



EPN Analysis Coordinator Report

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- EPN LAC Workshop 2008
- IGS MIT T2 RNAAC solution
- EPN rapid daily combination
- EPN multi-year combination
- Perspective

EPN LAC Workshop 2008



EUREF Permanent Network
6th Local Analysis Centres
Workshop
October 22 - 23, 2008
Frankfurt am Main
Germany

Session 1: Reports from the EPN Coordination Group

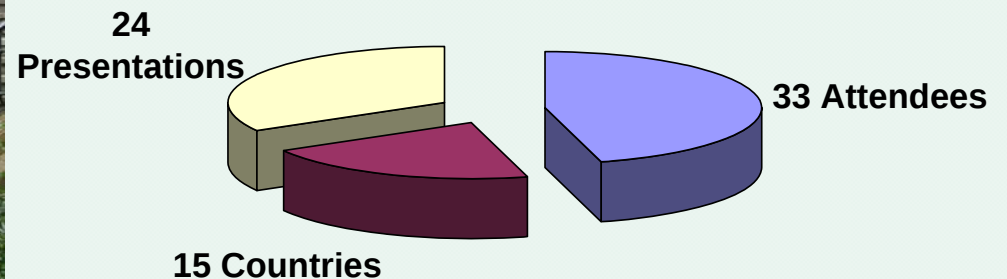
Session 2: Local Analysis Centres reports

Session 3: Experiences with new processing strategies

Session 4: New Analysis Products

Session 5: Site, receiver, antenna and other issues

Session 6: Wrap-up and closing session





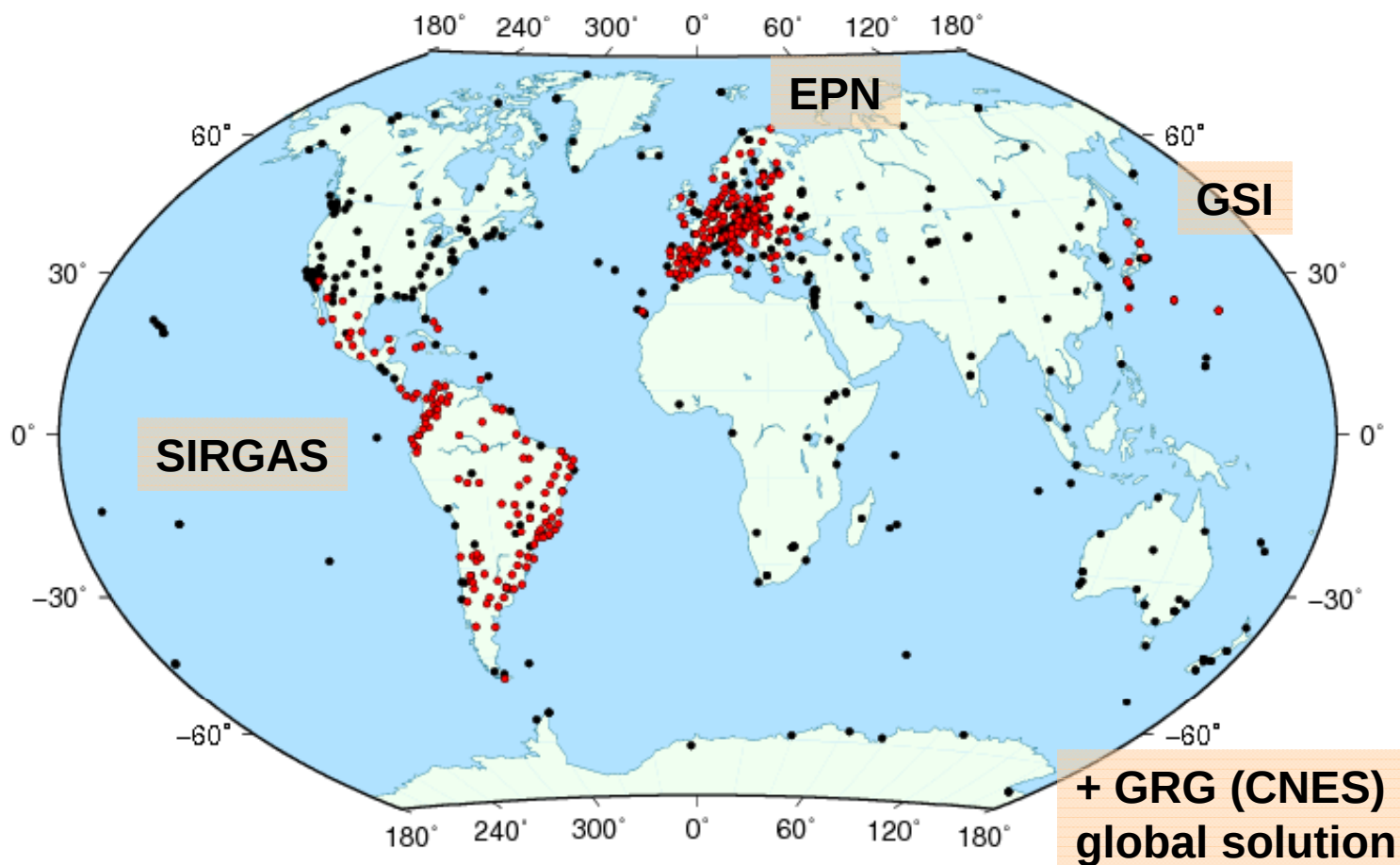
EPN LAC Workshop 2008 – Minutes (Highlights)

- EPN Re-Processing Initiative
 - New Working Group to be established
 - Christof Völksen was elected chairman
- Improved Feedback to EPN LACs
 - e.g., visualization of LAC-specific issues at EPN-CB
- Better visibility of LACs
 - EPN-CB, EPN Flyer,...
- Collaboration with EUMETNET and EGVAP
 - compare GNSS derived ZTD parameters with radiosondes
- Promotion to include GLONASS in EPN analysis
- Minutes and presentations available
 - EPN-CB

http://www.epncb.oma.be/_newsmails/workshops/EPNLACWS_2008/

MIT T2 RNAAC – IGS Regional Combination

MIT1520P – IGS/Regional Combination



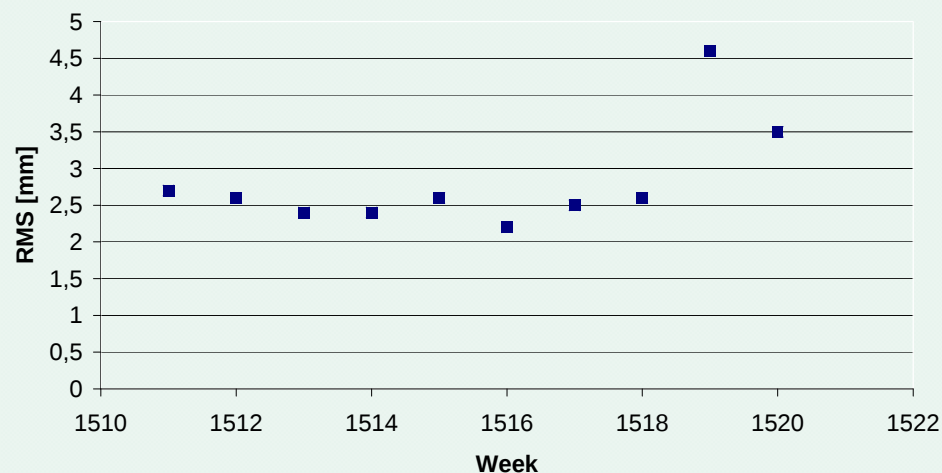
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Solution published after 8 weeks delay

MIT T2 RNAAC – IGS Regional Combination (cont.)

