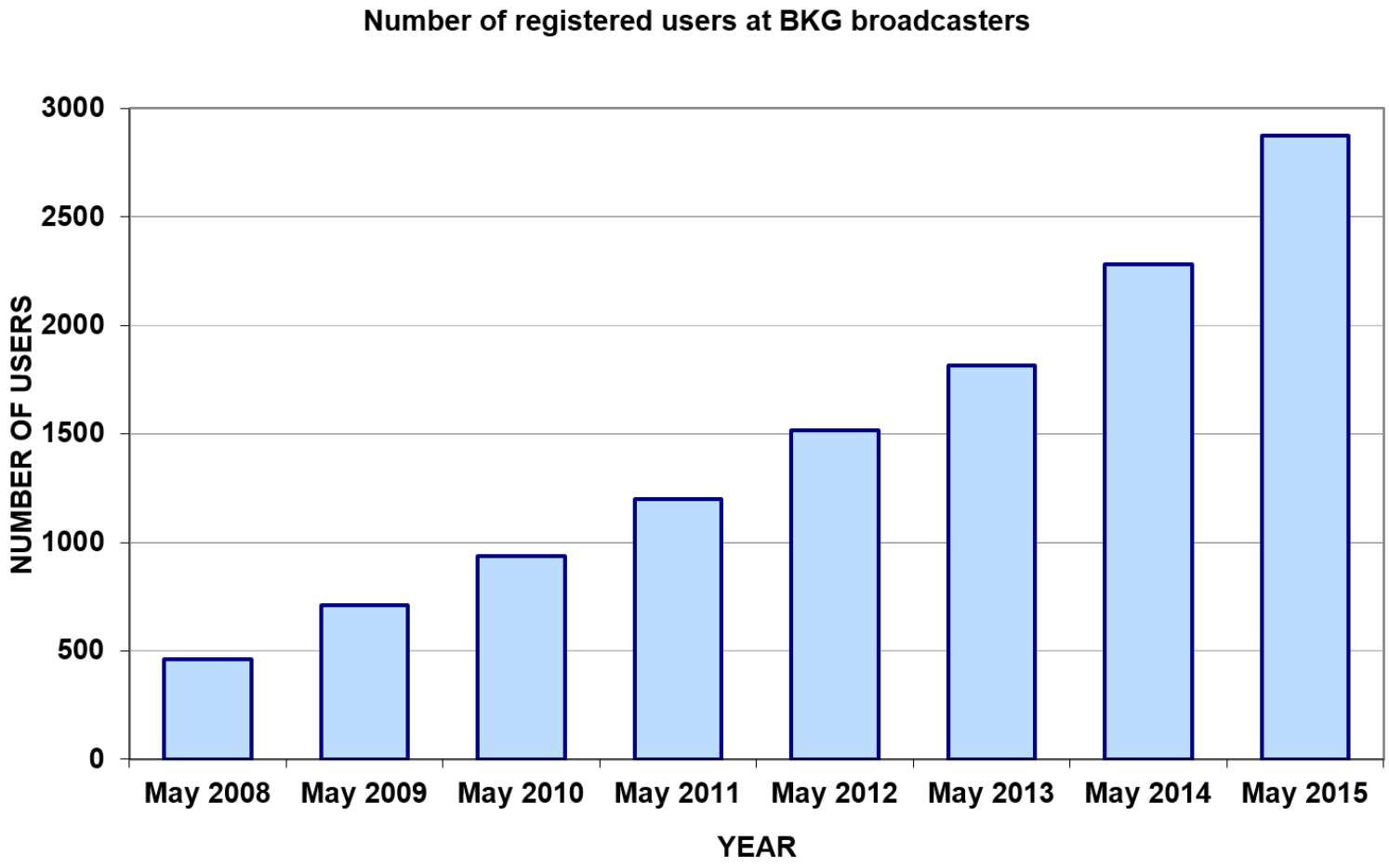
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 294> EUREF-IP: KARL1: RecType skl: 'JPS LEGACY' - sourcetable: 'JAVAD TRE_3 DELTA'
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: KRA10: AntHeight skl vs. scanned: 0.0000 <-> 0.0001
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: LAMA0: AntHeight skl vs. scanned: 0.0600 <-> 0.0599
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: MALL0: AntHeight skl vs. scanned: 0.0600 <-> 0.0599
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: MATE0: AntType skl vs. scanned: 'LEIAT504GG NONE' <-> 'LEIAT504GG'
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: MOP20: AntType skl vs. scanned: 'TRM55971.00 TZGD' <-> 'TRM57971.00 TZGD'
2015/10/08 06:21:32 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: ORID0: AntType skl vs. scanned: 'LEIAT504GG LEIS' <-> 'LEIAT504GG'
2015/10/08 06:21:33 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: PLAN0: AntType skl vs. scanned: 'TRM57971.00 NONE' <-> 'TRM57971.00'
2015/10/08 06:21:33 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: SALA0: AntHeight skl vs. scanned: 0.0600 <-> 0.0599
2015/10/08 06:21:33 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 308> EUREF-IP: SOFI0: AntType skl vs. scanned: 'LEIAR25.R3 LEIT' <-> 'LEIAR25 LEIT'
2015/10/08 06:21:33 [fwv201.bkg] /home/rtmon/scripts/bin/checkSourcetables.pl 324> EUREF-IP: SOFI0: AntHeight skl vs. scanned: 0.2200 <-> 0.2199

