

Bundesamt für Landestopografie
Office fédéral de topographie
Ufficio federale di topografia
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Processing strategies at swisstopo LAC

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Transition from Bernese Version 4.2 to Version 5.0: Processing Options

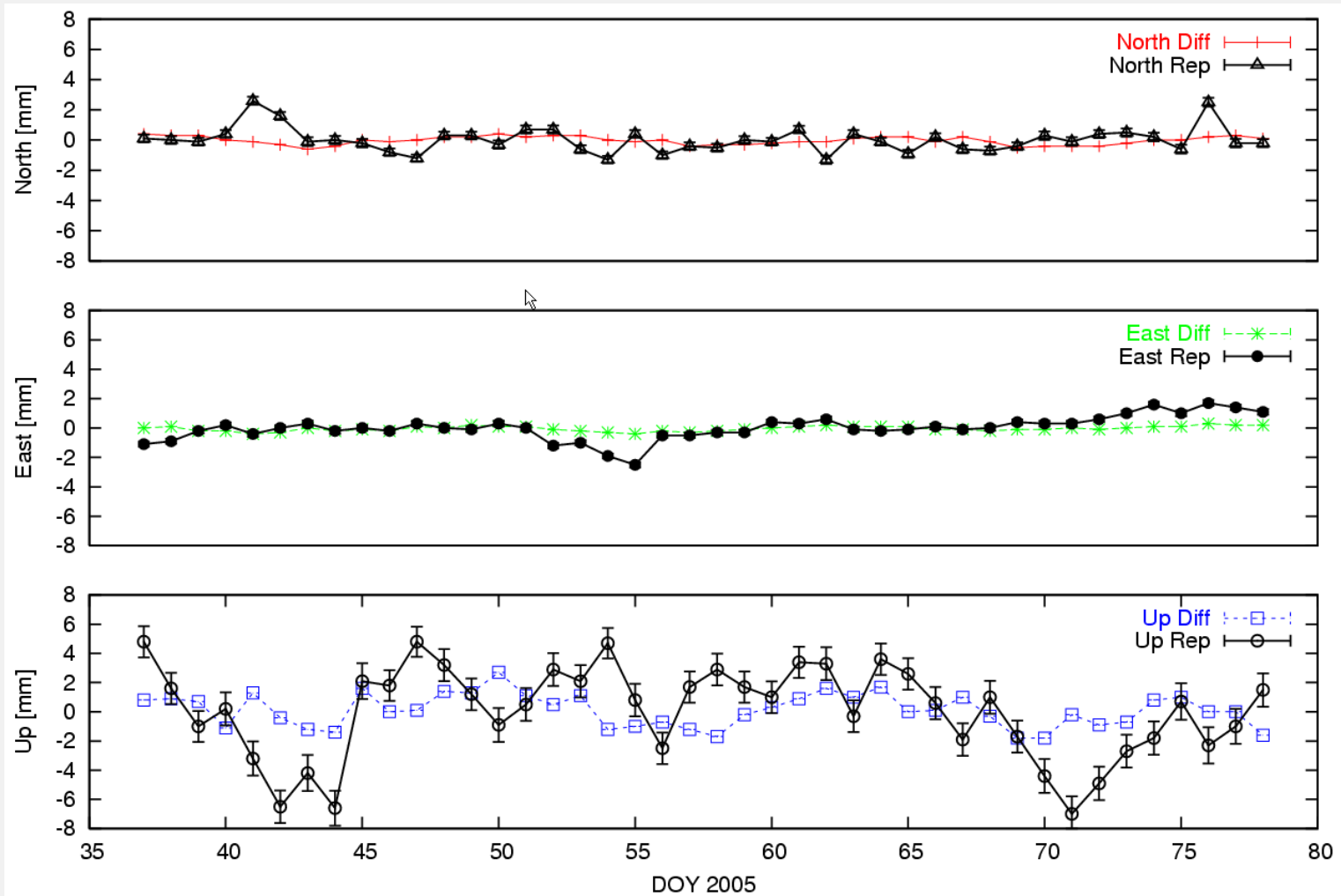
As in Version 4.2:

- Elevation dependent weighting ($\cos(z)^2$), sampling rate 180 s, cut-off angle 10 degrees

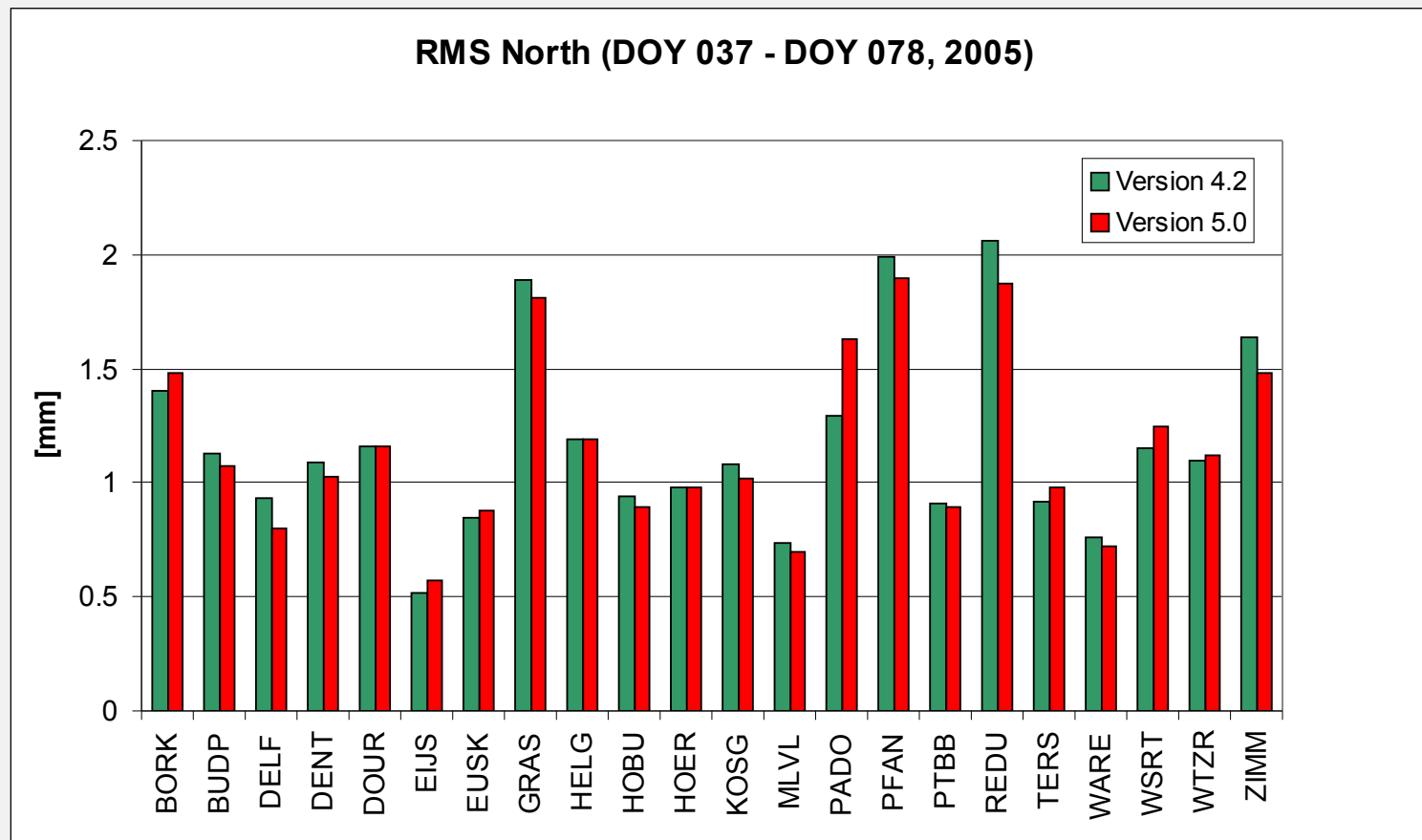
Most important changes compared to Version 4.2 processing:

- Tropospheric modeling using piece-wise linear functions
- Mapping using dry-Niell in conjunction with wet-Niell MF
- Refined ambiguity resolution (L5/L3, QIF), using CODE ionosphere model
- Datum definition: 3 translation conditions (minimum constraint) to ITRF2000
- Earth tides (TIDE2000 model), Step-2 correction problem resolved, ocean loading (GOT002)

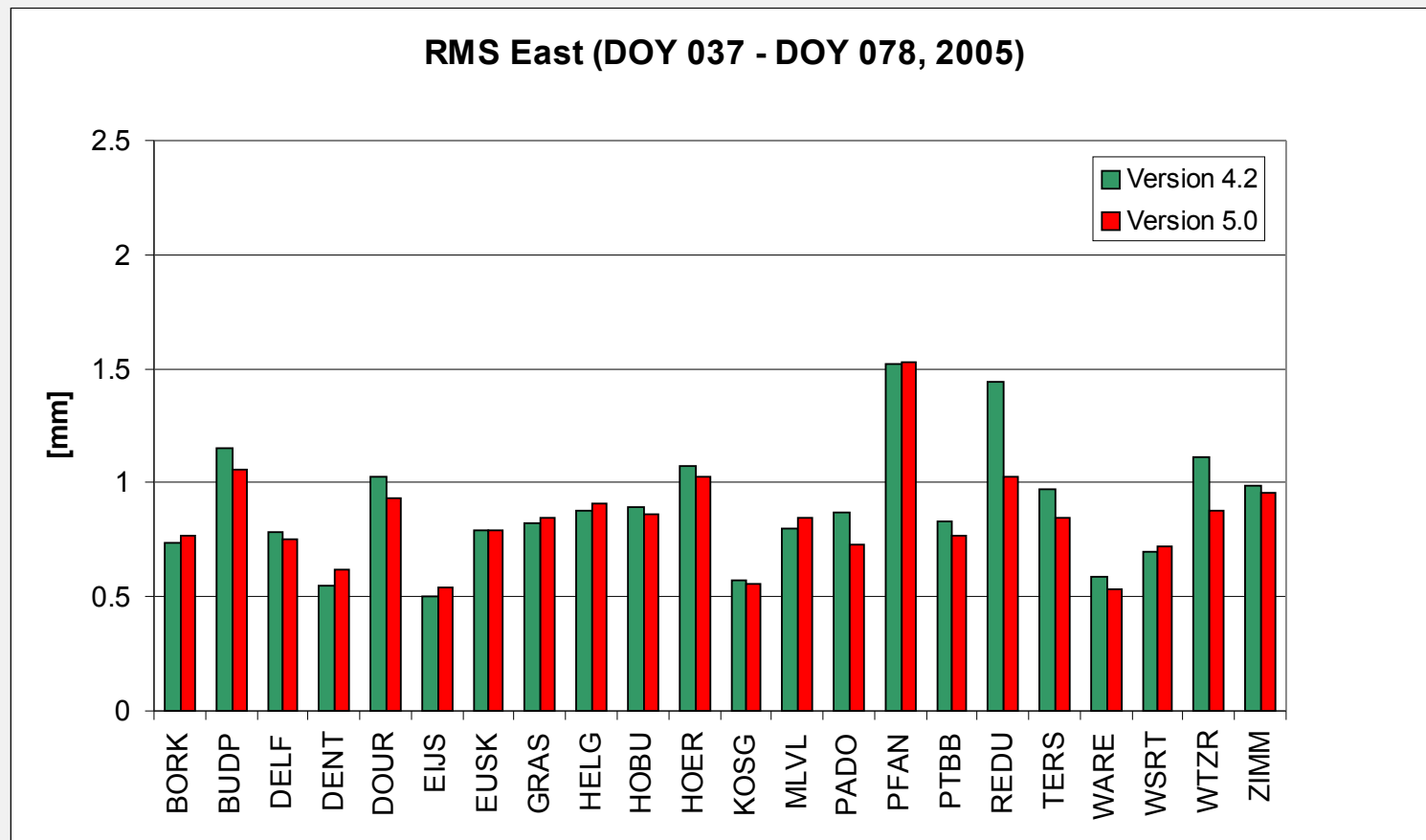
Difference V4.2/V5.0 versus Repeatability: Station TERS (Terschelling, NL)