WEEK 1520	Scope	RMS of comparison	# Rejected stations (8/8/15 mm lat/lon/Hgt)
MITg-MITp	Influence of regional combination	2.6	22
EPN-MITg	Compare EPN to global network	3.5	2
EPN-MITp	Compare EPN to combined network	2.4	3

EPN vers. MIT-G



- Global alignment 2 – 4 mm
- Usage to be evaluated



Rapid Daily Combination – Product Description

- **Schedule**

- Product latency 23 hours
(daily combination @ 22:50 UTC)
- IGS rapid product latency of 17 hours
- 6 hours time for file transfer
and processing

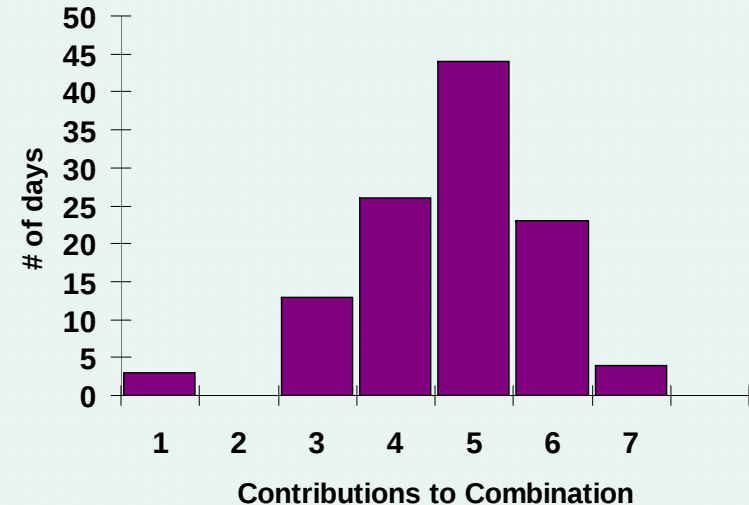
- **Contributions**

- Scheduled for 9 LACs

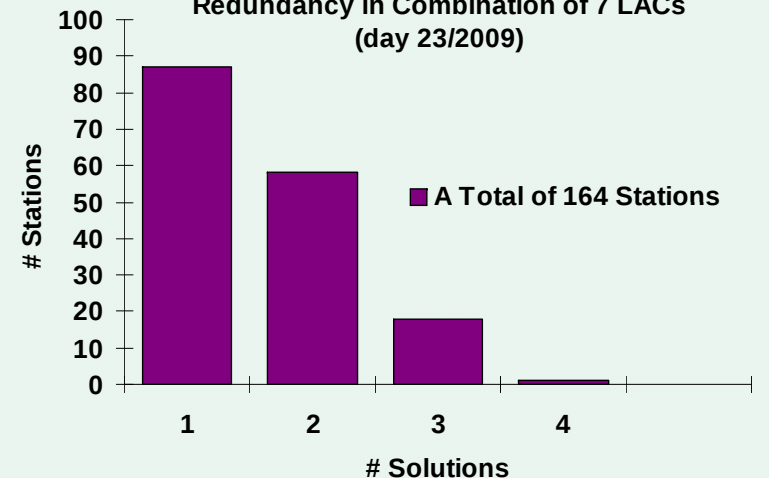
- **Result files**

- EURwwwwd.CRD/SNX/SUM

Rapid Daily Solutions in 2009 (001-114)

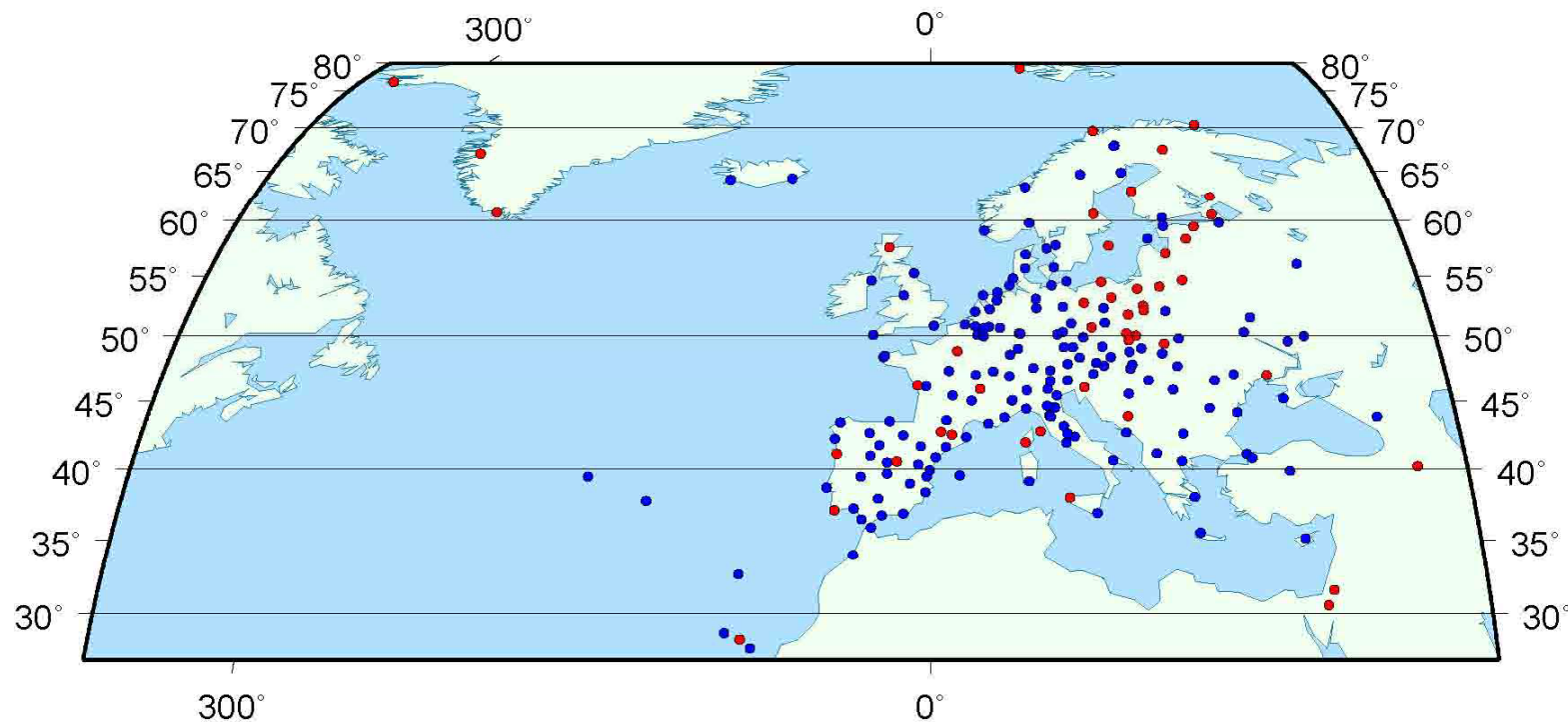


Redundancy in Combination of 7 LACs
(day 23/2009)

