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# ITRF2005 ->ETRF2005 transformation validations: user perspective

E. Brockmann

# “Recomputation” of B1 approach

- Approach B1 gives identical results to approach A but has advantages: single transformation instead of 2-step !
  Users and programmers prefer a direct transformation

Consequently the computed 14 parameters from ITRF2005 to ETRF2000 are:

| | T1 mm | T2 mm | T3 mm | D 10-9 | R1 mas | R2 mas | R3 mas | Epoch y |
|---|---|---|---|---|---|---|---|---|
| -------- | 54.0 | -- 49.8 | ---------- | | | | | |
| | 54.1 | 50.2 | -53.8 | 0.40 | 0.891 | 5.390 | -8.712 | 00:001 |
| Rates | -0.2 | 0.1 | -1.8 | 0.08 | 0.081 | 0.490 | -0.792 | |

with ITRF2005 – ITRF2000 information from http://itrf.ensg.ign.fr/ITRF_solutions/2005/tp_05-00.php

with Memo values

-> only one official set of transformation parameters for users necessary !

# “Old” Memo values

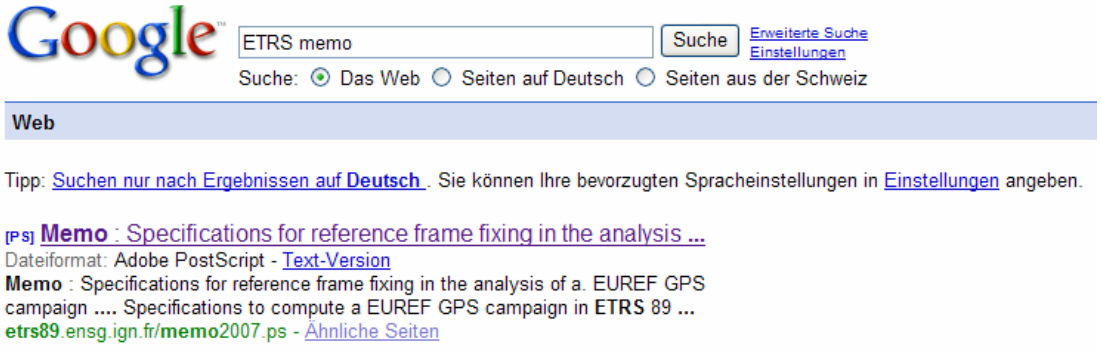
- 6 parameters of the “old” Memo values ETRF05
  Memo (27.3.2007) http://etrs89.ensg.ign.fr/memo2007.pdf

**Table 3:** Estimation of $T_{YY}$

| $YY$ | | T1 cm | T2 cm | T3 cm |
|---|---|---|---|---|
| 05 | A | 5.6 | 4.8 | -3.7 |
| | B | 3.6 | 4.2 | -4.1 |
| | ± | 0.4 | 0.4 | 0.4 |

**Table 4:** Estimation of $\dot{R}_{YY}$

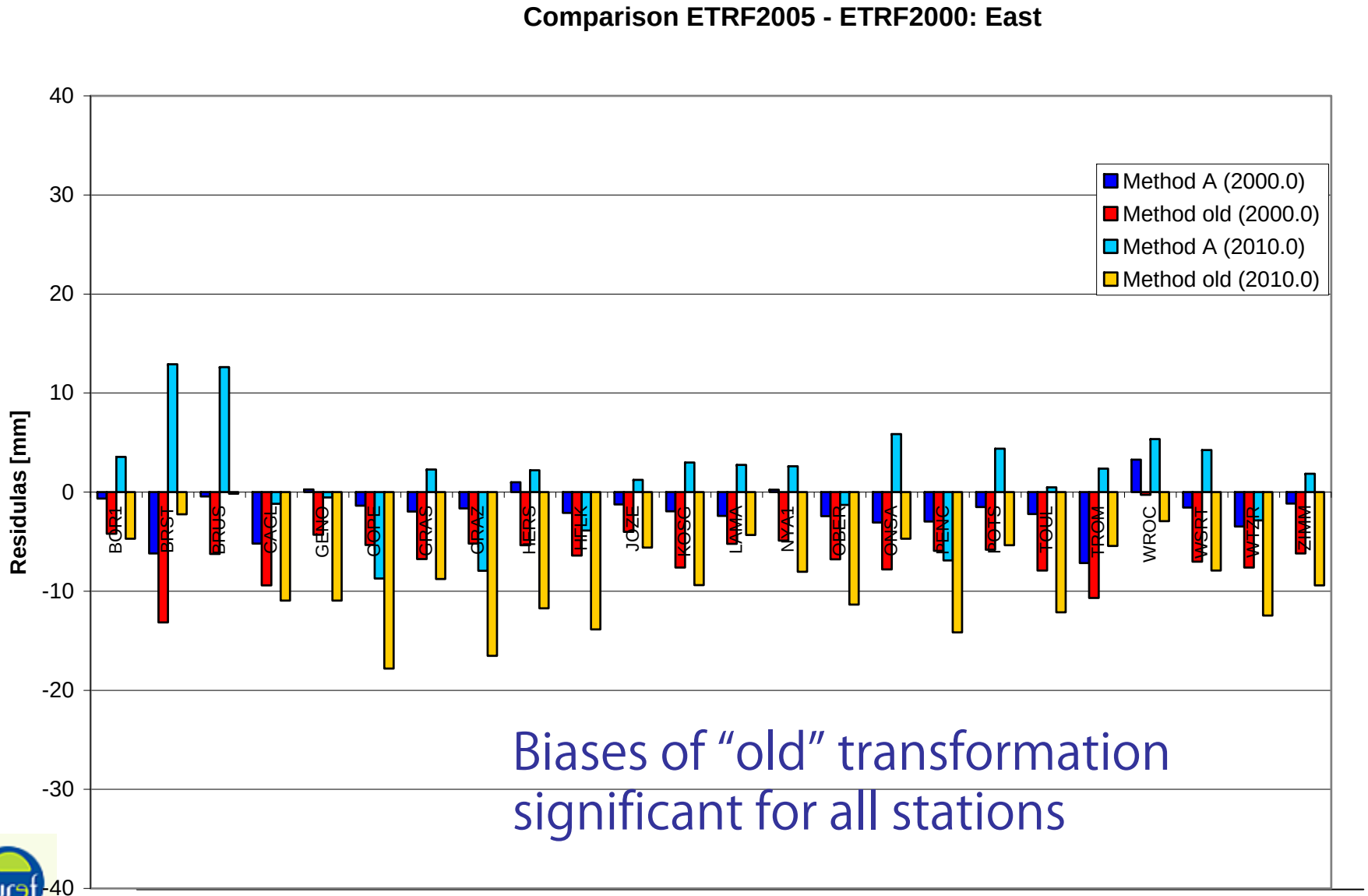
| $YY$ | $\dot{R}1$ mas/y | $\dot{R}2$ mas/y | $\dot{R}3$ mas/y |
|---|---|---|---|
| 05 | 0.054 | 0.518 | -0.781 |
| | ±0.009 | ±0.006 | ±0.011 |



