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Multi-GNSS Working group

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Part 1: GNSS activities swisstopo / EPN

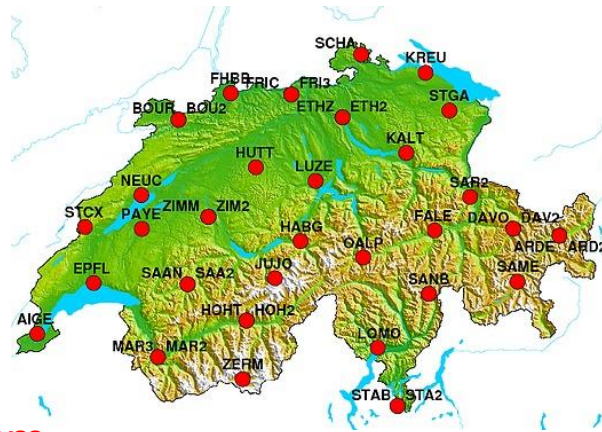
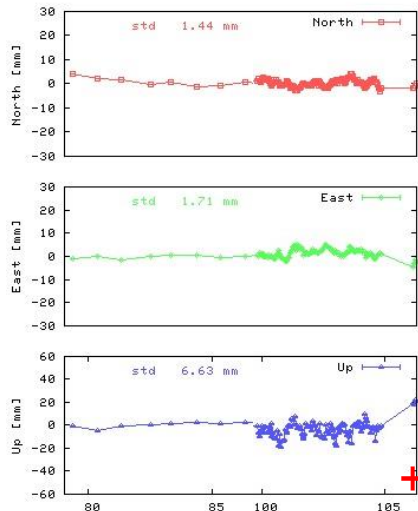
E. Brockmann



Multi-GNSS at Swiss permanent stations

- Feb-May 2015: all 41 Swiss stations are enhanced from **GPS/GLO receivers to Multi-GNSS** (+ 15 chokering antennas: causing jumps of ~ 2 cm despite individual antenna PCVs)

PAYE



ZIMJ
(Javad)



16/04/15 13:56



Data flow RINEX3 parallel to RINEX2

- Daily and hourly data flow RINEX3 since June 19, 2015 (after EUREF symposium)