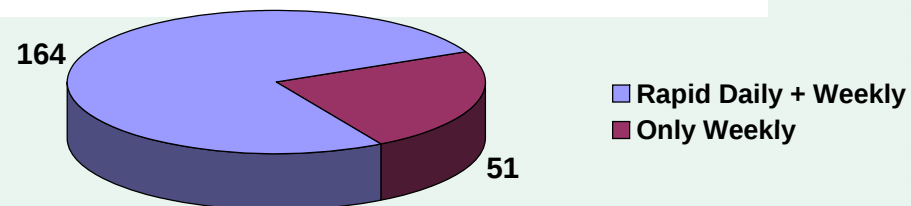


Rapid Daily Combination – Station Distribution

EPN Rapid Daily

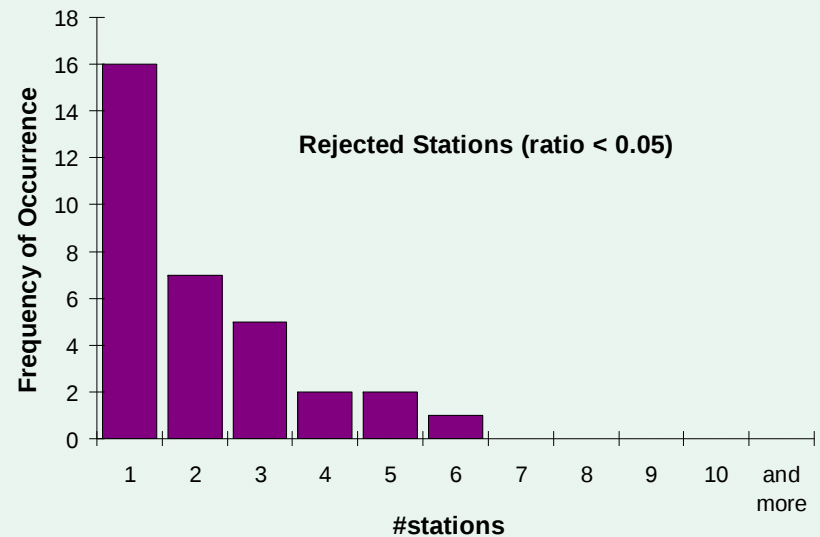
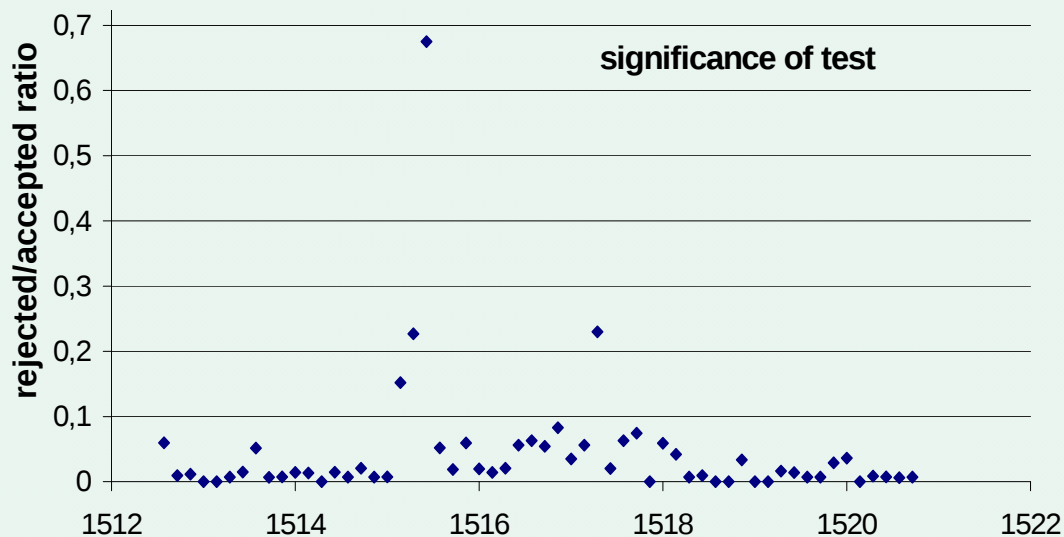
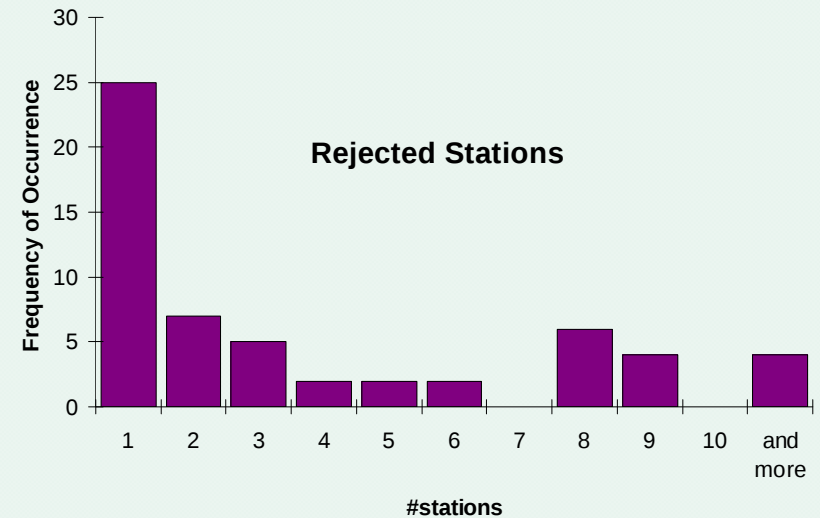
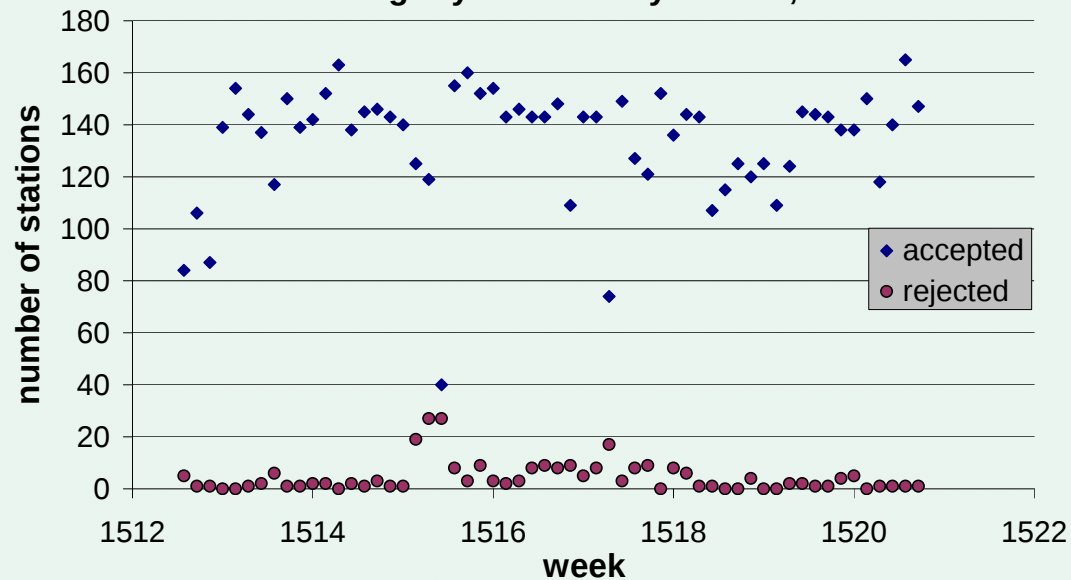