# Transformation comparison

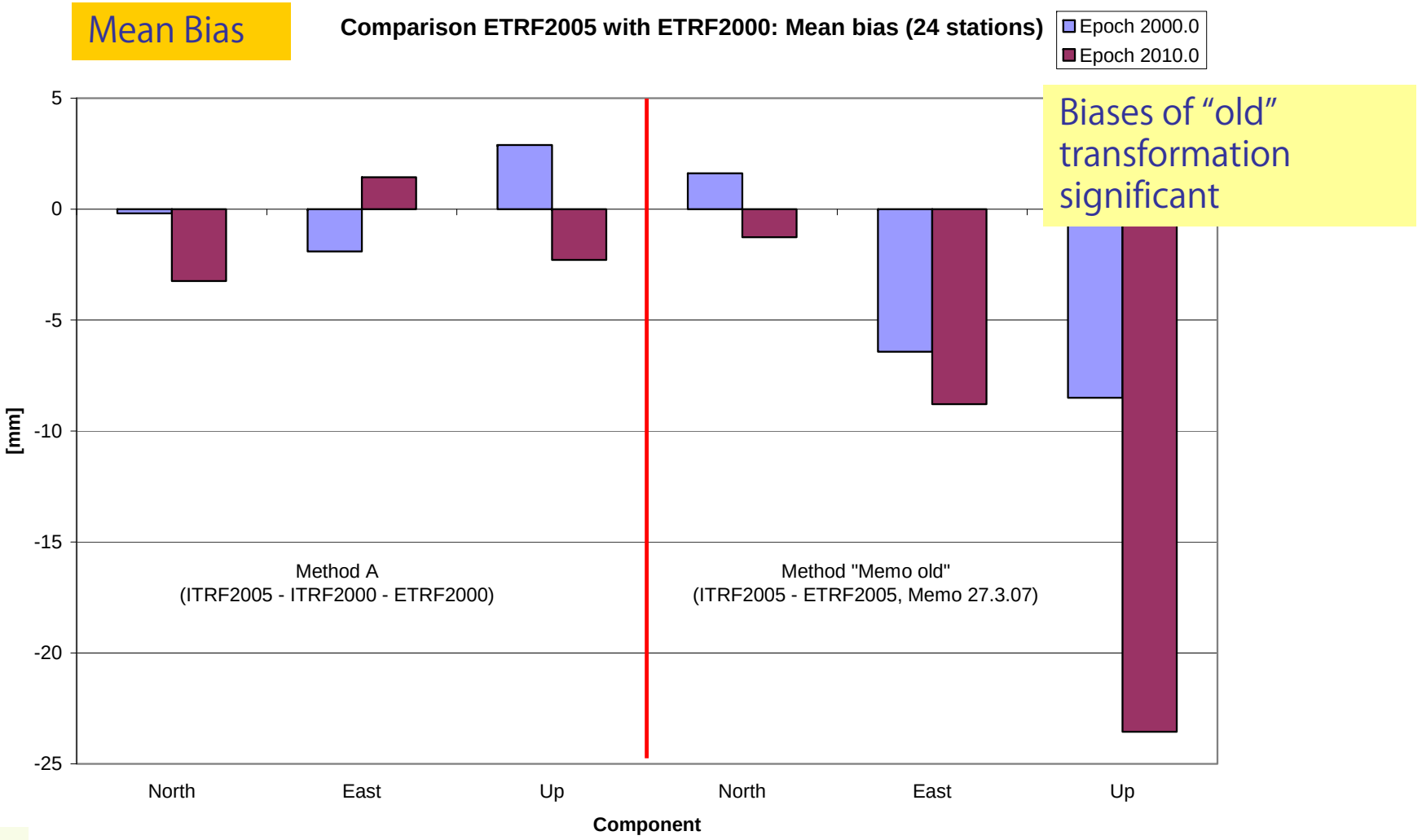
- Compare coordinates I05-35.SNX (coordinates + velocities) at epoch 2000.0 and 2010.0 with E00-35.SNX at Epoch 2000.0
- No use of individual intraplate velocities in ETRF
- Use of 24 stations: Not used: MATE, MEDI, NOTO, SOFI, THU1, UPAD, HOFN, KELY, KIRU, MAR6, METS not on the stable part of Europe or weakly determined velocities in ITRF2005 or problems ETRF2000