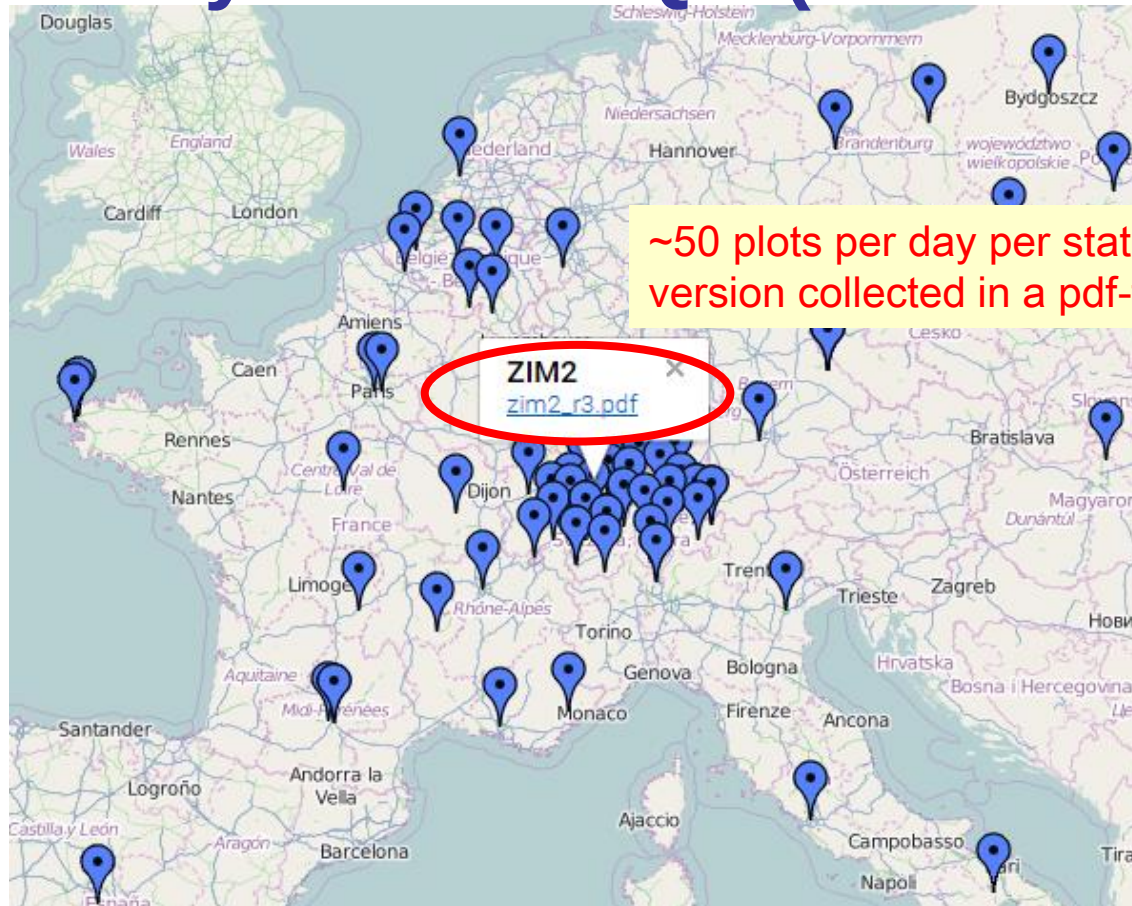


S/S	0/F	RINEX observation codes and their priority											
***	***	***	***	***	***	***	***	***	***	***	***	***	***
G	L1	L1C	L1P	L1W									
G	L2	L2W	L2P	L2L	L2S	L2X	L2C	L2D					
G	C1	C1C	C1P	C1W									
G	C2	C2W	C2P	C2L	C2S	C2X	C2C	C2D					
R	L1	L1C	L1P										
R	L2	L2P	L2C										
R	C1	C1C	C1P										
R	C2	C2P	C2C										
E	L1	L1C	L1X										
E	L2	L5Q	L5I	L5X									
E	C1	C1C	C1X										
E	C2	C5Q	C5I	C5X									

- Also first network solutions making use of Galileo in parallel since Aug 2015 -> using BSW53 -> experimental -> see EUREF Multi-GNSS presentation Leipzig + upcoming EUREF LAC WS in next days (Berne)



Daily RINEX 3 QC (100 stations)



~50 plots per day per station per RINEX version collected in a pdf-file !



G-Nut/Anubis
-> GOPE

BNC-> BKG

MARKER	RECEIVER	ANTENNA	Vers	In	Epo	G	R	E	C	PDF
AJAC 10077M005	LEICA GR25	TRM57971.00	NONE	3.02	30	2880	30	24	6	8 ajac_r3.pdf
AUTN 10080M001	LEICA GR25	TRM57971.00	NONE	3.02	30	2880	30	24	6	8 autn_r3.pdf

http://www.swisstopo.admin.ch/swisstopo/geodesy/pnac/html/en/anubis_monitor_r3.html