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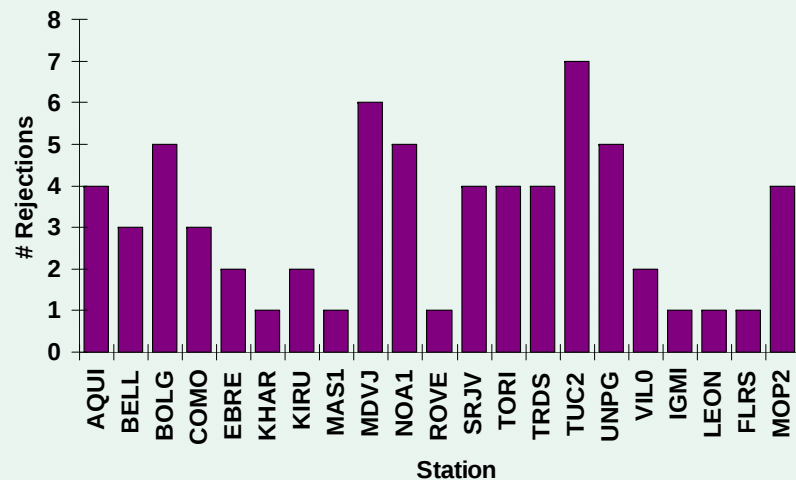
Rapid Daily *versus* Delayed Weekly EPN Solution

Integrity Control Days 1 - 58, 2009

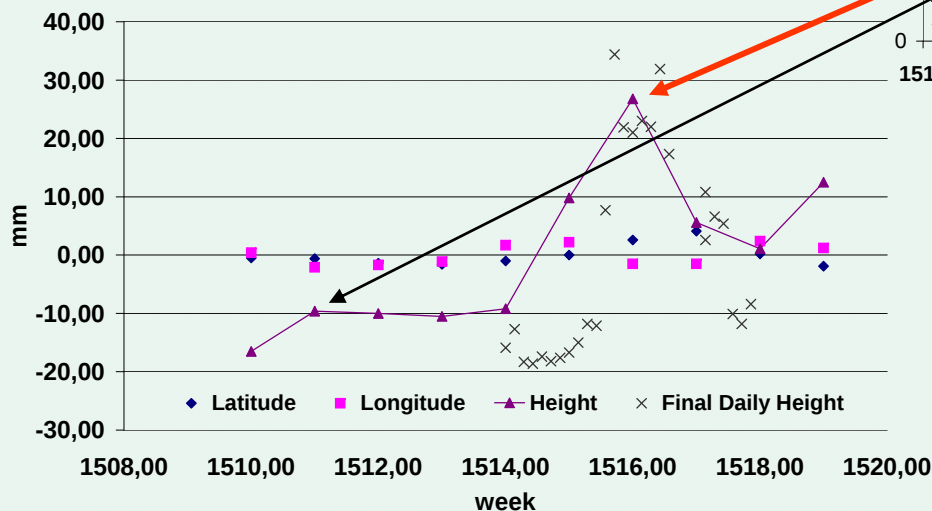


Evaluation of Events (filtered for ratio < 0.05)

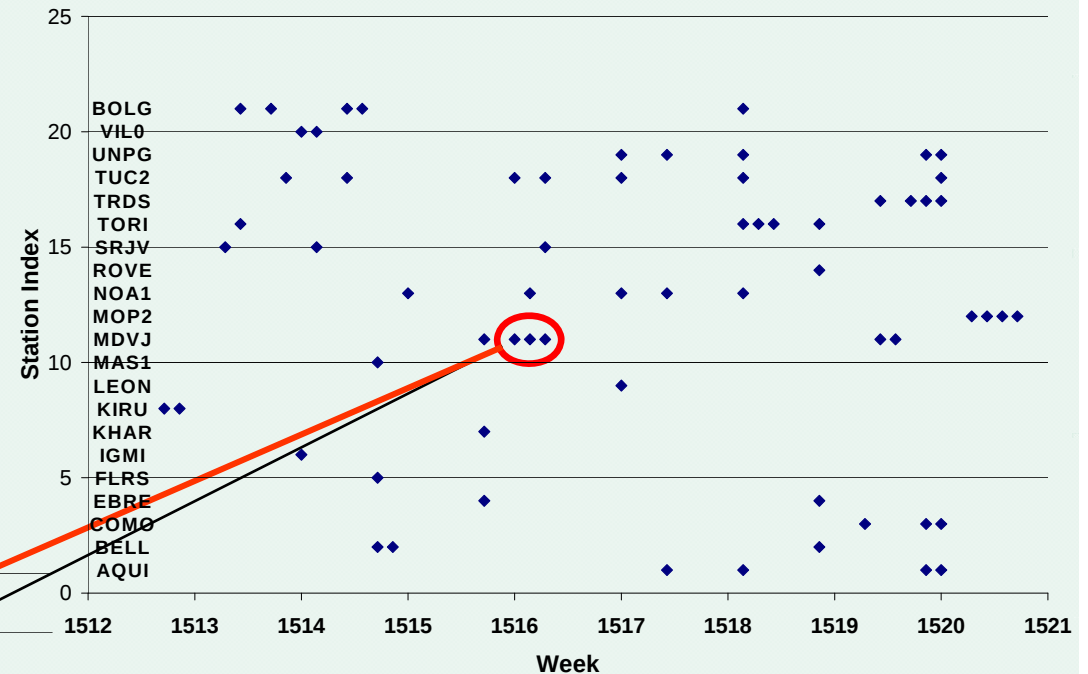
Rejection of Individual Stations



MDVJ - Weekly Solutions



Rejected Rapid Daily Solutions



- Meaningful warning (Note: Week 1511 used as reference)
- No information at EPN-CB about event
- Warning confirmed by „final daily solution“