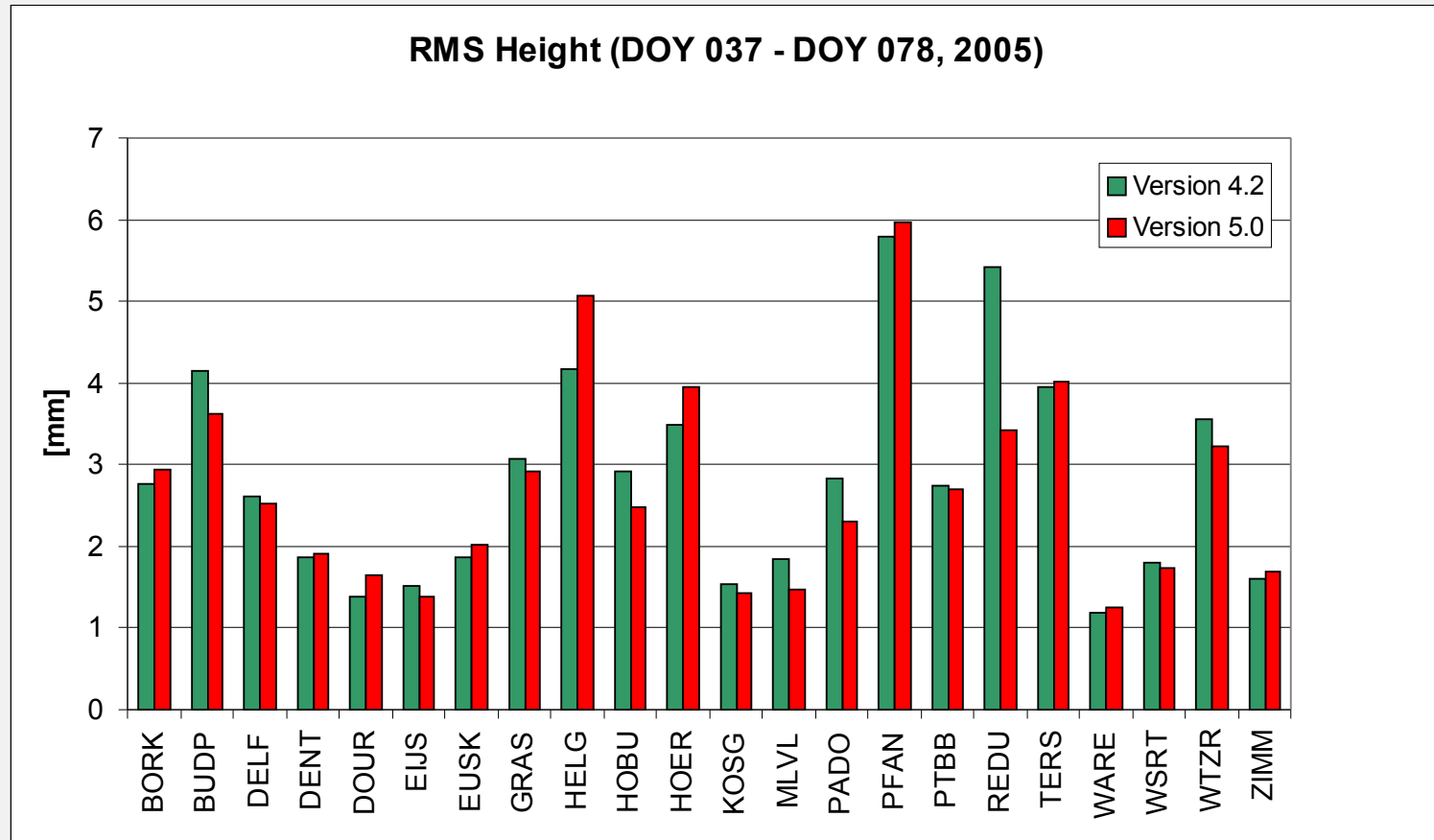
Coordinate Repeatability V4.2/V5.0 (North)



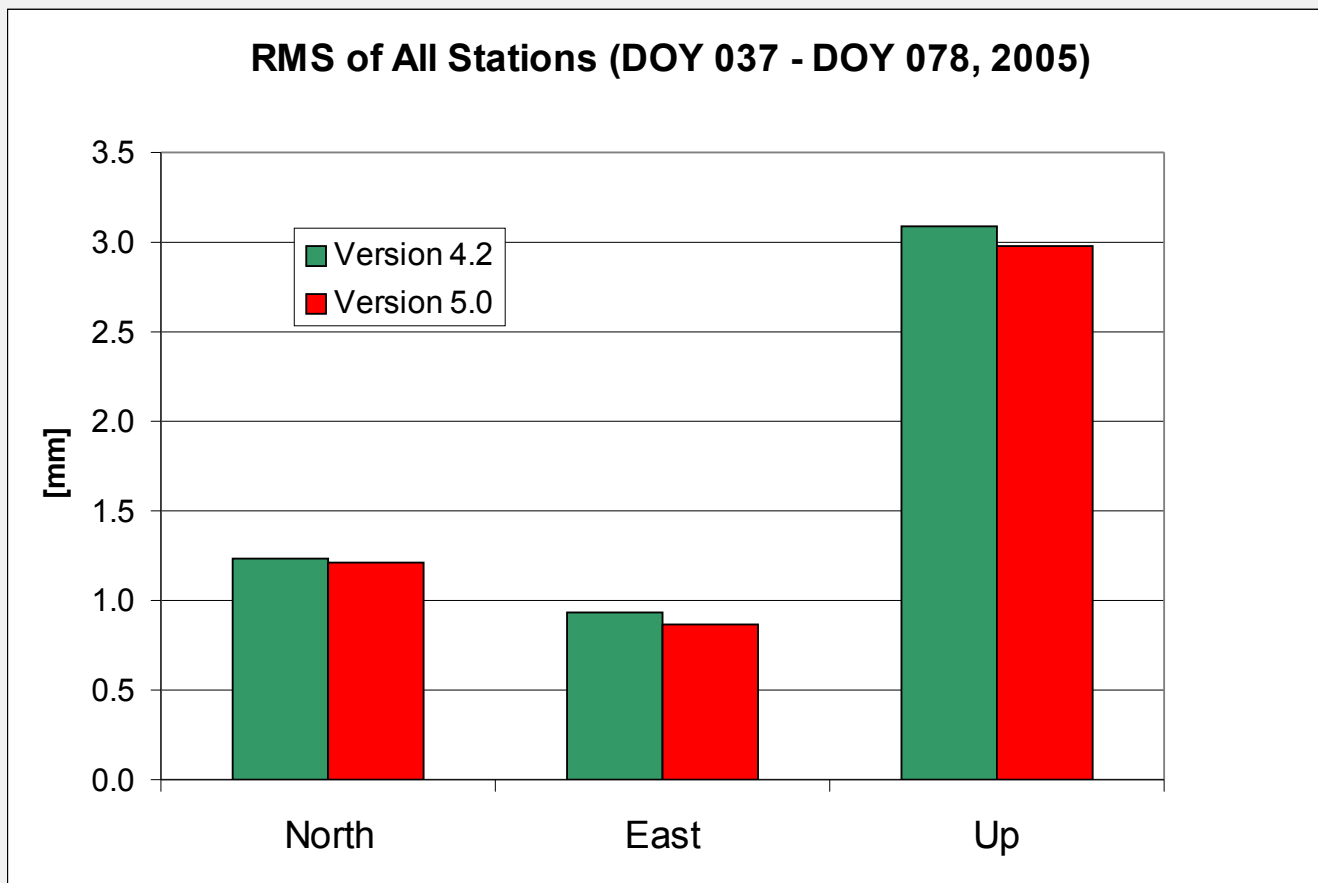
Coordinate Repeatability V4.2/V5.0 (East)



Coordinate Repeatability V4.2/V5.0 (Height)



Coordinate Repeatability V4.2/V5.0 (RMS)

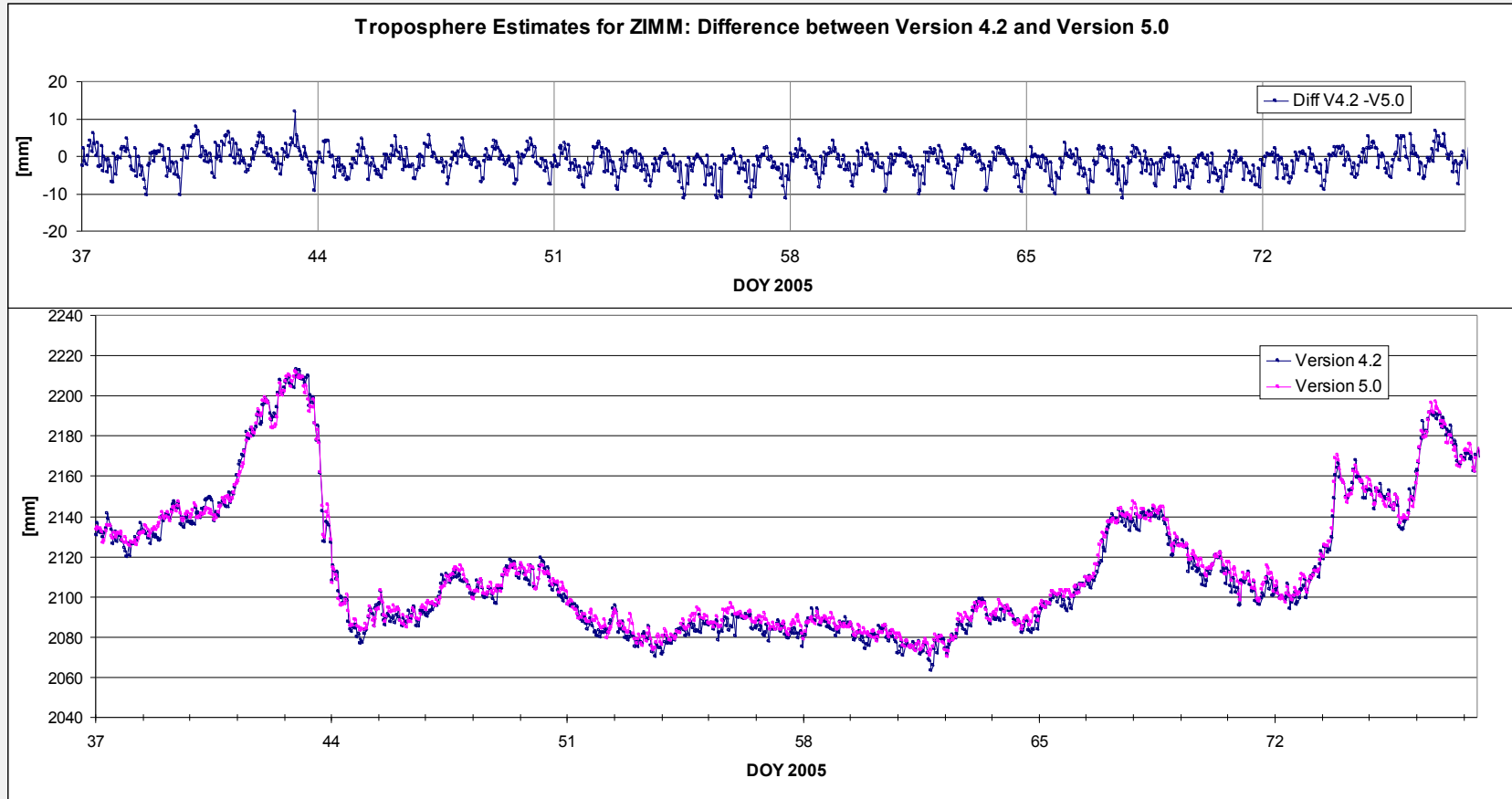


Comparison of Estimated Coordinates: Helmert Transformation: Version 4.2 vs. Version 5.0

	RMS North	RMS East	RMS Height
6 Parameter	0.7 mm	0.2 mm	0.6 mm
7 Parameter	0.1 mm	0.2 mm	0.6 mm

→ Small but significant scale parameter of 1.7 ± 0.2 ppb

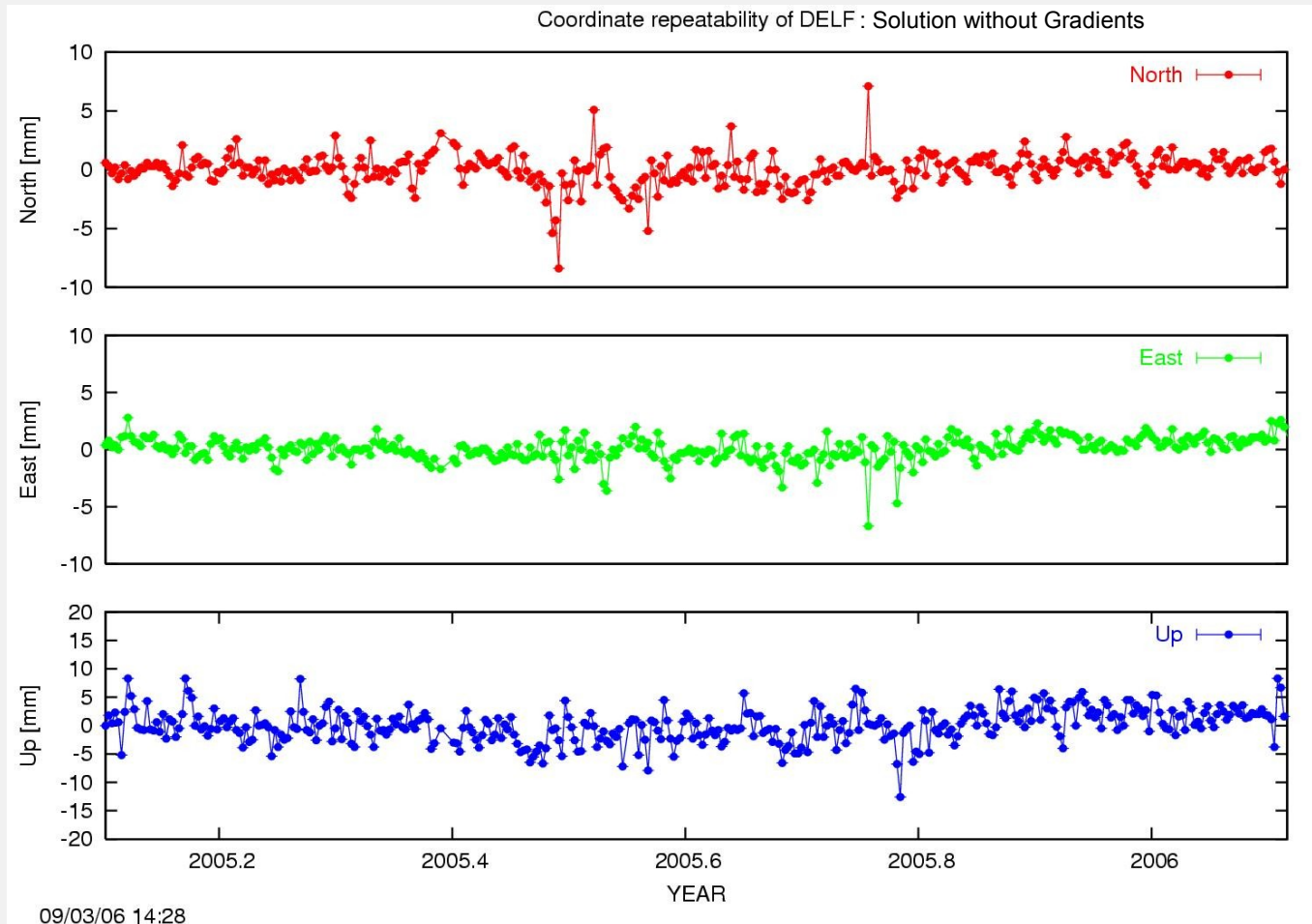
Troposphere Estimation: V4.2 / V5.0, Site ZIMM