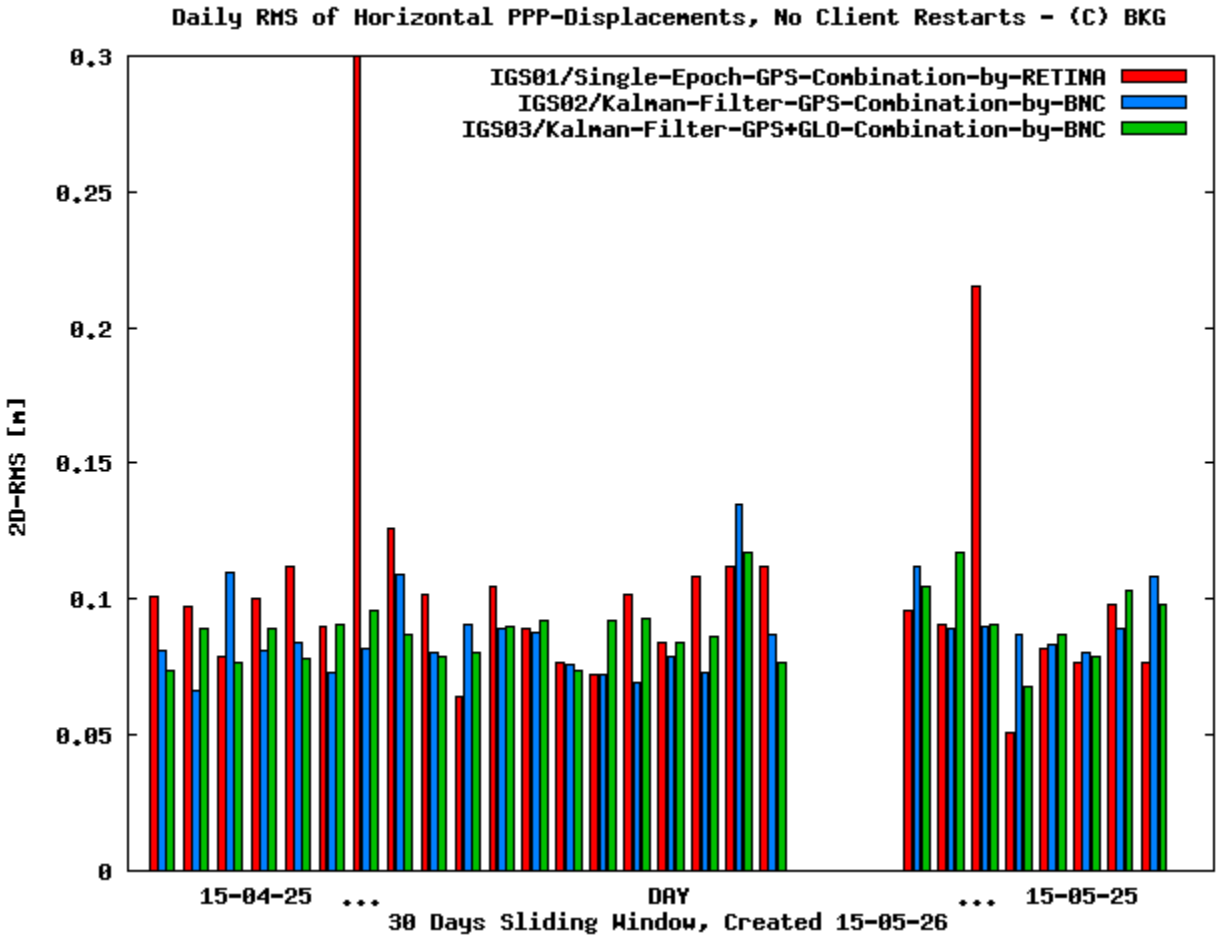
Real-Time User Registrations



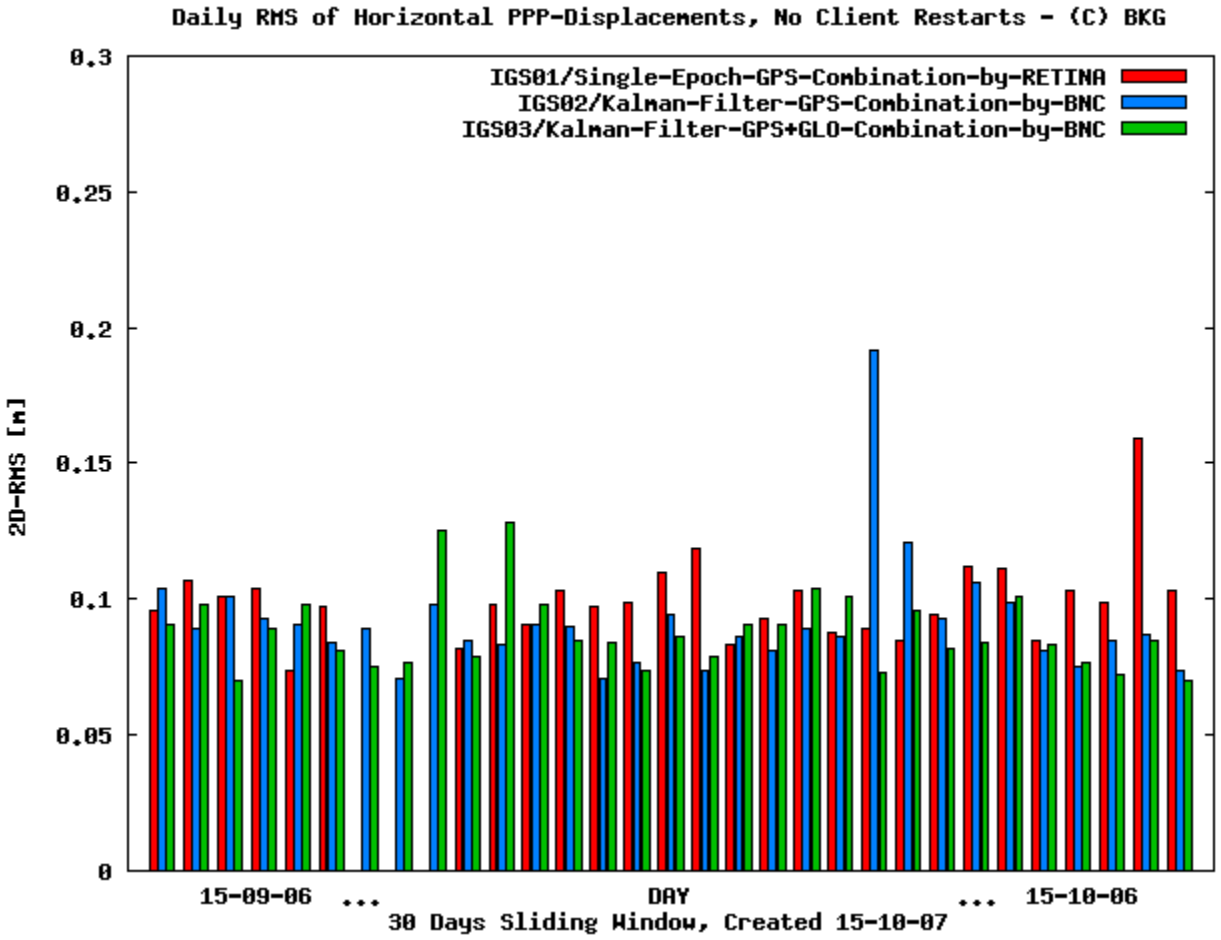
IGS RT Analysis

- IGS Real-Time Service (RTS) started in 2013
  - 10 RT ACs – 8 contributing routinely
  - 8 individual contributions for GPS, 4 for GPS+GLO
  - IGS01: GPS-only combined solution by ESOC
  - IGS02: GPS-only combined solution by BKG
  - IGS03: GPS+GLO combined solution by BKG
  - Combined product IGS01 very stable with clock standard deviation (sigma) of 0.15 ns
- EPN RT Data used as input for IGS RTS
  - Only few European stations necessary equally distribution and for global coverage