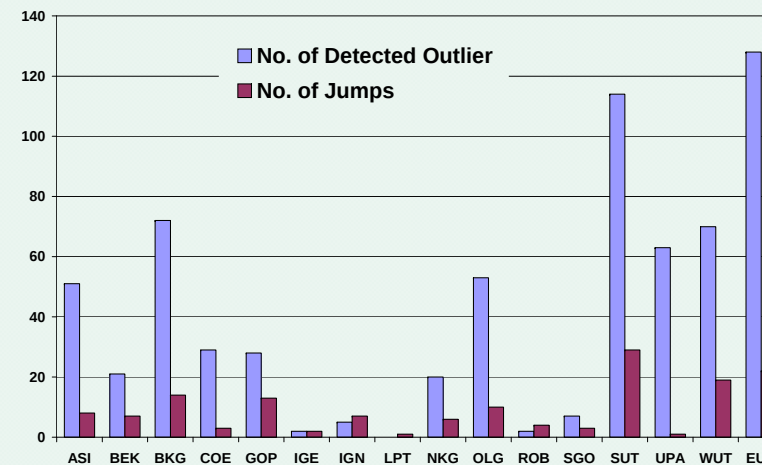
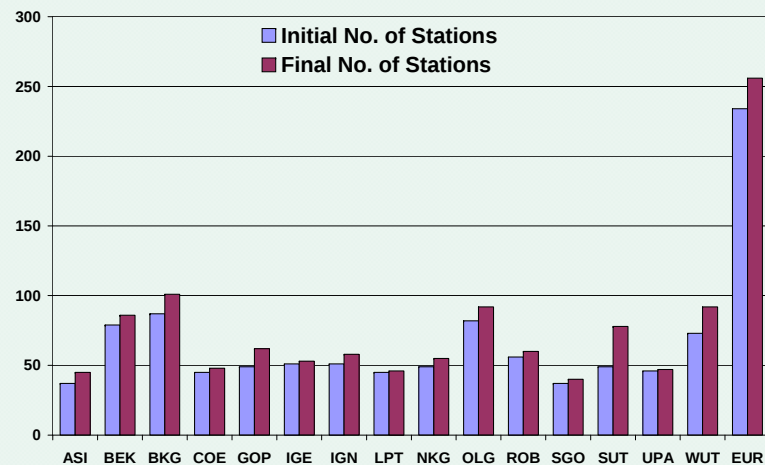
- Long-term goals
 - Continuous combination of weekly (and possibly daily) solutions
 - Comparison to EPN Time Series Project and ITRF
 - LAC-specific time series for purpose of LAC validation
- Implementation
 - Apply ADDNEQ2 and FODITS of Bernese GNSS software
 - Development of new comparison tools
- Status
 - Test of methodology for weeks 1400 - 1525



Outlier and Discontinuity Detection with FODITS

- Model for time series
 - 1 year minimum interval length for velocity
 - Set up annual period
- Discontinuity detection level
 - 10 mm/10 mm horizontal/vertical component
- Outlier detection level
 - 10 mm/20 mm horizontal/vertical component

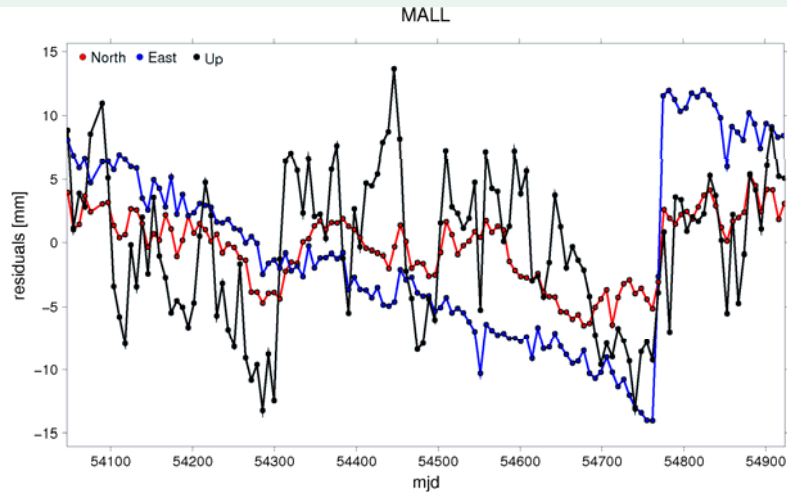
Outlier and Discontinuity Statistics



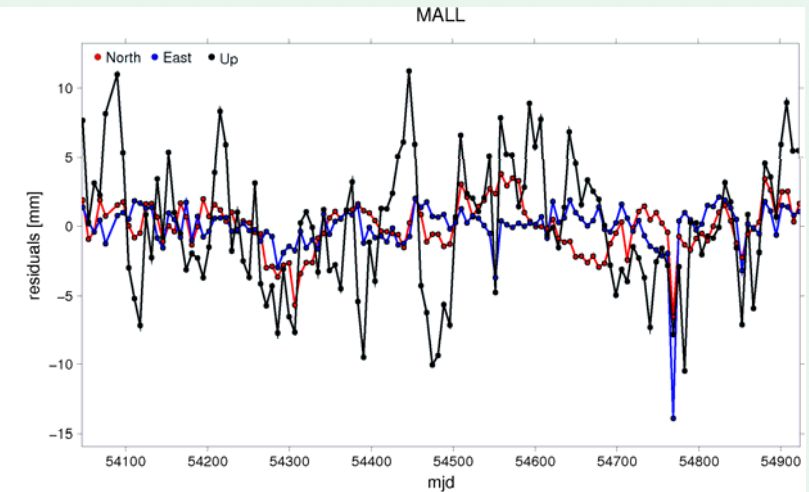
LAC	Initial RMS		No. of		Final RMS		Diff. RMS		Jumps
	Initial No. of Stations	Unit Weight [m]	Detected Outlier	No. of Jumps	Final No. of Stations	Unit Weight [m]	Unit Weight [m]	/station	
ASI	37	0,010	51	8	45	0,009	0,000	0,09	
BEK	79	0,011	21	7	86	0,010	-0,001	0,04	
BKG	87	0,016	72	14	101	0,009	-0,008	0,07	
COE	45	0,011	29	3	48	0,010	-0,001	0,03	
GOP	49	0,015	28	13	62	0,008	-0,006	0,11	
IGE	51	0,011	2	2	53	0,009	-0,002	0,02	
IGN	51	0,010	5	7	58	0,008	-0,002	0,06	
LPT	45	0,009	0	1	46	0,009	0,000	0,01	
NKG	49	0,011	20	6	55	0,009	-0,002	0,05	
OLG	82	0,014	53	10	92	0,009	-0,005	0,05	
ROB	56	0,010	2	4	60	0,009	0,000	0,03	
SGO	37	0,011	7	3	40	0,010	-0,001	0,03	
SUT	49	0,020	114	29	78	0,012	-0,007	0,25	
UPA	46	0,013	63	1	47	0,008	-0,004	0,01	
WUT	73	0,018	70	19	92	0,010	-0,008	0,11	
EUR	234	0,007	128	22	256	0,004	-0,002	0,04	



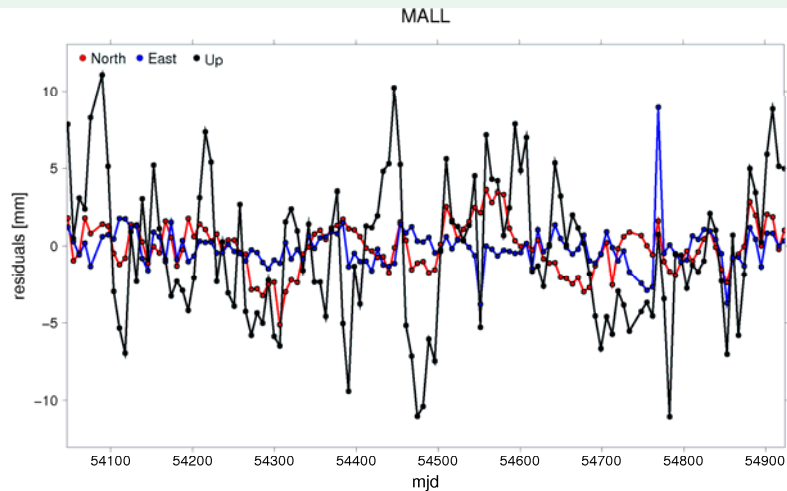
Multi-Year Combination – Discontinuity Validation