# Approach A/B1 versus “old” Memo



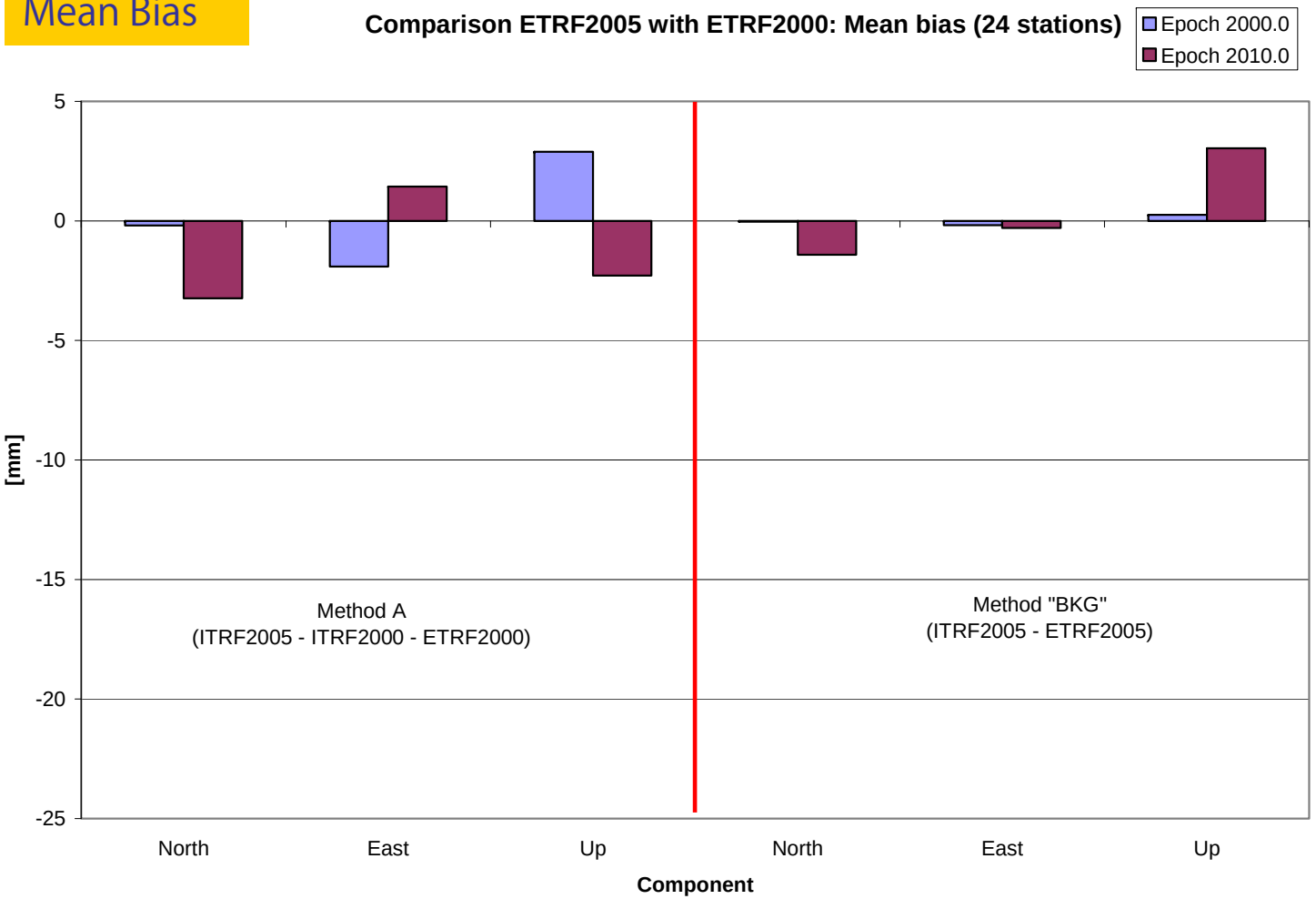
# Approach A/B1 versus “old” Memo

Mean Bias



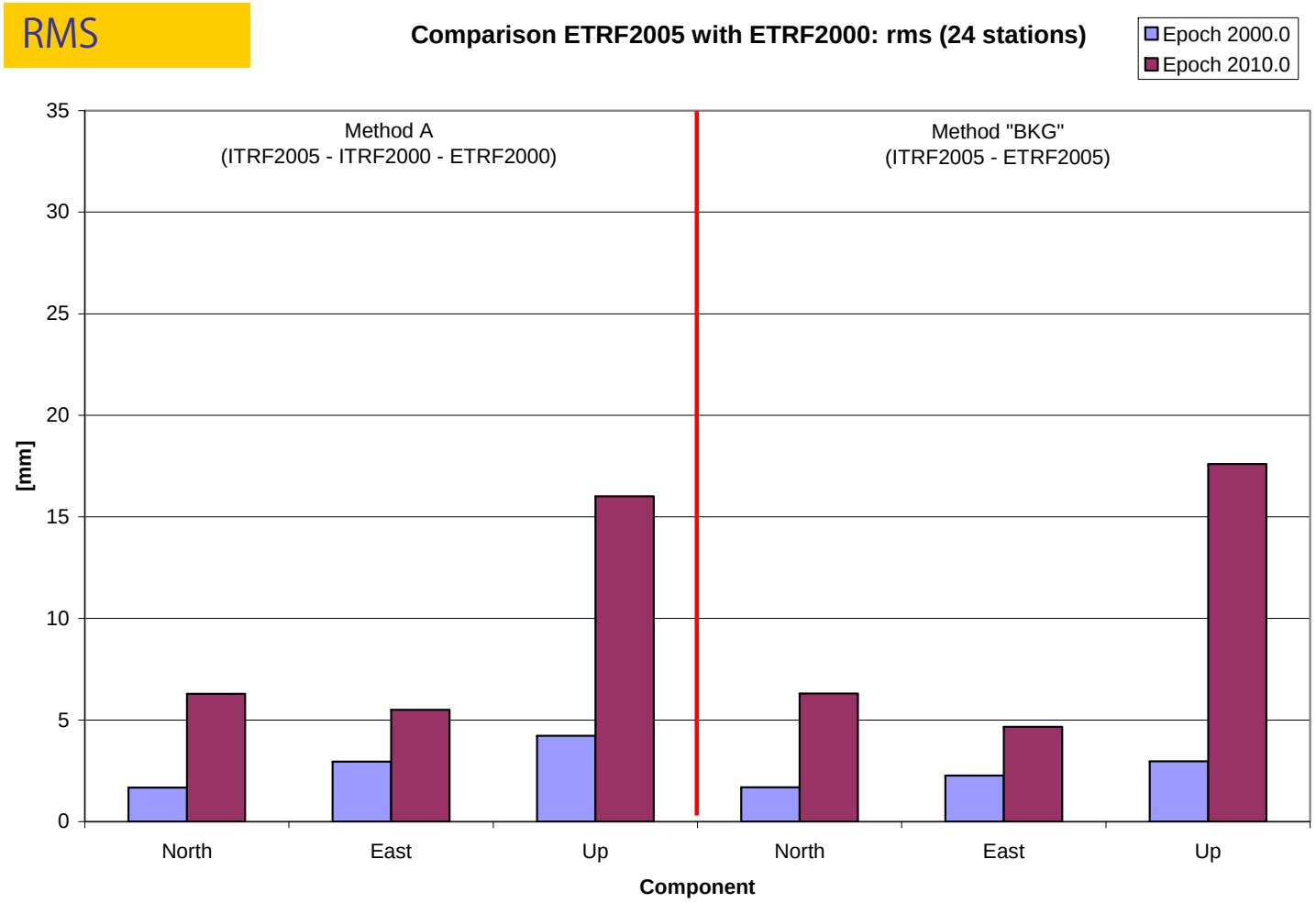
# Approach A/B1 versus Approach BKG

Mean Bias



# Approach A/B1 versus Approach BKG

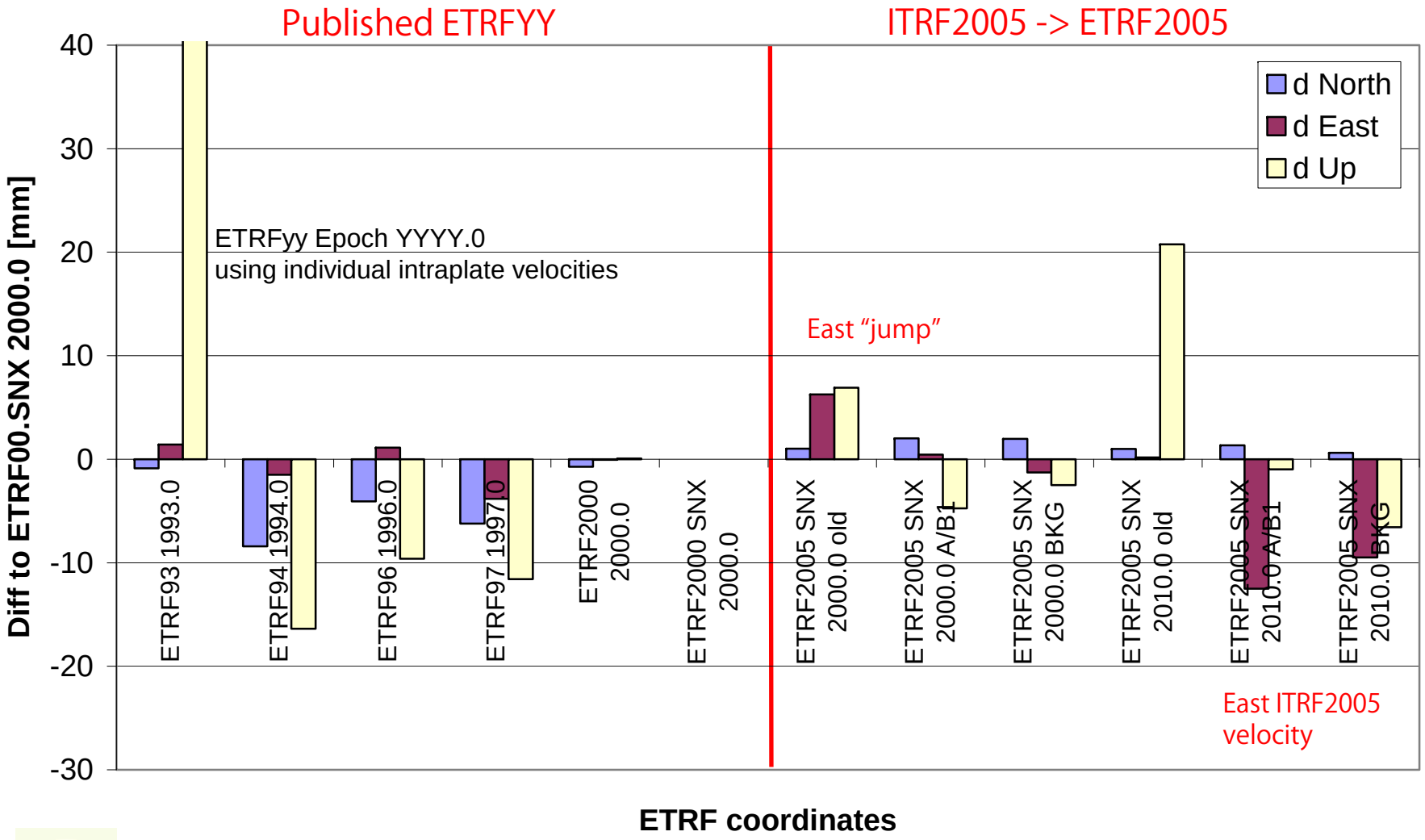
RMS



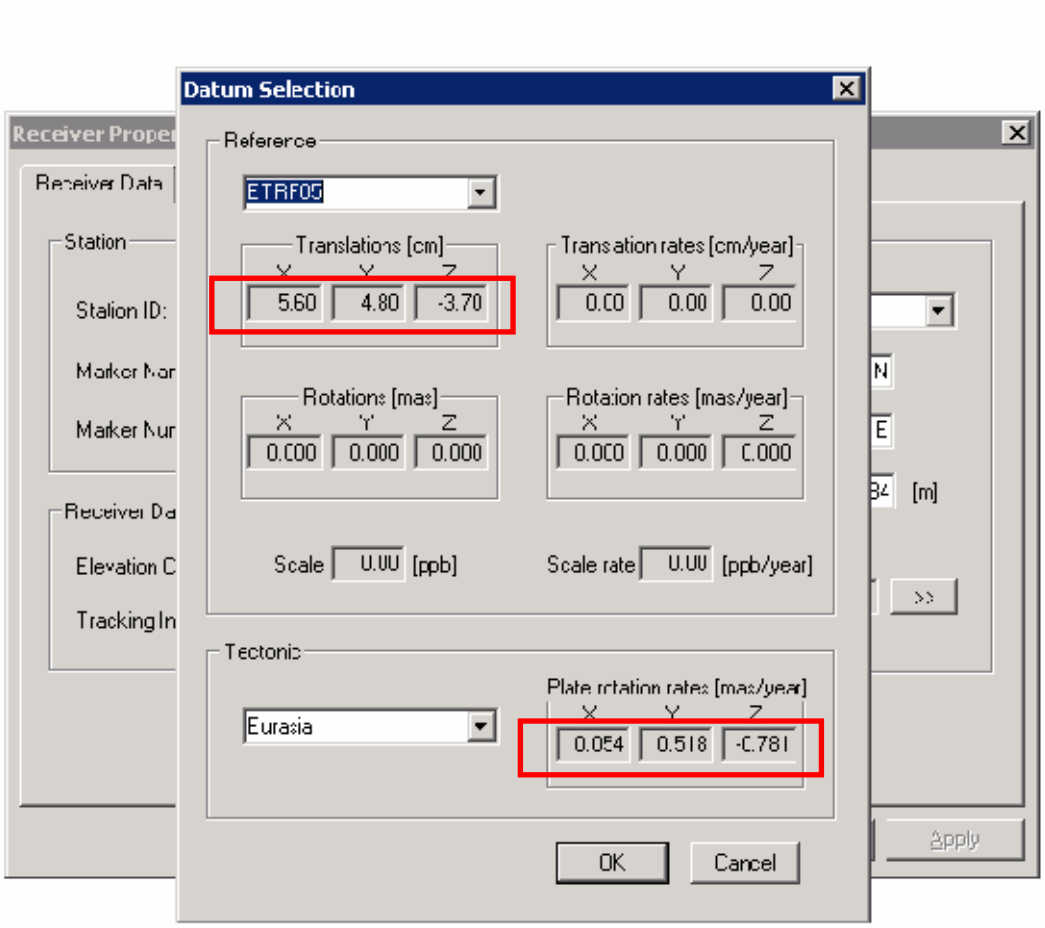

Individual (vertical !) velocities at epoch 2010.0 ⋯

# ETRF coordinate series: BRUS

**Brussels ETRF coordinates**



# Trimble Transformation Manager




"old" Memo values in use

Used in VRS software GPSNET 2.61, but uncritical, because used for forward-backward transformation

# Trimble Transformation Manager (2)

## A) Trimble Transformation Information

C:\Program Files\Trimble\GpsNet\config\FrameTransformations.txt

| From | Td | To | Td | Tk | Tx(cm) | Ty(cm) | Tz(cm) | Rx(mas) | Ry(mas) | Rz(mas) | D(ppb) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ITRF05 | 2000.0 | ITRF00 | 1997.0 | 1997.0 | 0.01 | -0.08 | -0.58 | 0.000 | 0.000 | 0.000 | 0.40 |
| | | | | | -0.02 | -0.01 | -0.18 | 0.000 | 0.000 | 0.000 | 0.08 |

## B) Web page information

http://itrf.ensg.ign.fr/ITRF_solutions/2005/tp_05-00.php

Additional Transformations ITRF05 – ITRFYY:

Different values than memo

| | T1 mm | T2 mm | T3 mm | D 10-9 | R1 mas | R2 mas | R3 mas |