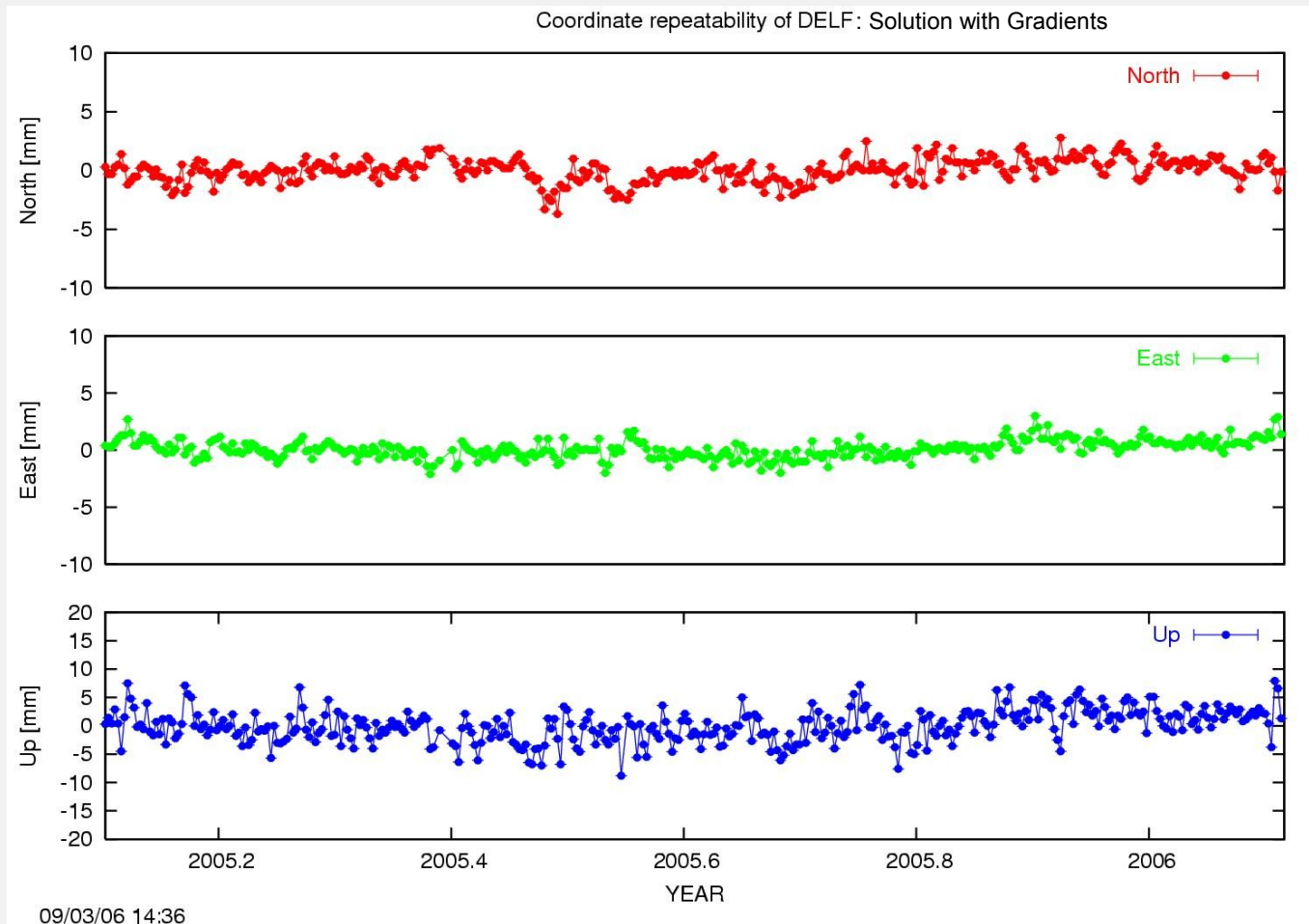
Test Solutions with Tropospheric Gradients and Low Elevation Data

- Two additional test solutions set up since switching to Version 5.0 (from DOY 037, 2005 till DOY 042, 2006):
 - Gradient solution: Based on the same NEQ file as the official contribution.
 - Low elevation data solution: Observations down to 3 degrees. (Antenna calibration values, however, only available till 10 degrees (igs_01.pcv): Below extrapolated values used)
- Comparison of one year of daily solutions with respect to the official swisstopo solution contributed to EPN

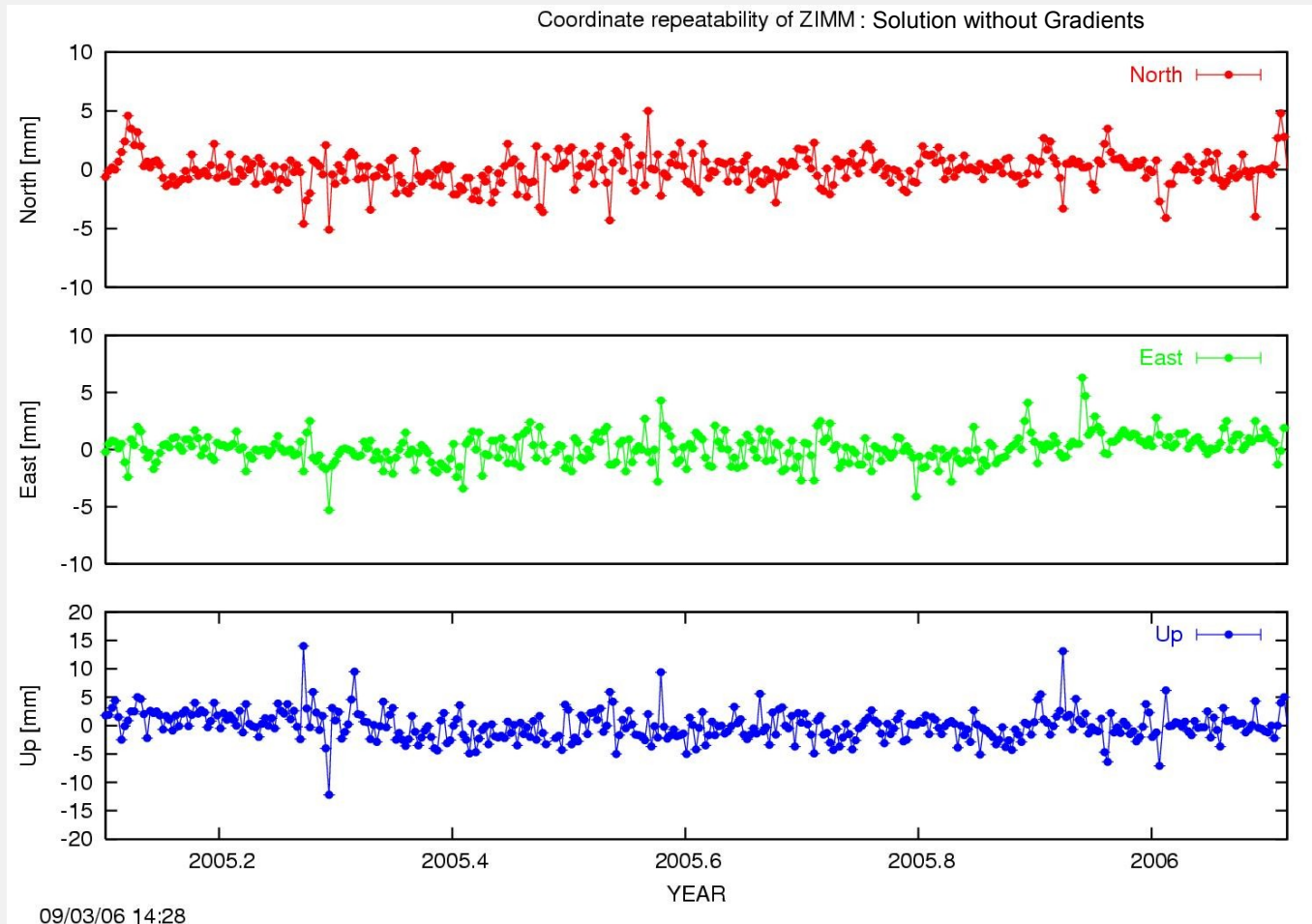
Comparison Coordinate Repeatability: Influence of Gradient Estimation (1): Site DELF



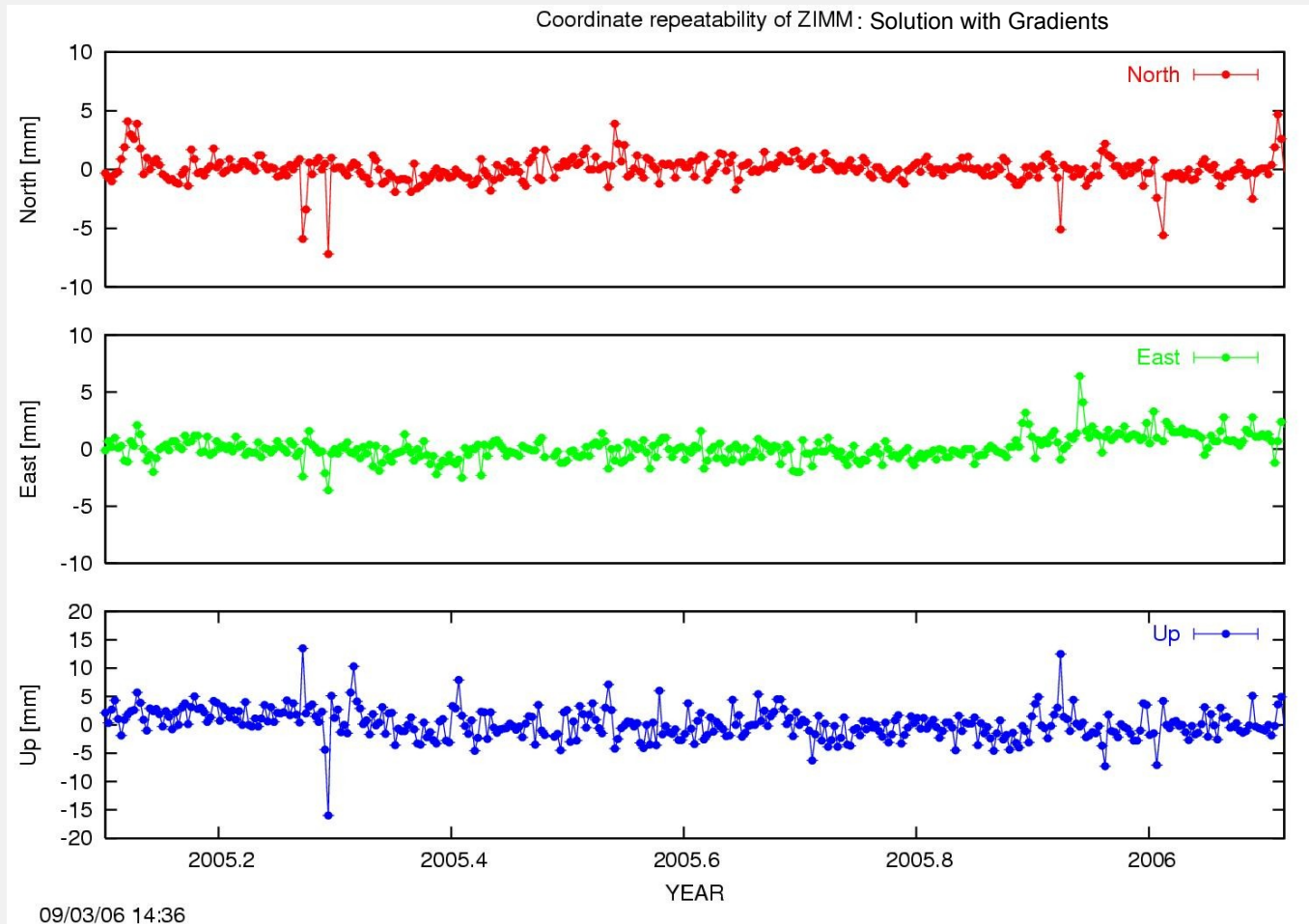
Comparison Coordinate Repeatability: Influence of Gradient Estimation (1): Site DELF