Initial ADDNEQ



FODITS

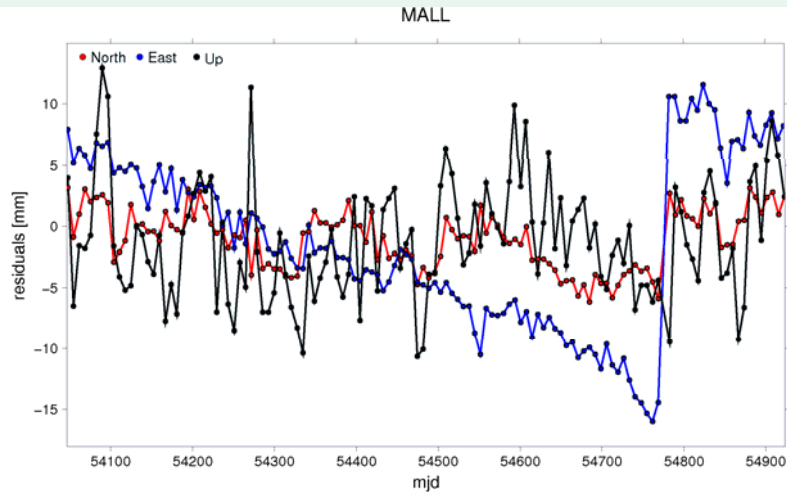


Final ADDNEQ

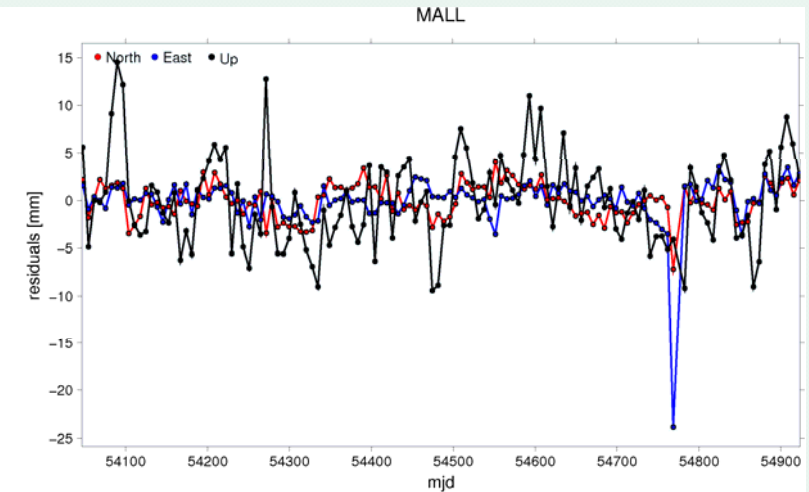
- BKG
- MALL 13444M001 2007-07-25
0.0026 -0.0002 0.0125 JUMP
- MALL 13444M001 2008-10-29
0.0082 0.0236 0.0106 JUMP



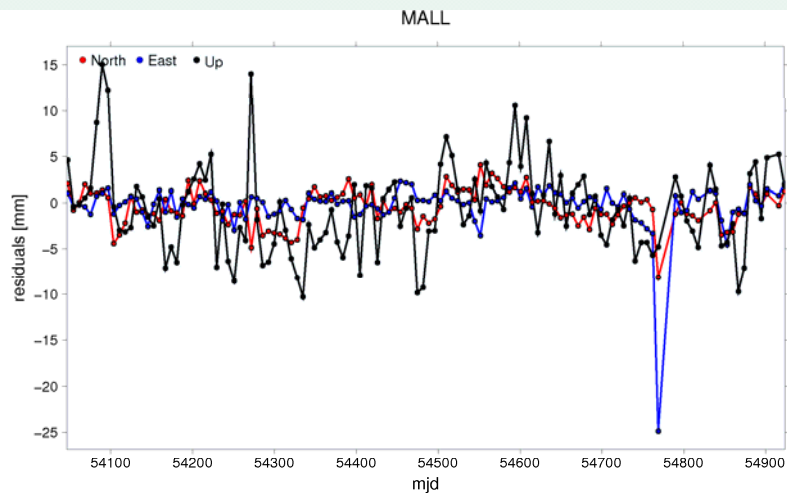
Multi-Year Combination – Discontinuity Validation



Initial ADDNEQ



FODITS

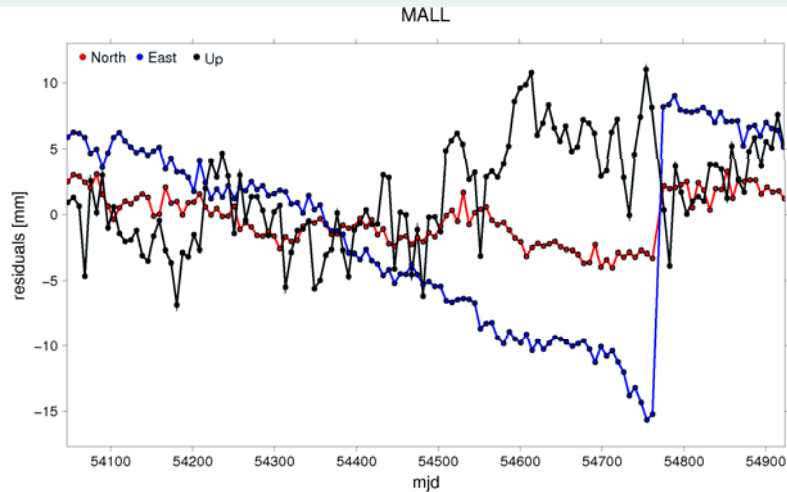


Final ADDNEQ

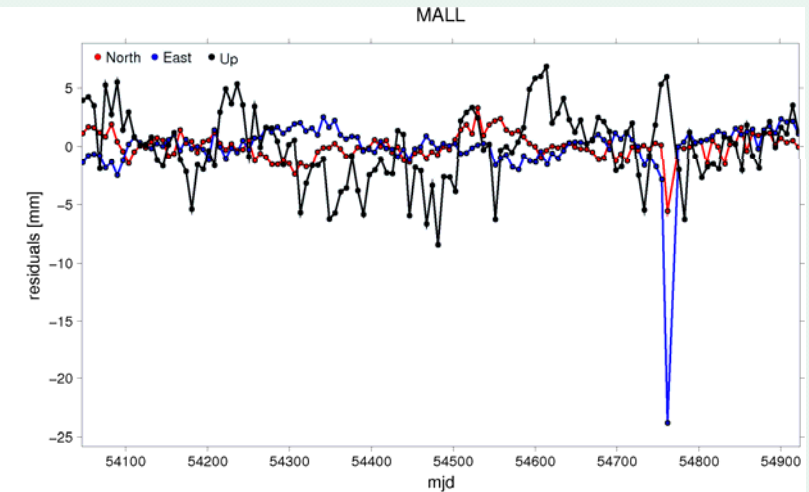
- GOP
- MALL 13444M001 2008-10-29
0.0051 0.0221 0.0007 JUMP



