



# ***ASI Analysis Center E-GVAP Report***

**R. Pacione, B. Pace, F. Vespe**

- ASI E-GVAP AC Processing Status: ASI and ASIC solutions
- Individual and ASIC solutions validation versus RS, EUREF and VLBI
- Quality Control Evaluation

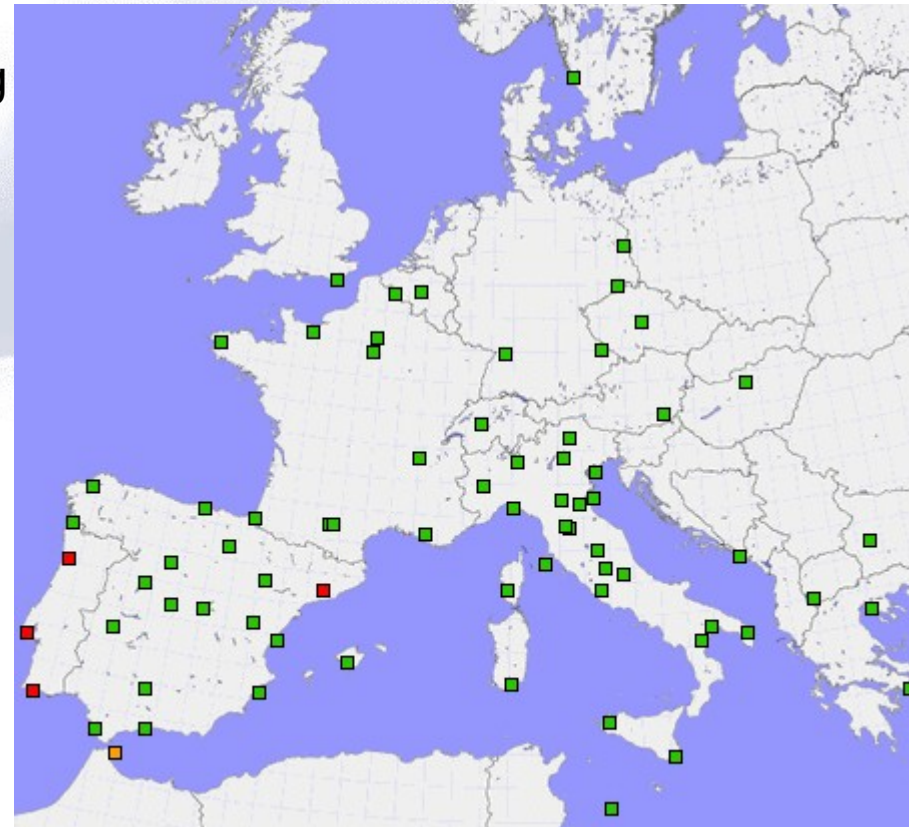
# E-GVAP AC @ ASI/CGS, Matera (October 2011)

## ASI solutions

- No relevant changes since the last meeting in the processing and network status

- *Network Adjustment*
- *IGS Ultra-Rapid Products*
- *24 h sliding window, 1 h forward step*
- *Bad sta/sat automatically removed according to post-fit phase residuals*
- *Site coordinates fixed based on 30 days of Post-Processing*
- *ZTD extracted from last hour of the processing window*
- *ZTD estimated every 5 min*
- *4 scores per hourly sol. every 15 min*

- All E-GVAP Super Sites
- April 2011, update GIPSY version (from 5.0 to 6.0) and IGS08-based solutions (igs08\_www.atx)
- Failures mainly due to the unavailability of internet connections

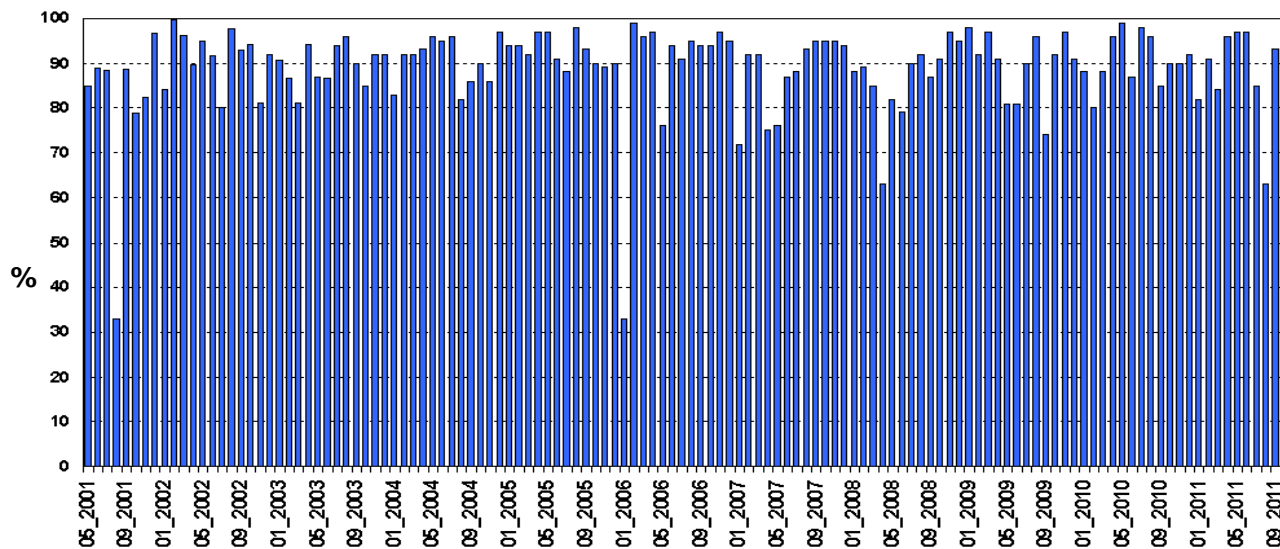


**ASI Operational E-GVAP sub network**

## Plans for 2012

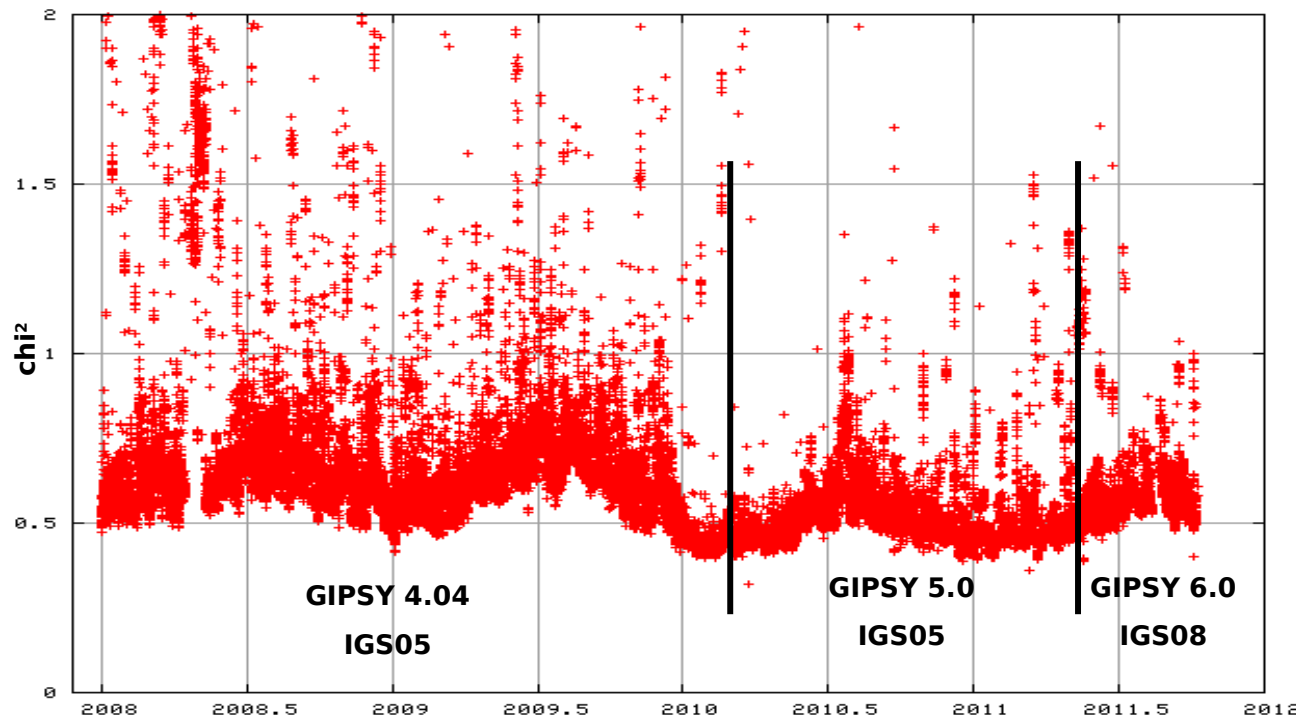
- Switch to GIPSY 6.01
- Switch to GMF
- Estimate tropo gradients
- Test to reduce the latency
- New hw platform available

# E-GVAP AC @ ASI/CGS: some statistics



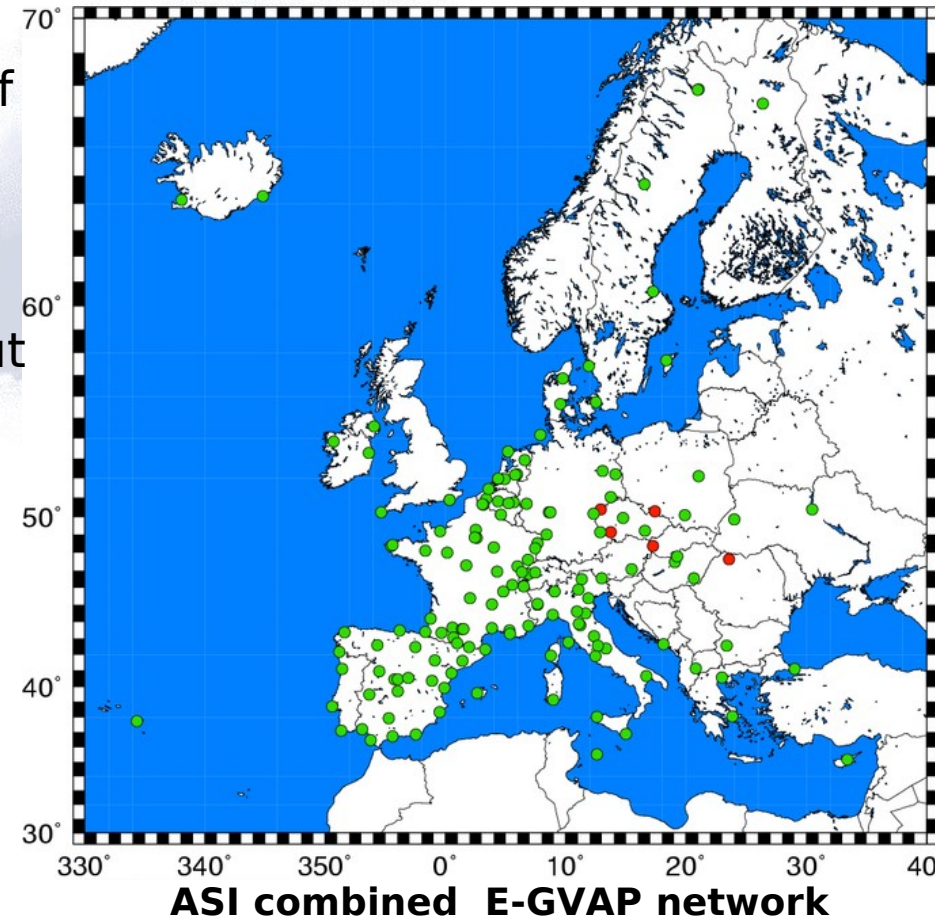
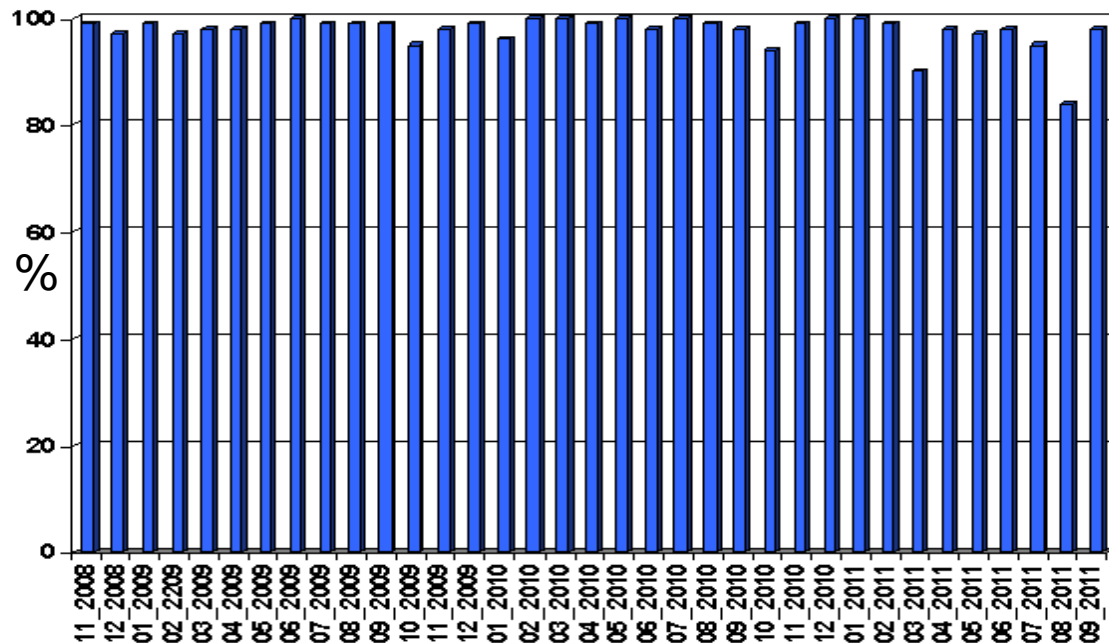
% (monthly basis) of ASI hourly solutions delivered since May 2001

hourly solutions  $\chi^2$   
(Jan08-Sept11) higher  
during summer months



# ASIC: Combined E-GVAP Solution

- ASIC is a **combined ZTD solution** made by a statistical combination of a number (at least 3) of individual ZTD estimates [Pacione et al., JASR 47 (2011) 323-335]
- ASIC is officially available from November 2008 (pre-operational phase June-Nov 2008) with about 1h:30 delay w.r.t. the last hourly solutions covering the interval [-1h:h]
- ~ 250 sites every hour
- 4 scores per hourly sol. every 15 min



% (monthly basis) of ASIC combined ZTD solutions delivered since November 2008

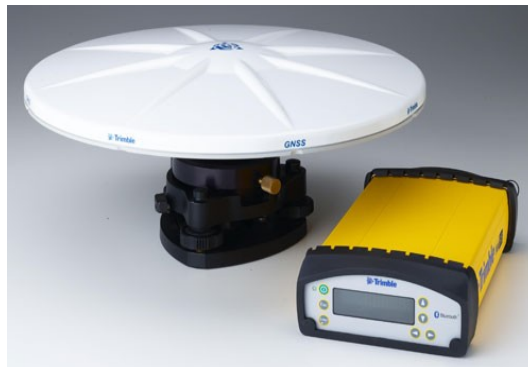


# COST File Integrity

**The first step** in the combination is reading the cost files and checking their integrity:

- gross errors (ZTD sigma  $\geq$  30mm) detected and removed,
- vfile only with header section,
- vfile with repeated lines in the header section,
- vfile with time stamp errors,
- vfile with FORTRAN format error.

Sporadic time stamp changes (ex. from hh:00/15/30/45 to hh:05/20/35/50).