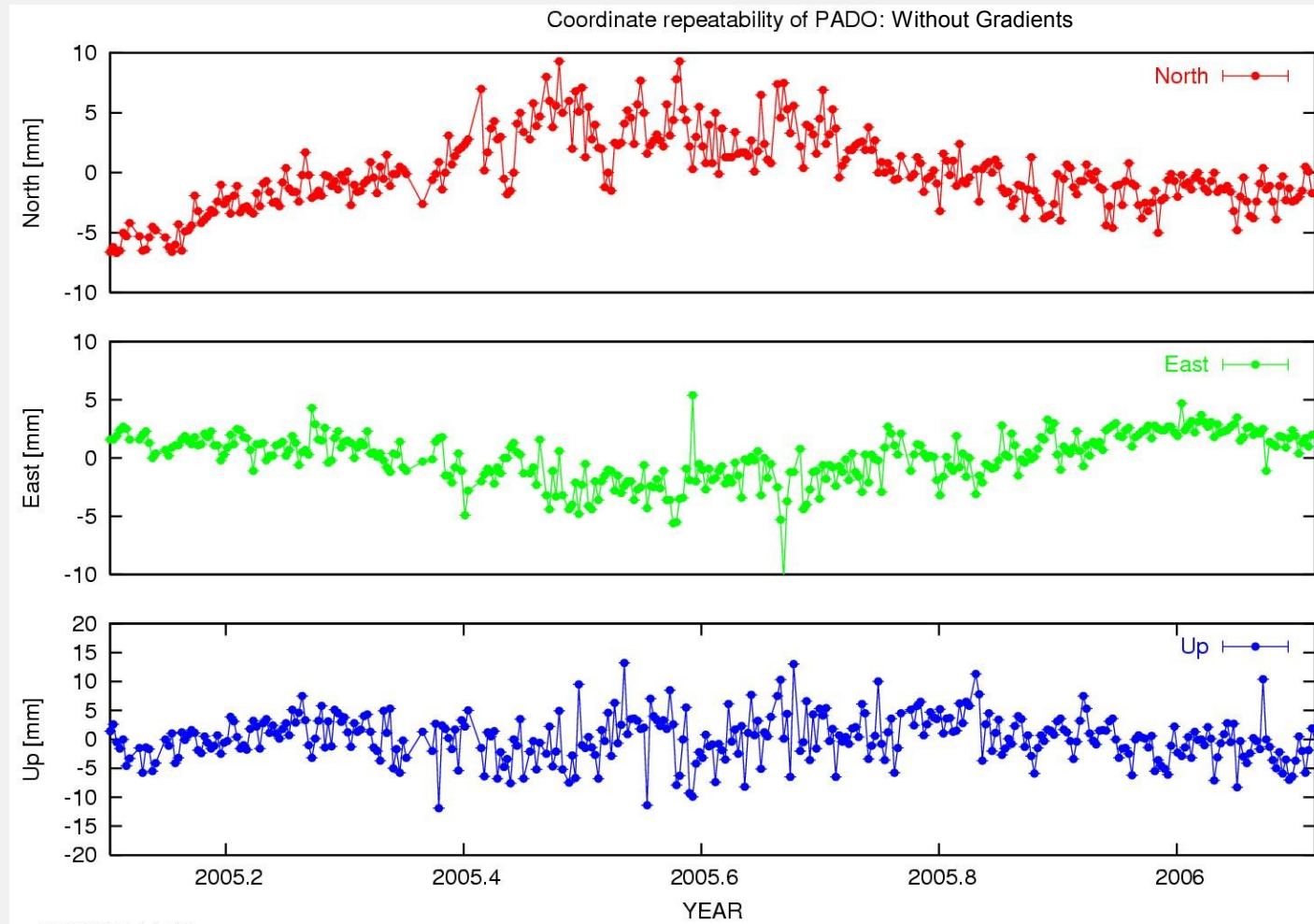
Comparison Coordinate Repeatability: Influence of Gradient Estimation (2): Site ZIMM



Comparison Coordinate Repeatability: Influence of Gradient Estimation (2): Site ZIMM

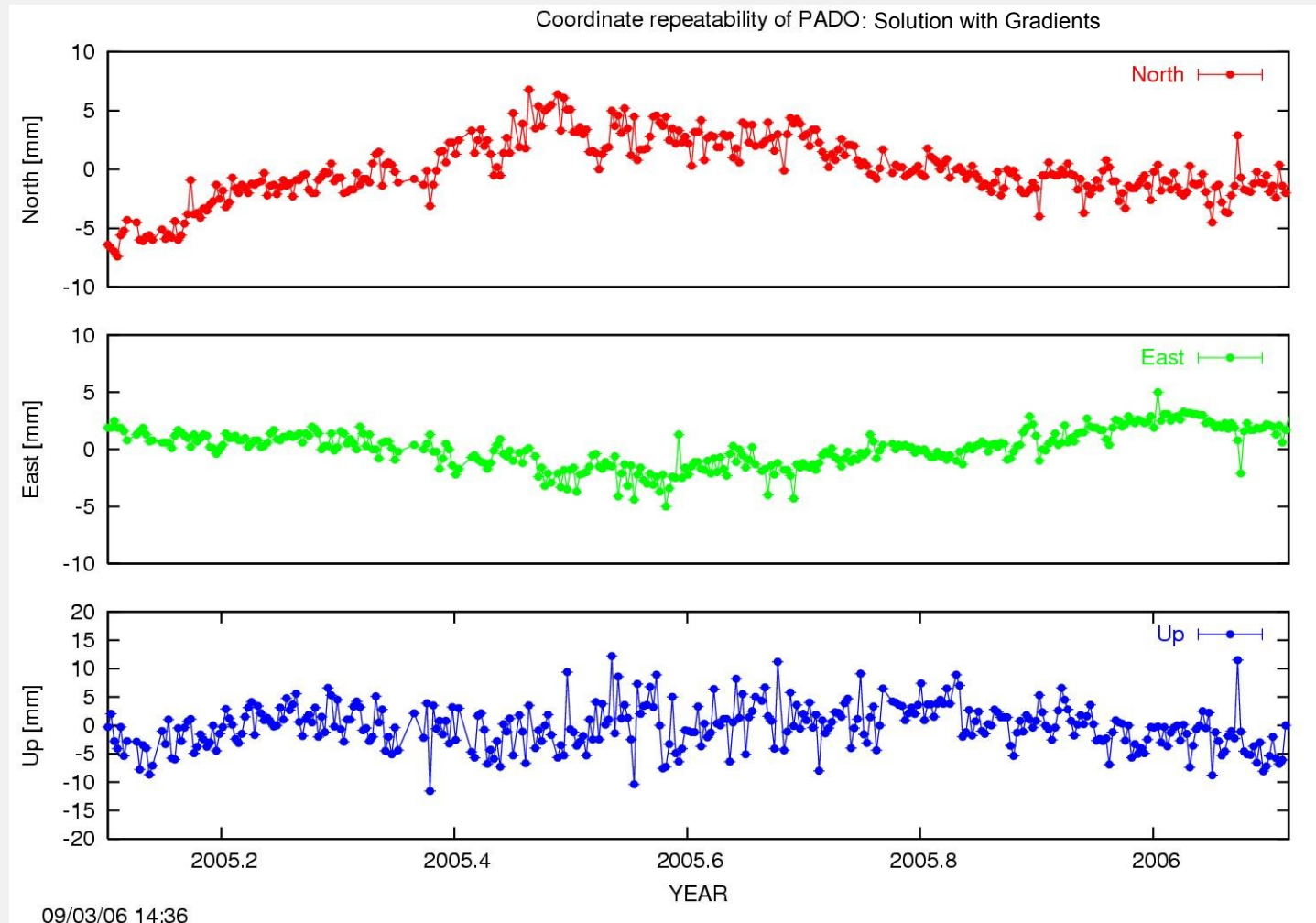


Comparison Coordinate Repeatability: Influence of Gradient Estimation (3): Site PADO

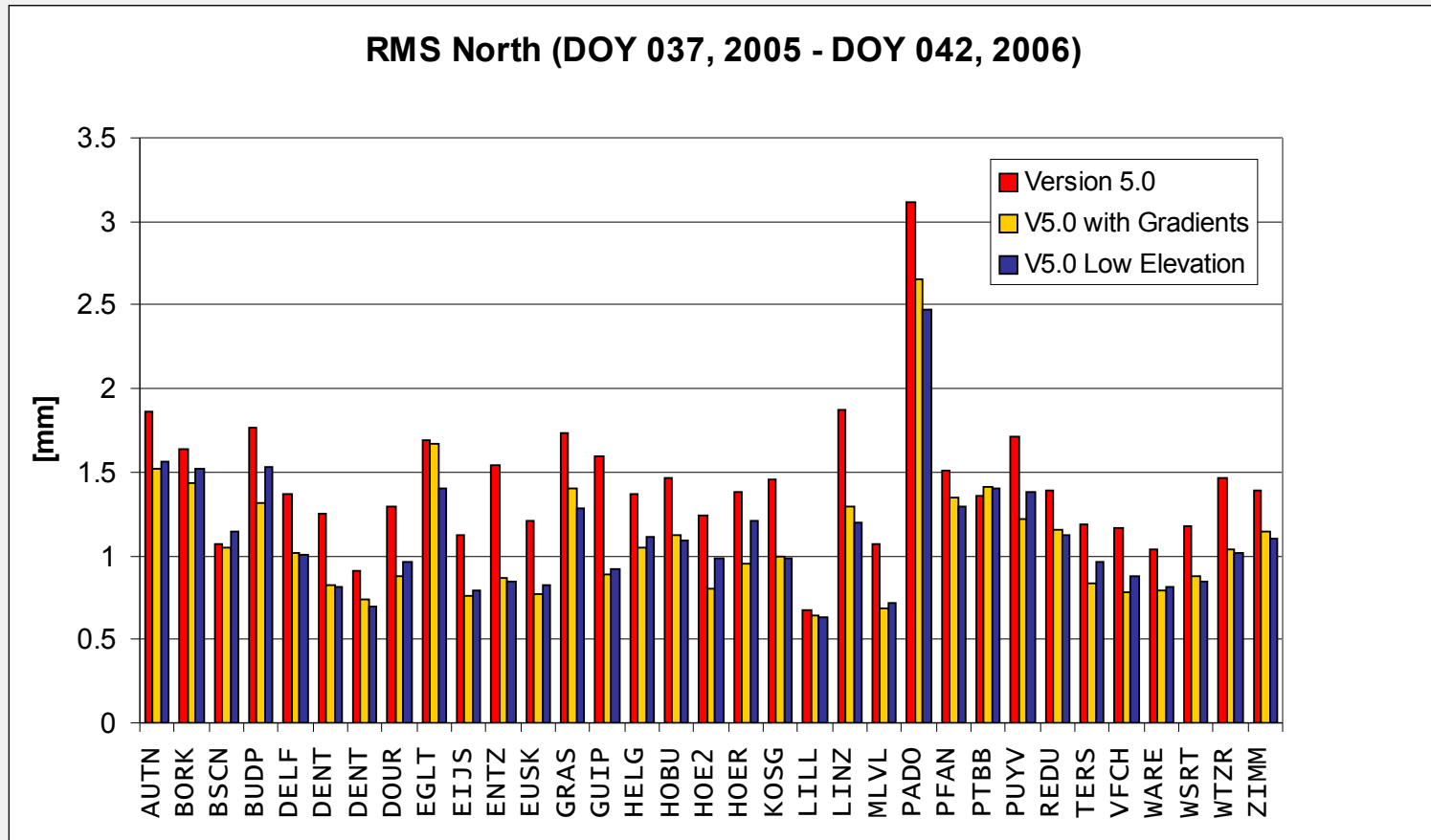


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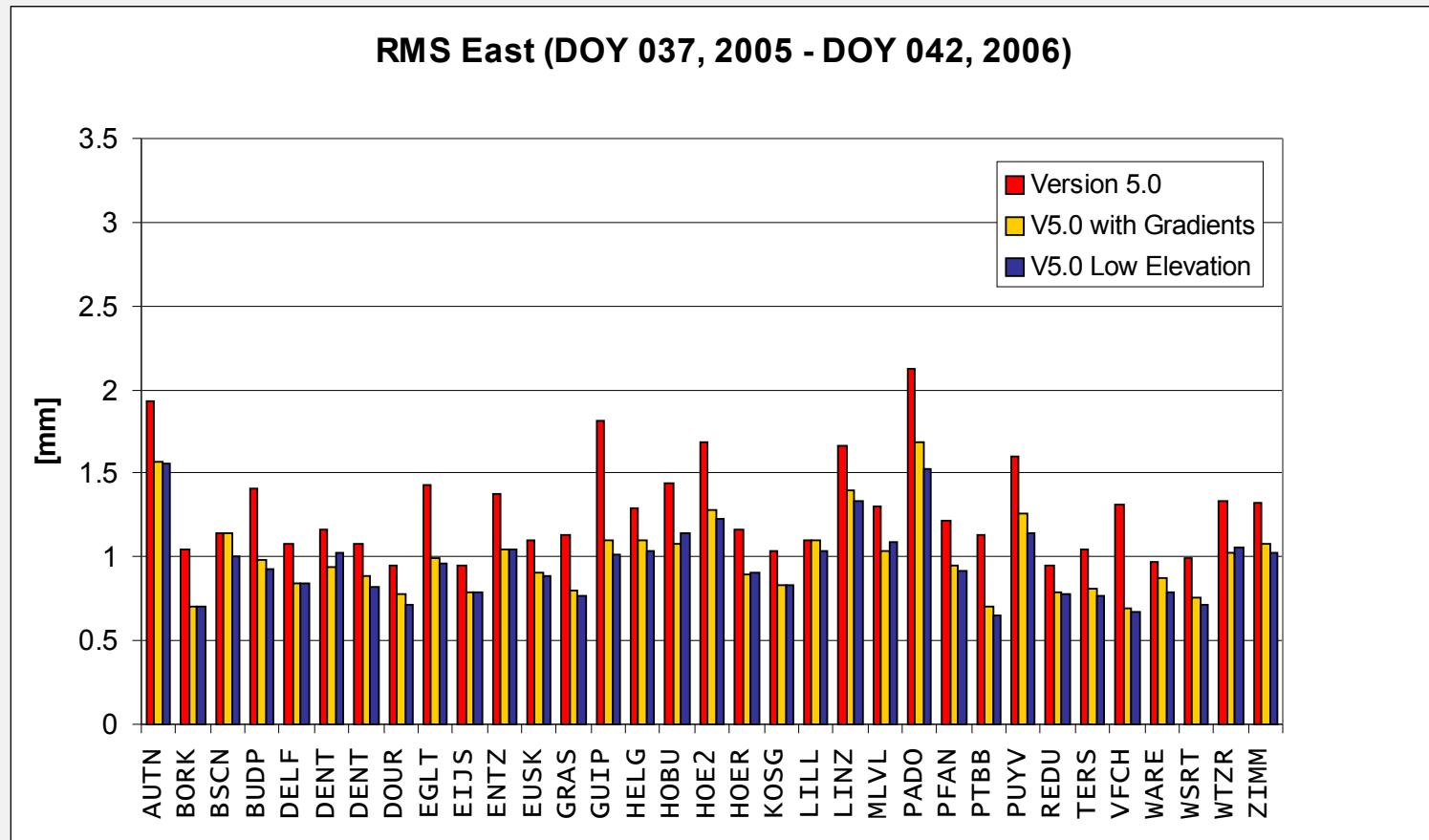
Comparison Coordinate Repeatability: Influence of Gradient Estimation (3): Site PADO