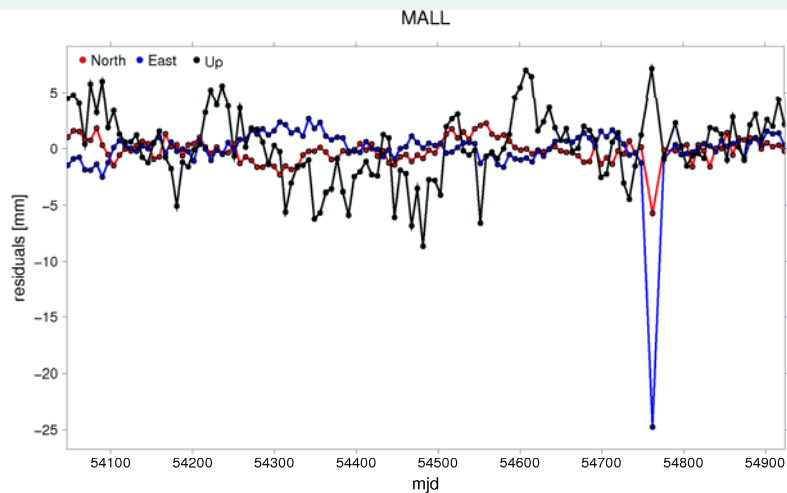
Multi-Year Combination – Discontinuity Validation



Initial ADDNEQ



FODITS

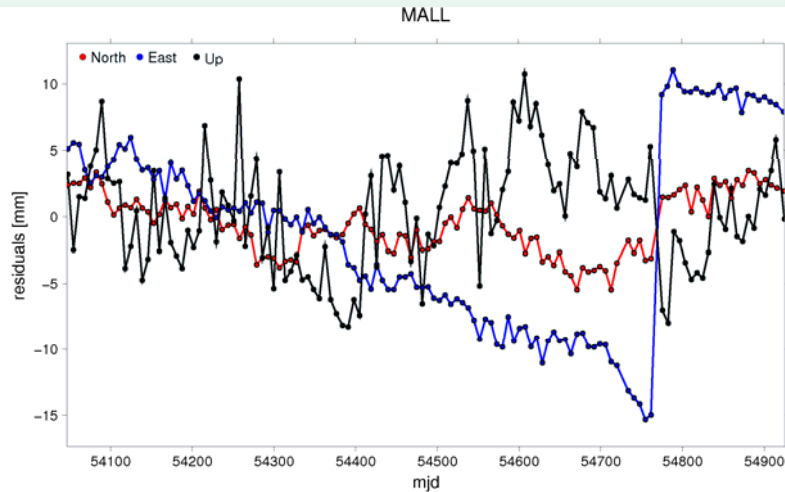


Final ADDNEQ

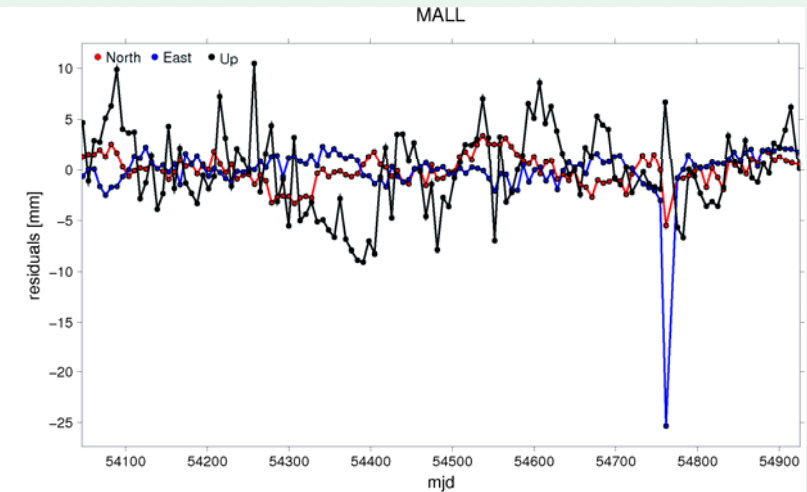
- IGE
- MALL 13444M001 2008-10-22
0.0054 0.0216 -0.0036 JUMP



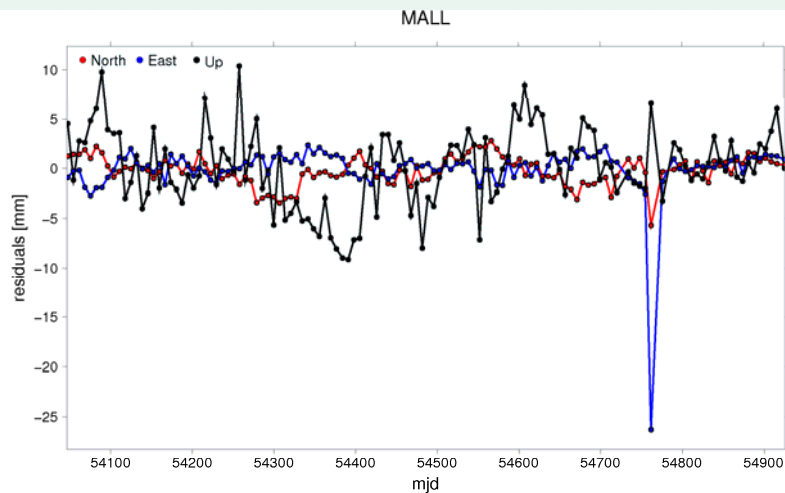
Multi-Year Combination – Discontinuity Validation