Preparing for G-Nut/Anubis 1.4

☺ Progress in development of new/enhanced functionalities

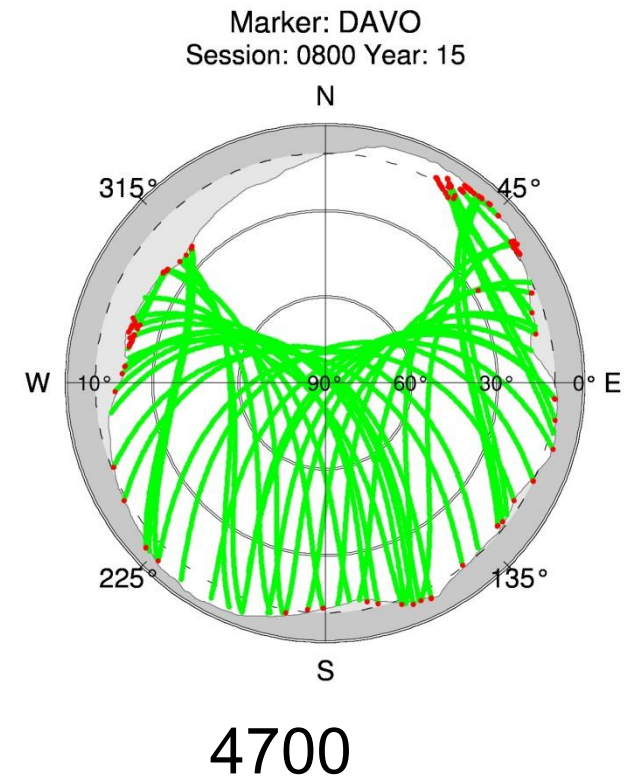
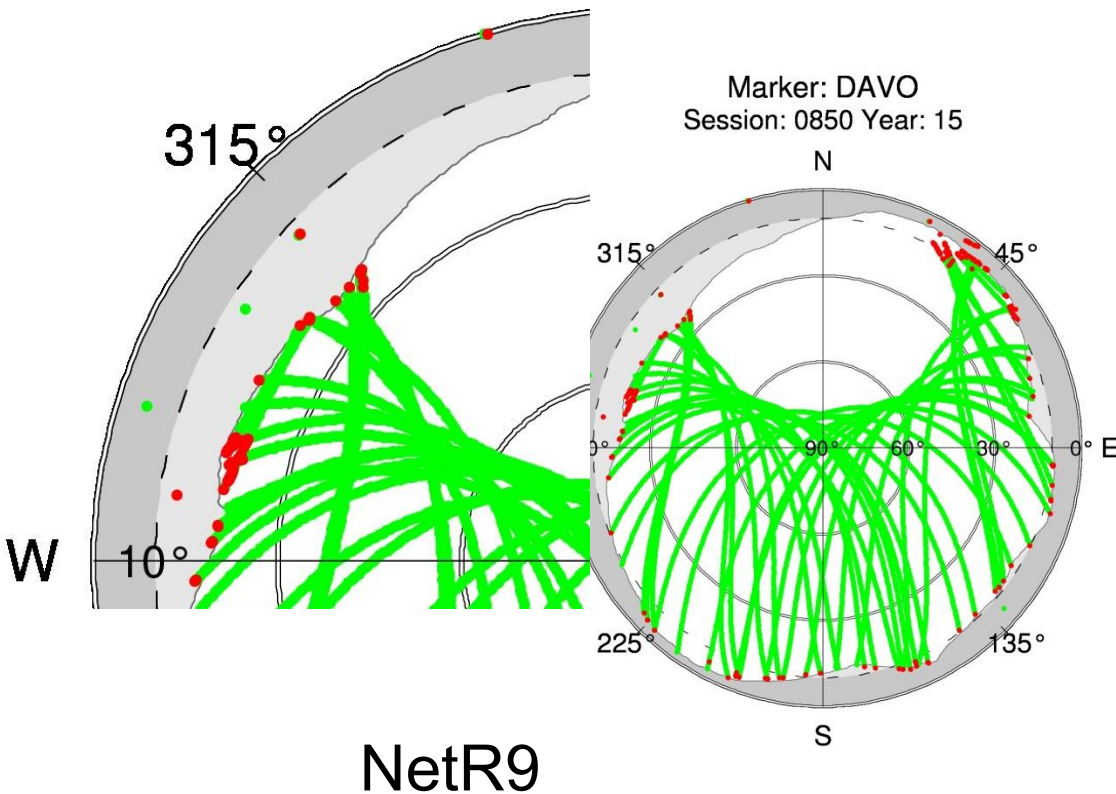
- Added signal-to-noise ratio monitoring
- Added support for SP3-format to facilitate a full QC
- New output – a high-resolution satellite information in external file
 - receiver/satellite coordinates, elevations, azimuths at a pre-defined sampling rate
- QC & positioning in static and kinematic mode
- Support for RINEX 3.03
- Windows-compatible version (support pre-compiled binaries)
- Several minor bugs/functionalities fixed according to user feedbacks

☹ Time unavailability to complete/check the new release



Examples

- Davos (GPS observations behind mountains for Multi-GNSS receiver)