# Validation of E-GVAP ZTD solutions

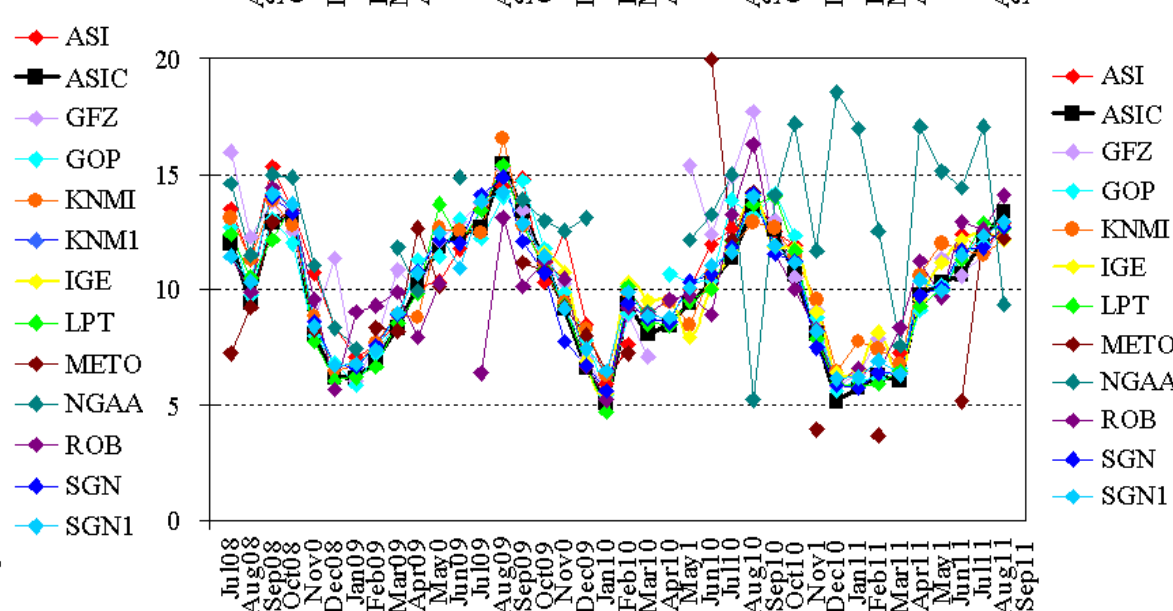
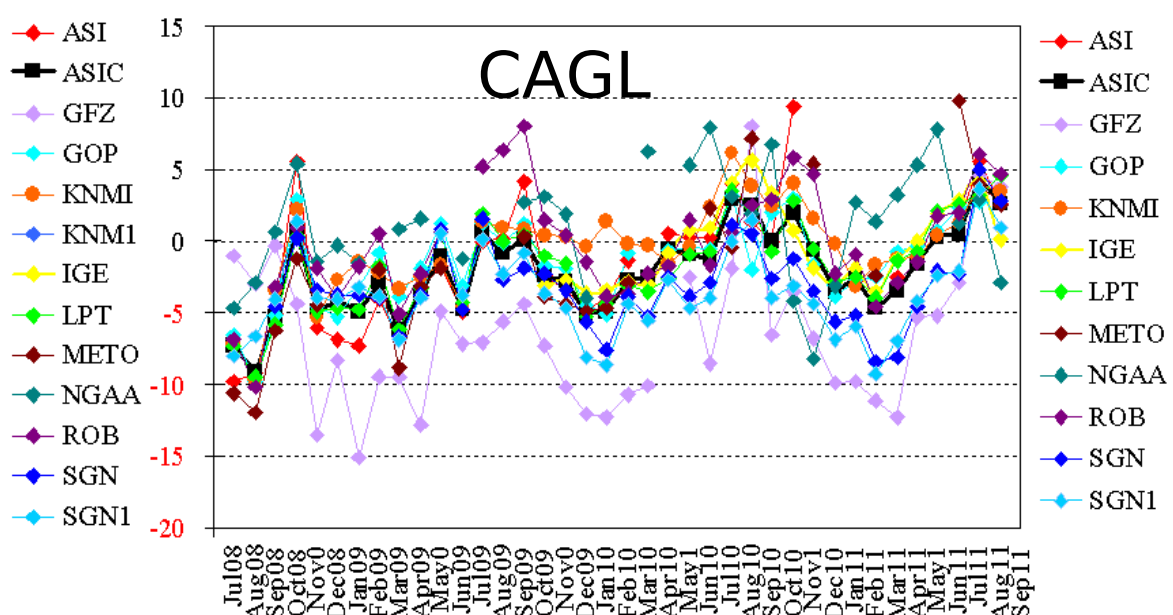
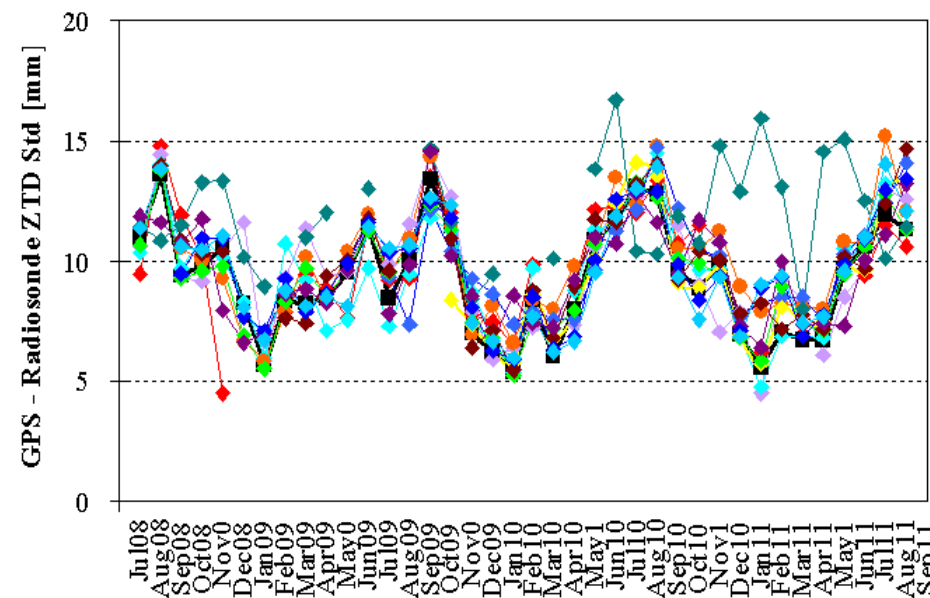
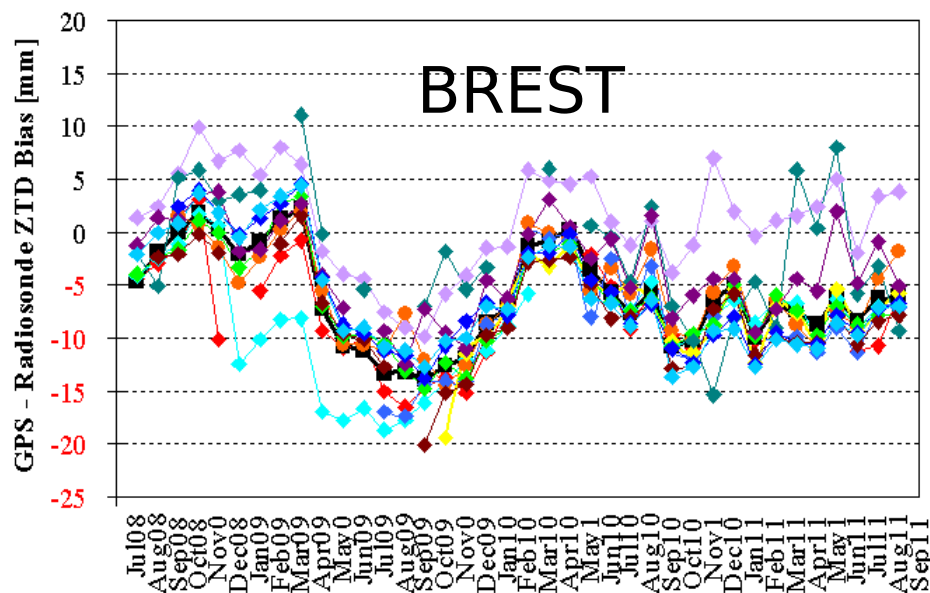
- Individual and ASIC solutions versus RS
- ASIC solutions versus EUREF
- ASIC solutions versus VLBI



**EUREF Permanent Network**

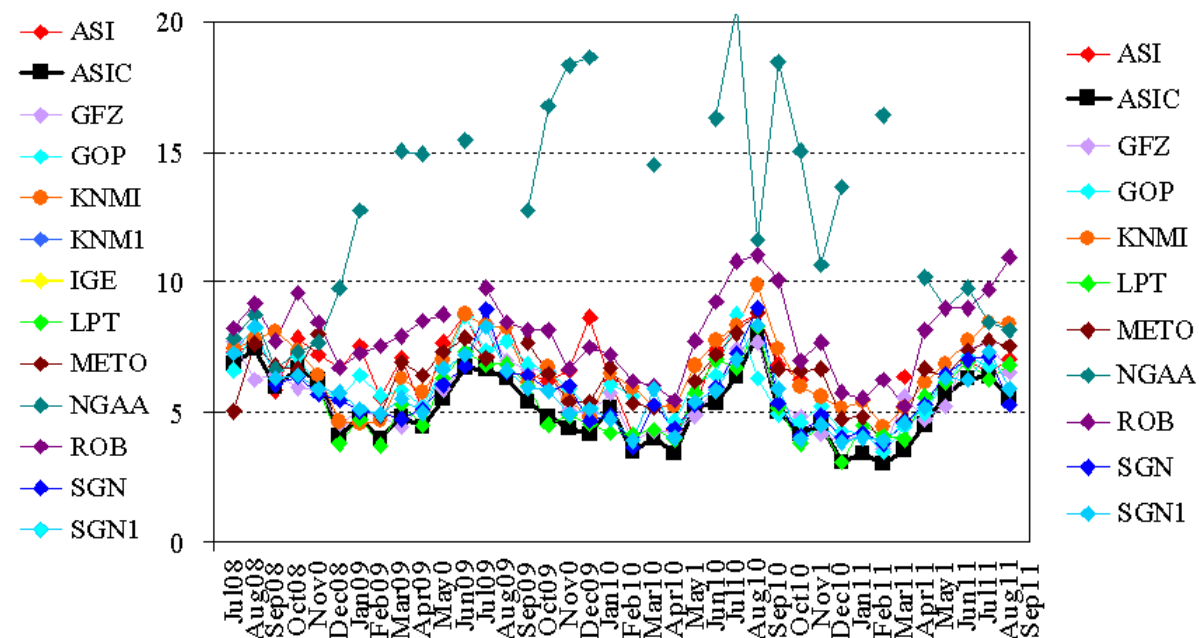
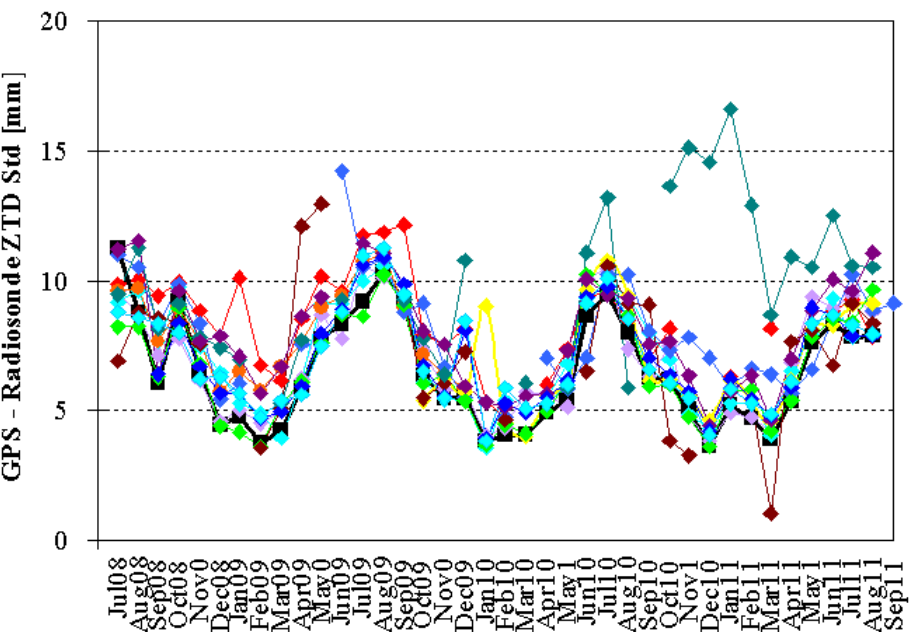
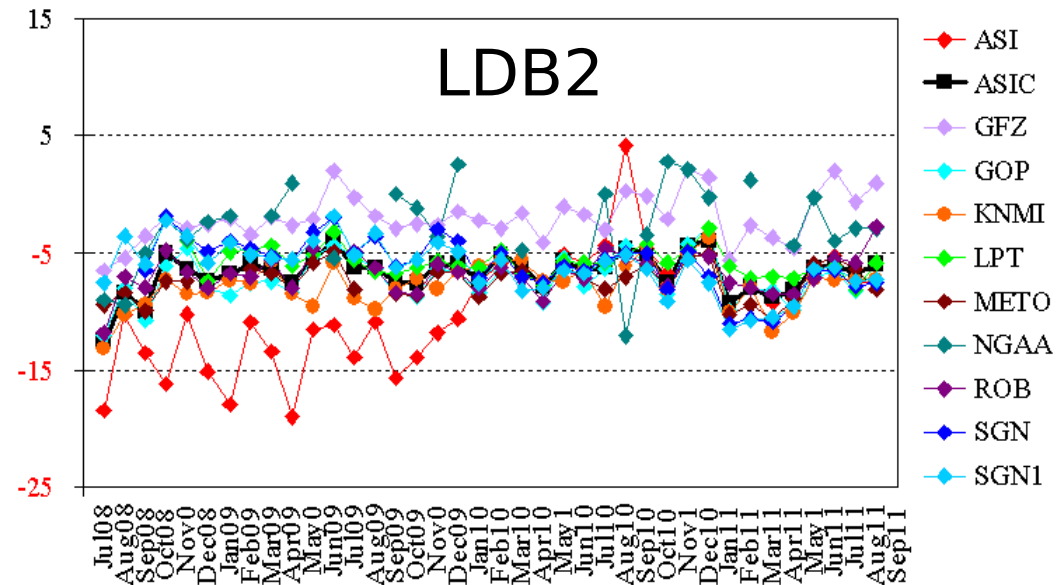
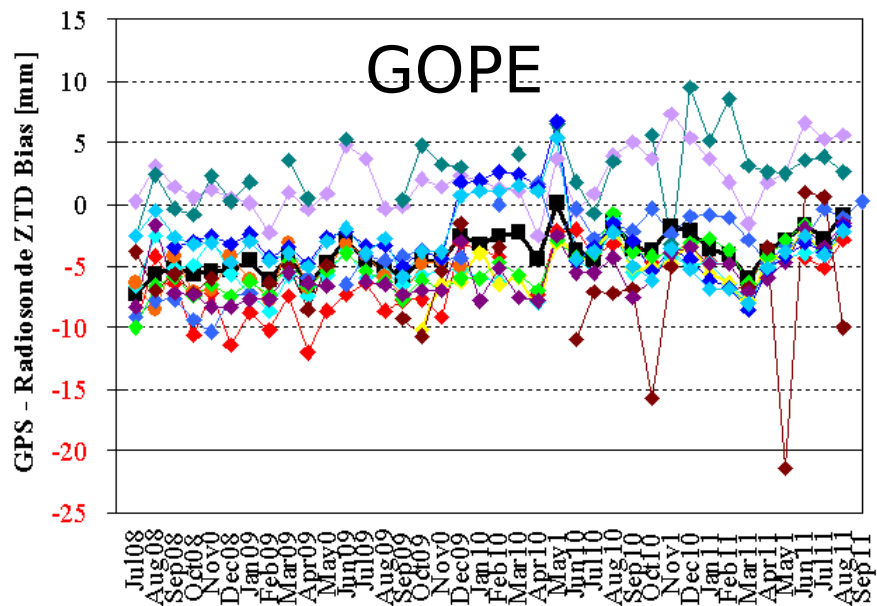


# Individual and ASIC solutions versus RS (1/6)



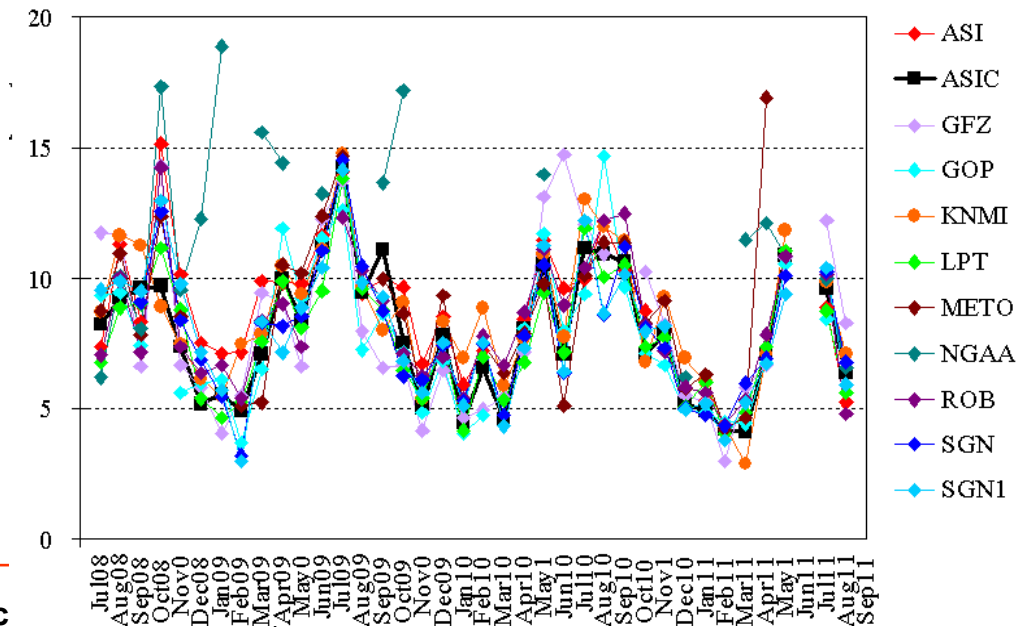
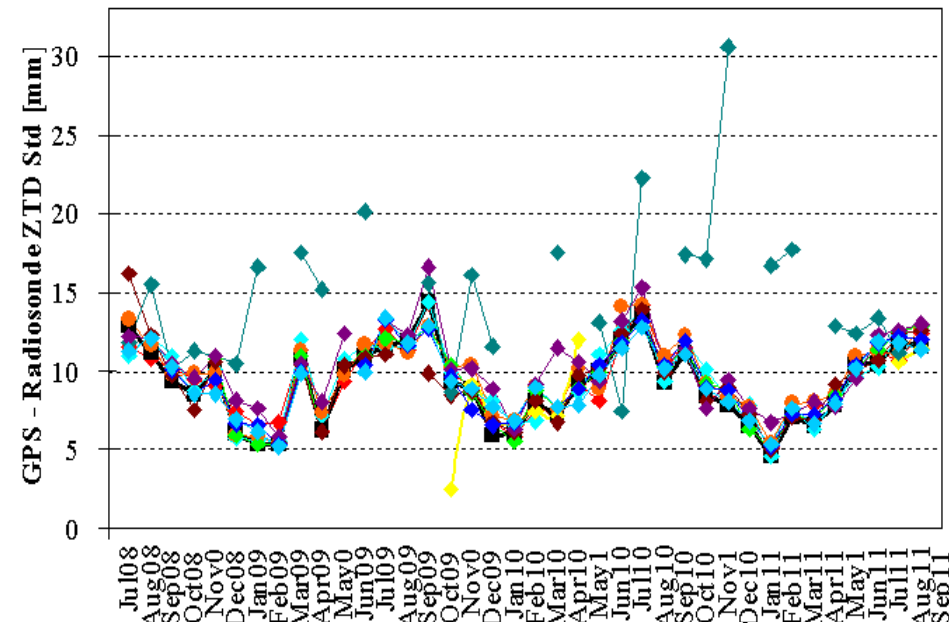
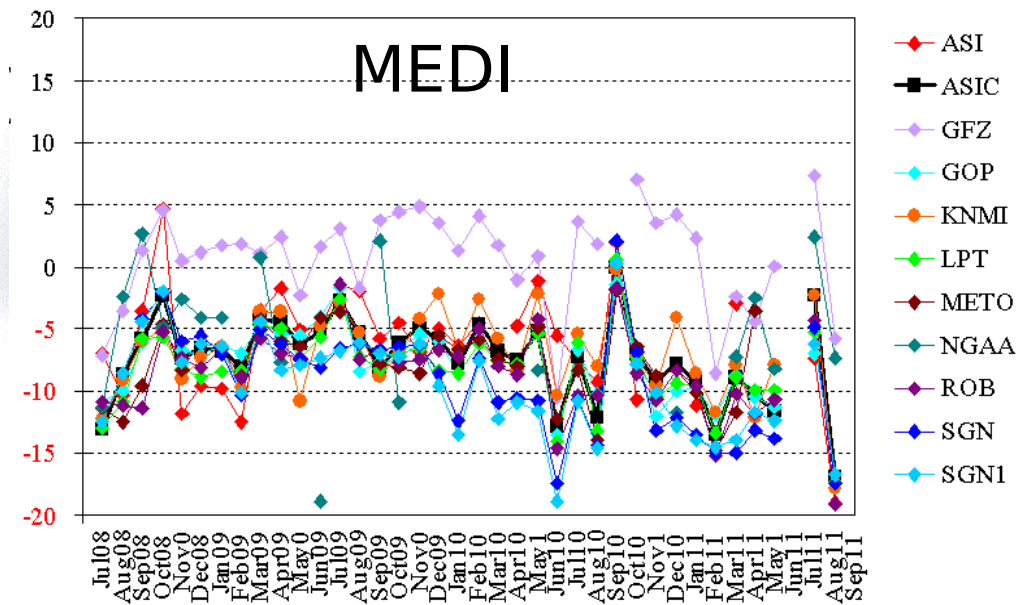
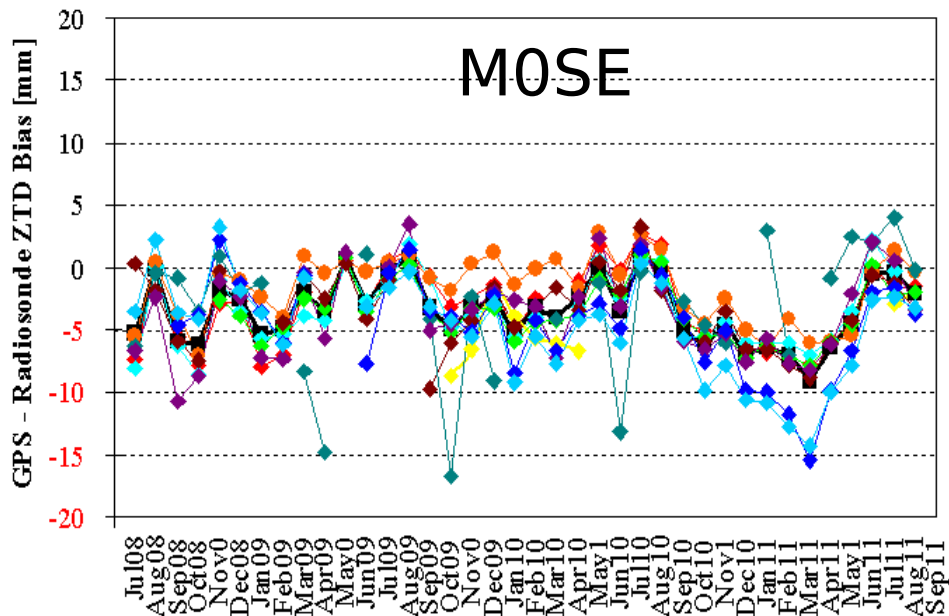