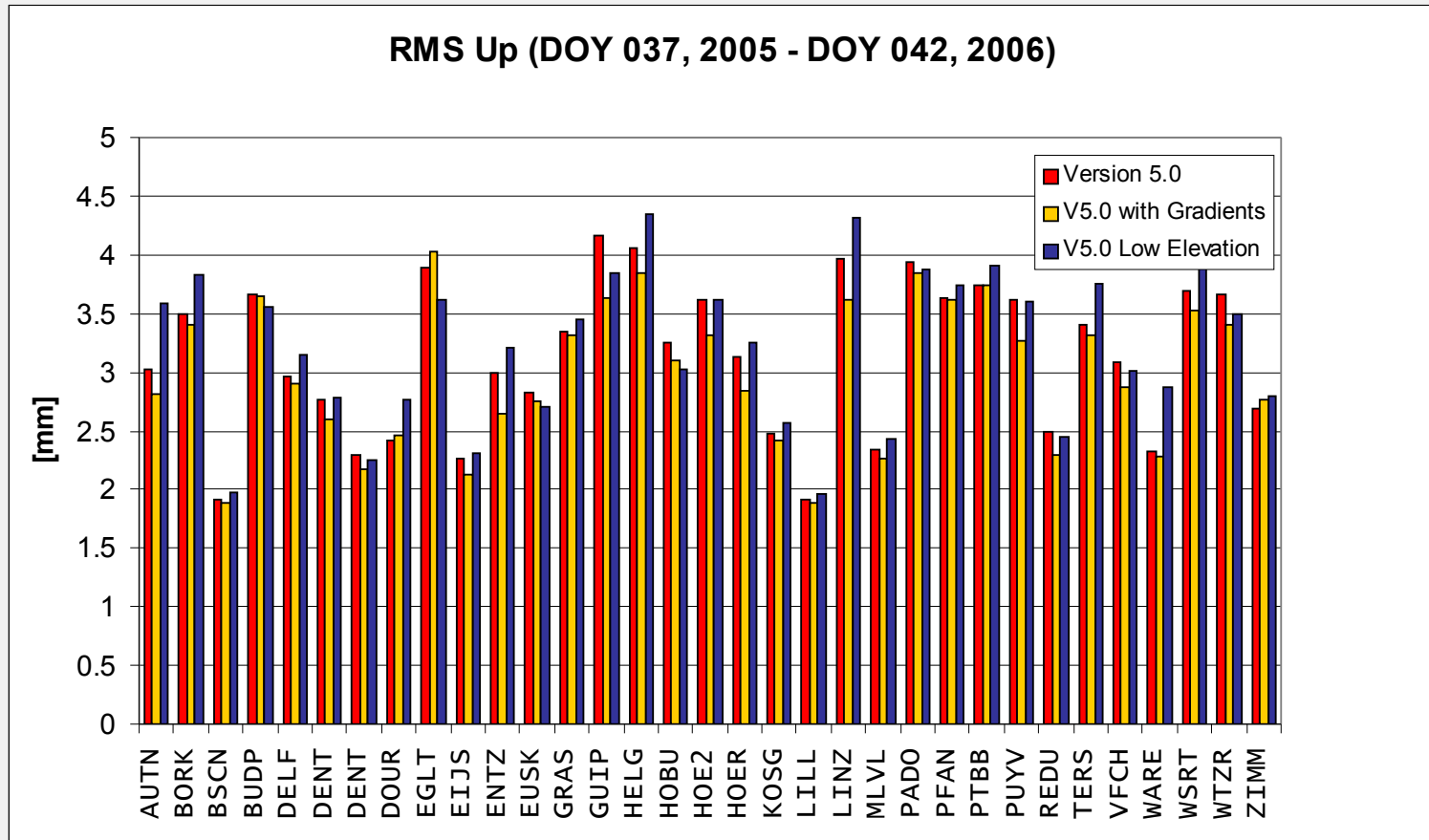
Gradient Estimation / Low Elevation Data: RMS North Component



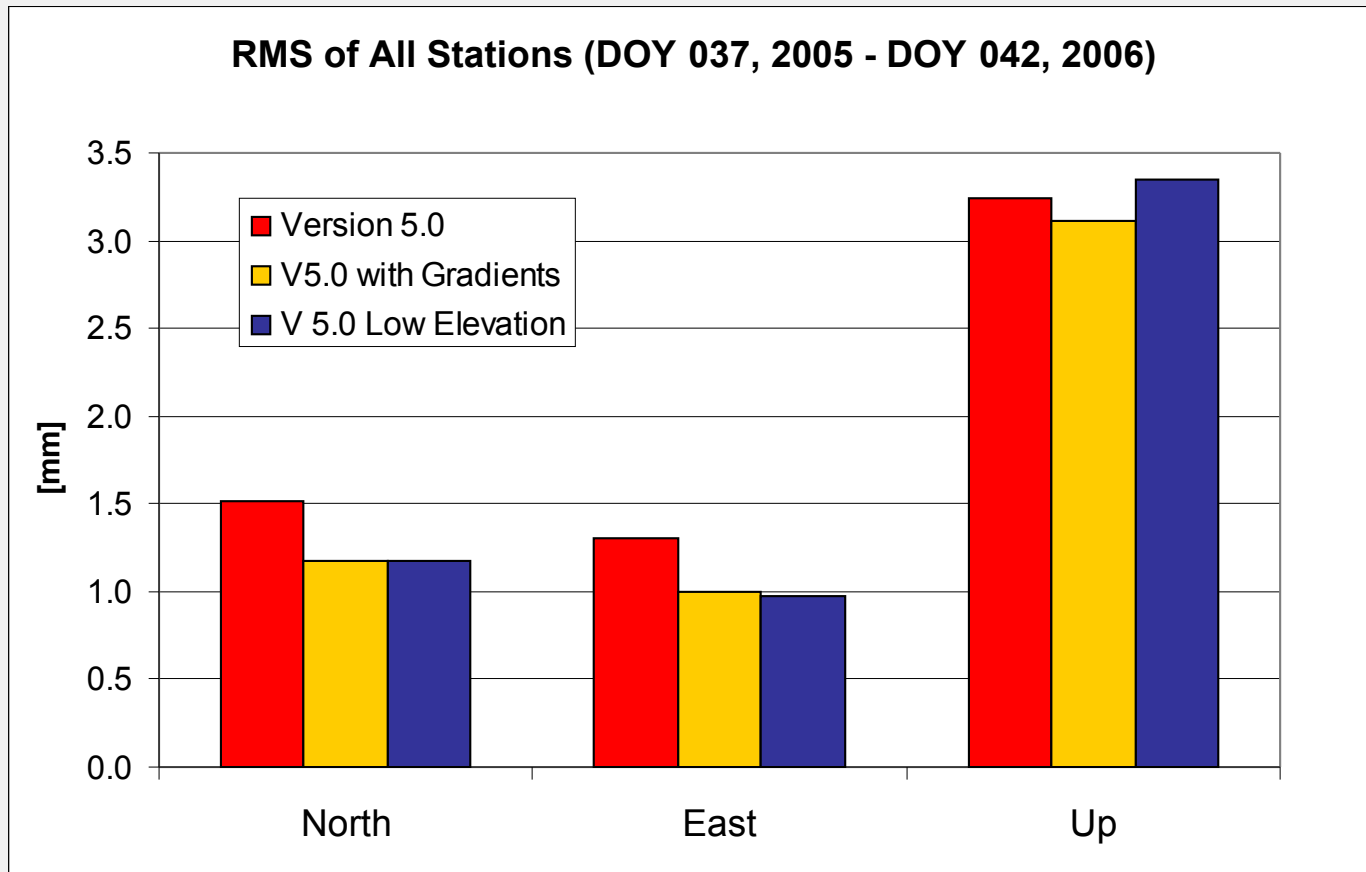
Gradient Estimation / Low Elevation Data: RMS East Component



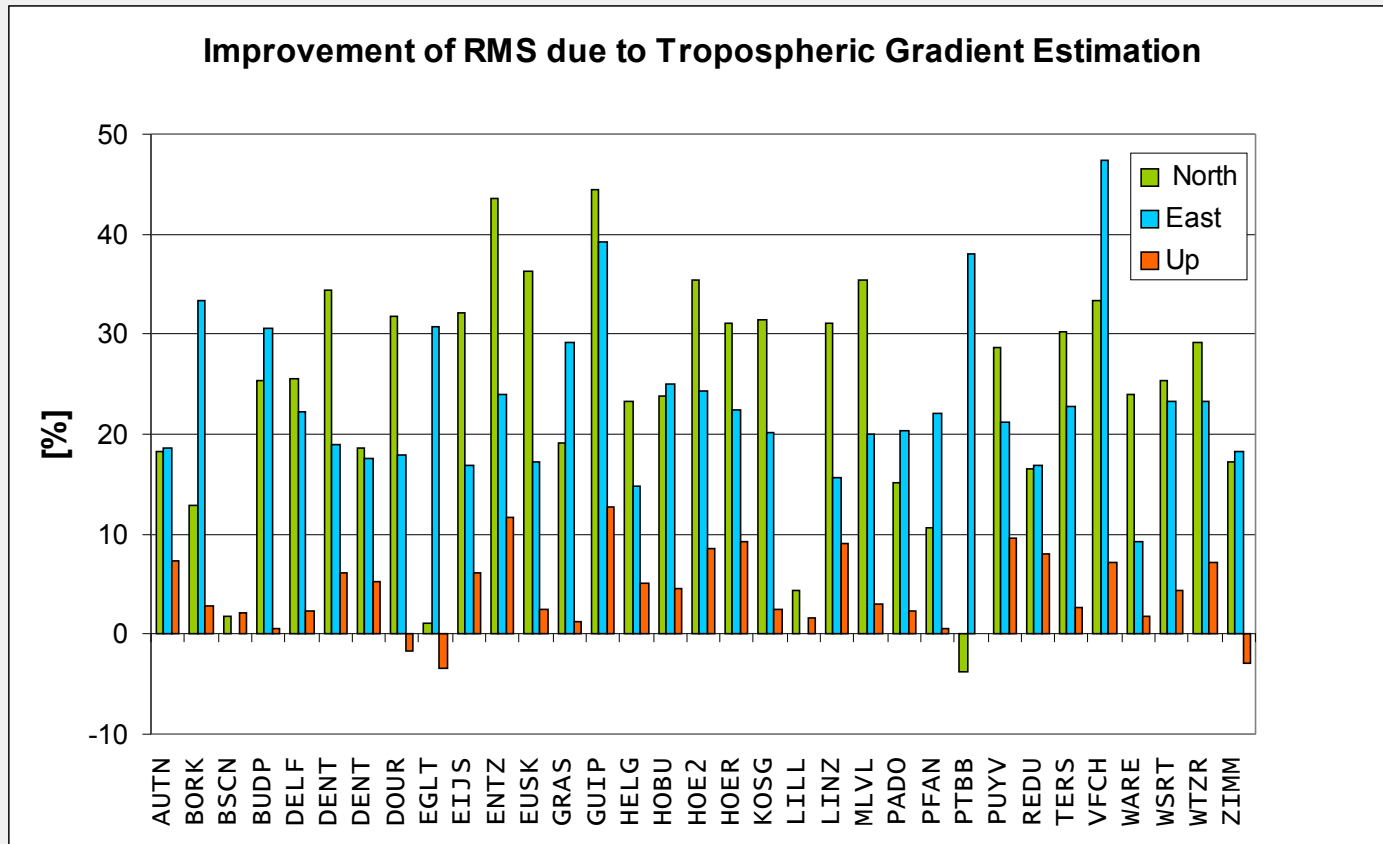
Gradient Estimation / Low Elevation Data: RMS Up Component