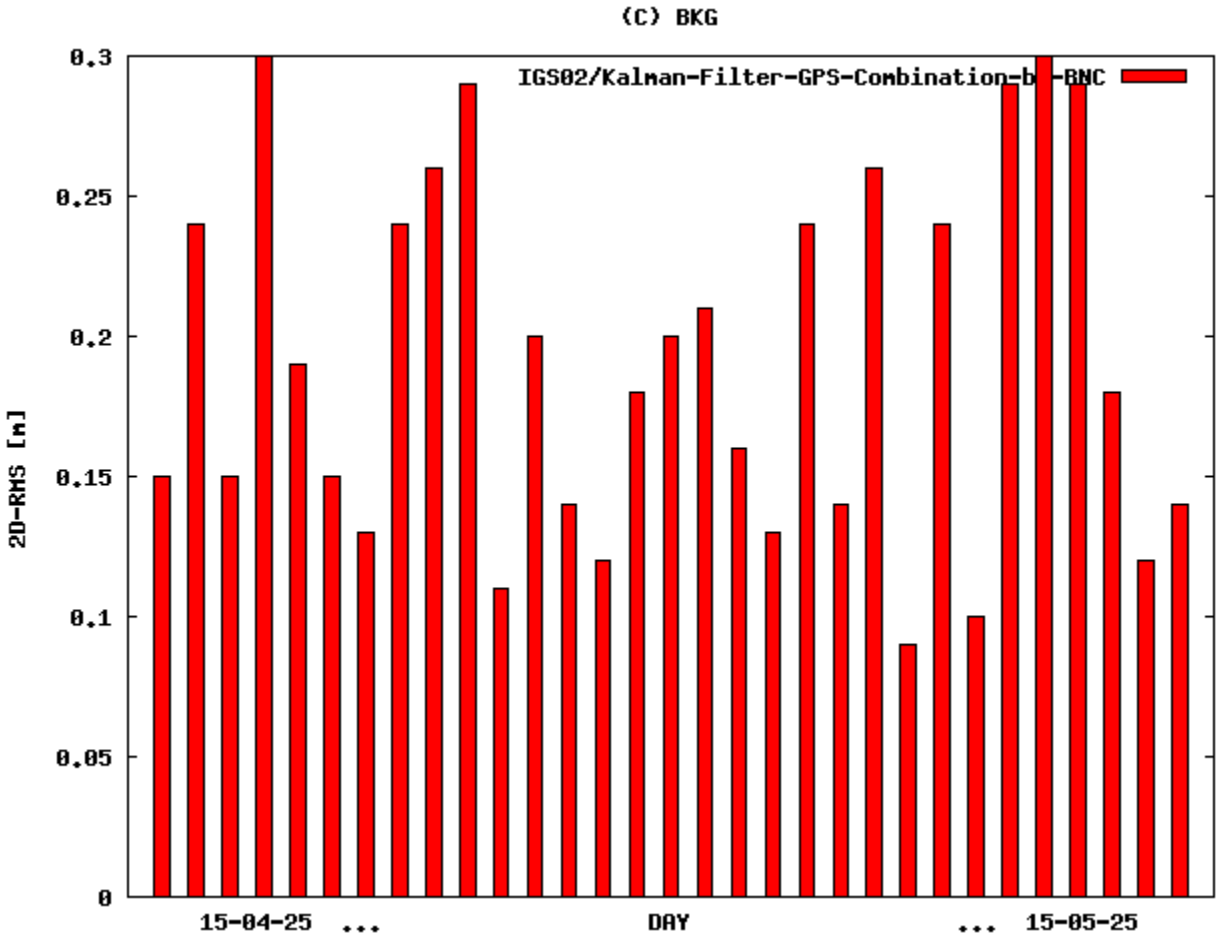
IGS RT Analysis



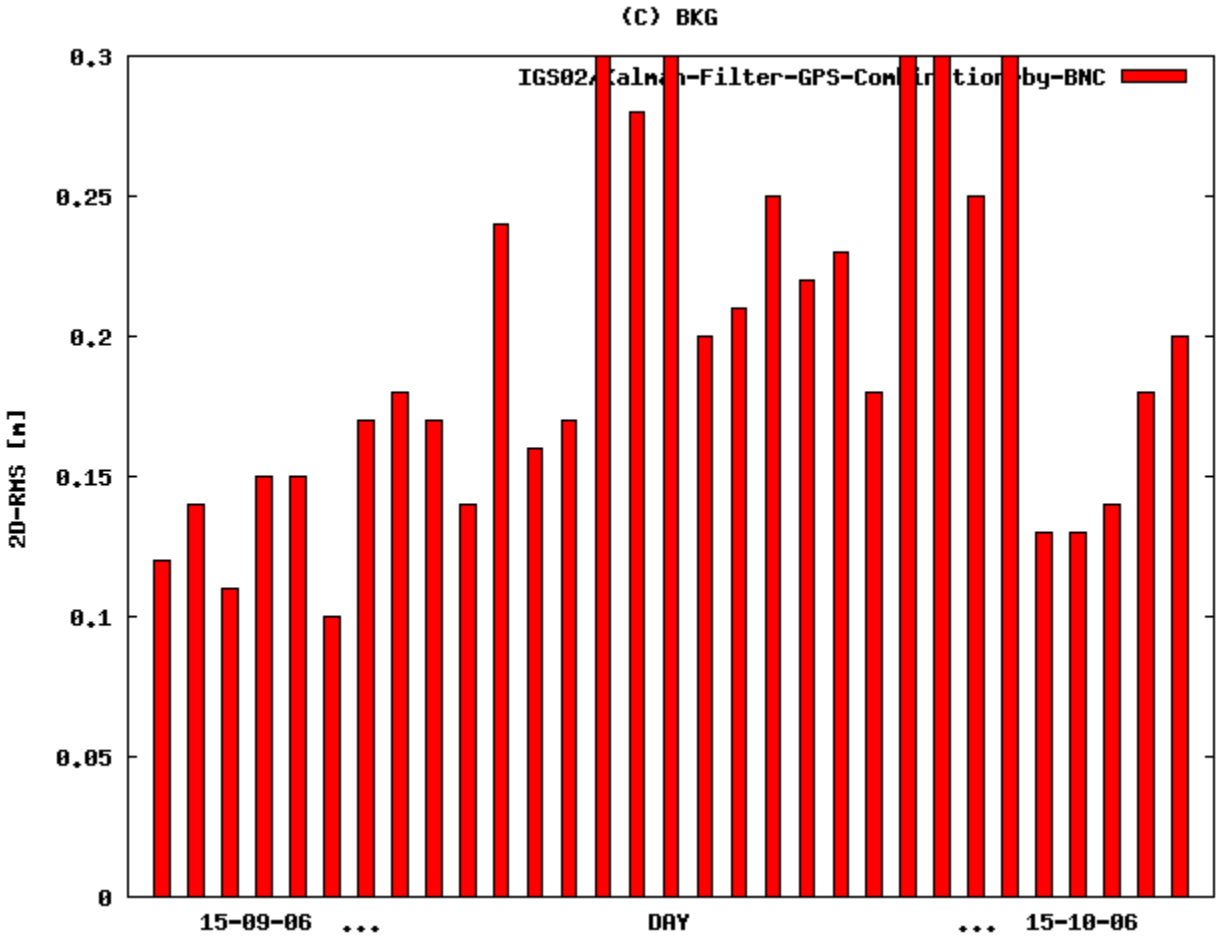
IGS RT Analysis



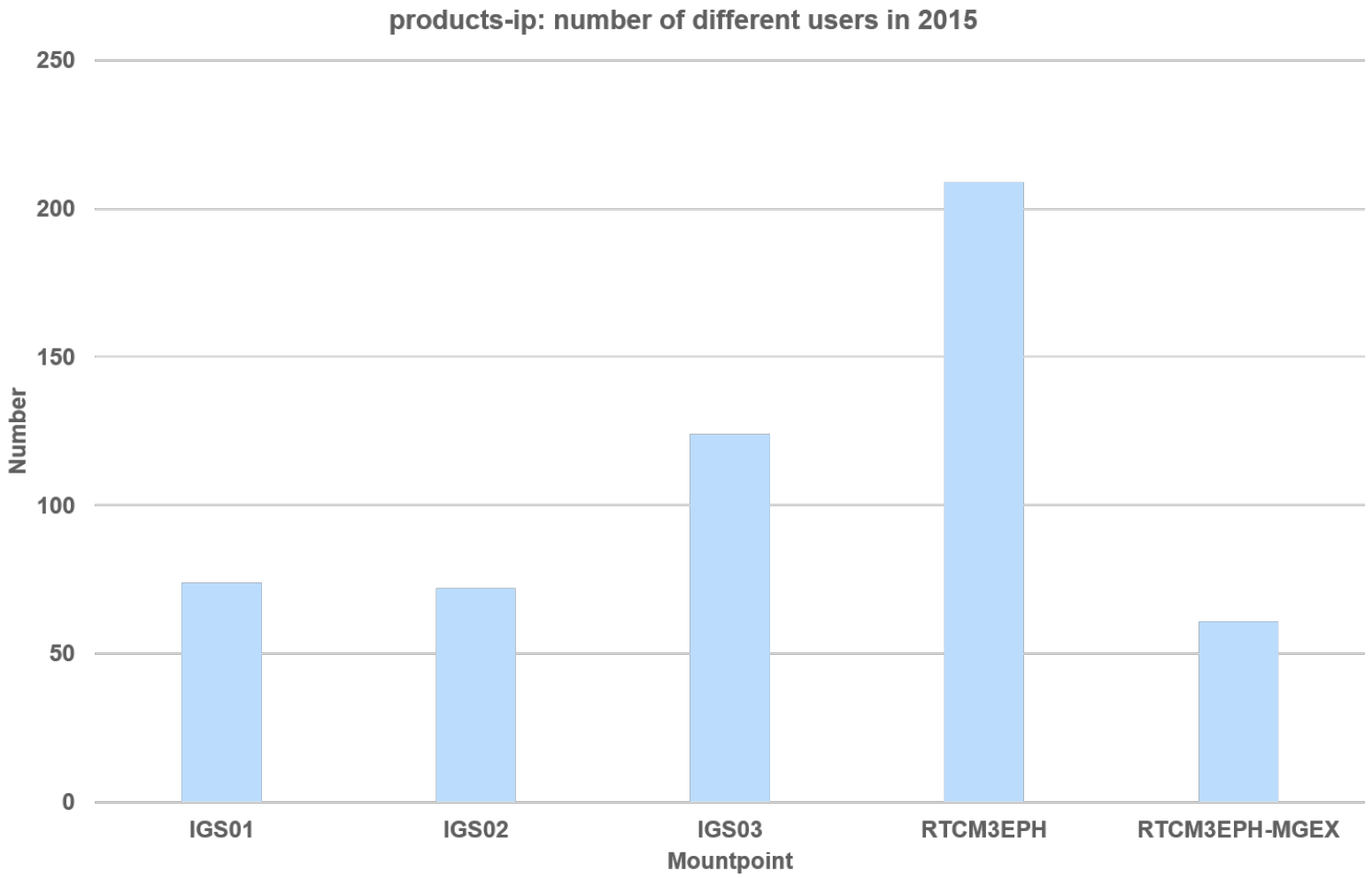
IGS RT Analysis



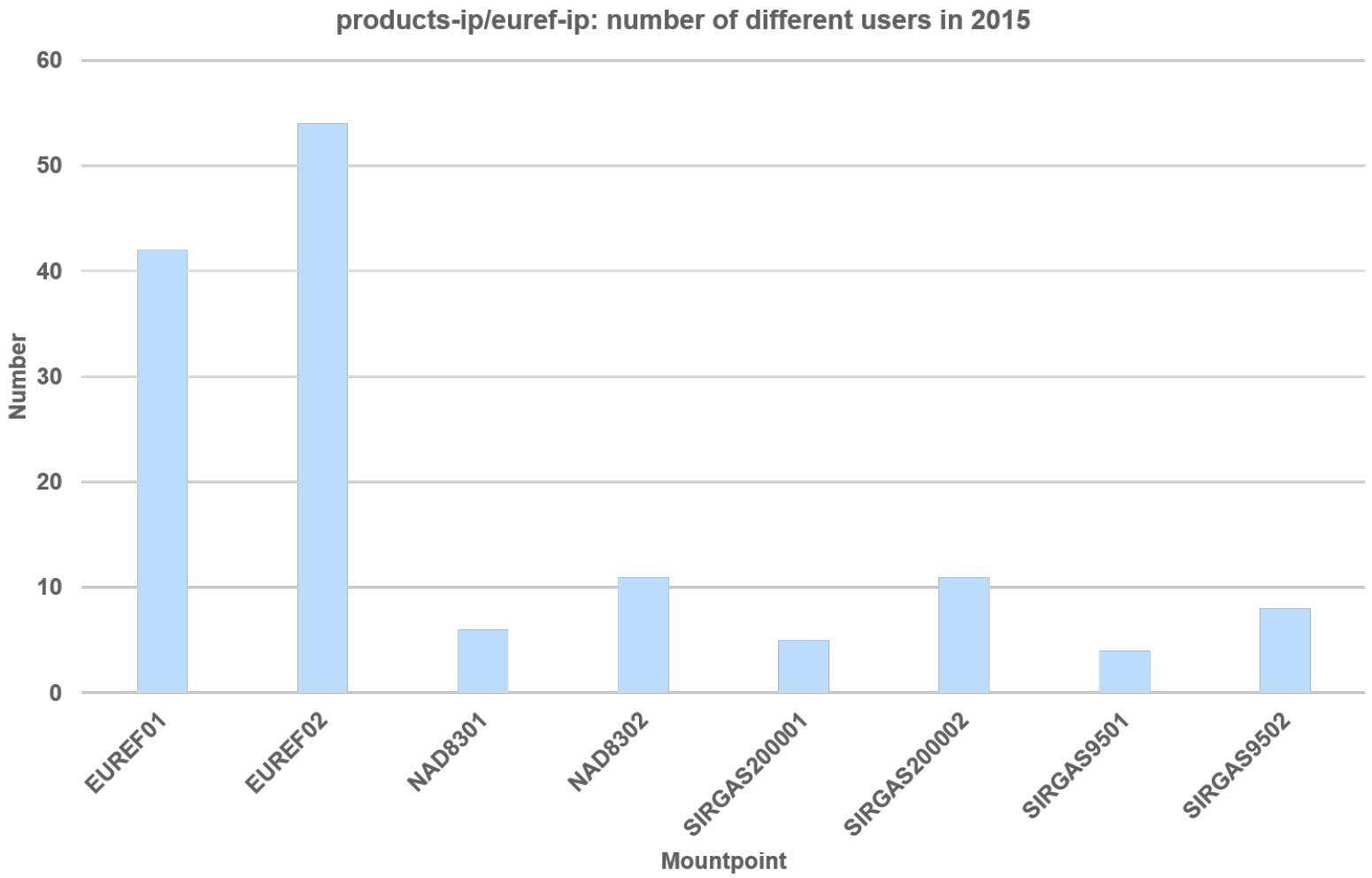
IGS RT Analysis



Real-Time Products User



Real-Time Products User



Multi-GNSS: RTCM 3.2 MSM

- MSM: Multi Signal Messages
- GPS and GLONASS as the basis
- Additional constellation or system mandatory:
  GAL, BDS, QZS, SBAS
- Message types: 1071-1077 (GPS), 1081-1087 (GLO), 1091-1097 (GAL), 1101-1107 (SBAS), 1111-1117 (QZS), 1121-1127 (BDS)
- European stations so far available at broadcaster mgex-ip:
  BRST, BRUX, DLF1, DYNG, GOP6, GRAC, HOFN, KIR8, KZN2, LLAG, M0SE, MAR7, MATG, METG, MYVA, NYA2, OBE4, ONS1, POTS, REYK, TLSE, WTZ2, WTZ3, WTZZ, ZIM3 (25)

RT Navigation Message

- Purpose: get navigation messages of each satellite of each constellation immediately after initialization
- Currently not possible from space segment
- RTCM3EPH-MGEX
  - Contains GPS(1019)+GLO(1020)+GAL+BDS+QZS(1044)+SBAS(1043)
  - Sampling rate every 5/10 seconds
- GAL message type 1045/1046
  - Issue with F/NAV (E5A) vs. I/NAV (from E1B and E5B)
- BDS preliminary message type 63
  - implemented by BKG, DLR and Geo++ for independent testing
  - CDV now to be prepared