# Individual and ASIC versus RS (2/6)



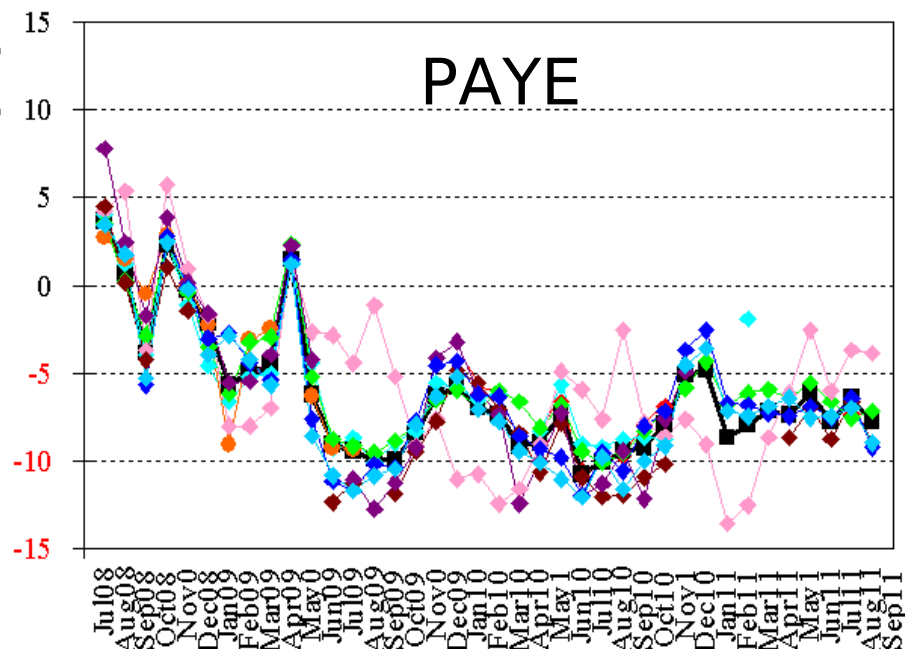


# Individual and ASIC versus RS (3/6)

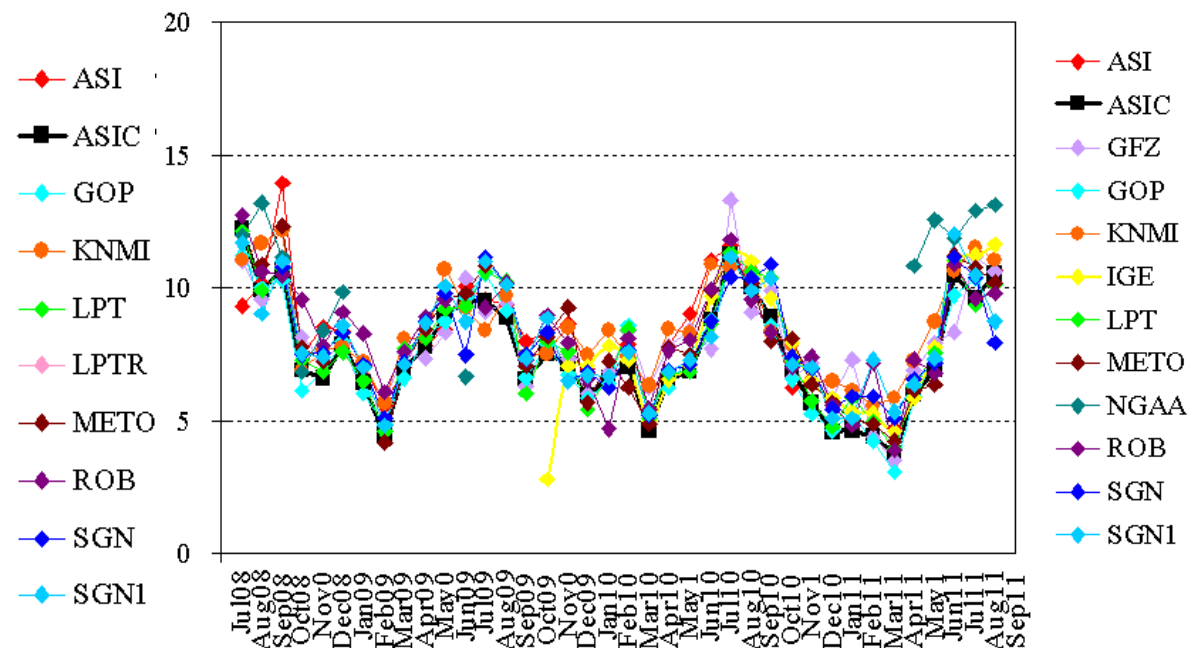
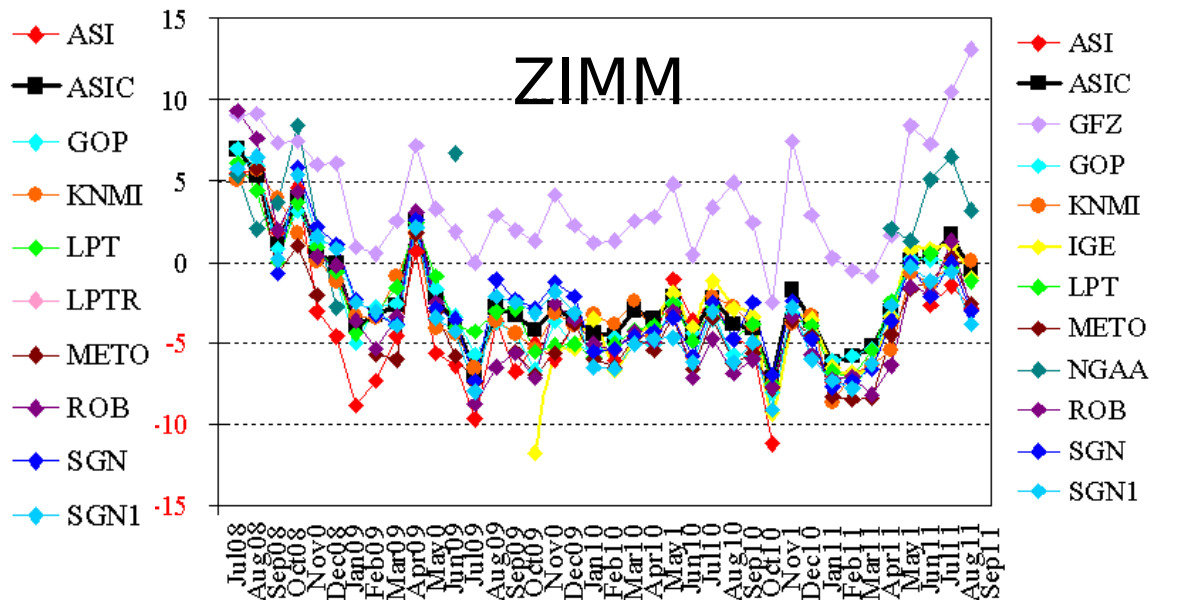
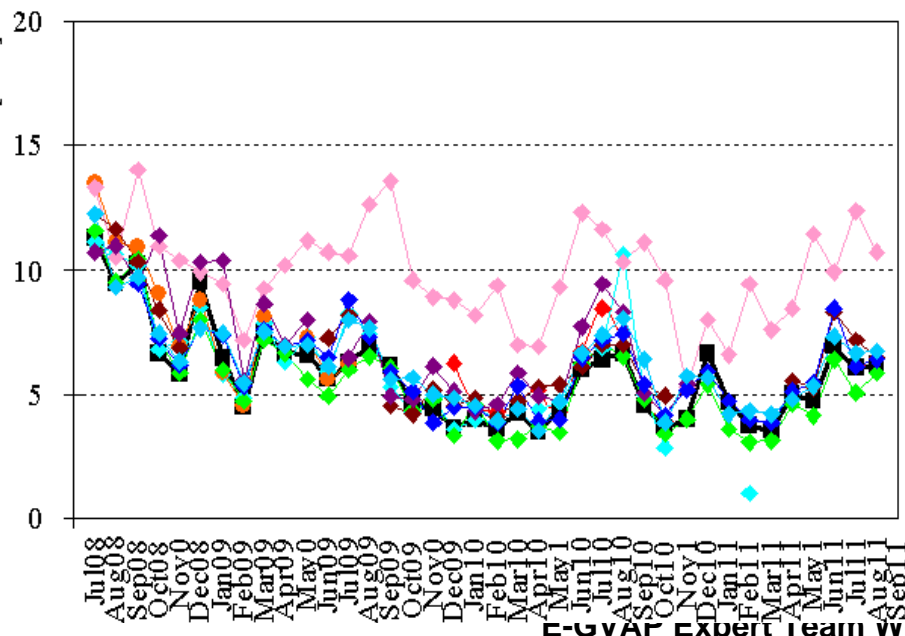


# Individual and ASIC versus RS (4/6)

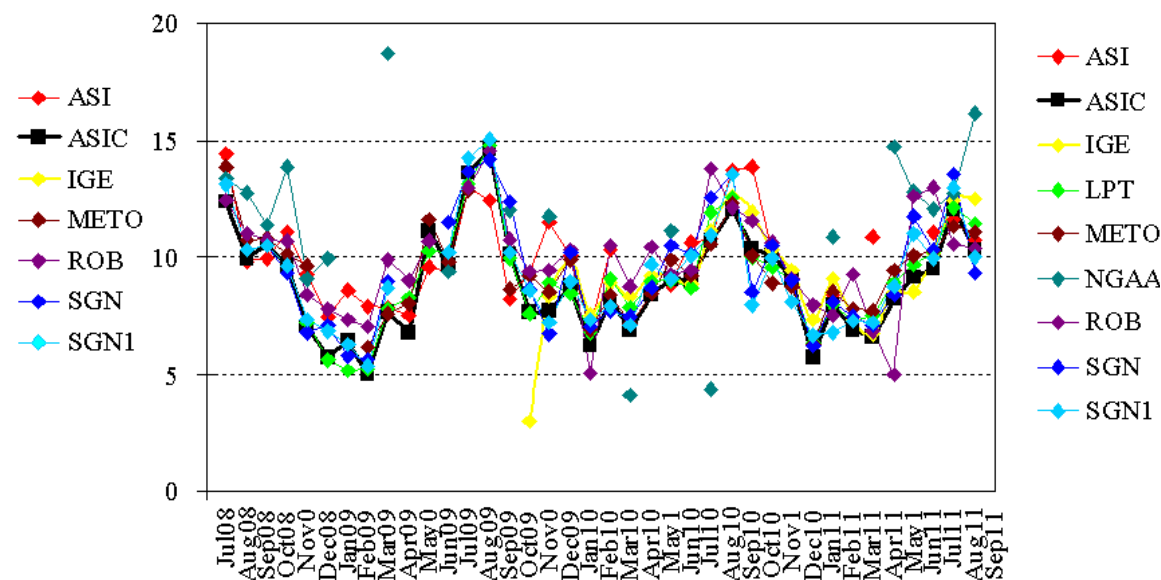
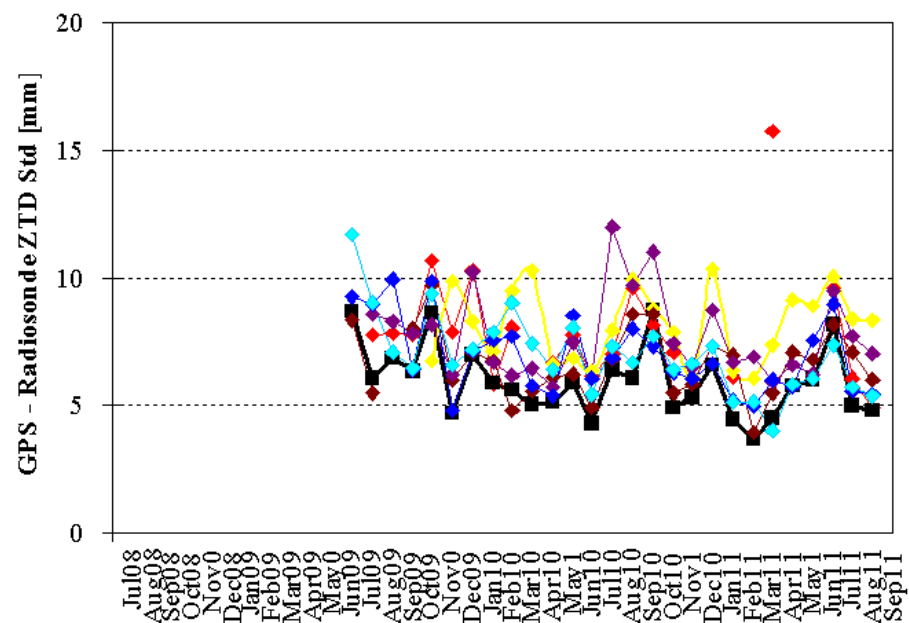
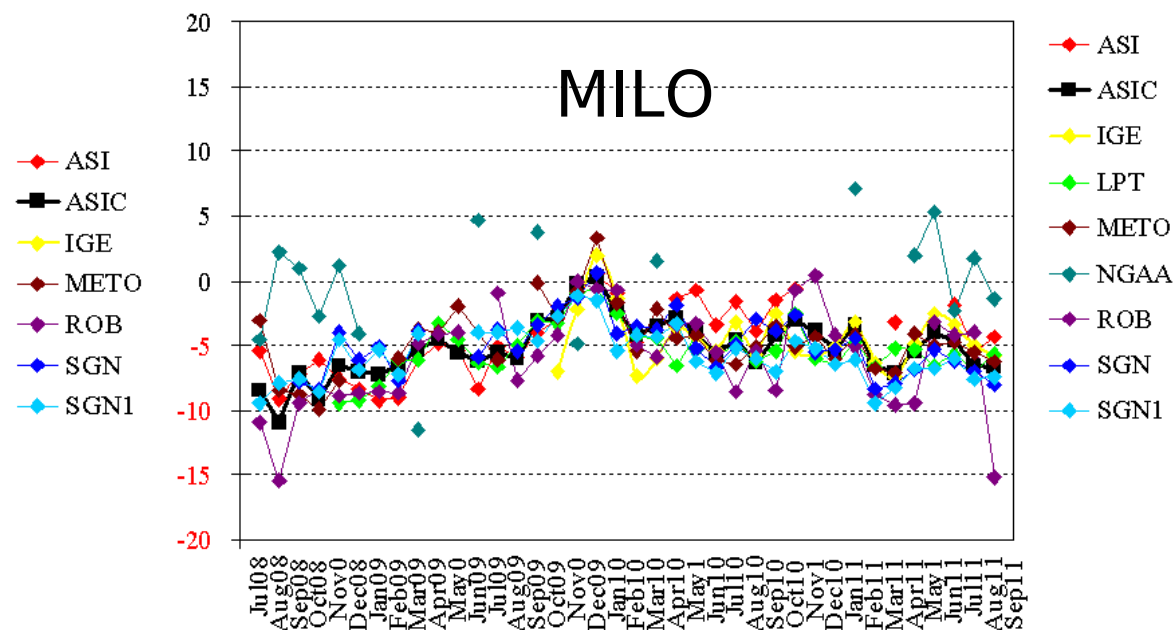
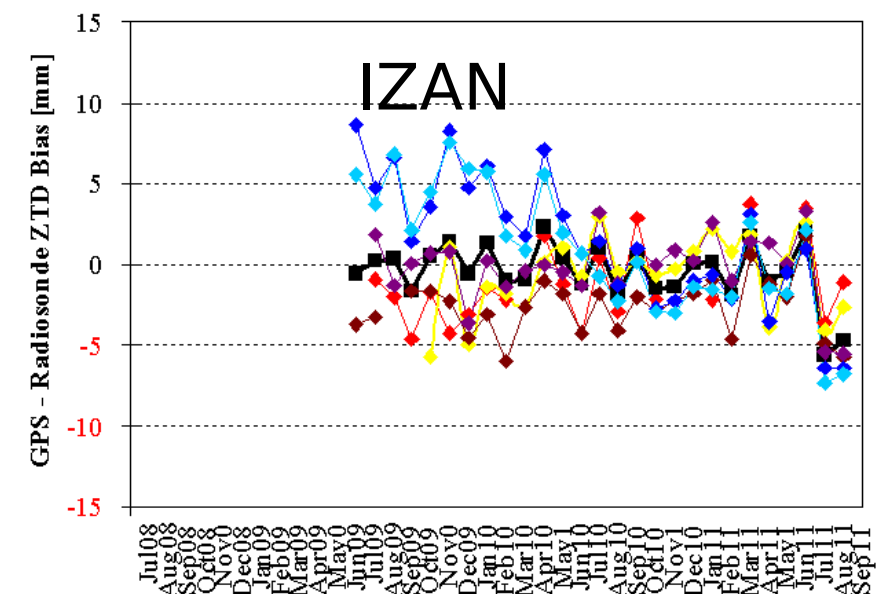
GPS - Radiosonde ZTD Bias [mm]



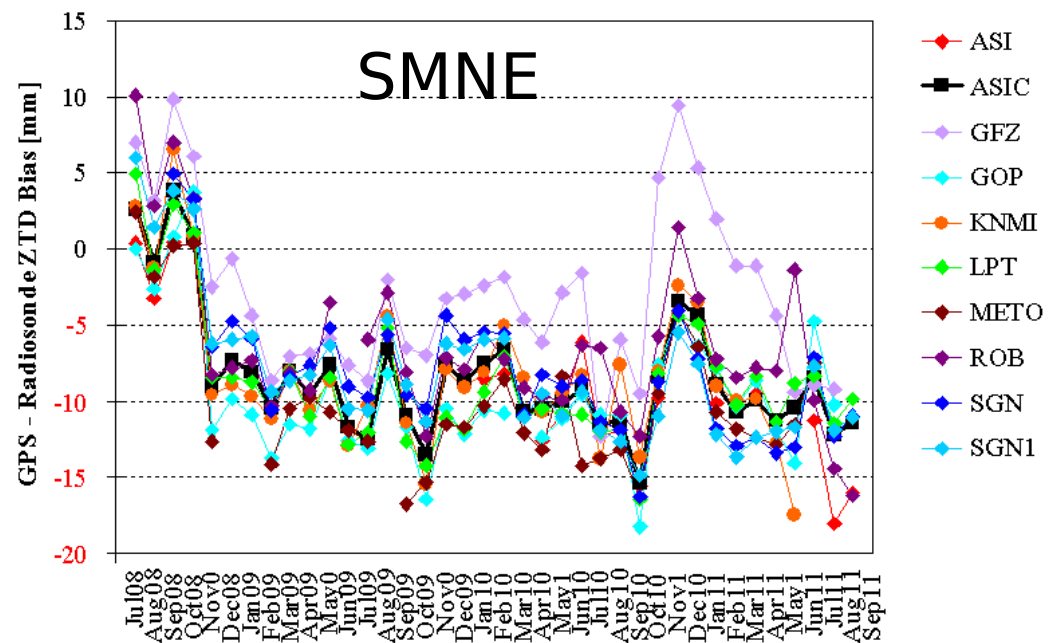
GPS - Radiosonde ZTD Std [mm]