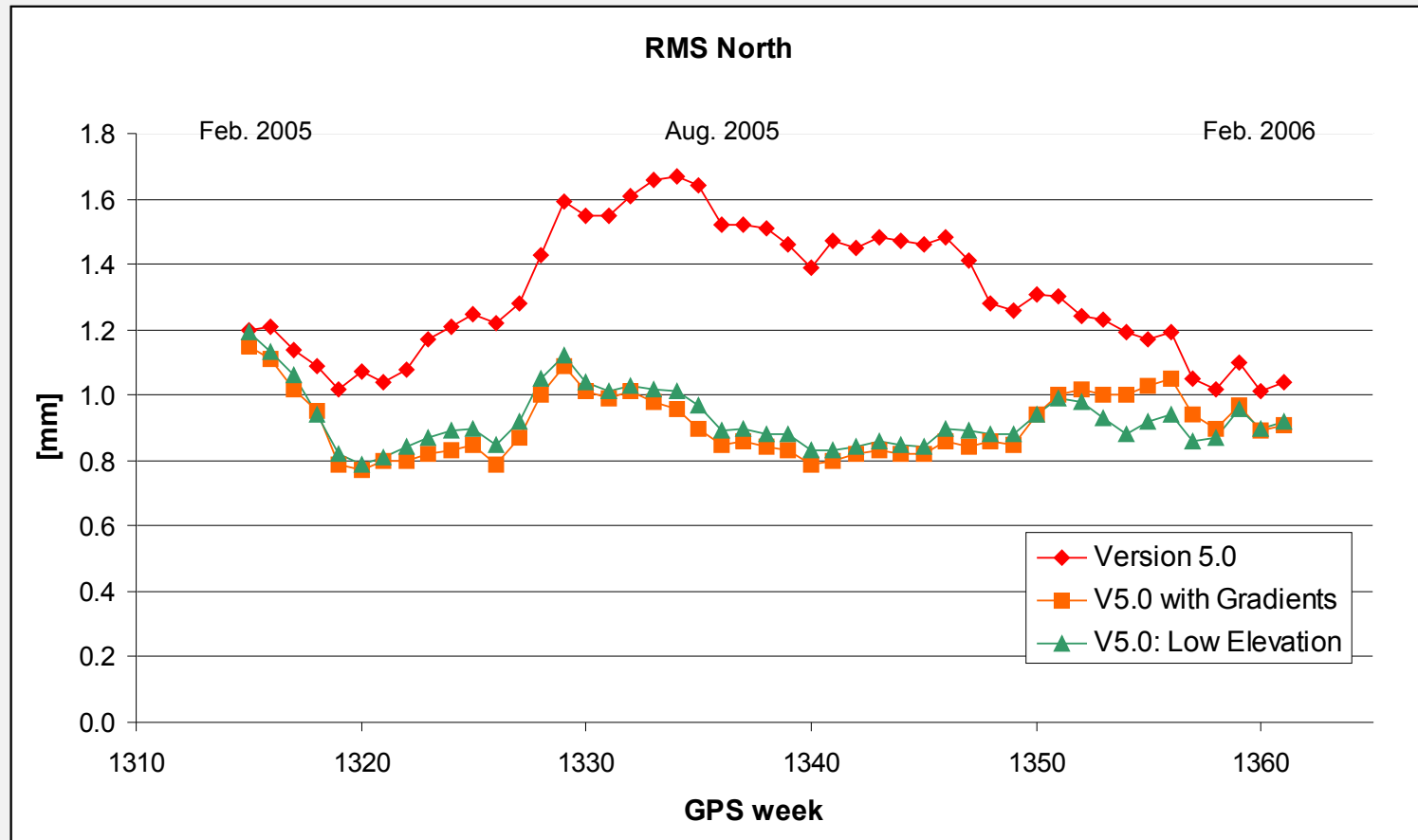
Gradient Estimation / Low Elevation Data: RMS of all Sites



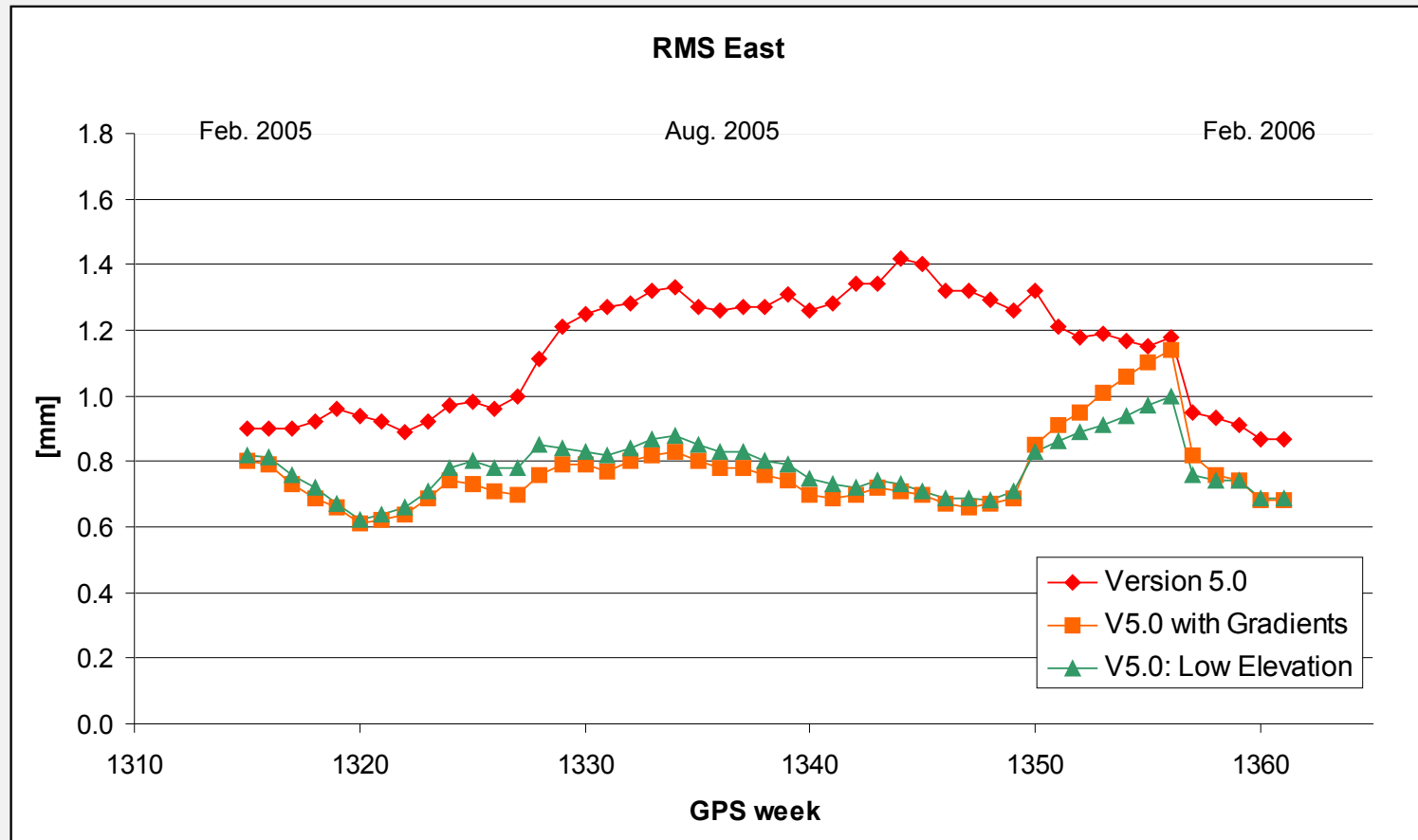
Estimation of Tropospheric Gradients: Improvement of Coordinate Repeatability RMS



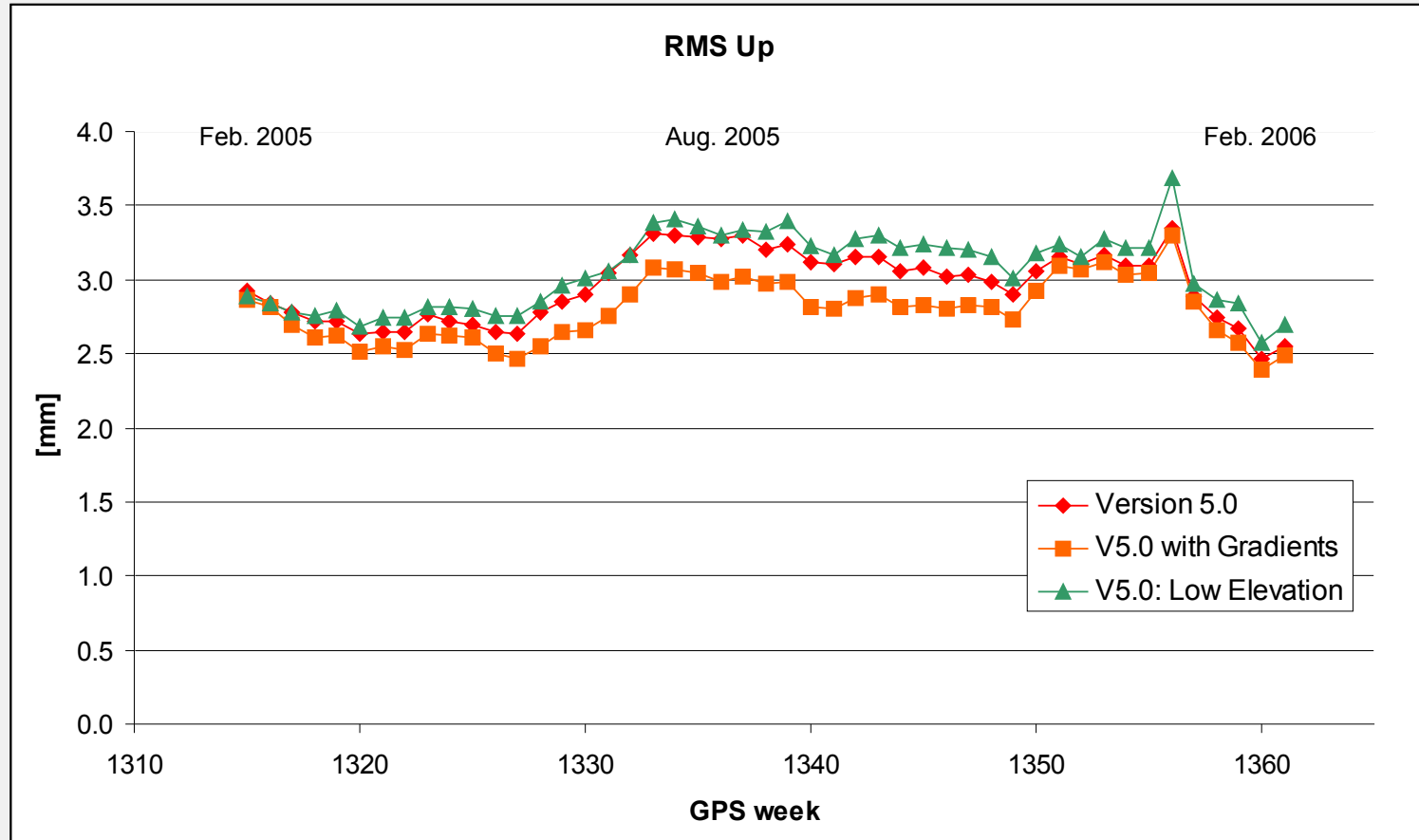
Sliding 7-Week Combination: Daily Coordinate Repeatabilities (North)



Sliding 7-Week Combination: Daily Coordinate Repeatabilities (East)



Sliding 7-Week Combination: Daily Coordinate Repeatabilities (Up)