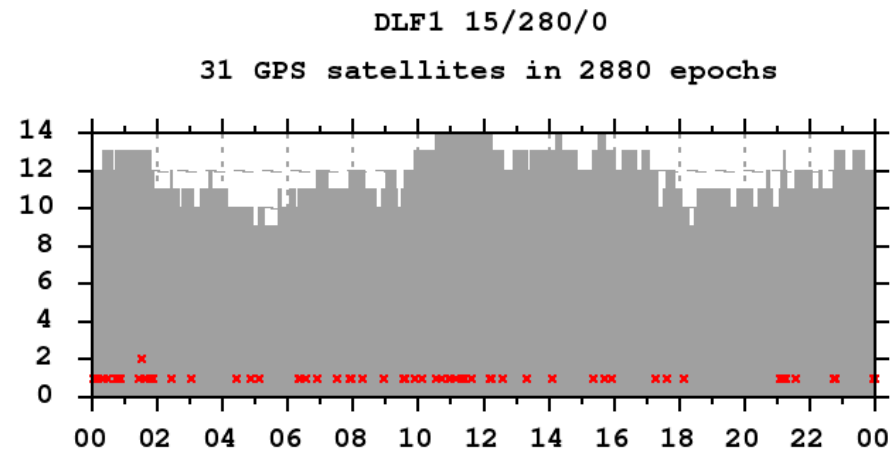
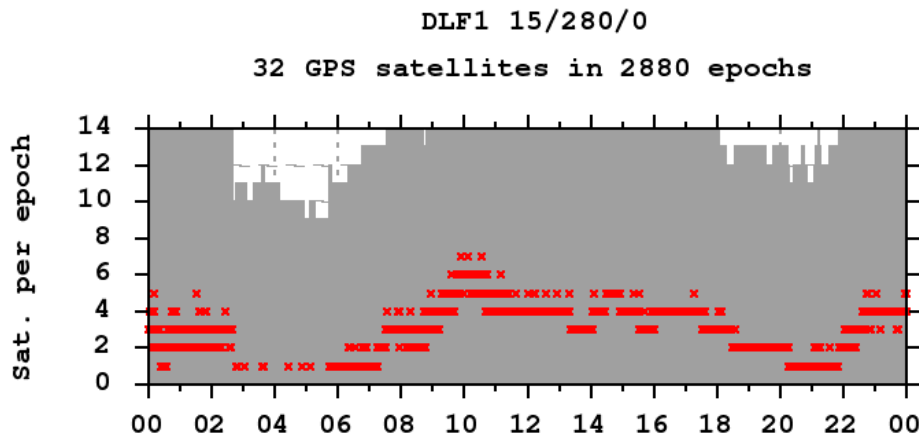




Examples: DLF1

Multi-GNSS receiver NetR9 (+ Leica antenna)

Lots of observations are below -5 degrees
- partly -58 degrees...:



Rinex 2

via teqc (Mar23,2013 – not dealing 4.85-
>4.93 version changes in T02 files) ->

Rinex 3

from receiver

16.12.2015



First RINEX3 campaign data

- 7 stations Leica GS14 (Multi-GNSS) in Turtmann network
- 2 weeks of measurements (bacholor thesis)
- First successful analysis of RINEX3 using BSW52
 - Using bnc for RINEX3 -> RINEX2
 - Using RNXSMT
- Commercial software LGO comparison successfull



Difference LGO – BSW52			
	ΔE [mm]	ΔN [mm]	Δh [mm]
	0.20	0.96	2.97
	0.68	0.95	2.98
	0.04	1.04	14.37
	0.08	0.25	1.45
	0.71	2.08	5.64
	0.58	0.69	10.21
	-0.26	0.93	0.39
	-0.24	0.88	3.50
Mean	0.22	0.97	5.19
std	0.39	0.51	4.77