# Individual and ASIC versus RS (5/6)



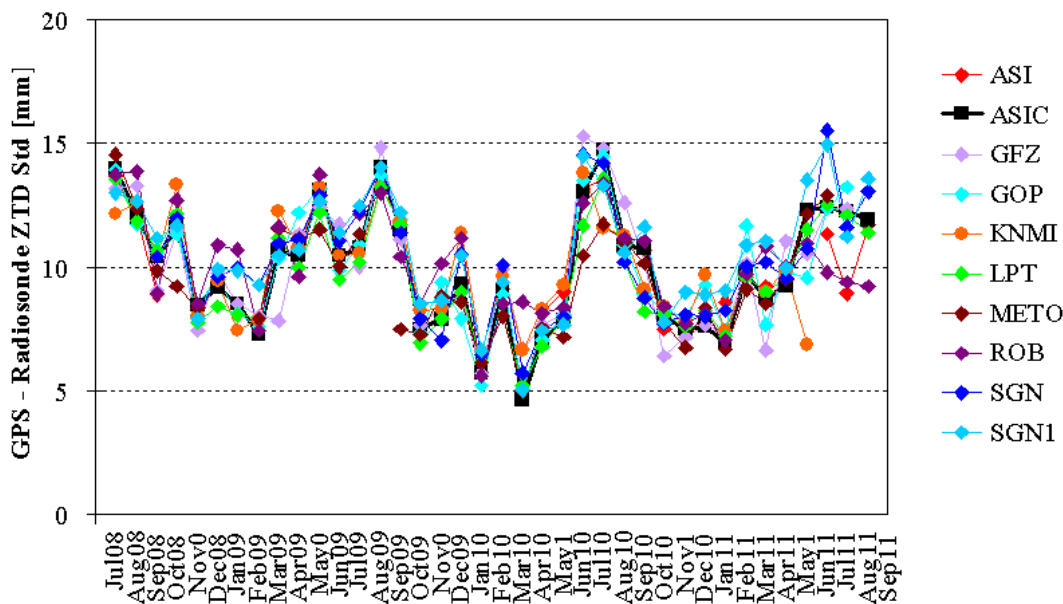
# Individual and ASIC versus RS (6/6)



➤ CAM0 too few data

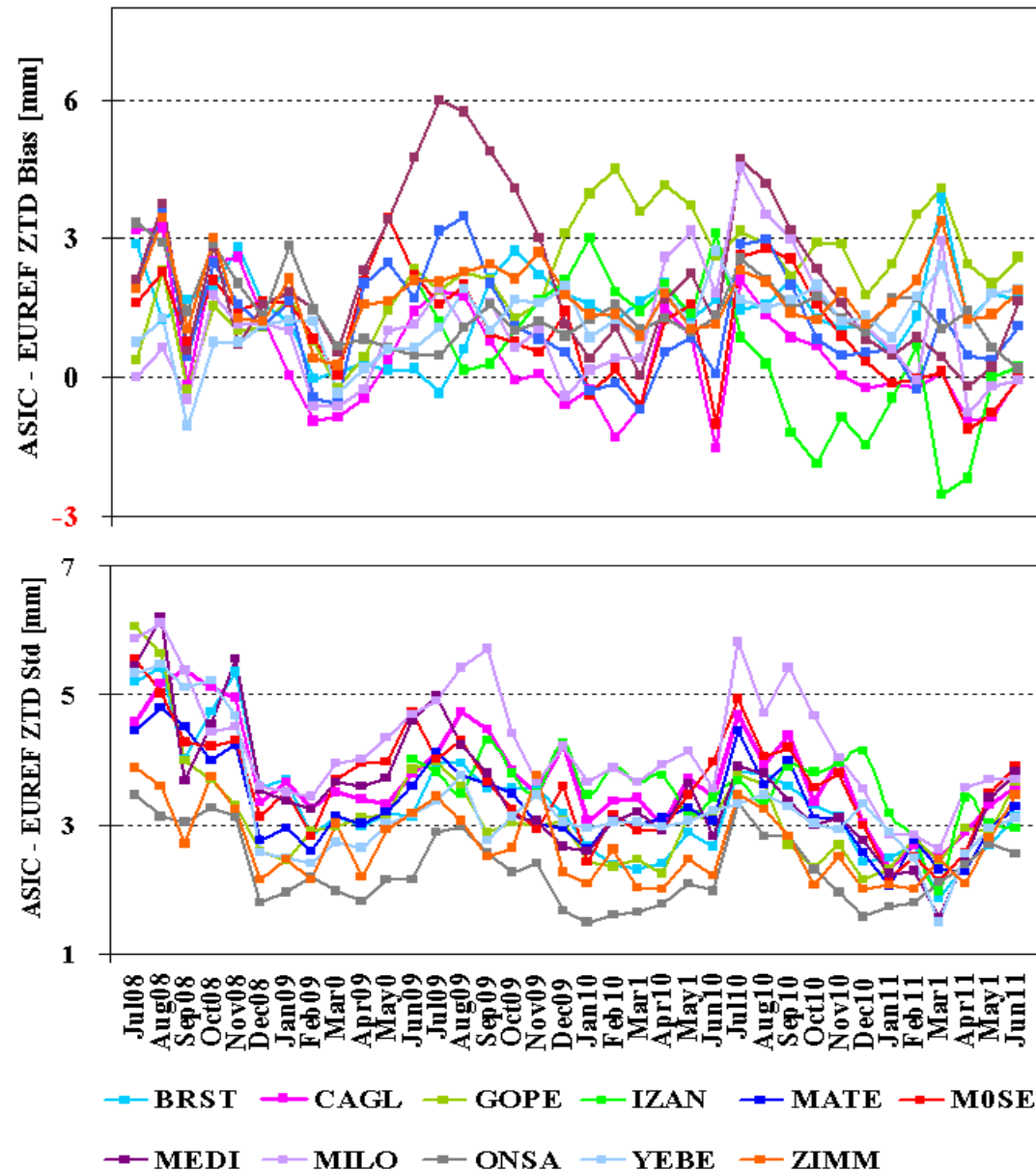
➤ STD: better agreement in winter than in summer

➤ Bias: Slightly negative, GPS slightly dryer

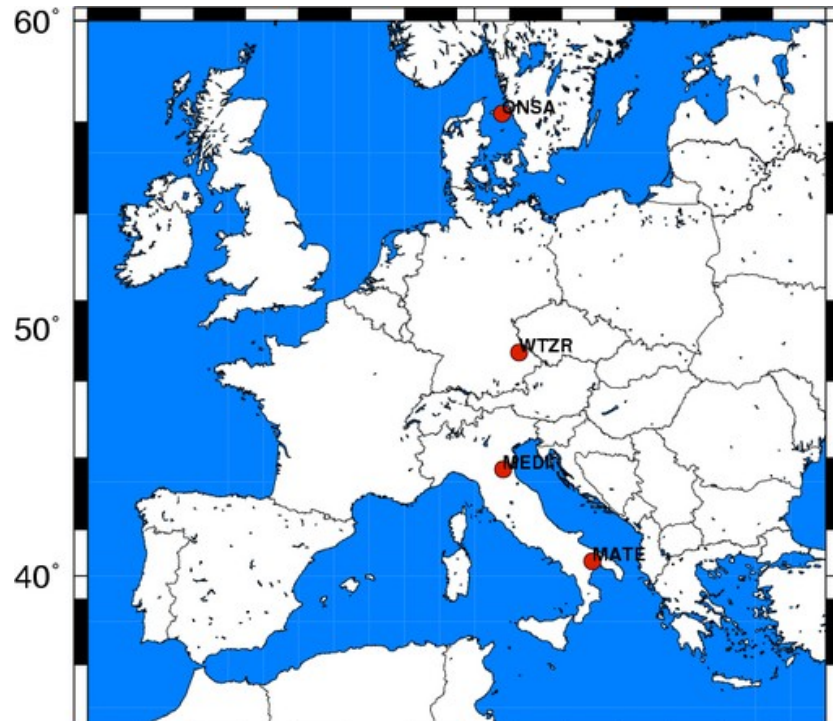




# ASIC versus EUREF (November 2008-July 2011)



# ASIC versus VLBI (1/2)

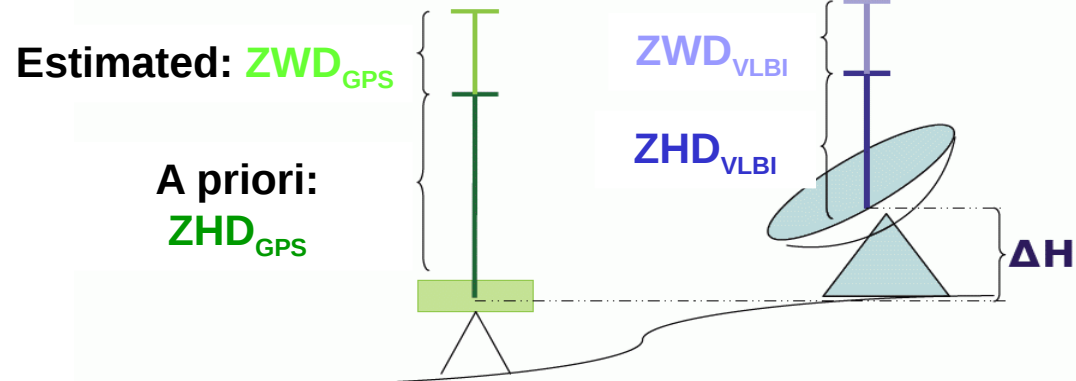


November 2008-September 2011

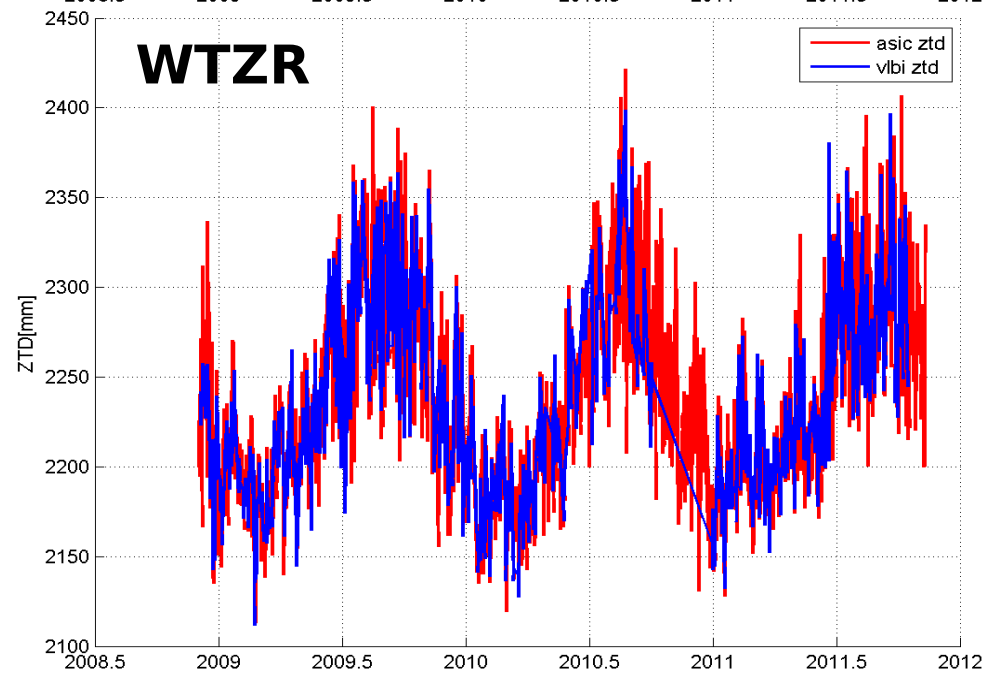
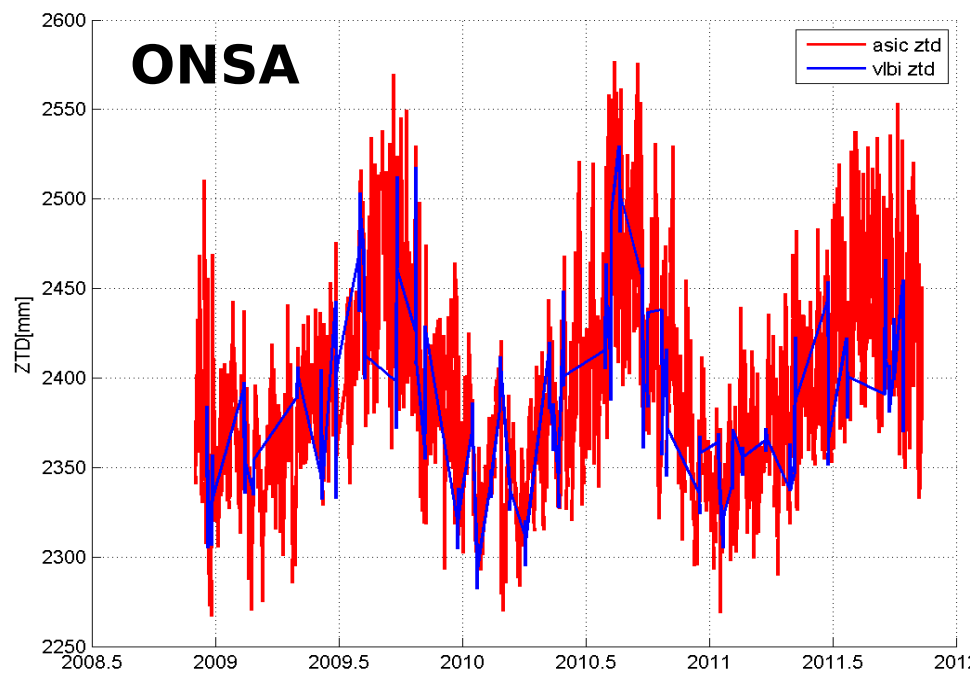
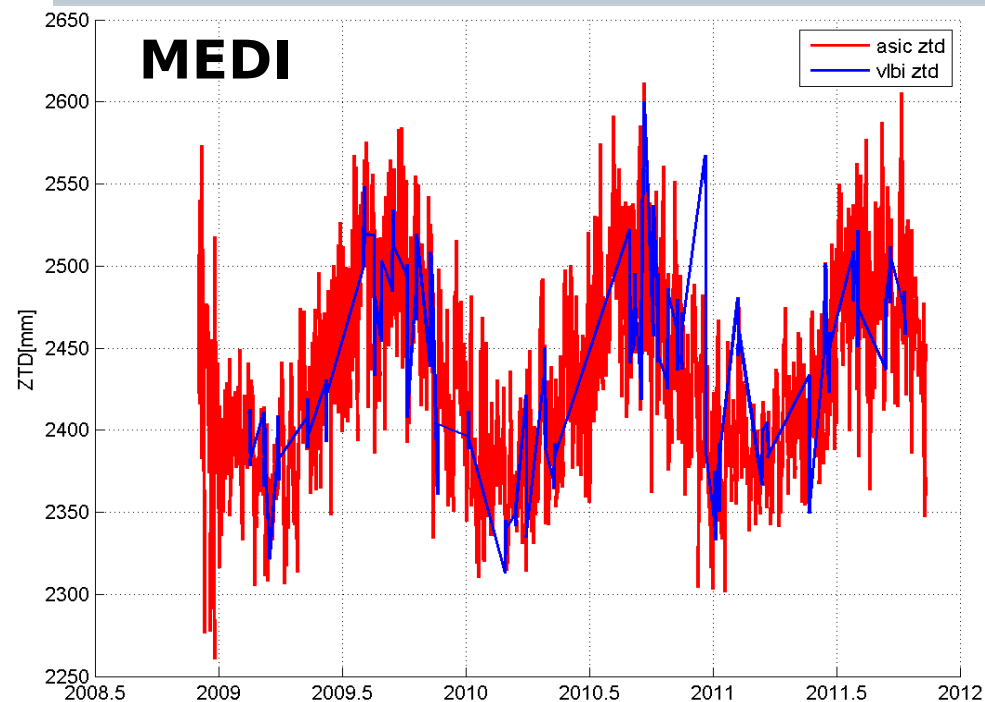
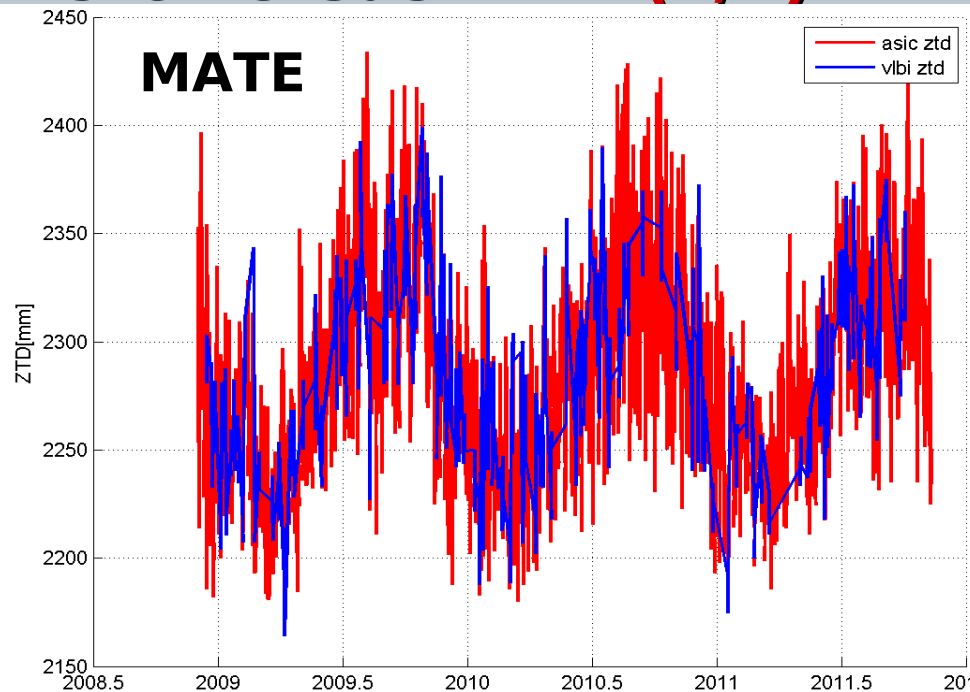
	(VLBI -GPS) height [m]	theoretical bias [mm]	ASIC
<b>MATE</b>	<b>7,7</b>		
#			<b>2883</b>
bias		<b>2,31</b>	<b>-1,96</b>
std			<b>6,71</b>
<b>MEDI</b>	<b>17,1</b>		
#			<b>934</b>
bias		<b>5,13</b>	<b>-1,18</b>
std			<b>7,60</b>
<b>ONSA</b>	<b>13,7</b>		
#			<b>1044</b>
bias		<b>4,11</b>	<b>-0,94</b>
std			<b>5,59</b>
<b>WTZR</b>	<b>3,1</b>		
#			<b>5469</b>
bias		<b>0,93</b>	<b>0,65</b>
std			<b>5,53</b>
<b>ALL</b>			
#			<b>10330</b>
bias			<b>-0,86</b>
std			<b>6,36</b>

**GPS**

**VLBI**



# ASIC versus VLBI (2/2)



# Quality Control Evaluation

The QC test is based on

$$-15\text{mm} < (\text{reference-estimates}) < 15\text{mm}$$

where reference is:

- the median: fast (@0h:35), moderate (@0h:45), final (@1h:30),
- the combined ZTD solution (@1h:30),
- NWP data (@ 00 06 12 18 UTC).