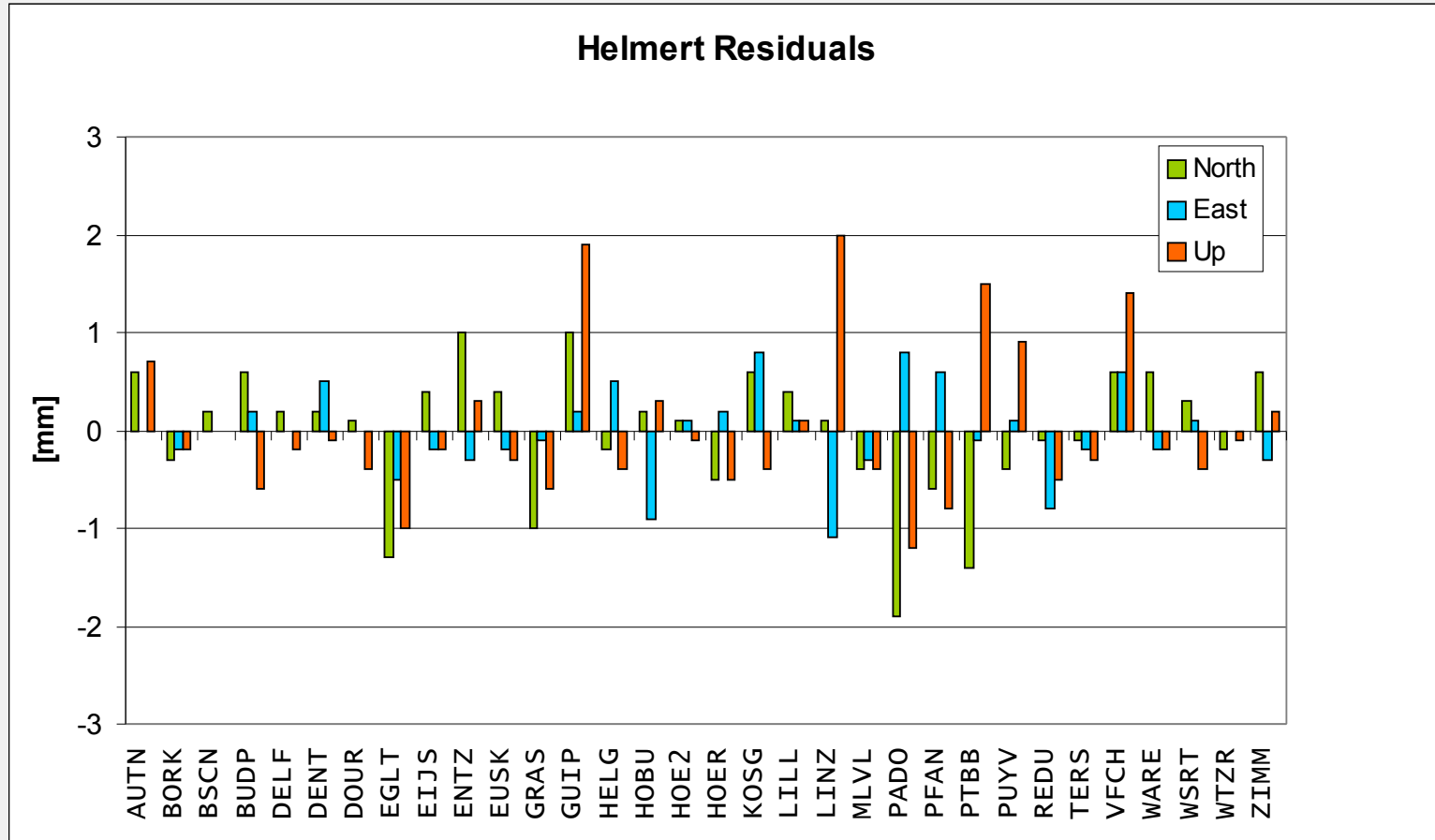


Comparison of Estimated Coordinates: Helmert Transformation

	RMS North	RMS East	RMS Height
V5.0 / V5.0 Gradients:			
3 Parameter:	0.7 mm	0.4 mm	0.8 mm
7 Parameter:	0.6 mm	0.5 mm	0.8 mm
V5.0 / V5.0 Low Elevation			
3 Parameter:	0.8 mm	0.6 mm	2.6 mm
7 Parameter:	0.5 mm	0.3 mm	2.3 mm

- No significant transformation parameters for solution with gradients
- Scale parameter of -1.9 ± 0.6 ppb for solution with low elevation data

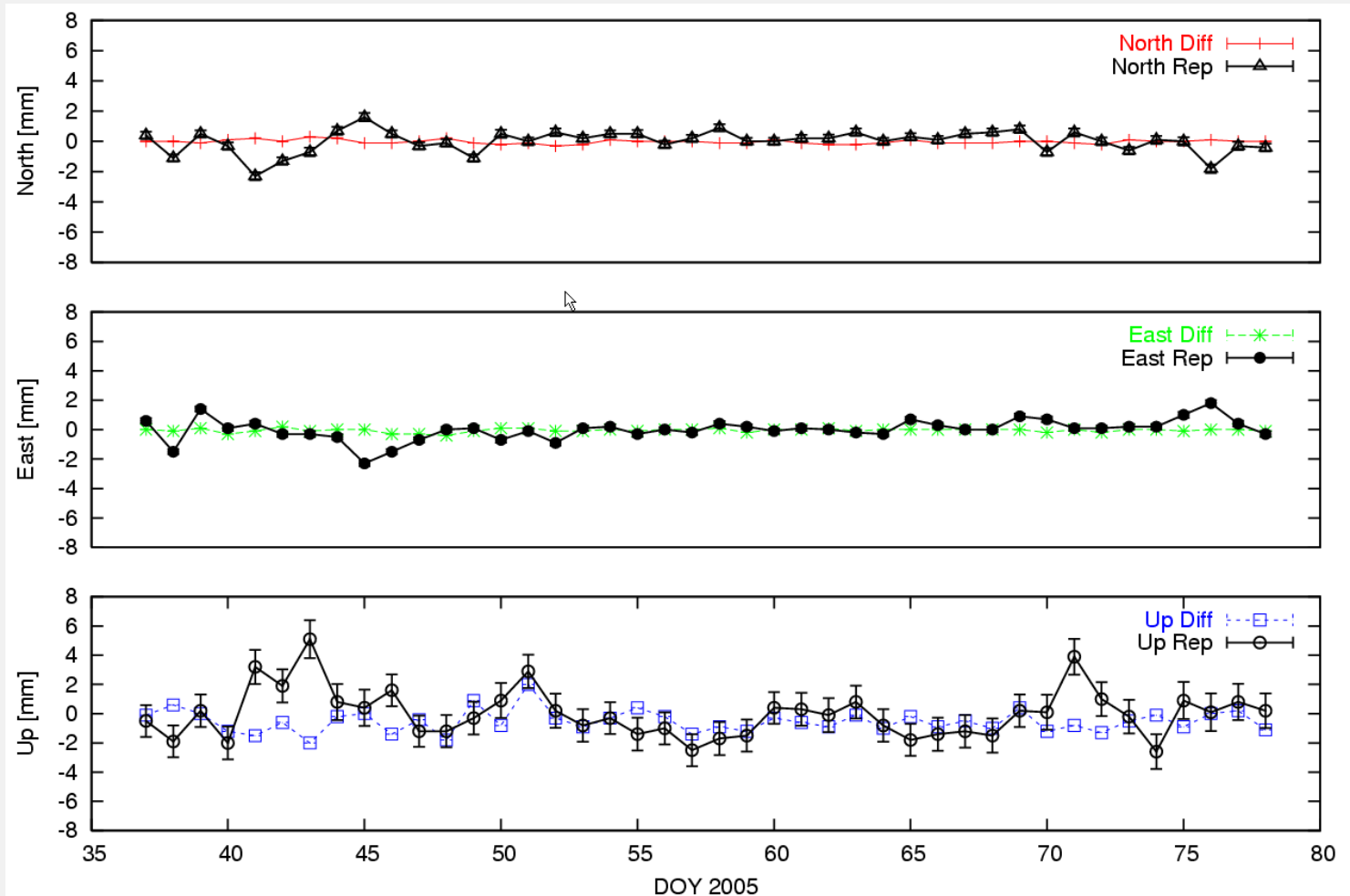
Helmert Comparisons: V5.0 compared to V5.0 with Gradients



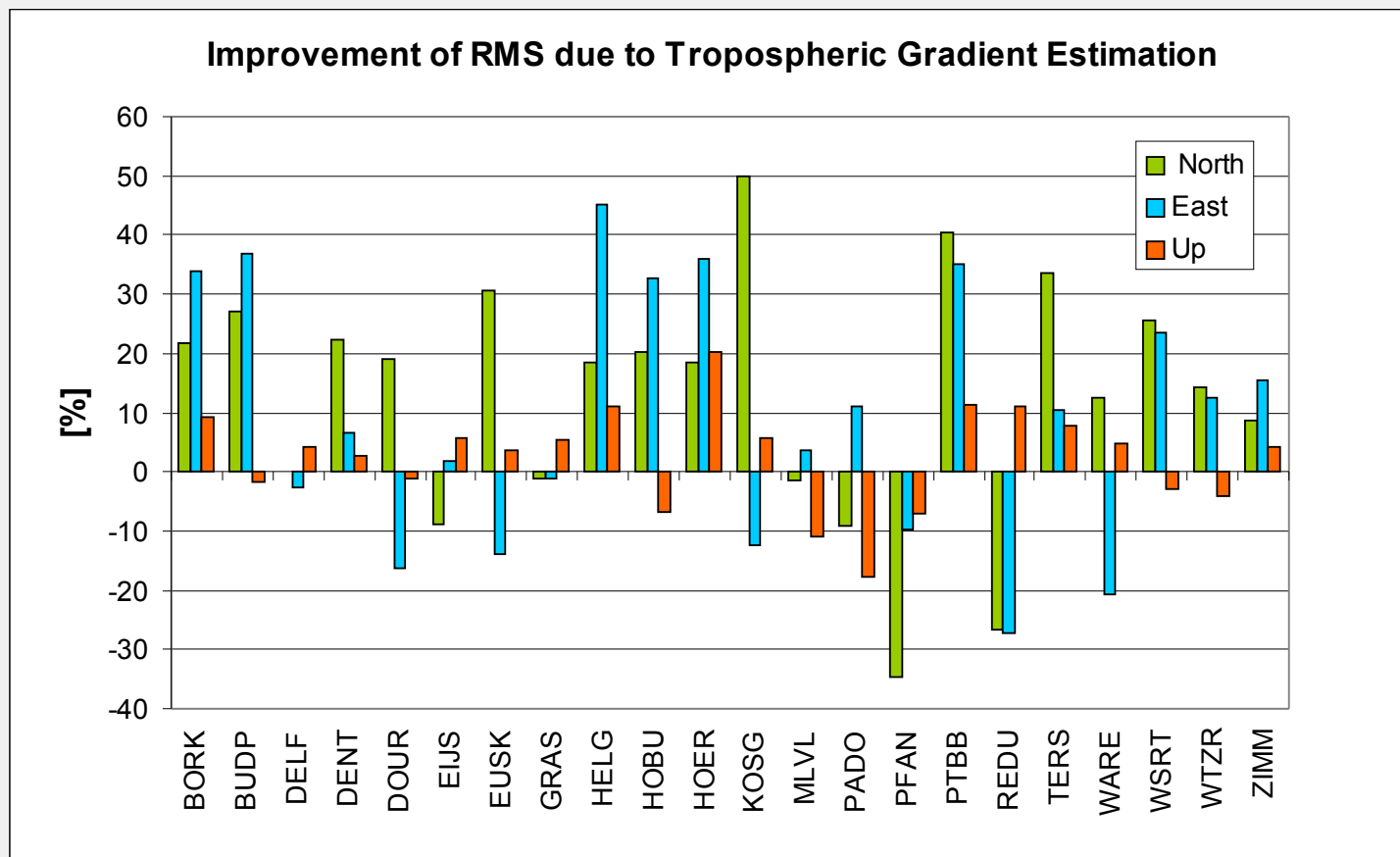
Summary

- Transition from Bernese Version 4.2 to Version 5.0 done in March 2005:
 - Most important change: Troposphere modeling/mapping function
 - Slightly improved coordinate repeatability
 - Scale factor of 1.7 +/- 0.2 ppb
- Test solutions with gradient parameters and low elevation data compared for a time period of one year.
 - Estimating gradient parameters improves horizontal coordinate repeatability (more than 20%). Recommended option for future EUREF solutions.
 - Low elevation data show similar performance as gradient solution. No antenna calibration data available, however, below 10 degrees in igs_01.pcv. Interesting option in context with absolute antenna calibration data.

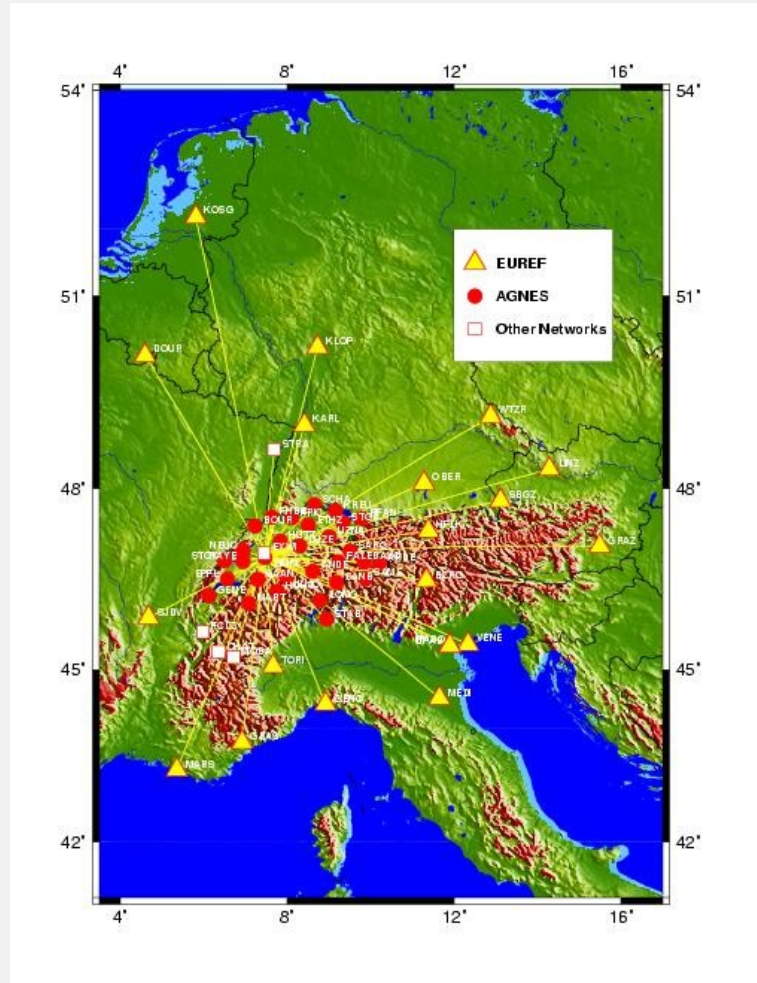
Difference V4.2/V5.0 versus Repeatability: Station EUSK (Euskirchen, D)