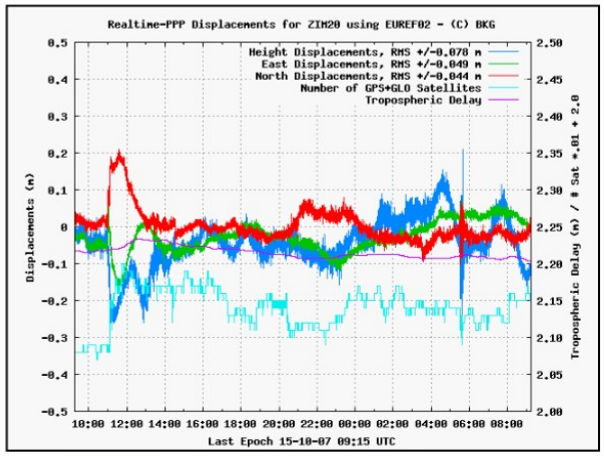
RTCM SSR

- SSR stage 1
  - Orbit and clock corrections, code biases
  - Already available for GPS and GLONASS
  - In preparation for Galileo and QZSS
  - Issues for BeiDou and SBAS (patent problem)
- SSR stage 2
  - Phase biases and VTEC
  - Under discussion in SC104

EPN RT Analysis

PPP Monitor Scenario 26

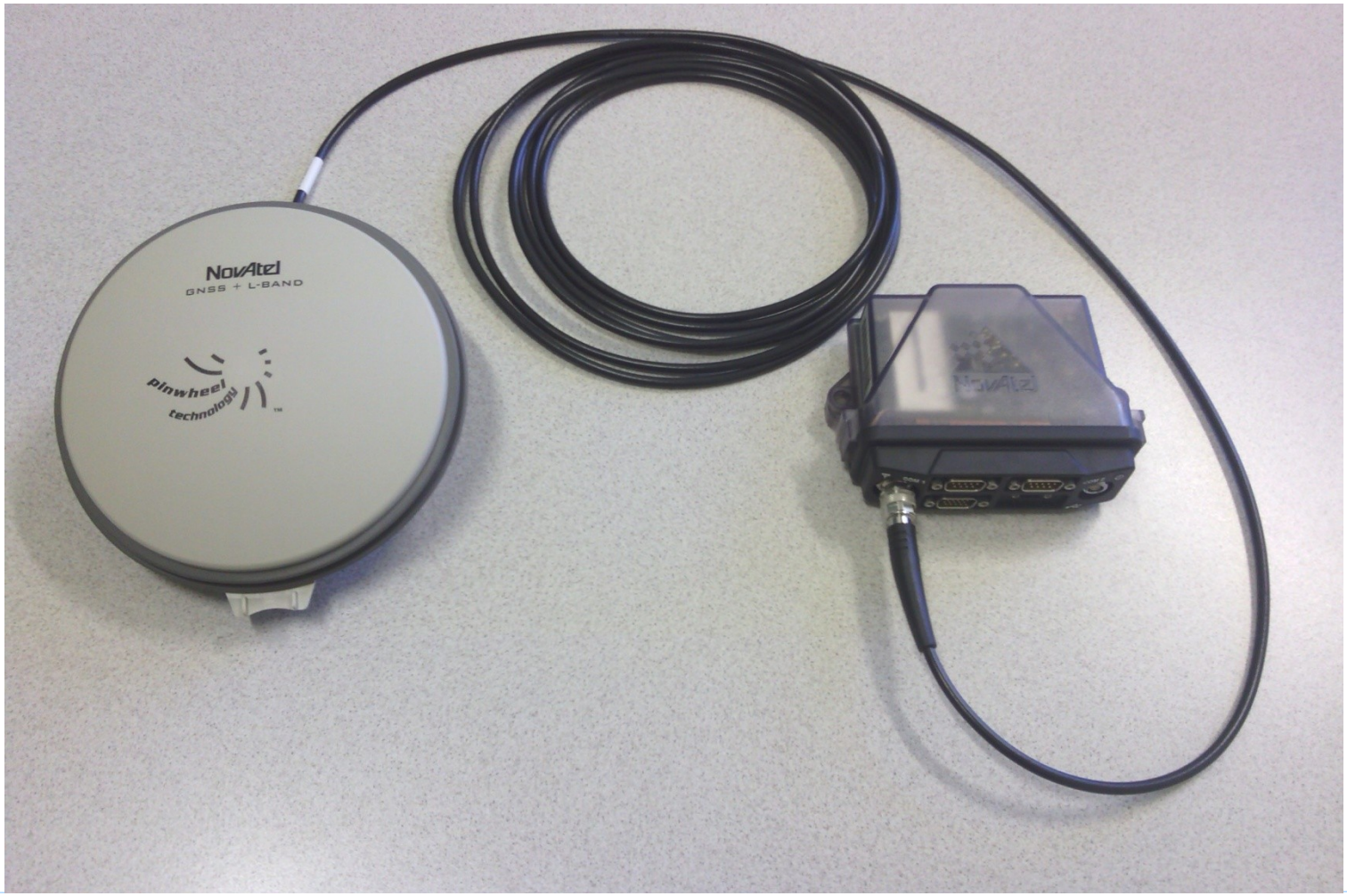
- PPP client software: BKG Ntrip Client (BNC)
- Location: IGS reference station ZIM2, Zimmerwald, Switzerland
- Observations: 1Hz, dual frequency, GPS and GLONASS
- Reference: ETRF2000, X=4331300.15m, Y=567537.08m, Z=4633133.51m
- Orbit/clock corrections software: BNC, Combination Option
- Orbits: CODE Ultra Rapid product
- Orbit/clock corrections stream: EUREF02 by BKG on www.euref-ip.net, combined EUREF product, Kalman Filter (KF) combination of CLK11(BKG), CLK91(CNES), CLK21(DLR), and CLK80(GMV)
- Orbit/clock corrections encoding: BKG Ntrip Client (BNC)
- Broadcast ephemeris stream: RTCM3EPH on products.igs-ip.net by BKG
- PPP mode: Fully kinematic
- Sigmas for code and carrier-phase: ±50.0m, ±0.02m
- Sigma for troposphere variation: ±3e-6 m/s
- PPP client restart: None, 24 hour sliding window
- Plot update: Every 15 minutes