|---|---|---|---|---|---|---|---|
| | 0.1 | -0.8 | -5.8 | 0.40 | 0.000 | 0.000 | 0.000 |
| +/- | 0.3 | 0.3 | 0.3 | 0.05 | 0.012 | 0.012 | 0.012 |
| Rates | -0.2 | 0.1 | -1.8 | 0.08 | 0.000 | 0.000 | 0.000 |
| +/- | 0.3 | 0.3 | 0.3 | 0.05 | 0.012 | 0.012 | 0.012 |

Table 1: Transformation parameters at epoch 2000.0 and their rates from ITRF2005 to ITRF2000 (ITRF2000 *minus* ITRF2005)

# Proposal

- Official regret to the users in case they used the old Memo values
- Explanation:
  - ITRF2005 needs more than 6 trafo parameters to transform without systematic discontinuities to ETRF
  - New concept (ETRS is THE basis for GIS data in Europe)
    - discontinuities in the future ETRF realizations not acceptable by users (EUREF Resolution Nr. 5, London)
    - previous discontinuities are not “removed” (countries adopted older ETRFYY realizations)
    - minimal discontinuities to previous realizations
    - maintain previous realizations (similar as NMA do very carefully)
- Adopt one set of transformation parameters for a one-step transformation (B1 or BKG approach – favour is BKG approach because supports new concept)
  – both needs explanations to the user and modifications of software on the user side (6 -> 14 parameters)
- Write a new Memo with generally 14 transformation parameters for the ETRFYYYY trafo parameters