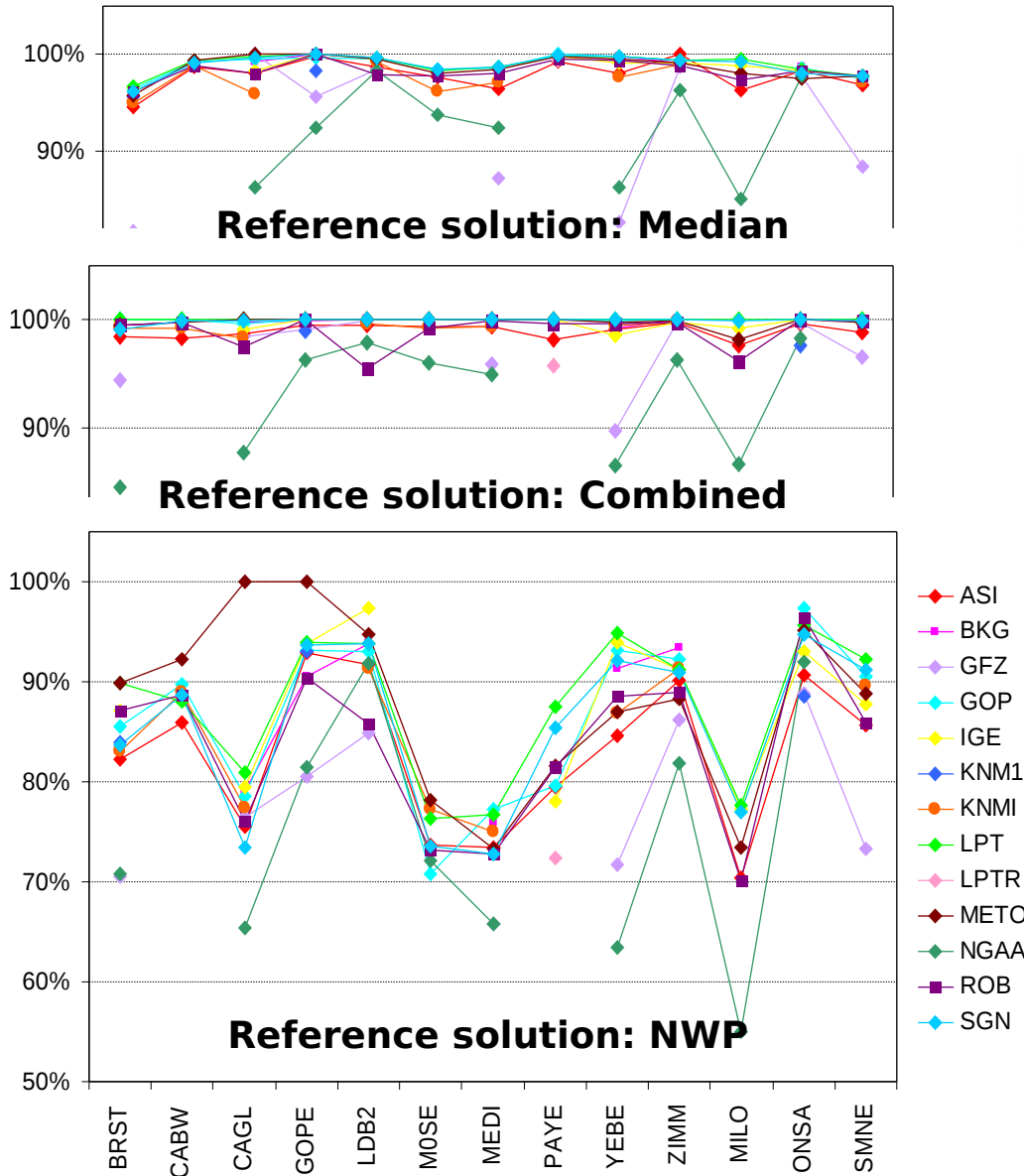
**Question: Is the threshold set too tight?**

In average 90% of the warning is in the range [15mm,25mm] or [-25mm,-15mm]



# Quality Control Evaluation

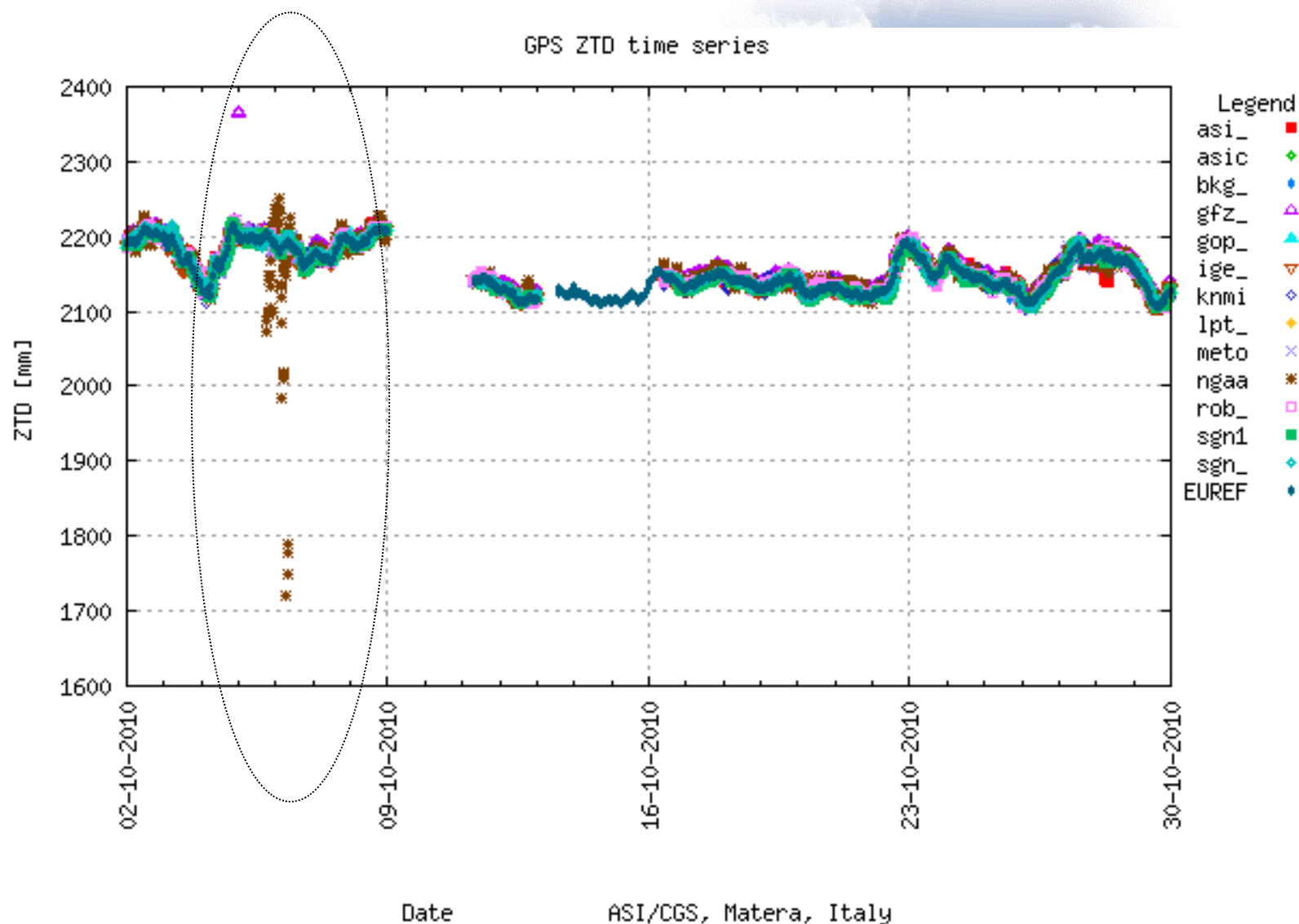
October 2010 % of ZTD solutions which passed the QC test.



The median and the combination roughly identify the same % of 'good' data.

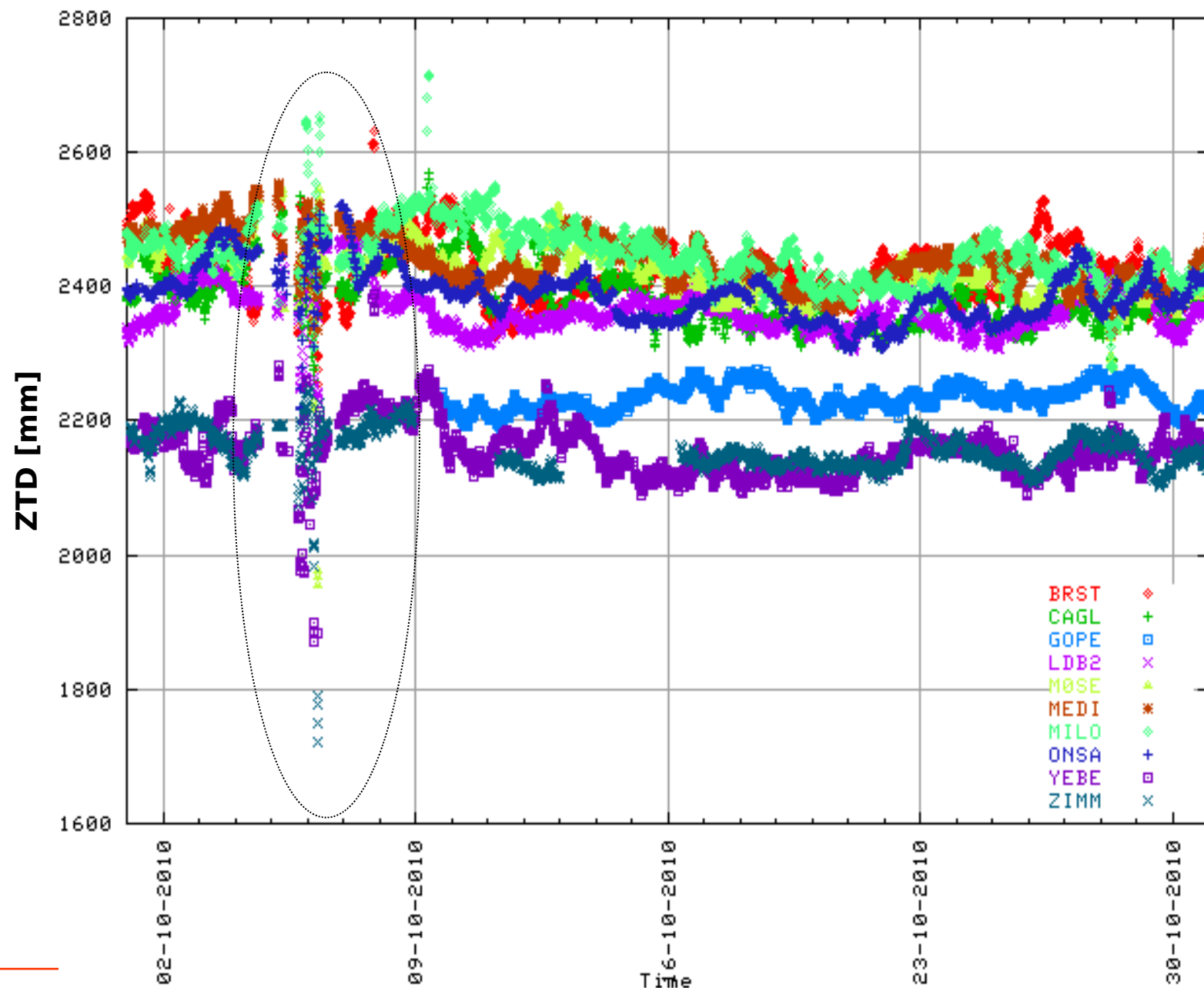
NWP performs poorly in comparison to the other methods.