EPN RT Analysis

- Precise Point Positioning (PPP) still growing market
  - „precise“ thanks to the availability of real-time corrections (orbits, clocks, biases, …)
  - RTCM SC104 WG on „State Space Representation“ (SSR) in charge with the standardisation
- Commercial receiver supporting open standard SSR
  - NovAtel Flex6 (OEM628 receiver board)
  - Allowing usage of open standard satellite orbit and clock corrections using RTCM SSR level 1 messages

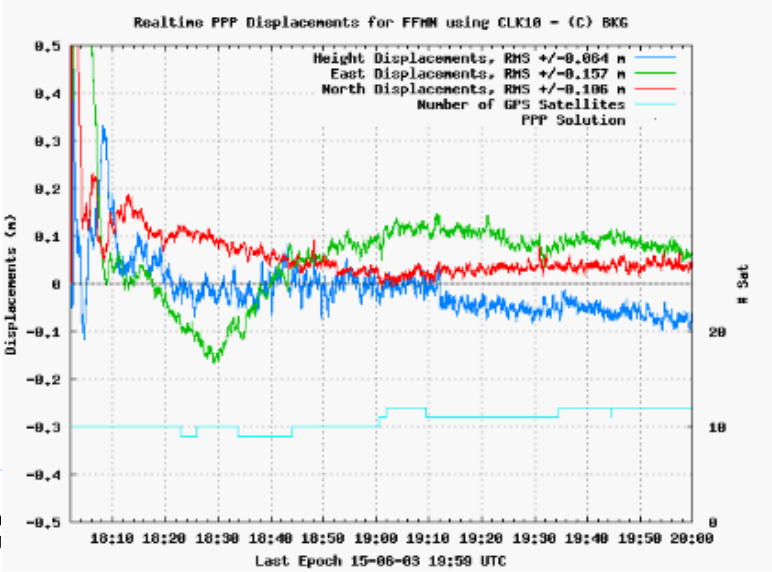
EPN RT Analysis



EPN RT Analysis

PP Monitor Scenario 27

- PPP client software: Novatel OEM628 Receiver
- Location: Station FFMN, Frankfurt, Germany
- Antenna: TRM29659.00
- Observations: 1Hz, dual frequency, GPS only
- Reference: ITFR2005/IGS05, Lat=50.09050462129, Lon=8.66499584663, Height=178.93m
- Orbit/clock corrections software: RTNet by GPS Solutions
- Orbits: CODE Ultra Rapid product
- Orbit/clock corrections stream: CLK10 on products.igs-ip.net by BKG
- Orbit/clock corrections encoding: BKG Ntrip Client (BNC)
- Broadcast ephemeris stream: RTCM3EPH on products.igs-ip.net by BKG
- PPP mode: Fully kinematic
- PPP filter converged criteria: Horizontal standard deviation 0.15m
- Sigma for a priori coordinates: ±10.0m
- Receiver restart: Every 2 hours
- Plot update: Every 2 hours



Conclusions & Outlook

- Real-Time Data
  - RT stations to keep the pace with overall EPN station evolvement
  - Homogeneous distribution of users to broadcasters still an issue
    → possibly open EPN RBCs to MSM and to global?
  - ...
- Real-Time Products
  - No „real“ EUREF / EPN RT product(s)
  - …
- RT PPP Software
  - BNC new version 2.12 close to final
  - G-nut/Tefnut – open source, download available
  - RTKLIB new version 2.4.3 (beta) available
- …

Thank you for your kind attention!

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