Initial ADDNEQ



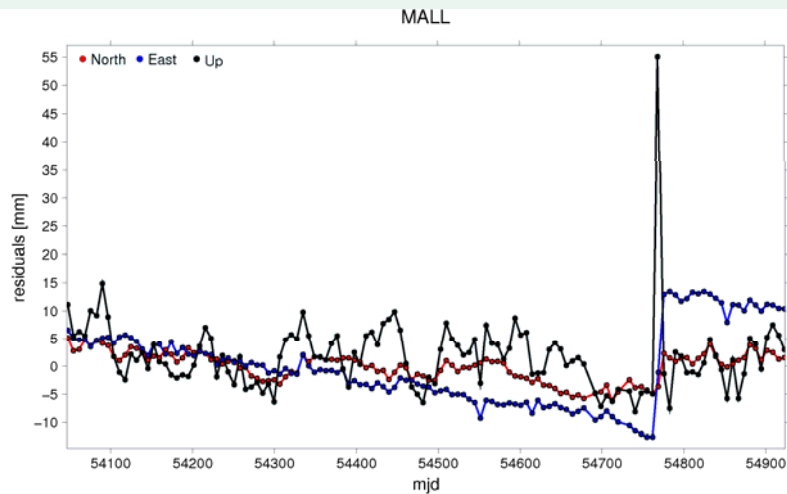
FODITS



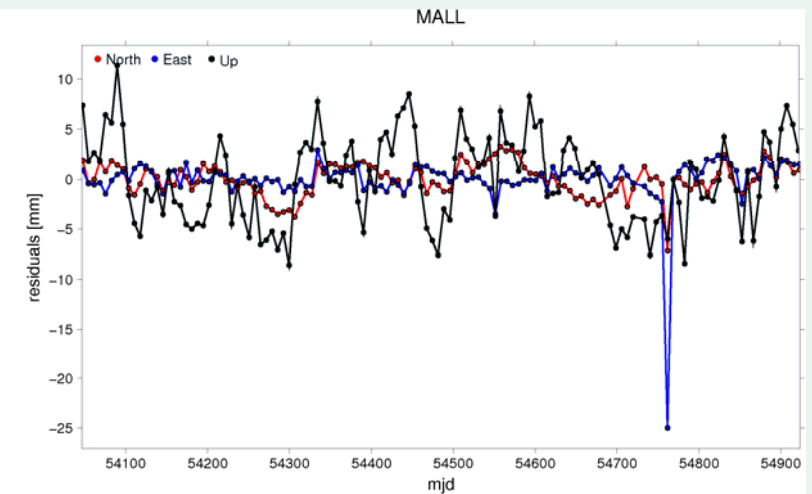
Final ADDNEQ

- IGN
- MALL 13444M001 2008-10-22
0.0057 0.0228 -0.0046 JUMP

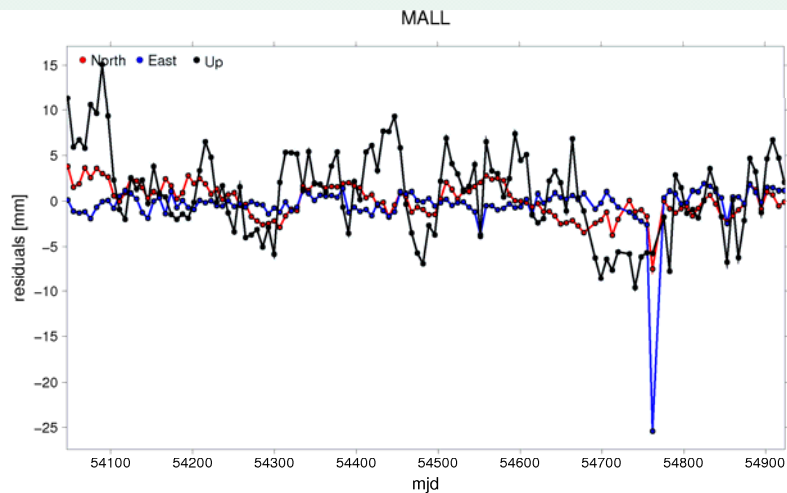
Multi-Year Combination – Discontinuity Validation



Initial ADDNEQ



FODITS



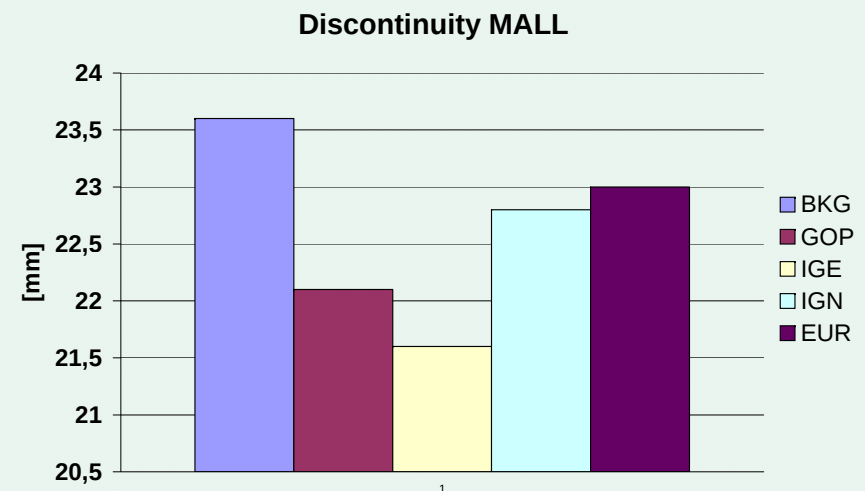
Final ADDNEQ

- EUR
- MALL 13444M001 2008-10-22
0.0063 0.0230 0.0017 JUMP
- MALL 13444M001 2008-10-29
0.0058 -0.0134 0.0541 OUTL



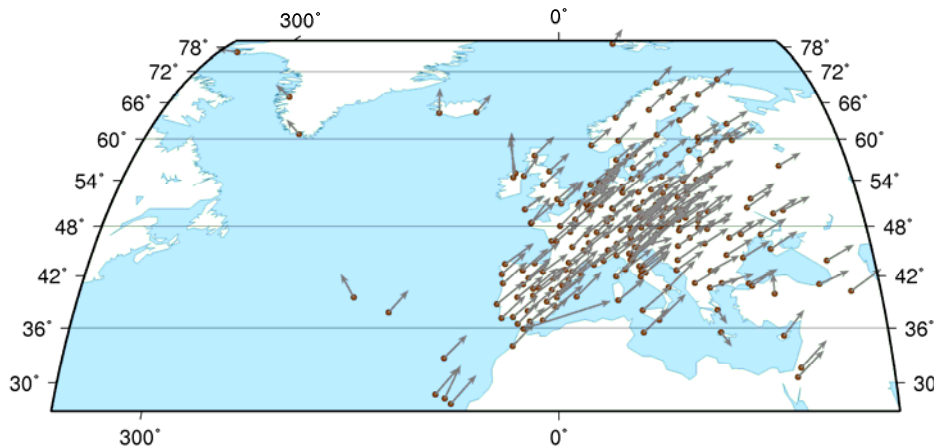
Discontinuity Validation – MALL Summary

- **Event:** Receiver and antenna change in week 1503
- Resulting discontinuity detected in all individual time series
- Jump obviously amplified in EUR combination
 - week 1503 marked as outlier and
 - jump moved to week 1502
- Jump results in the mean to 22.6 mm with 0.8 mm standard deviation
- 2 additional jumps in BKG time series not recovered in EUR combination



Station Velocity - MALL

EUR Combined Series



GMD 2009 May 19 11:02:26

LAC		X mm/year	Y mm/year	Z mm/year
BKG	MALL 13444M001	-13,6	20	10,6
BKG	MALL 13444M001AA	-13,6	20	10,6
BKG	MALL 13444M001AB	-13,6	20	10,6
EUR	MALL 13444M001	-8,8	19,1	18,6
EUR	MALL 13444M001AA	-8,8	19,1	18,6
GOP	MALL 13444M001	-10,2	18,8	15,2
GOP	MALL 13444M001AA	-10,2	18,8	15,2
IGE	MALL 13444M001	-13,3	18,2	12
IGE	MALL 13444M001AA	-13,3	18,2	12
IGN	MALL 13444M001	-10,4	18	14
IGN	MALL 13444M001AA	-10,4	18	14

- Final ADDNEQ results
- Velocities between solution numbers constrained (0.01 mm)
- Short period for study of methodology only
- (Note: No annual period accepted.)



Lessons Learned form Methodology Test

- LAC-specific multi-year solution needed
 - Inconsistency in data blocks of a few LAC SINEX files detected and excluded on LAC level
 - LAC-specific jump not re-covered in EUR combination
- Discontinuity reliable detected in individual LAC and combined EUR time series by FODITS

- Quality management
 - Establishment of warning system
 - Start from rapid daily solutions
- Continuous multi-year combination
 - Setup of weekly (daily?) combination
 - Additional individual LAC time series
 - Development of comparison tools
- Combination of re-processed EPN
- Update of EPN processing options in preparation – details to be discussed

Thank you!