# Quality Control Evaluation: ZIMM, October 2010

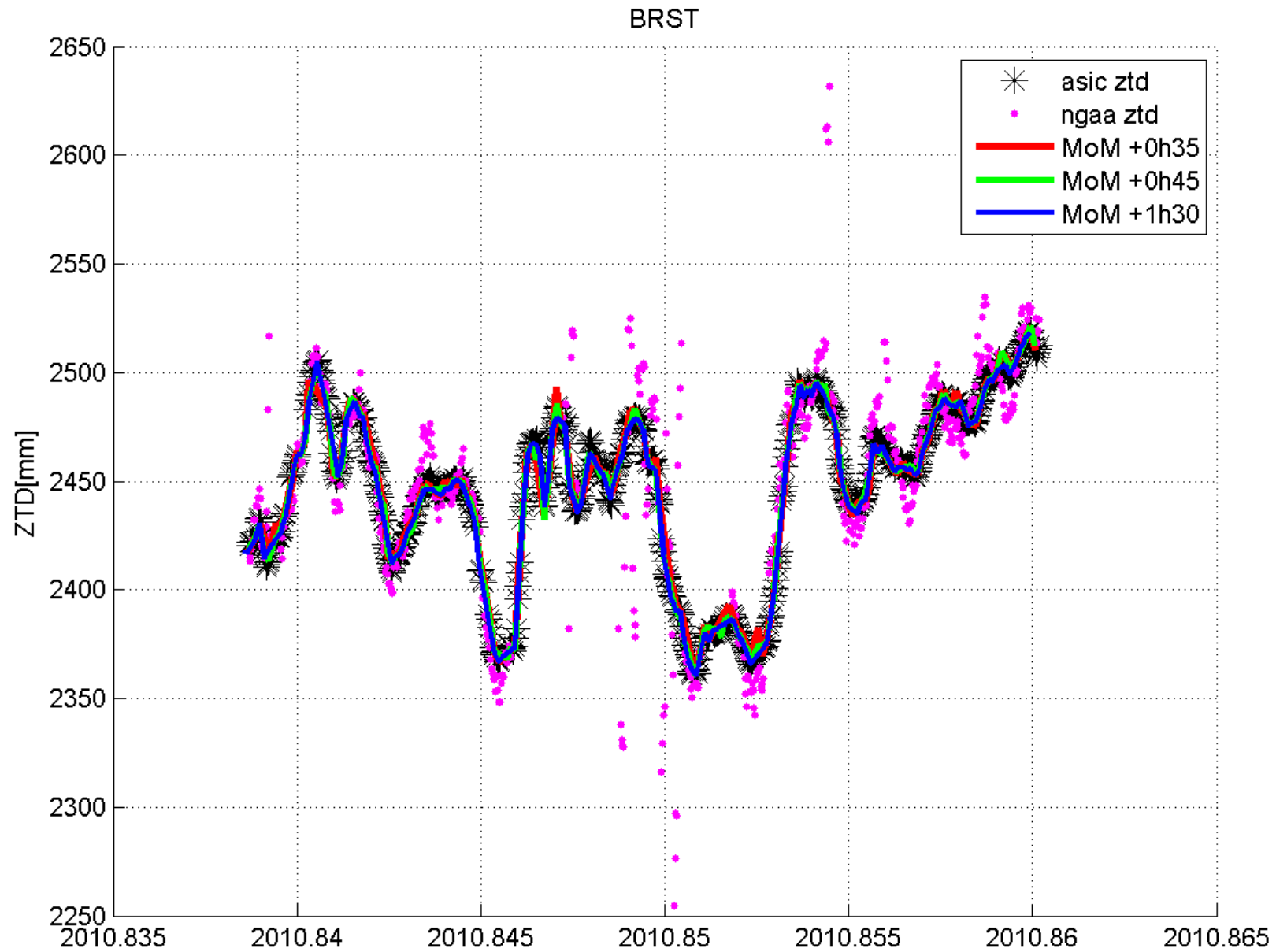


All ACs 'good' except one

# Quality Control Evaluation: NGAA, October 2010

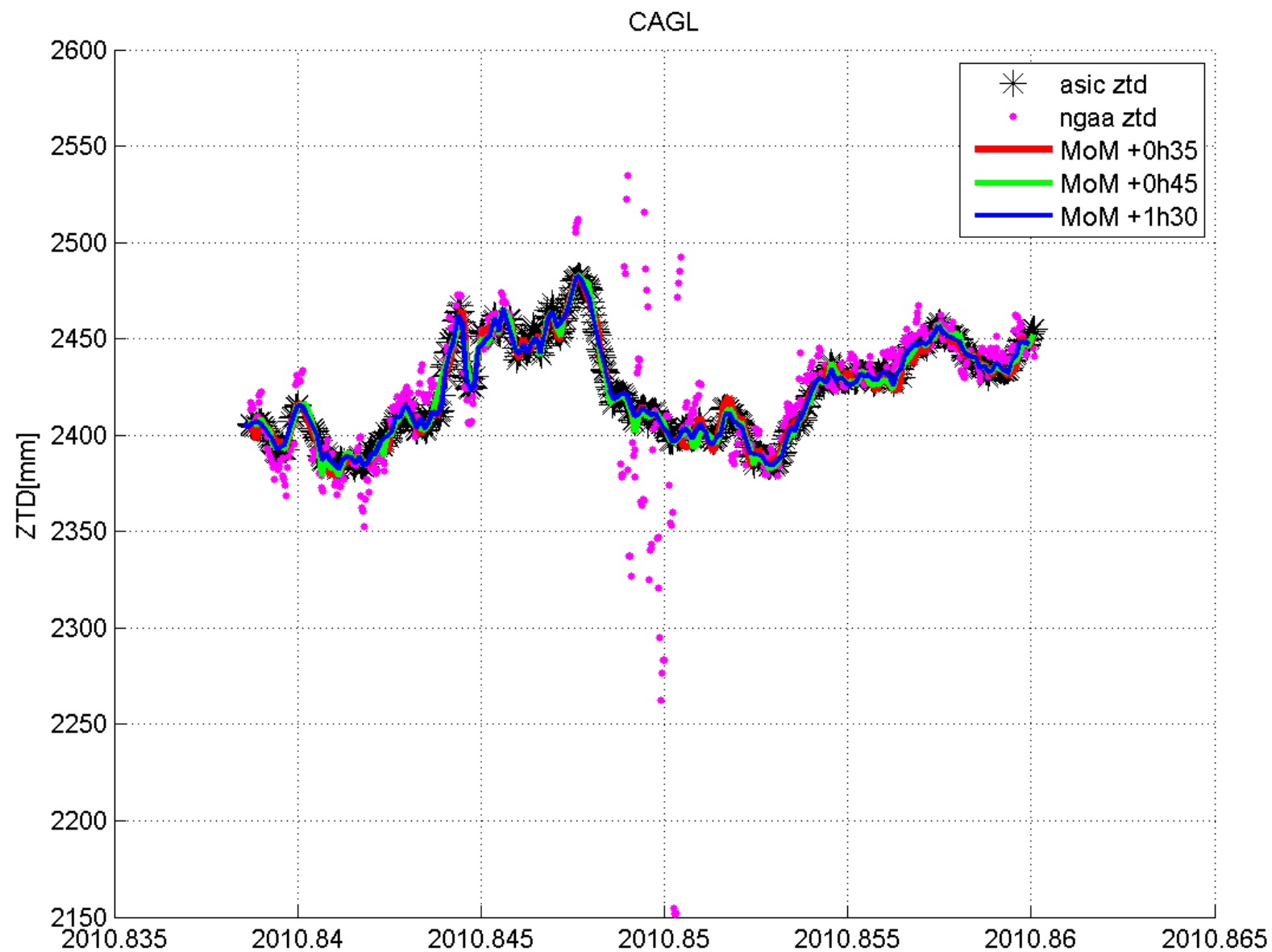


# Quality Control Evaluation: BRST October, 02-09, 2010

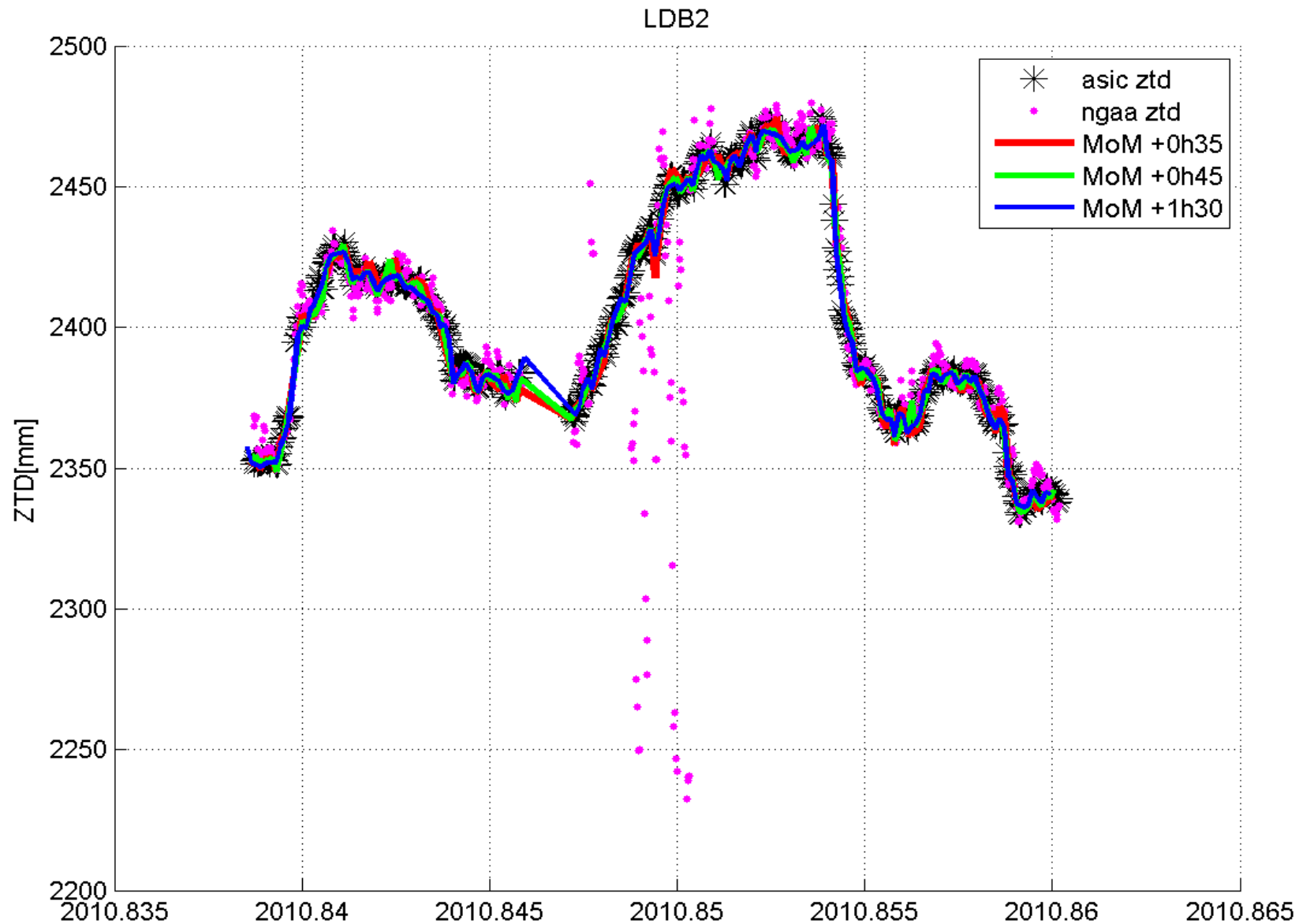




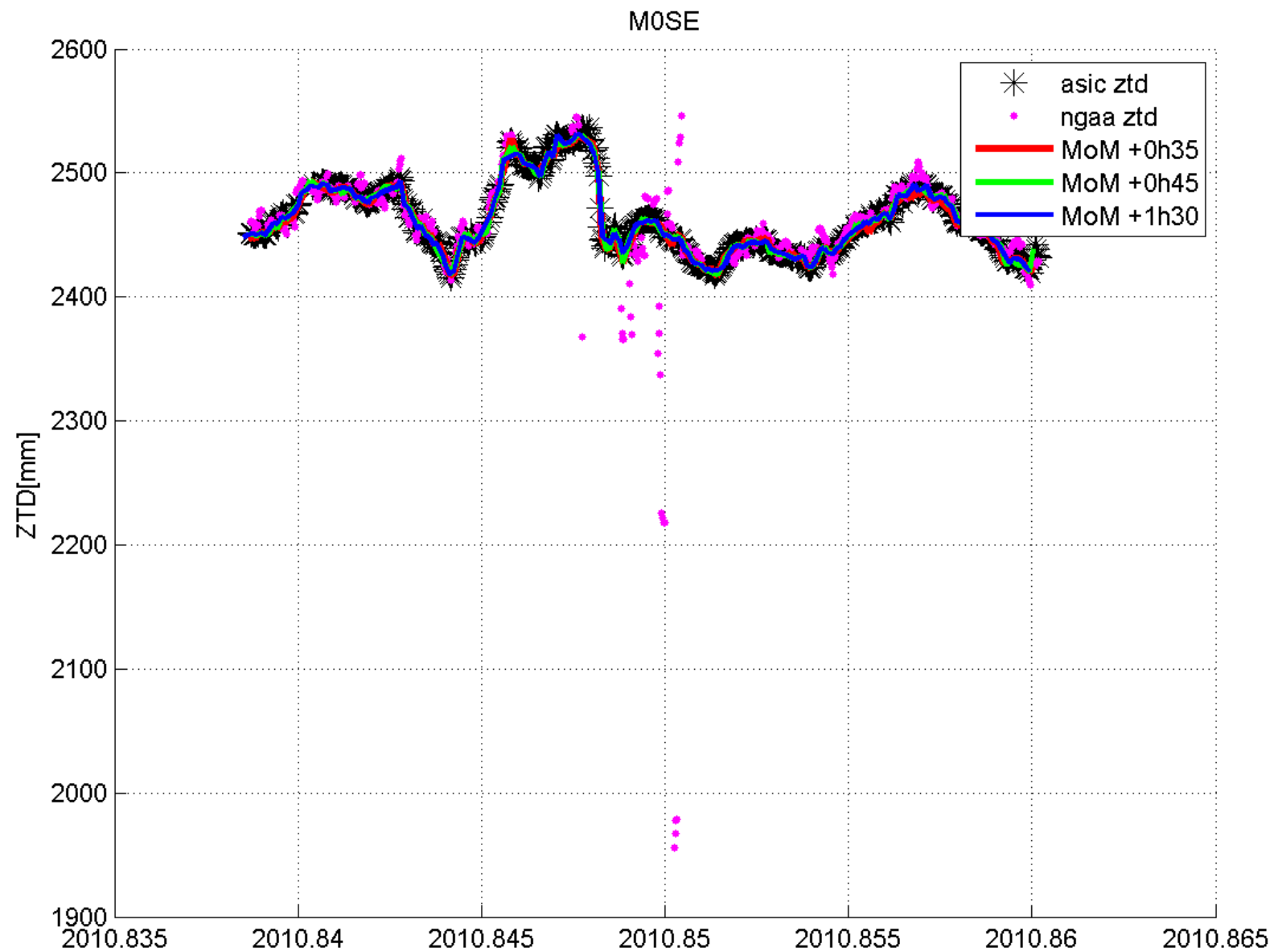
# Quality Control Evaluation: CAGL October, 02-09, 2010



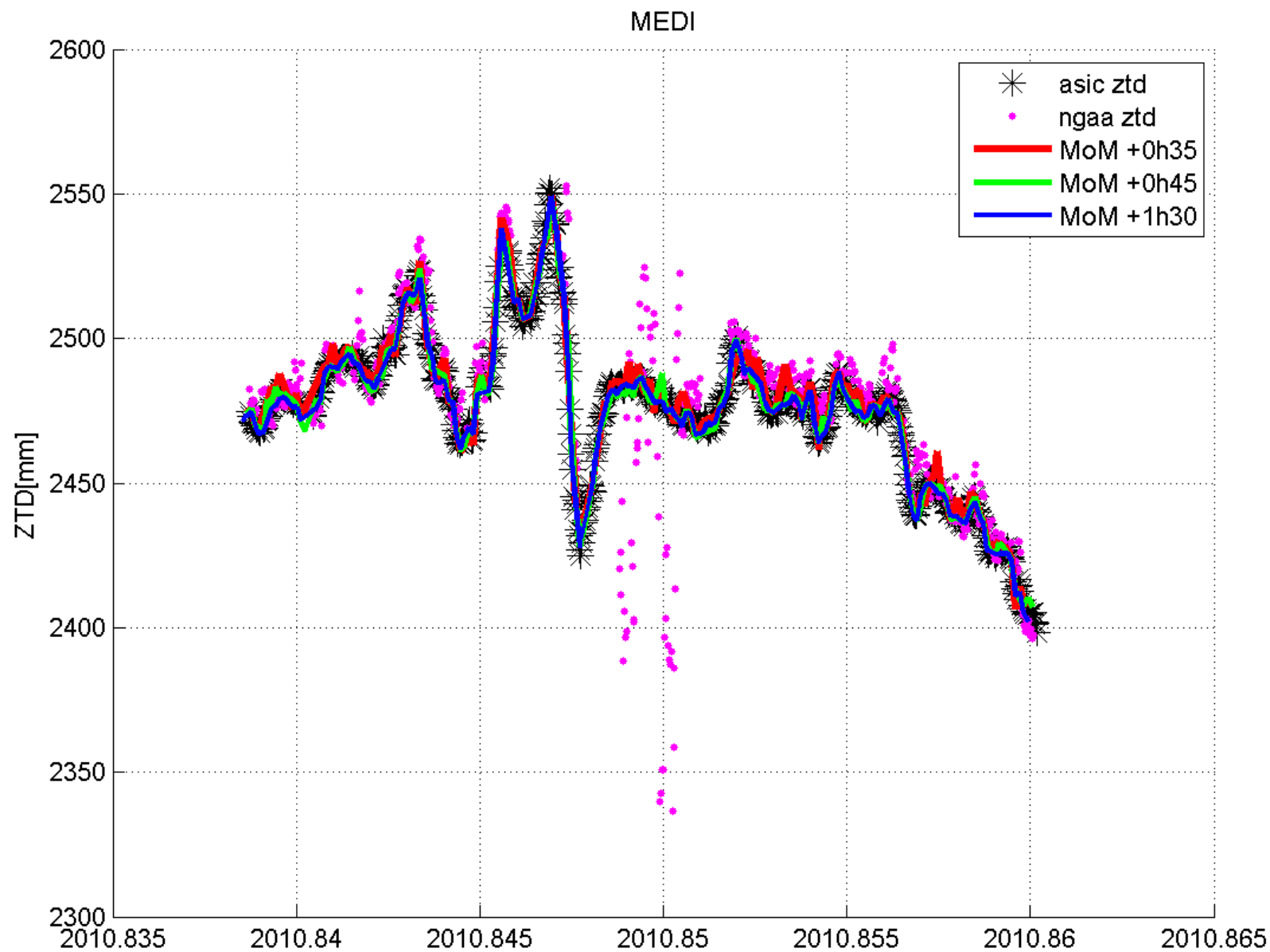
# Quality Control Evaluation: LDB2 October, 02-09, 2010