# Proposal (2)

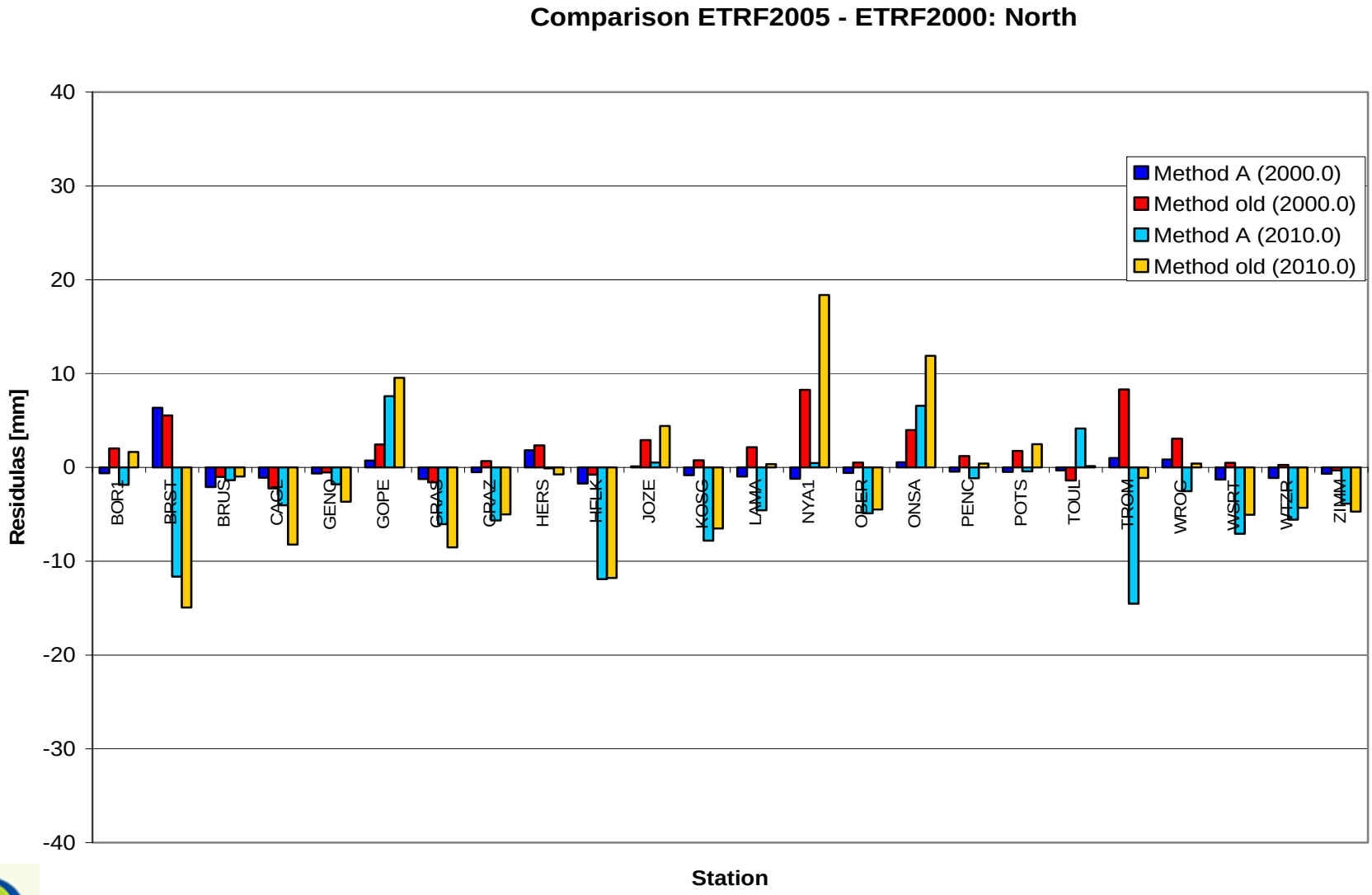
ITRF2005->ETRF2005

| | From | Td | To | Td | Tx(cm) / Tdx(cm/y) | Ty(cm) / Tdy(cm/y) | Tz(cm) / Tdz(cm/y) | Rx(mas) / Rdx(mas/y) | Ry(mas) / Rdy(mas/y) | Rz(mas) / Rdz(mas/y) | D(ppb) / Dd(ppb/y) | # Para |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aproach 1 | ITRF05 | 2000.0 | ETRF05 | 2000.0 | 5.41 | 5.02 | -5.38 | 0.891 | 5.390 | -8.712 | 0.40 | 14 |
| | | | | | -0.02 | 0.01 | -0.18 | 0.081 | 0.490 | -0.792 | 0.08 | |
| Aproach 2 | ITRF05 | 2000.0 | ETRF05 | 2000.0 | 4.84 | 5.46 | -4.85 | 0.990 | 5.650 | -8.860 | 0.56 | 11 |
| | | | | | 0.00 | 0.00 | 0.00 | 0.048 | 0.522 | -0.799 | -0.2 | |
| Old Memo | ITRF05 | 2000.0 | ETRF05 | 1989.0 | 5.60 | 4.80 | -3.70 | 0.000 | 0.000 | 0.000 | 0.00 | 6 |
| | | | | | 0.00 | 0.00 | 0.00 | 0.054 | 0.518 | -0.781 | 0.00 | |
| Other Trafos from Memo Tab. 3+4 | ITRF00 | 2000.0 | ETRF00 | 1989.0 | 5.40 | 5.10 | -4.80 | 0.000 | 0.000 | 0.000 | 0.00 | 6 |
| | | | | | 0.00 | 0.00 | 0.00 | 0.081 | 0.490 | -0.792 | 0.00 | |
| | … | | | | | | | | | | | |
| | ITRF93 | 1993.0 | ETRF93 | 1989.0 | 1.90 | 5.30 | -2.10 | 0.000 | 0.000 | 0.000 | 0.00 | 6 |
| | | | | | 0.00 | 0.00 | 0.00 | 0.320 | 0.780 | -0.670 | 0.00 | |
| | … | | | | | | | | | | | |
| | ITRF89 | 1989.0 | ETRF89 | 1989.0 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 | 0.000 | 0.00 | 3 |
| | | | | | 0.00 | 0.00 | 0.00 | 0.110 | 0.570 | -0.710 | 0.00 | |

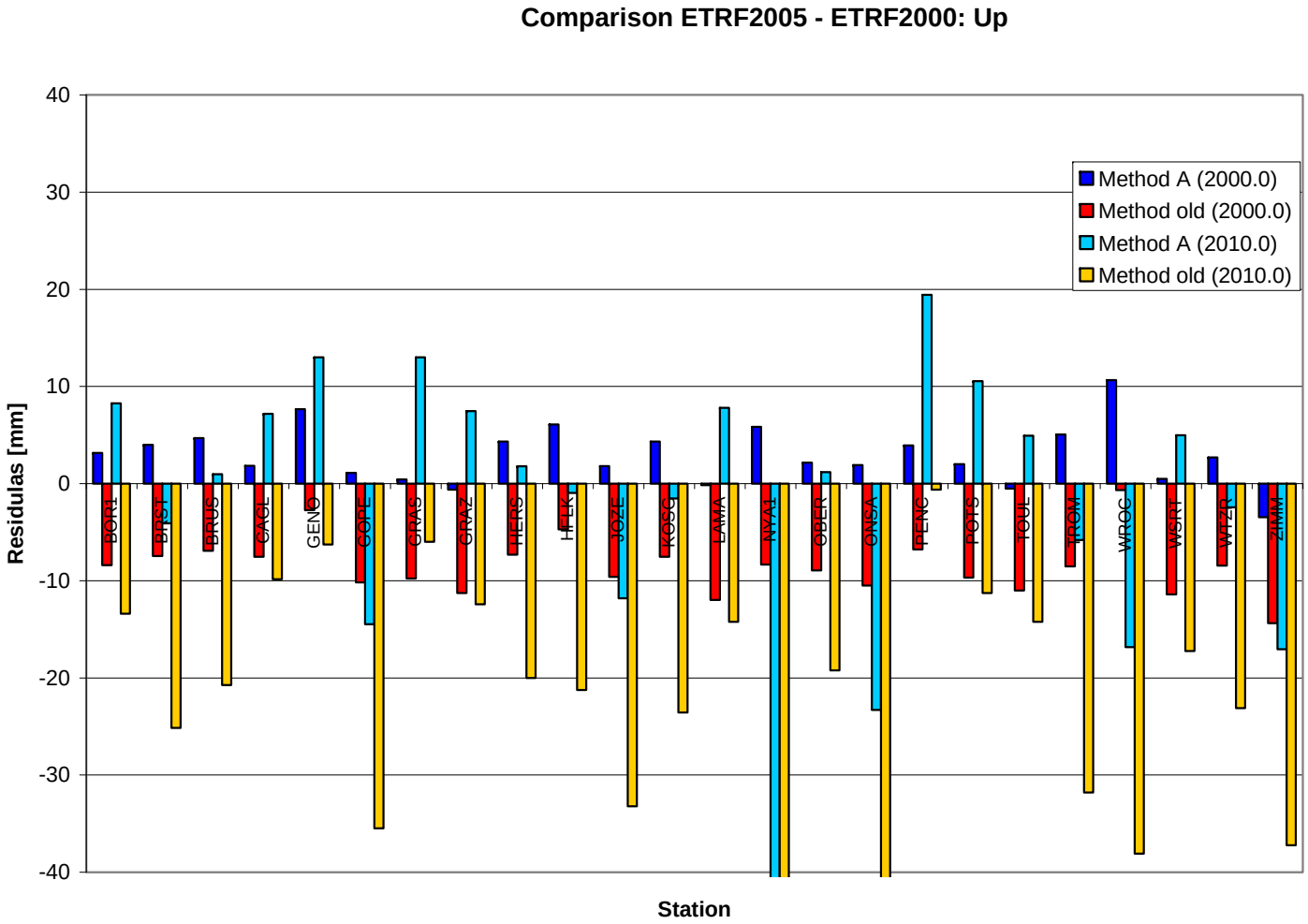
# Proposal (3)

- Add example computation to let users validate the results or if possible provide source code / dll tools for such a transformation
- Adopt the naming: ETRF2005 – coordinate list with ITRF2005 sites only (or EPN densification solution if ready and successfully compared to Time Series SP)