Campaign data analysis: Experiences R3->R2 conversion

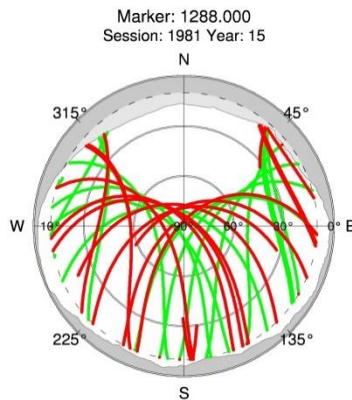
- GPS obs Rinex 3 L2: L2S || L2W

e.g. G01

e.g. G04

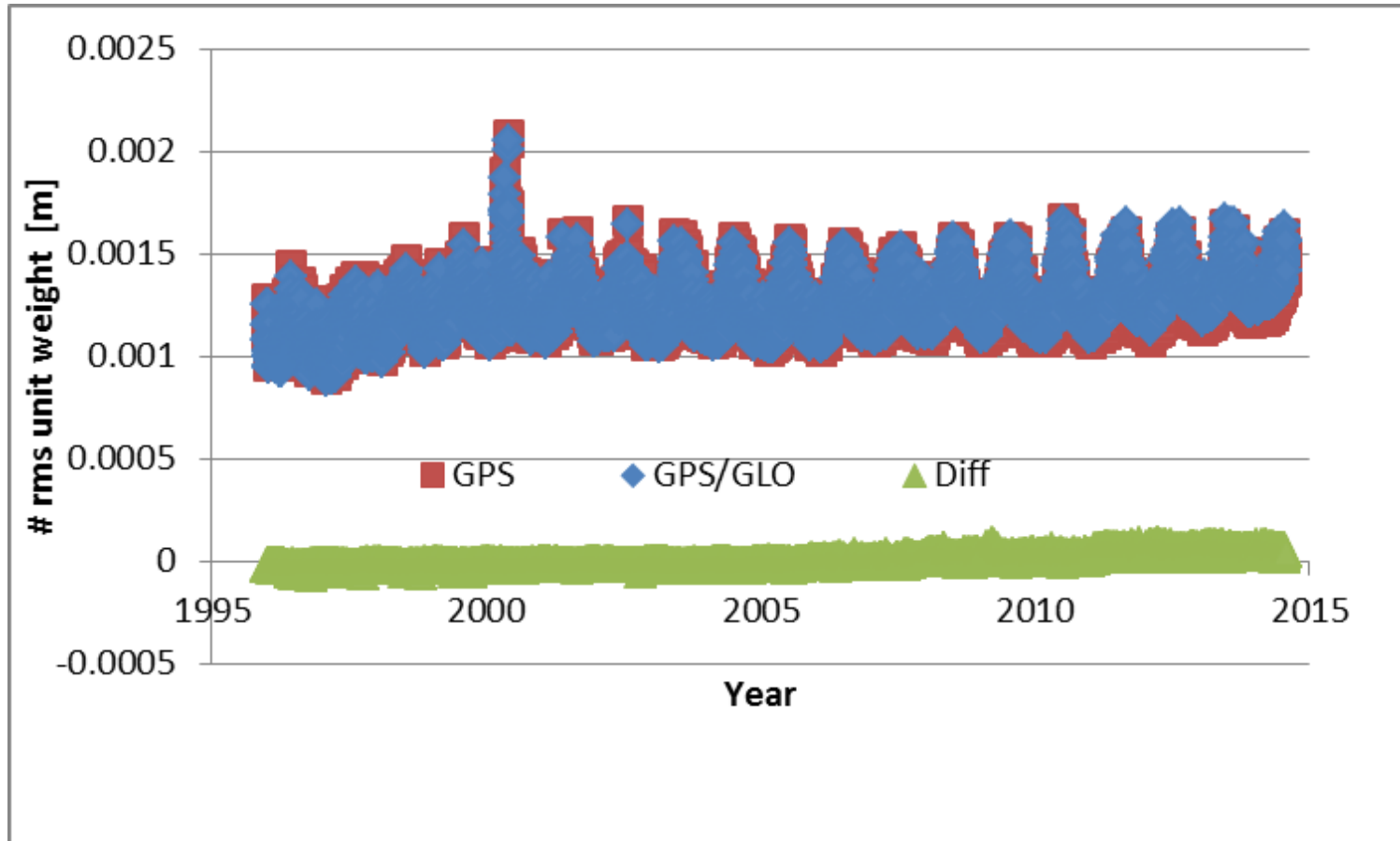
G	12	C1C	L1C	D1C	S1C	C2S	L2S	D2S	S2S	C2W	L2W	D2W	S2W	SYS	/	#	/	OBS	TYPES	
R	8	C1C	L1C	D1C	S1C	C2P	L2P	D2P	S2P					SYS	/	#	/	OBS	TYPES	
E	16	C1C	L1C	D1C	S1C	C5Q	L5Q	D5Q	S5Q	C7Q	L7Q	D7Q	S7Q	C8Q	SYS	/	#	/	OBS	TYPES

- After bnc R3->R2: only one of L2S or L2W is picked up – half of the GPS constellation lost....





Impact of rms of unit weight (daily)



GPS/GLO rms of unit weight ~ 6% higher than GPS-only rms (in 2015) ; + Multi-GNSS discrepancy even higher (see LAC WS)



Conclusion

- Analysis Multi-GNSS possible and very good progress in
 - data availability, data monitoring, RINEX3 handling tools
- But,
 - Procedures need to be implemented to operational
 - Careful look in results help to detect lots of tiny little details
- Lots of questions to answer:
 - Which observations to use (e.g. L2S, L2W, L2X – all results in different coordinates);
 - AC-Software ...
- Todo
 - Continue and further develop QC activity
 - Foresee a EPN test data analysis campaign (in 2016) to answer important analysis questions (observation selection; schedule to include GAL in EPN operational processing)



Part 2: Update on time scales biases and compatibility between SP3 and broadcast ephemeris

A. Caporali



Part 3: RINEX v3 long file names in EPN RDCs

G. Stangl