# Quality Control Evaluation: M0SE October, 02-09, 2010

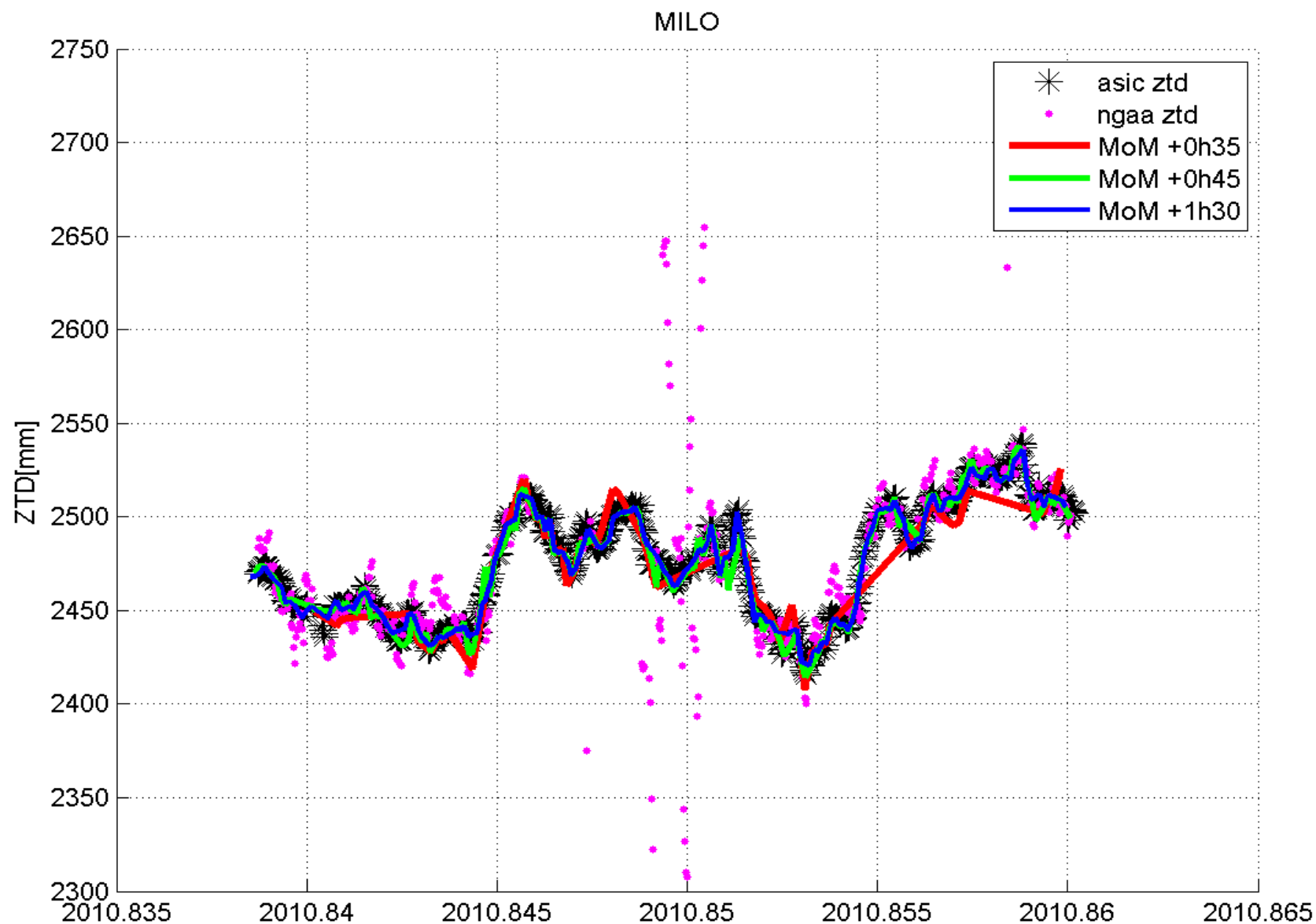


# Quality Control Evaluation: MEDI October, 02-09, 2010

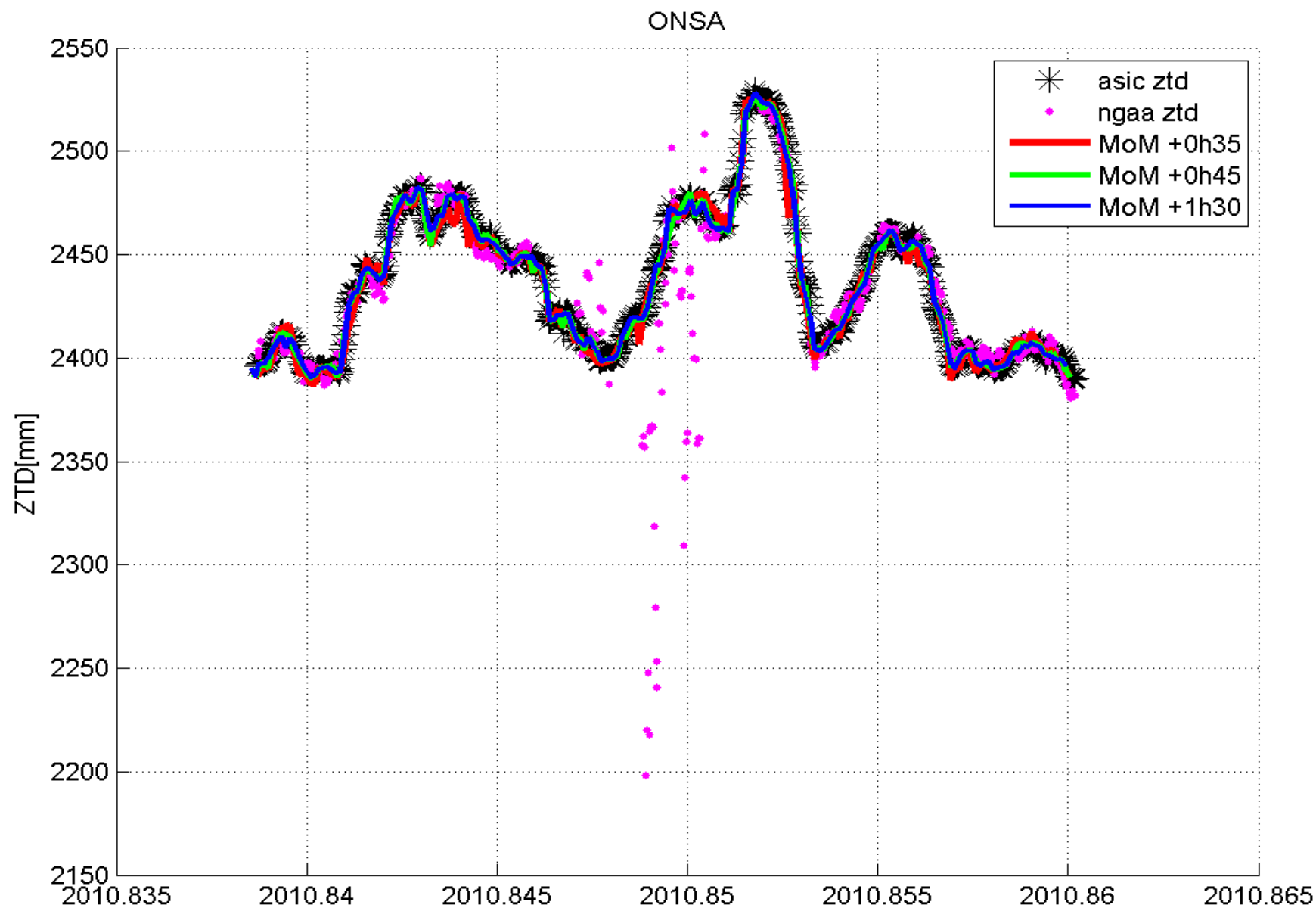




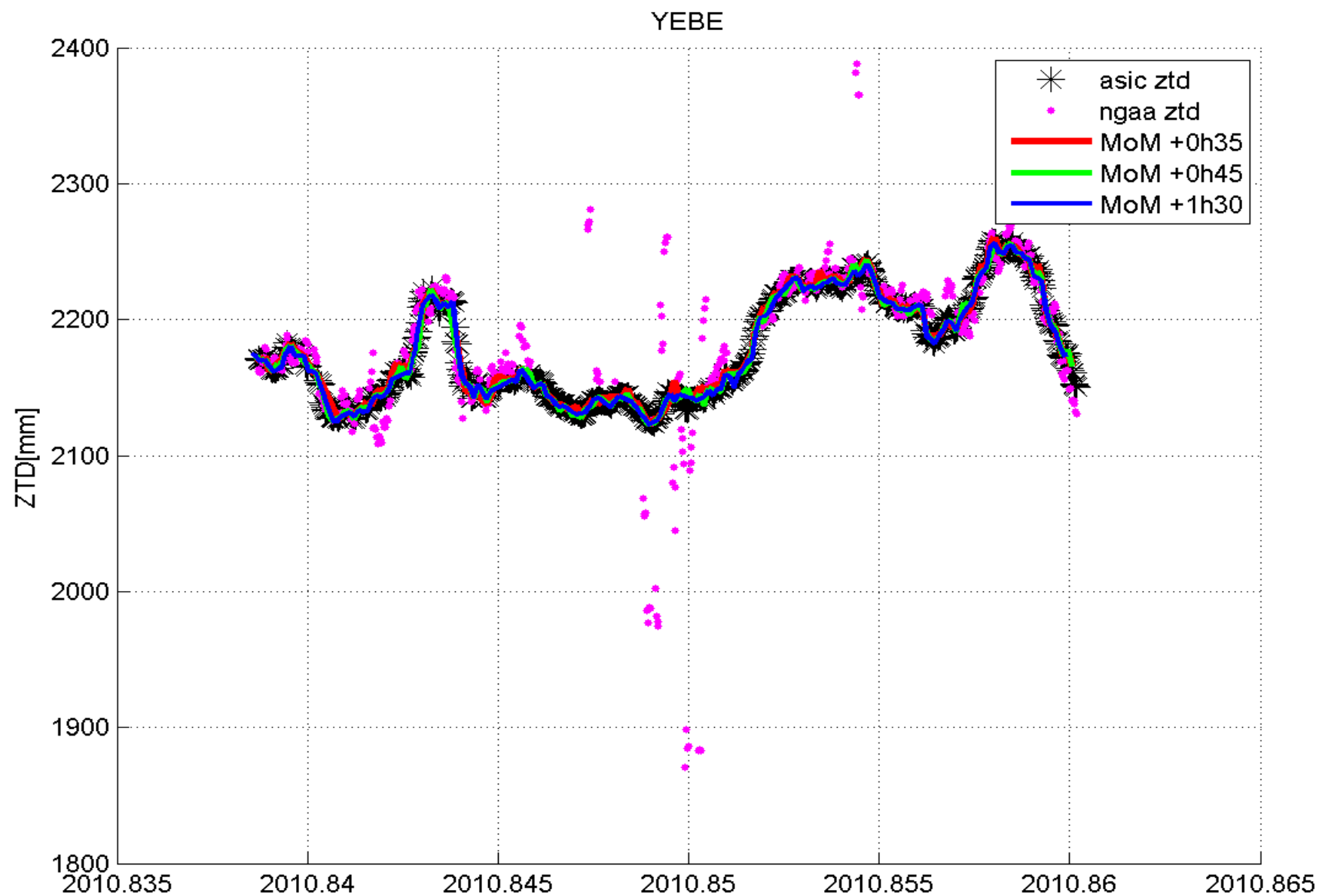
# Quality Control Evaluation: MILO October, 02-09, 2010



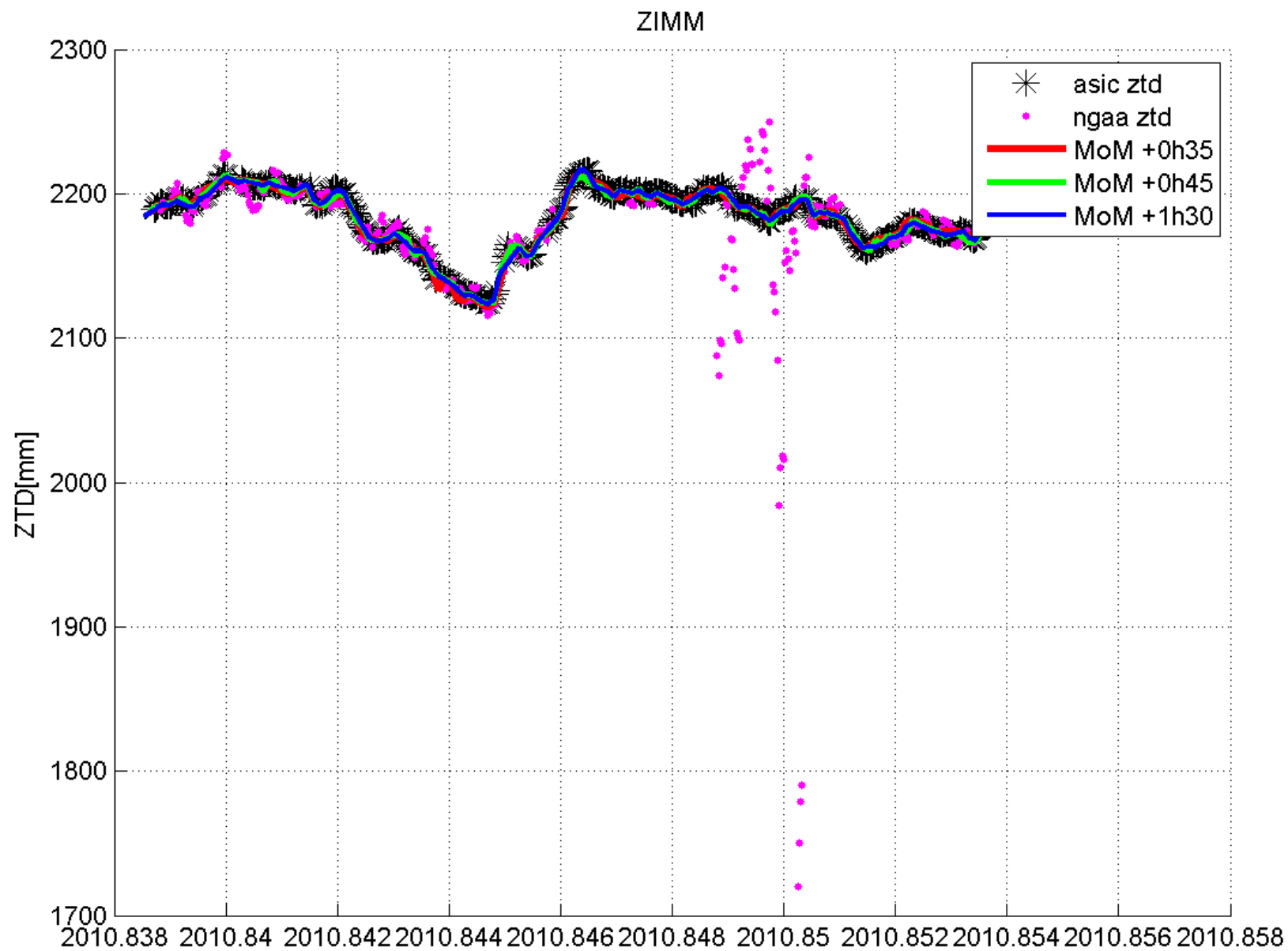
# Quality Control Evaluation: ONSA October, 02-09, 2010



# Quality Control Evaluation: YEBE October, 02-09, 2010



# Quality Control Evaluation: ZIMM October, 02-09, 2010



# Quality Control Evaluation: October, 02-09, 2010

# of ACs used

	BRST	CAGL	LDB2	MOSE	MEDI	MI LO	ONSA	YEBE	ZIMM
MoM_ +0h35	4	3	4	3	3	2	3	3	3
MoM_ +0h45	8	6	7	5	6	4	6	6	6
MoM_ +1h30	11	10	11	8	10	7	10	10	11
ASIC	10	9	10	8	10	6	10	9	10

- NGAA is not contributing to the fast MoM because it is not available at +0h35. It is contributing to the moderate and final MoM, but its value is so far from the others that it doesn't compromise the MoM.
- NGAA is excluded by the combination process because its sigmas are  $\geq 30\text{mm}$  or SDT w.r.t. the combined level\_1 solution is  $>30\text{mm}$ .
- With less than 3 contributions (which is frequent for non Super Site data) the MoM is weak because of very low observation redundancy. This is why, to get a reliable value, at least 3 contributions are required for the combination.

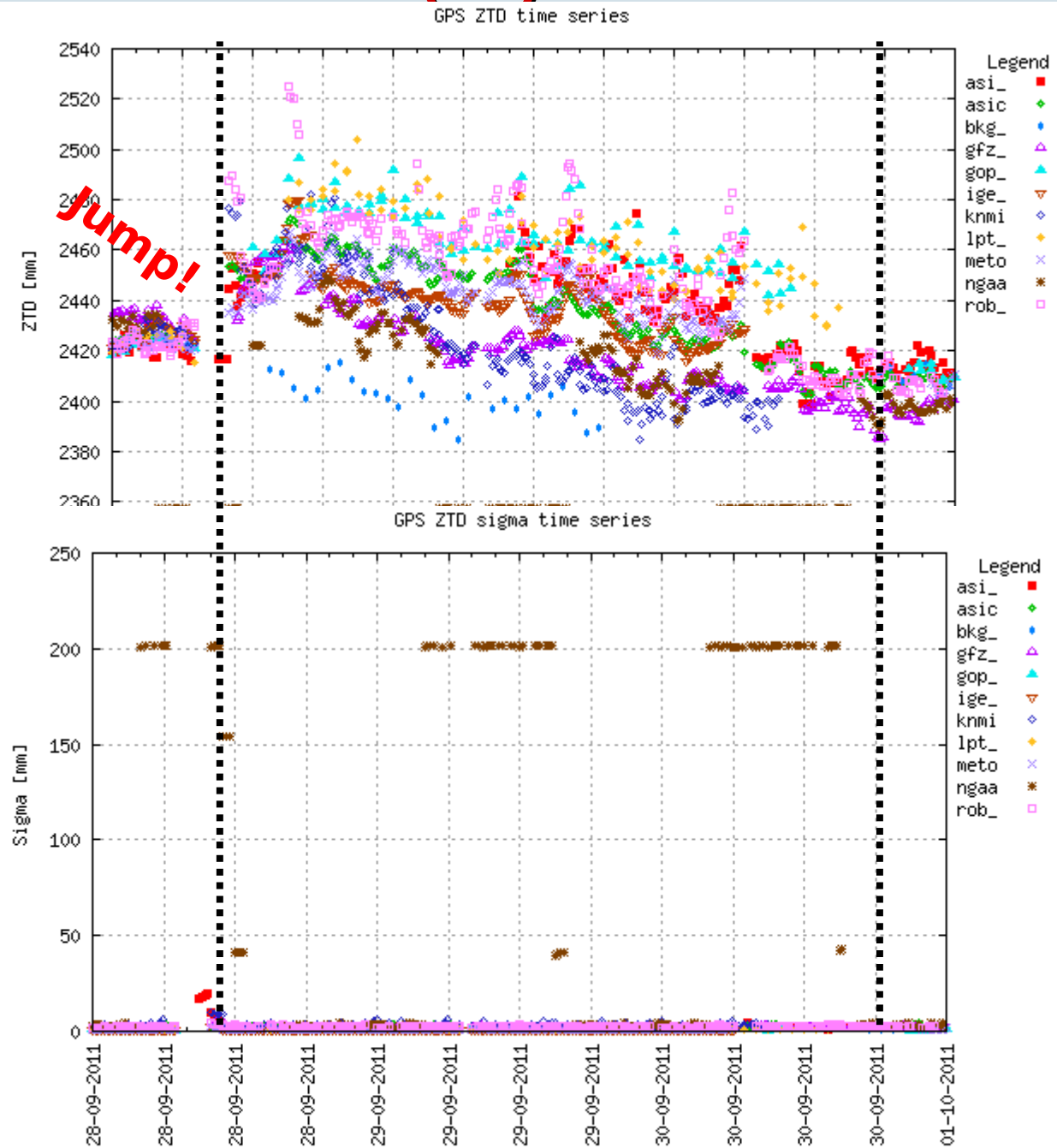


# Quality Control Evaluation: LDB2 case (1/4)

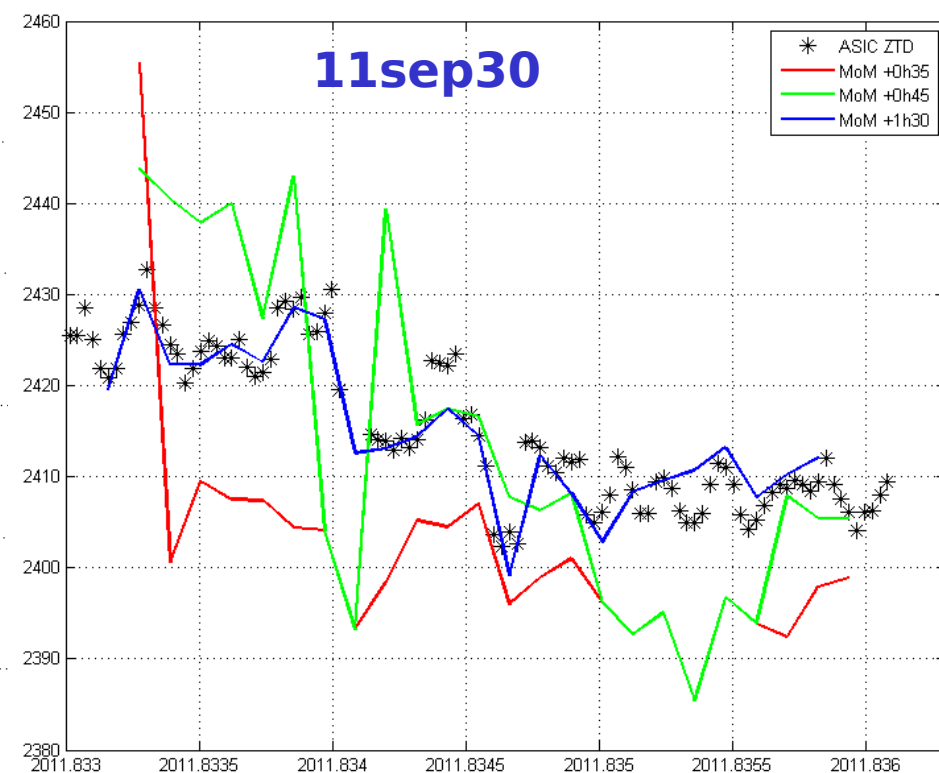
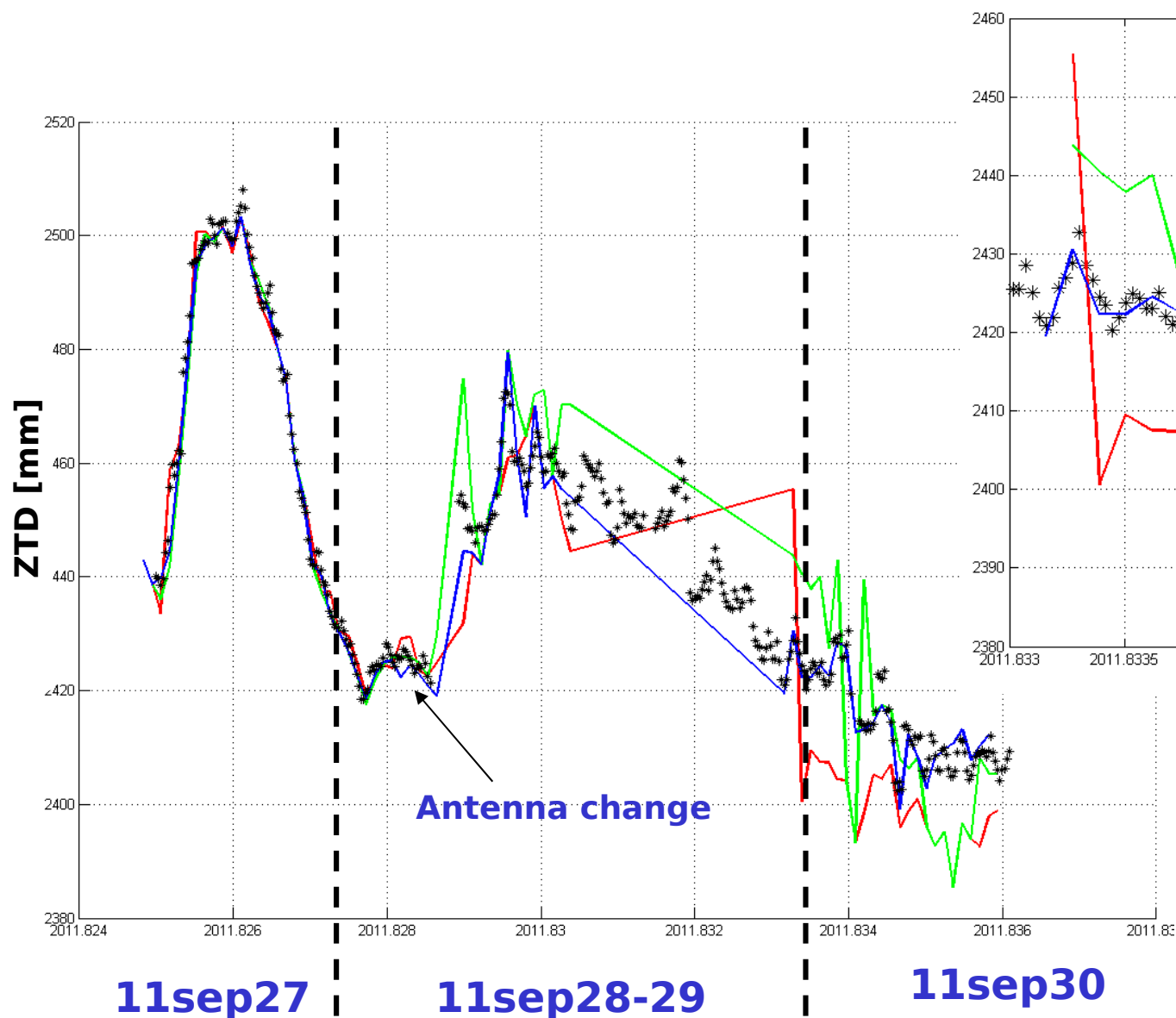
What does it happen if all the solutions (except one) are wrong?

On 2011-09-28 10:00 the antenna @ LDB2 was changed without notifying it to the ACs.