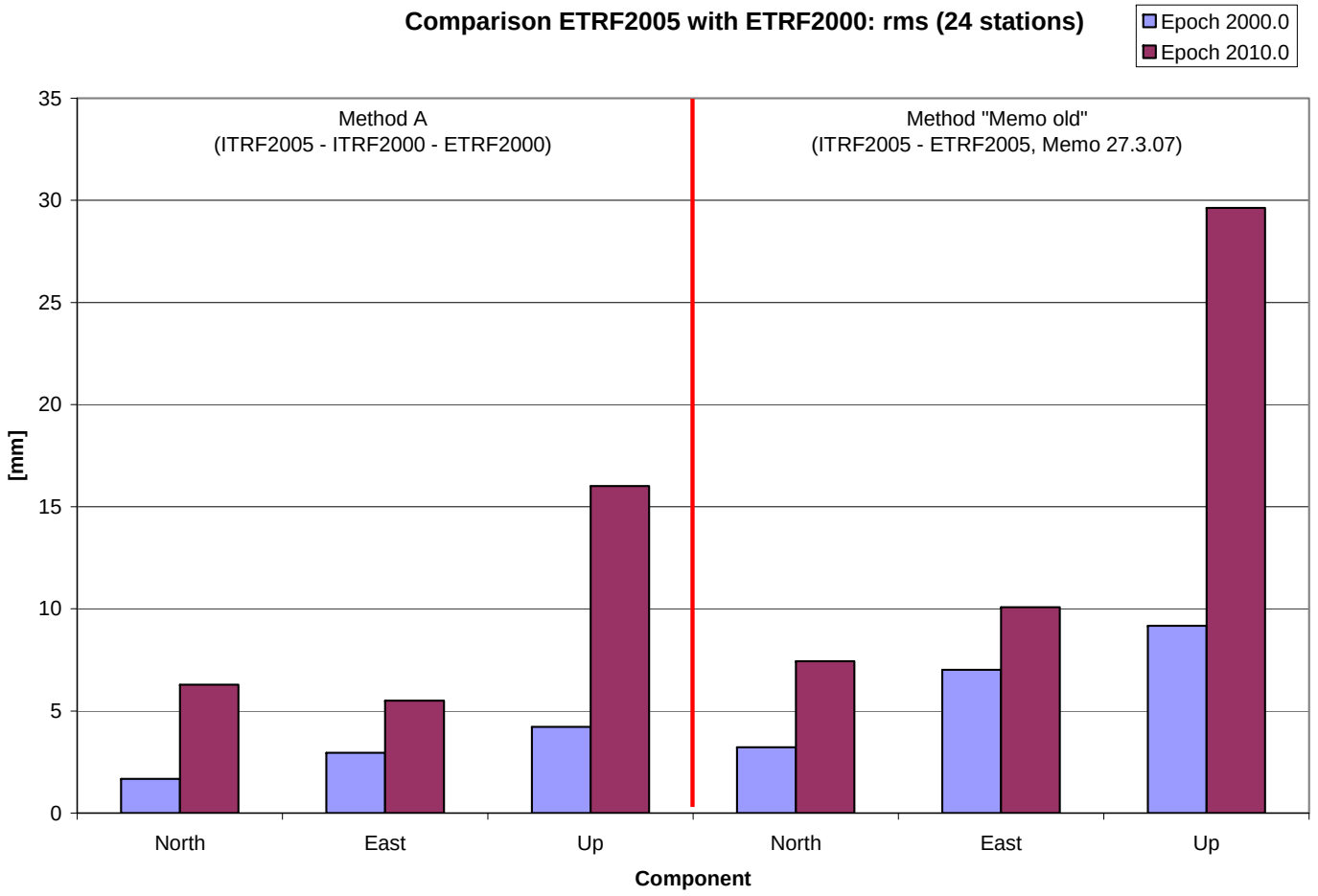
# Approach A/B1 versus “old” Memo



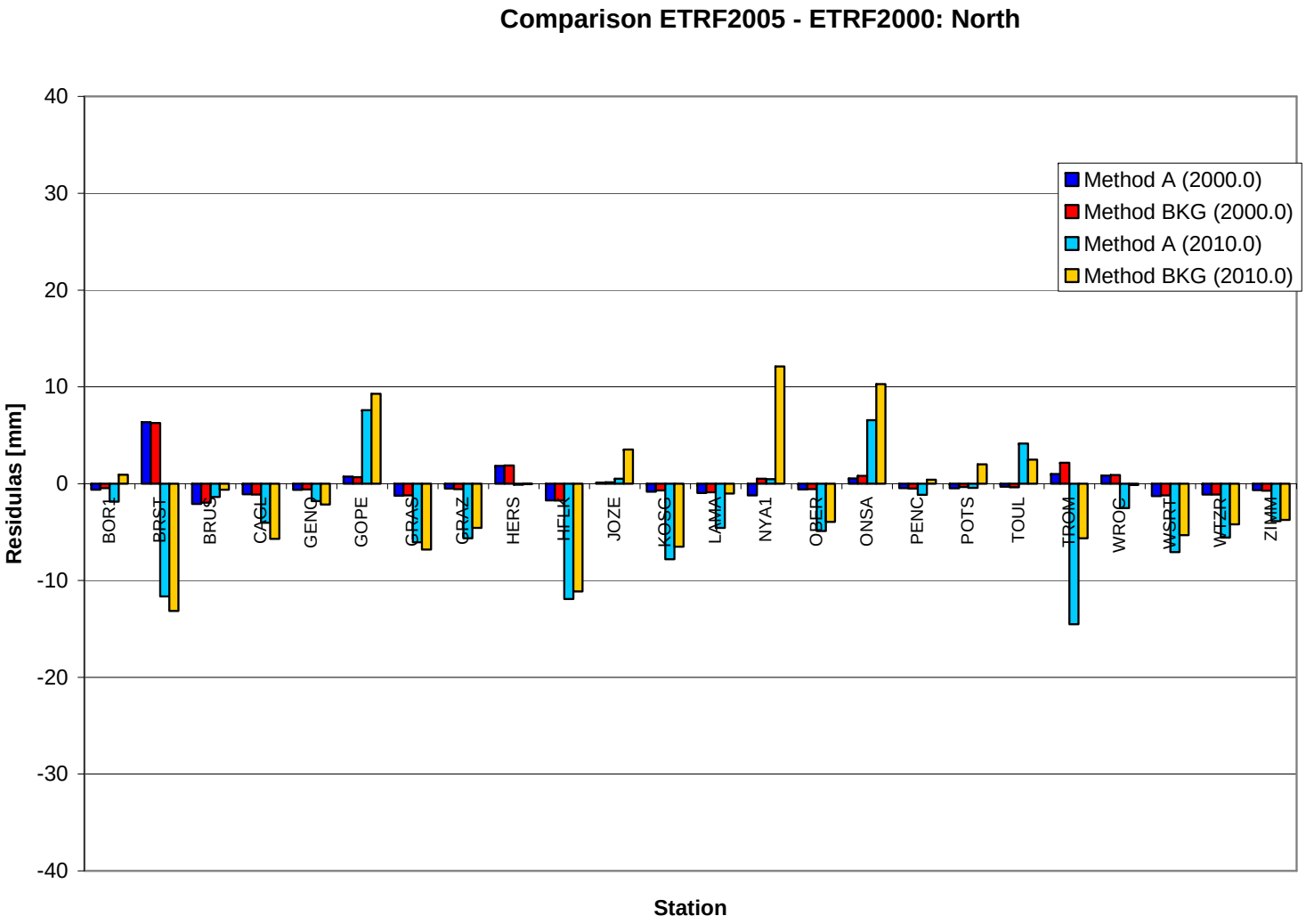
# Approach A/B1 versus “old” Memo



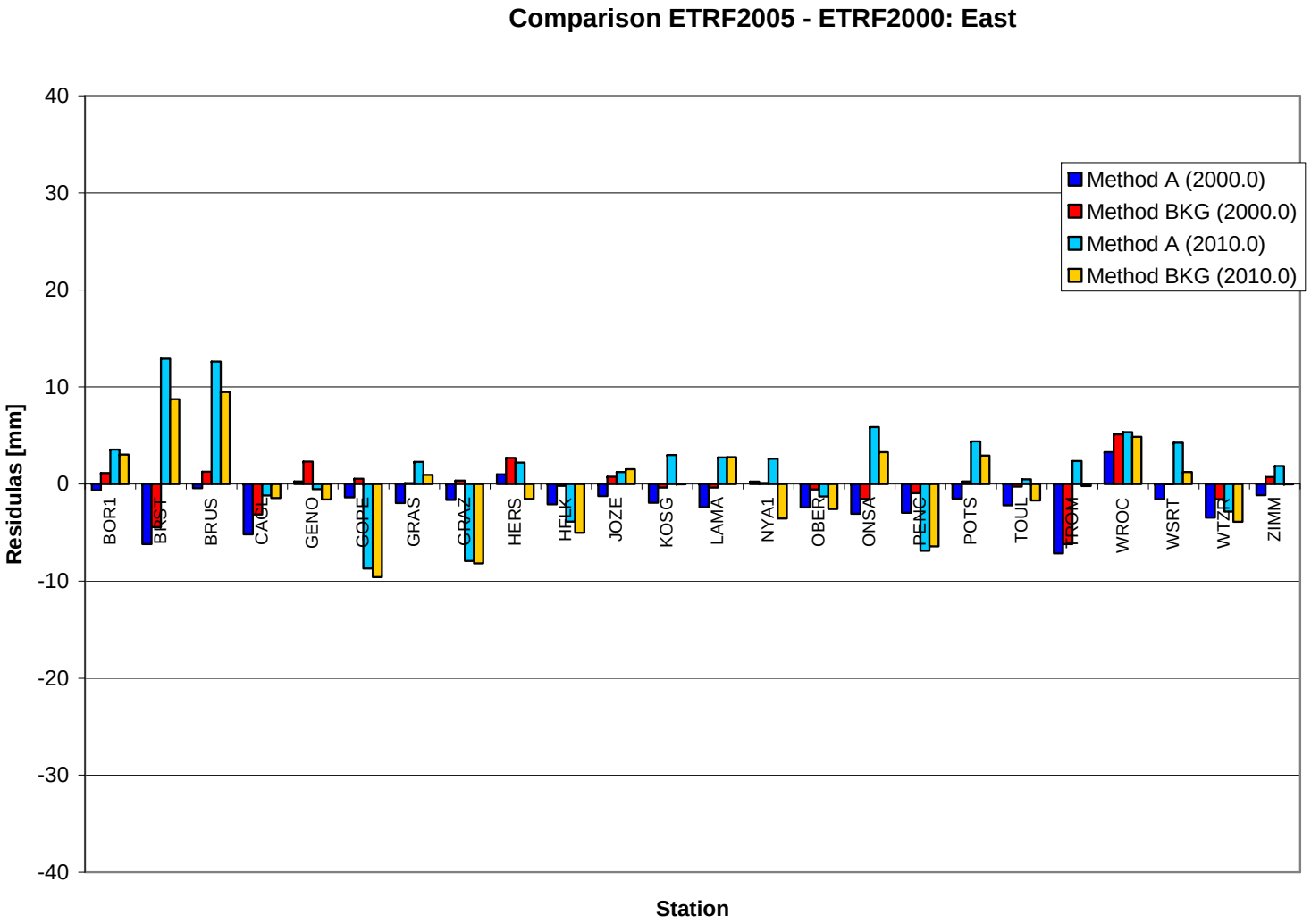