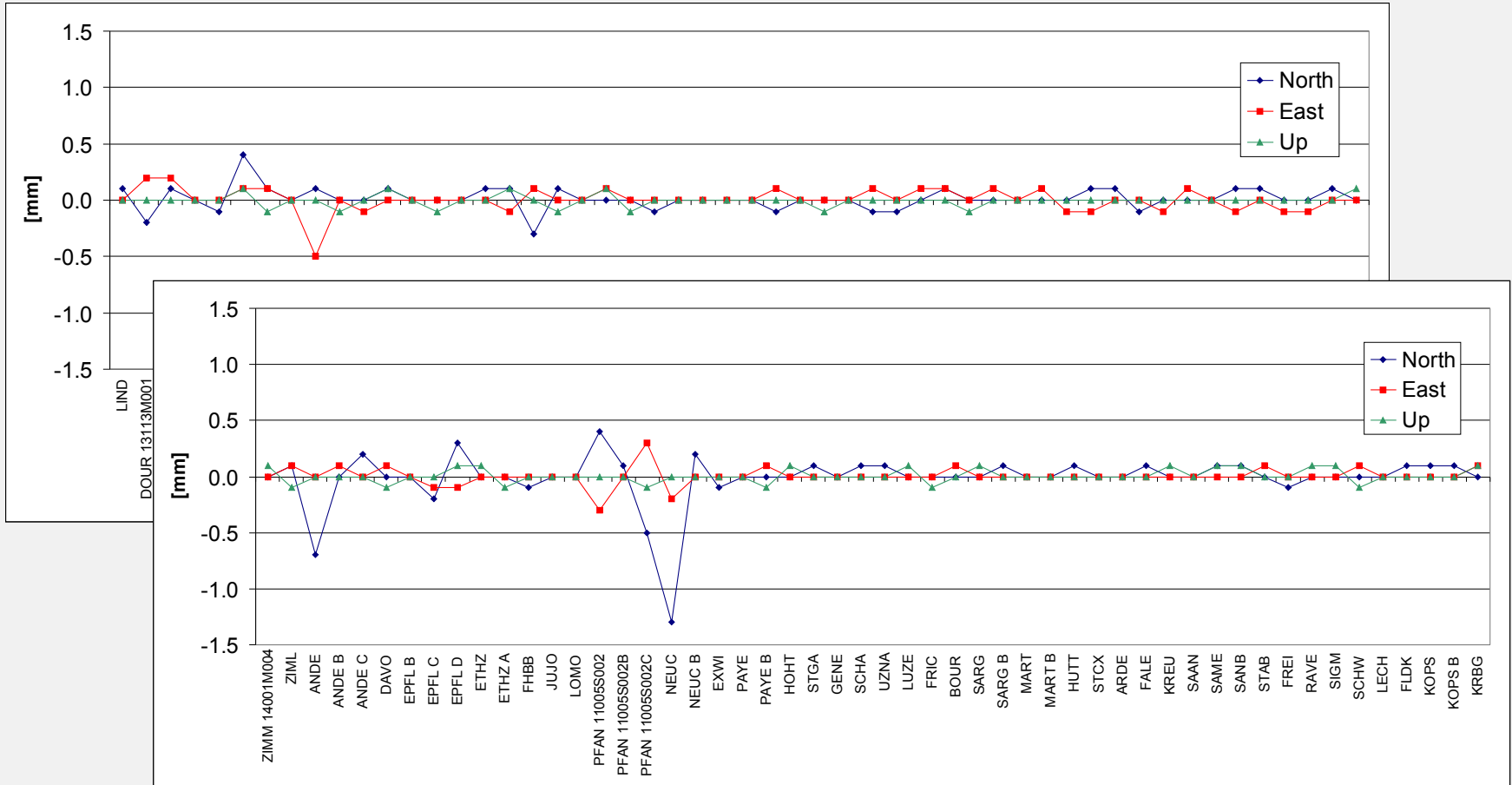
Improvement of RMS due to Tropospheric Gradient Parameter Estimation



AGNES 7-Year Combination of 350 Weekly ADDNEQ1 (V4.2) Solutions: Station Network

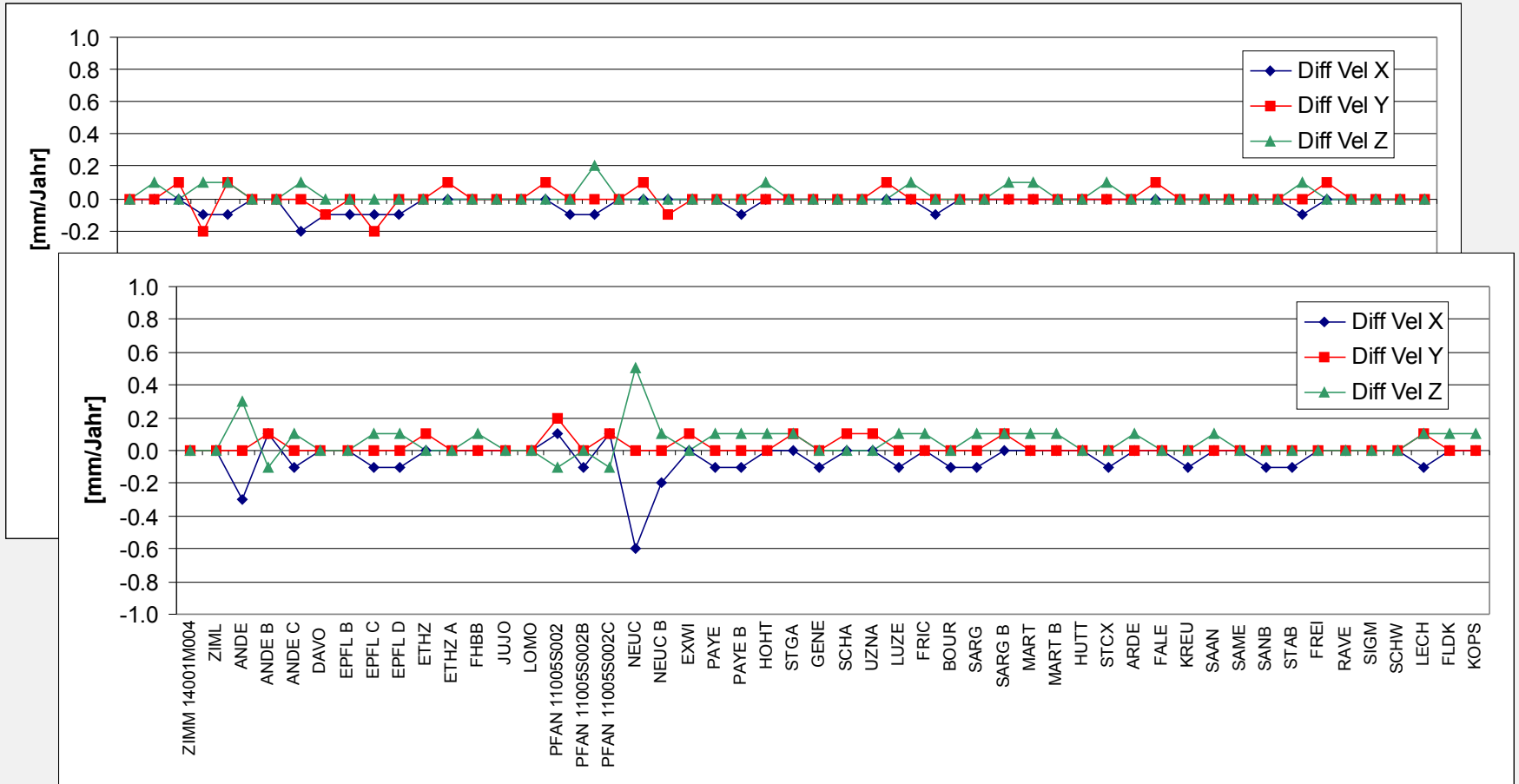


AGNES 7-Year Combination of 350 Weekly ADDNEQ1 (V4.2) Solutions: Coordinate Differences: ADDNEQ1 vs. ADDNEQ2 (V5.0)



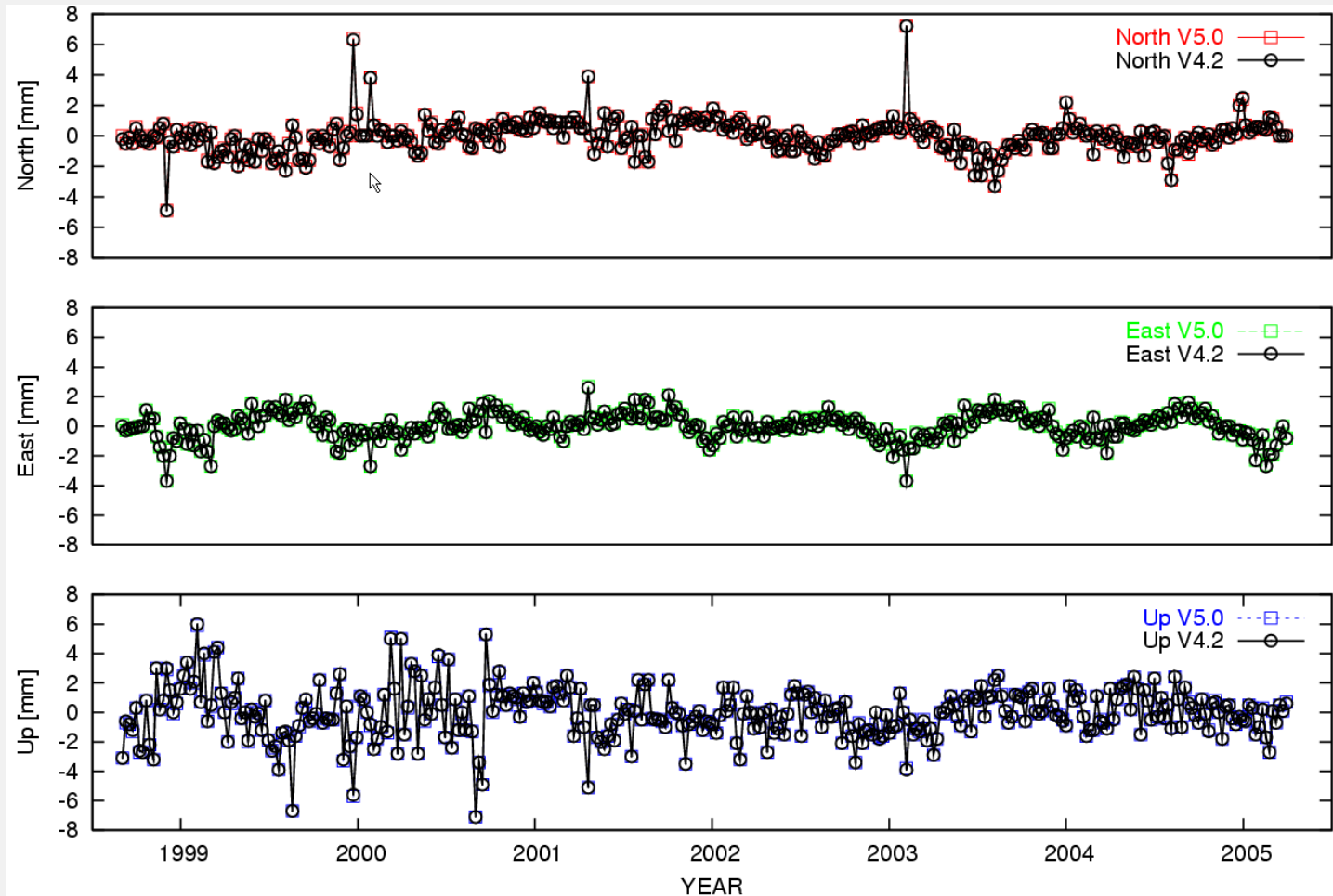
Differences mainly caused by „improved“ relative velocity constraining in V5.0 combination.

AGNES 7-Year Combination of 350 Weekly ADDNEQ1 (V4.2) Solutions: Velocity Differences: ADDNEQ1 vs. ADDNEQ2 (V5.0)



Differences mainly caused by „improved“ relative velocity constraining in V5.0 combination.

AGNES 7-Year Combination of 350 Weekly ADDNEQ1 (V4.2) Solutions: Residuals for ETHZ (CH), ADDNEQ1 vs. ADDNEQ2 (V5.0)



Helmert Comparisons

R1G_R1L_3P.OUT:	RMS / COMPONENT		0.9	0.6	2.7		
R1G_R1L_6P.OUT:	RMS / COMPONENT		0.9	0.6	2.6		
R1G_R1L_7P.OUT:	RMS / COMPONENT		0.3	0.3	2.6		
R1_R1G_3P.OUT:	RMS / COMPONENT		0.7	0.4	0.8		
R1_R1G_6P.OUT:	RMS / COMPONENT		0.6	0.5	0.8		
R1_R1G_7P.OUT:	RMS / COMPONENT		0.6	0.5	0.8		
R1_R1L_3P.OUT:	RMS / COMPONENT		0.8	0.6	2.6		
R1_R1L_6P.OUT:	RMS / COMPONENT		0.8	0.6	2.3		
R1_R1L_7P.OUT:	RMS / COMPONENT		0.5	0.3	2.3		