(From TPSCR3\_GGD CONE to LEIAR25.R4 LEIT)



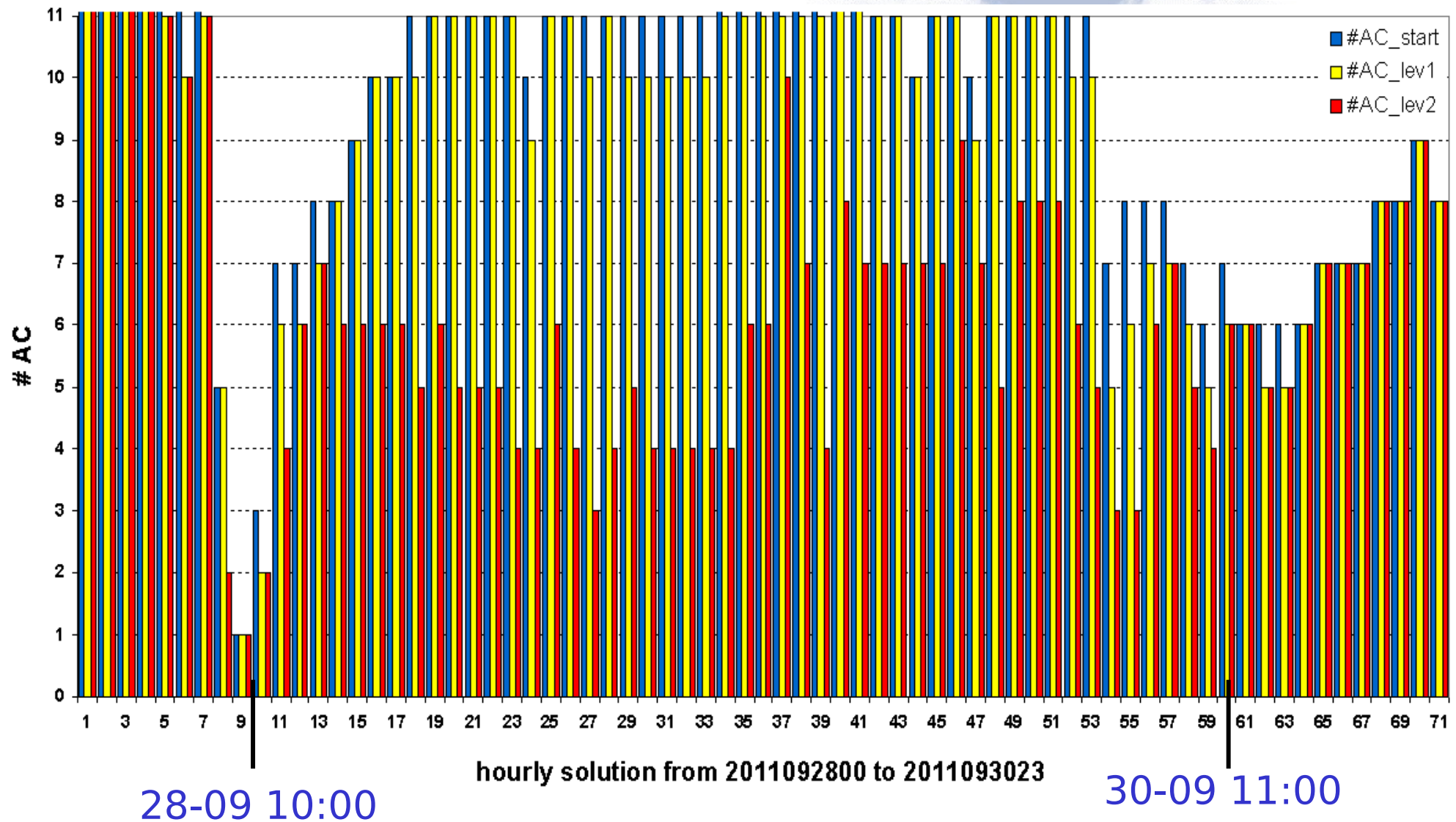
# Quality Control Evaluation: LDB2 case (2/4)



**# of ACs used**

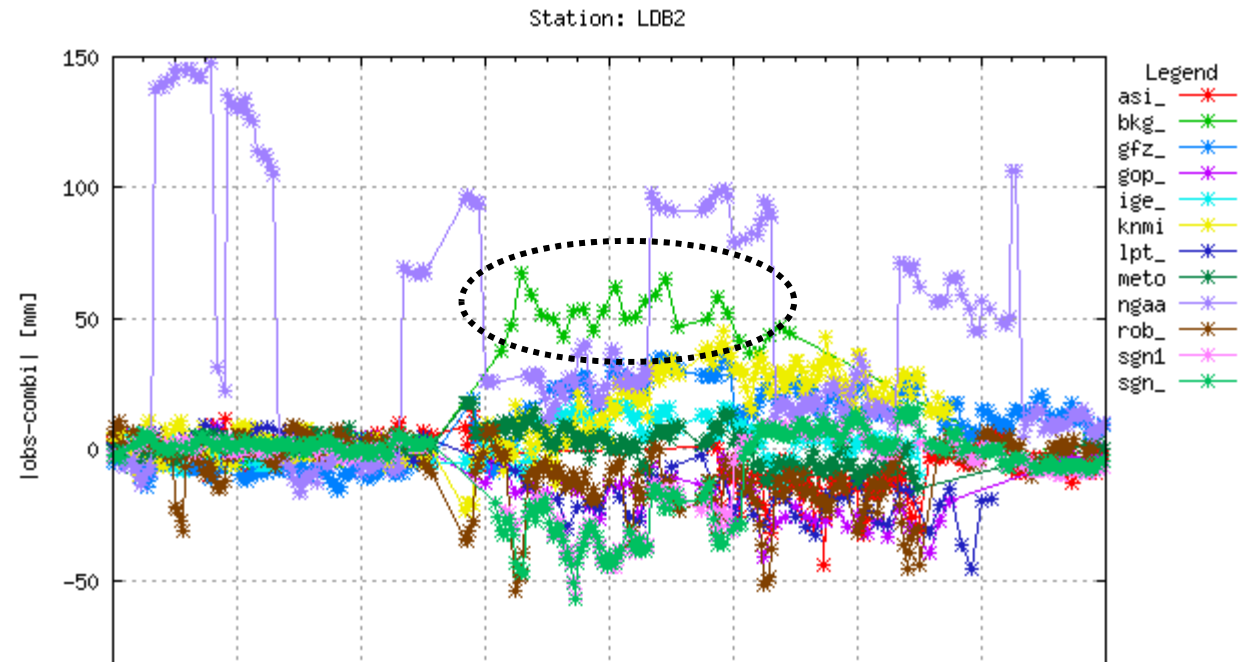
	<b>LDB2</b>
<b>MoM_+0h35</b>	3
<b>MoM_+0h45</b>	5
<b>MoM_+1h30</b>	10
<b>ASIC</b>	6

# Quality Control Evaluation: LDB2 case (3/4)

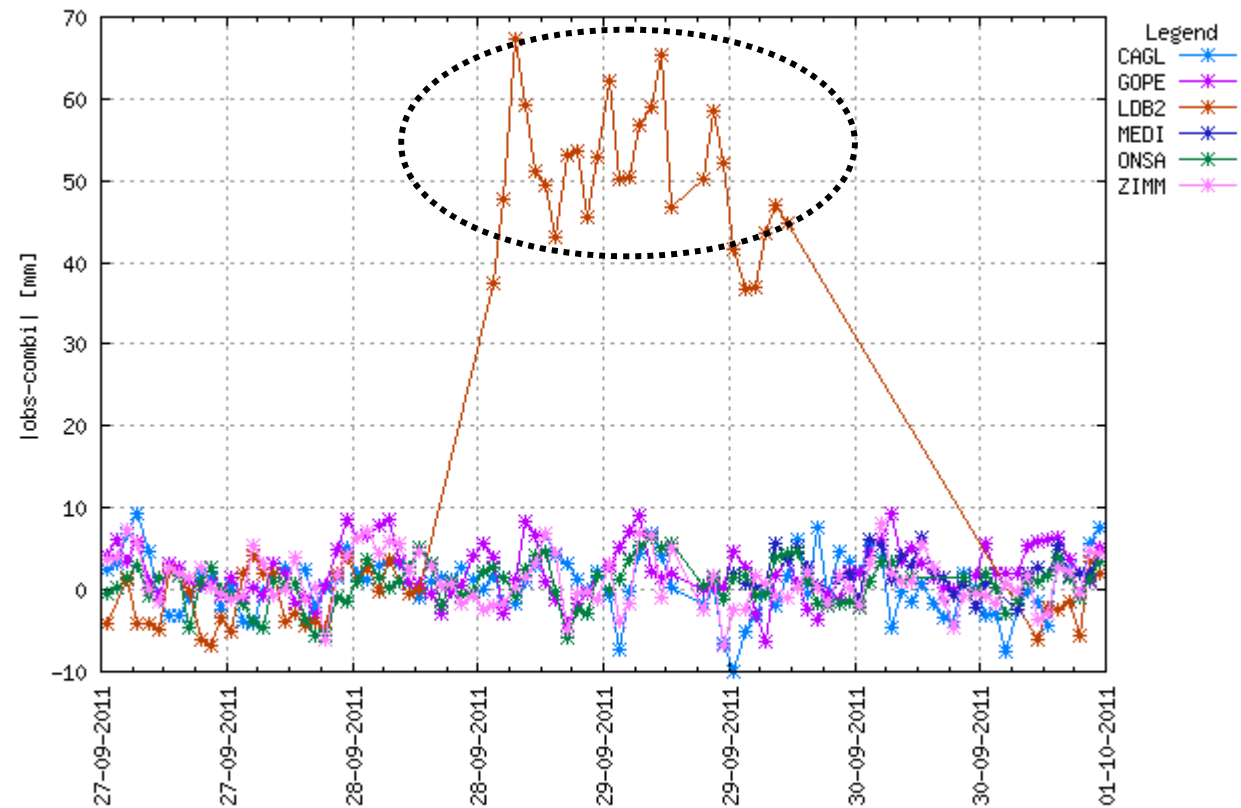


# Quality Control Evaluation

LDB2: all ACs



BKG: all Super Sites



# MoM or combination?

- Under nominal conditions, when all (or the majority of) the solutions are correct, the 4 reference time series: fast, moderate, final MoM and combination have the same behavior.
- In case of problems, as was the LDB2 case, the fast and moderate MoM are not reliable. To get a reliable MoM we have to wait for the final one, that is @1h:30min (just when the combination is available).
- The QEV based on  $-15\text{mm} < (\text{reference-estimates}) < 15\text{mm}$  may not be always reliable.
- The question is if the used QEV is enough to detect problems or beside it another indicator (for example the std w.r.t. a reference solutions) should be taken into account.
- It is worth noting that: gross error detection, bias & std evaluation are all inside the combination process.



# QC Flag File

For **combined ZTD solution**: every hour a QC flag file is send to METO and is archived in the AQC/flagging directory

File name convention **cost\_YYYYMMDDHH\_flag\_ac\_\_**

*This e-mail is generated automatically, please do not reply directly.  
ZTD estimates for this AC and the listed stations do not pass the QC  
test based on  $-15\text{mm} < (\text{combi-estimates}) < 15\text{mm}$ .*

*10-10-2011 11:00:00, PDEL, -44.7*

*10-10-2011 11:15:00, PDEL, -46.3*

*10-10-2011 11:30:00, PDEL, -47.1*

*10-10-2011 11:45:00, PDEL, -48.1*

The website on the ASI server

**[http://geodaf.mt.asi.it/gps\\_NRT\\_comb\\_solution.html](http://geodaf.mt.asi.it/gps_NRT_comb_solution.html)**

is public.

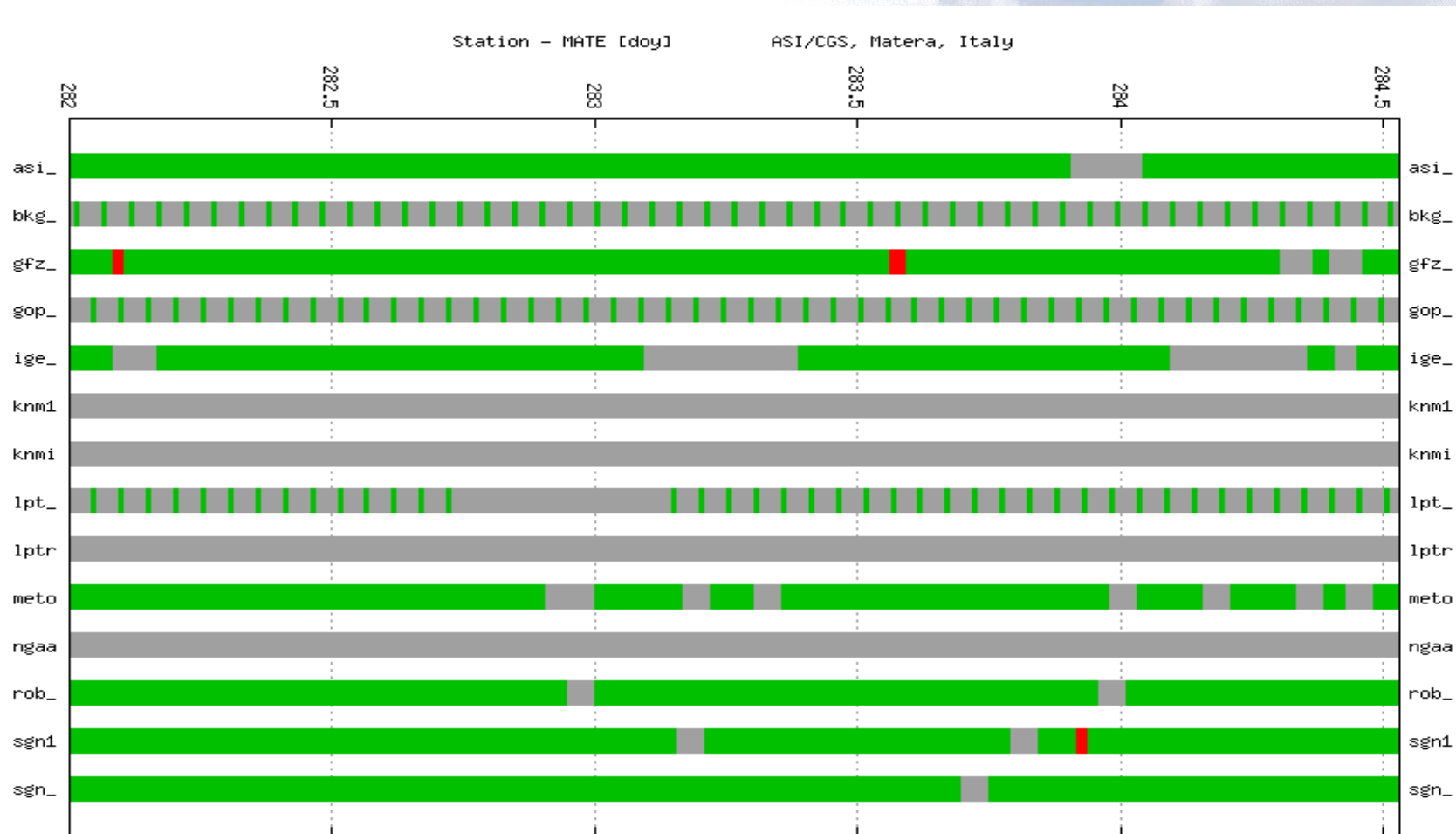
Useful for checking:

1. ASI Combined Network Status
2. NRT GPS Zenith Total Delay Time Series
3. NRT GPS Quality Control Evaluation

# NRT GPS Quality Control Evaluation @GeoDAF (1/3)

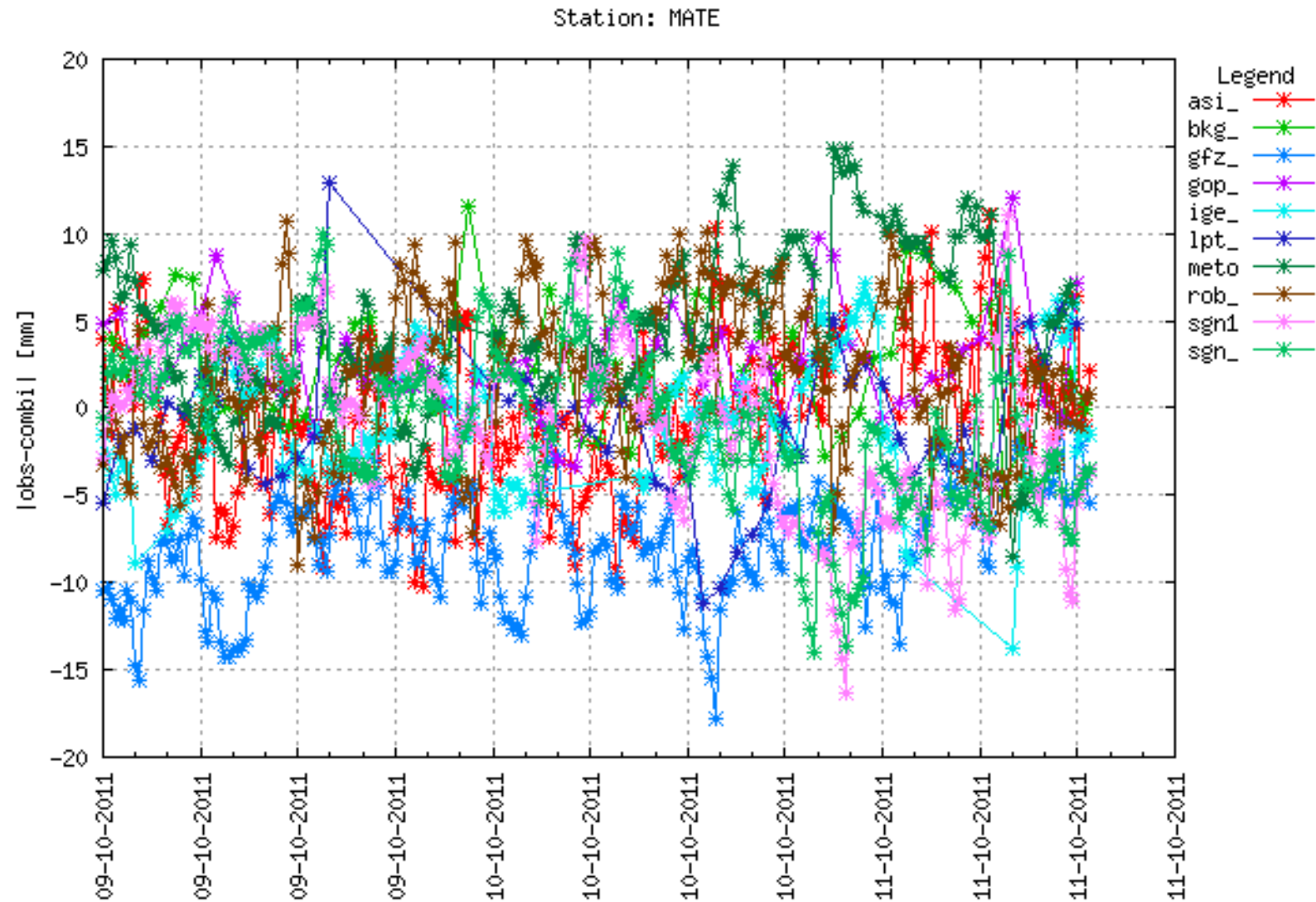
## Example

- Quality evaluation for MATE
- Time Resolution = 15min
- **OK**=|obs-combi|<15mm, **Not OK**, No Info



# NRT GPS Quality Control Evaluation @GeoDAF (2/3)

## ➤ Quality evaluation for station



# NRT GPS Quality Control Evaluation @GeoDAF (3/3)

## ➤ Quality evaluation for AC