# Approach A/B1 versus “old” Memo



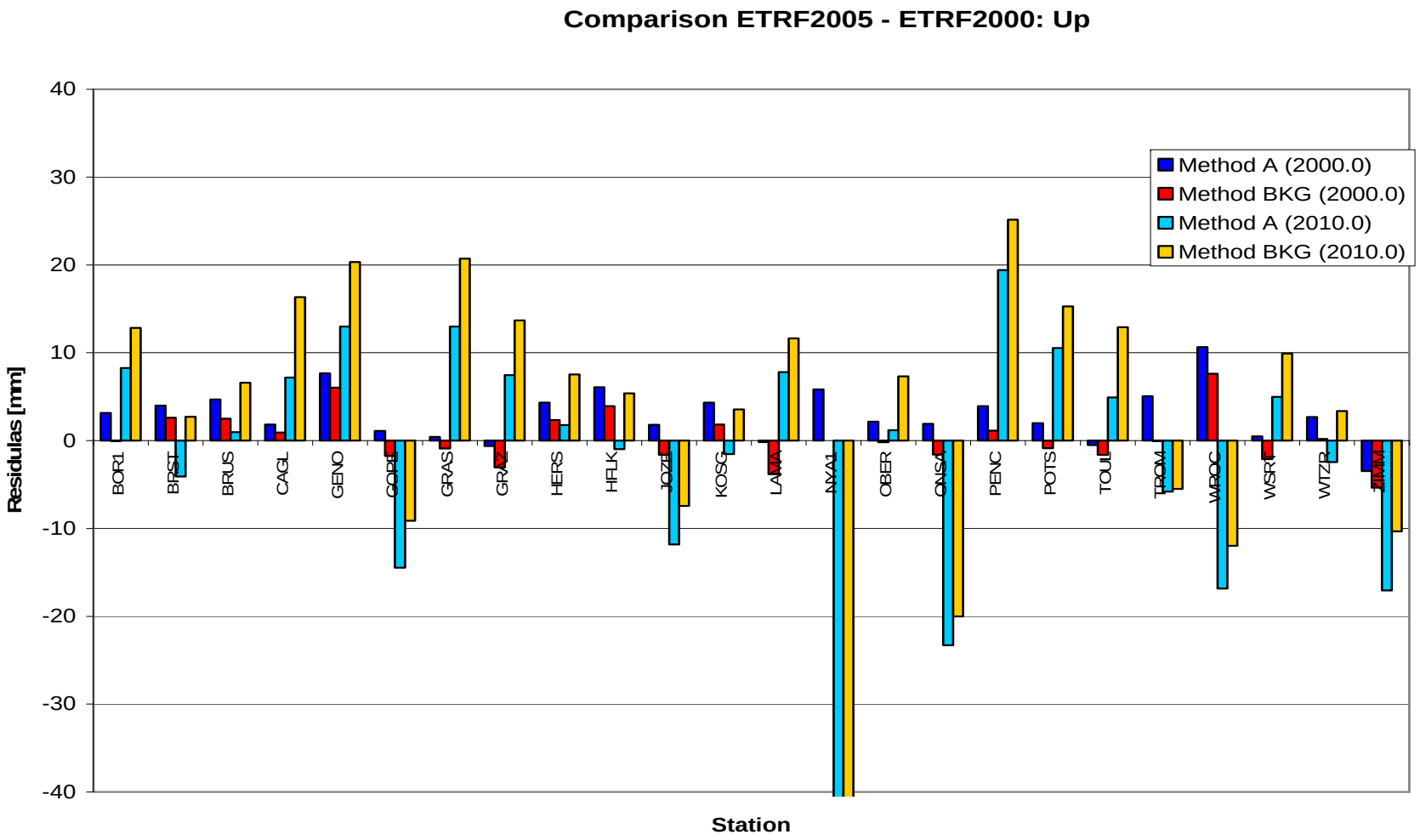
# Approach A/B1 versus Aproach BKG



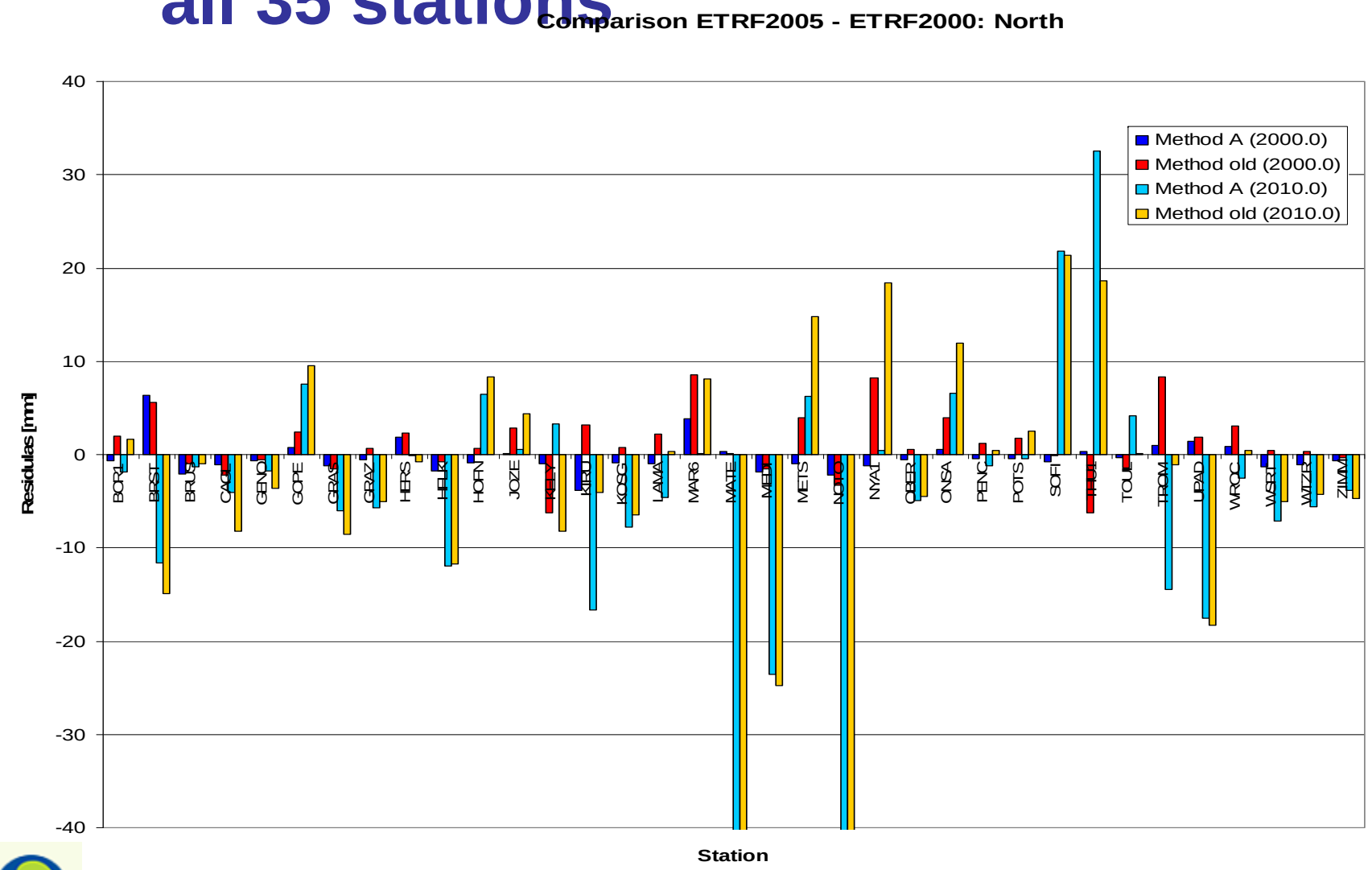
# Approach A/B1 versus Aproach BKG



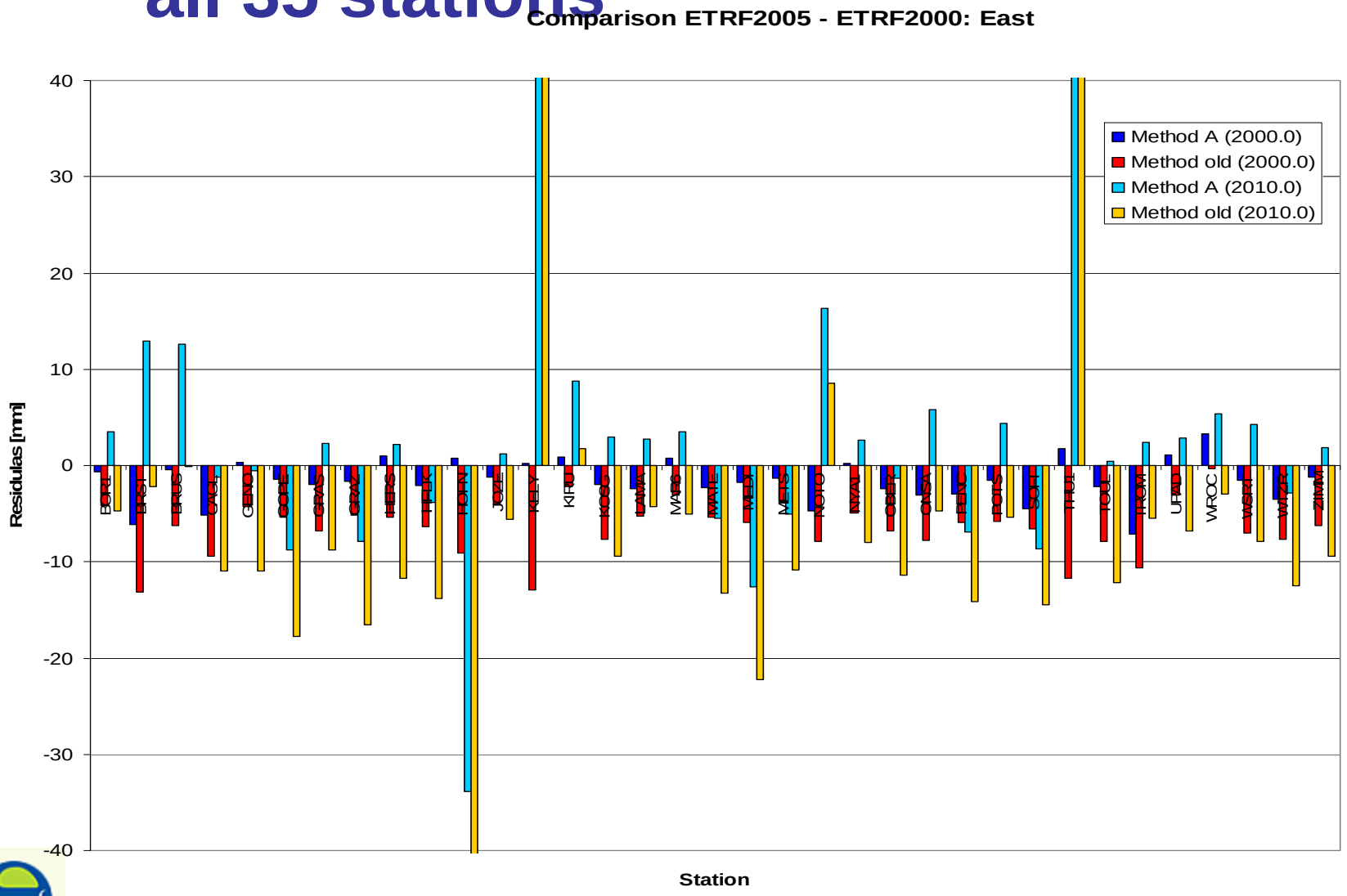
# Approach A/B1 versus Aproach BKG



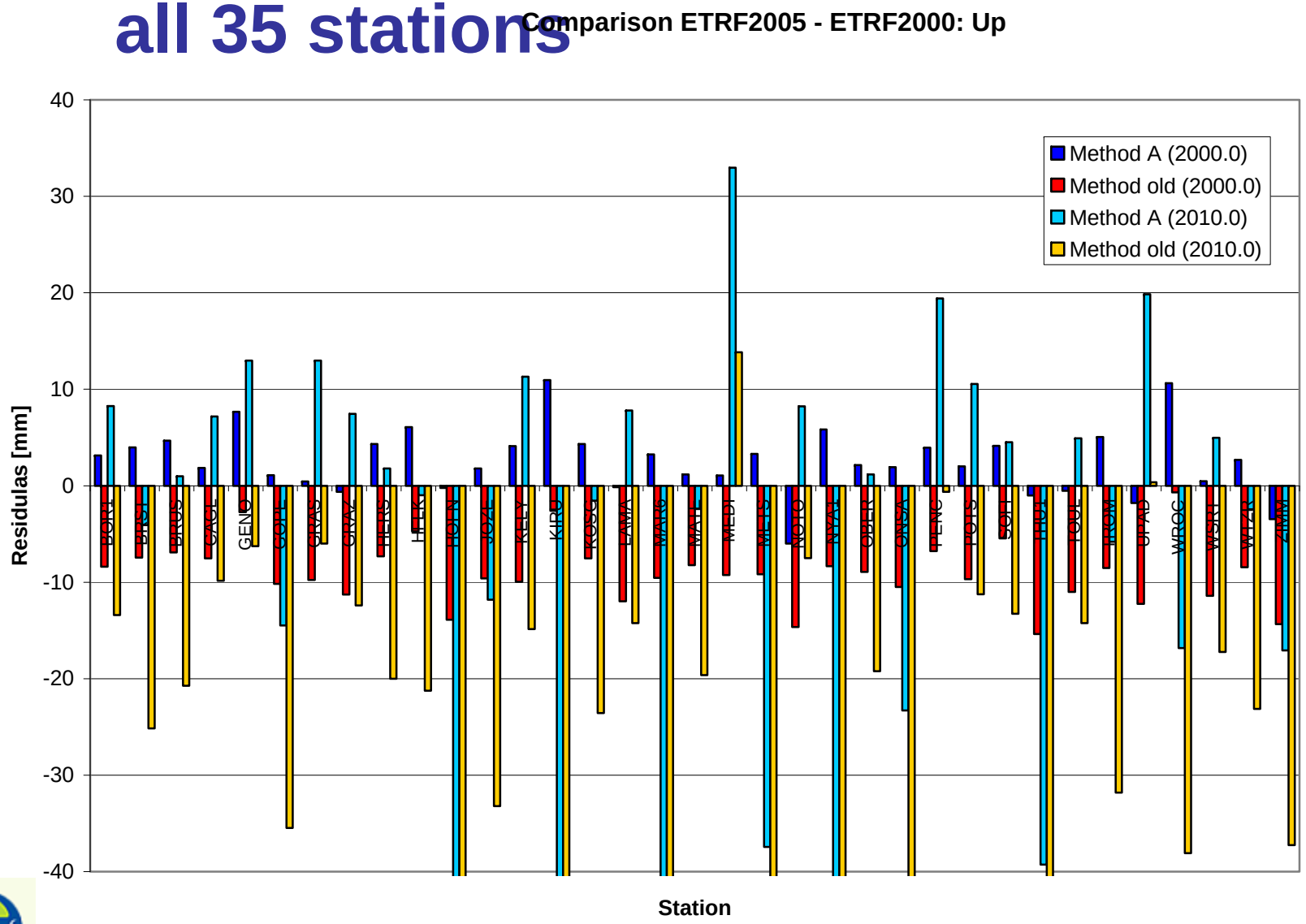
# Approach A/B1 versus “old” Memo all 35 stations



# Approach A/B1 versus “old” Memo all 35 stations

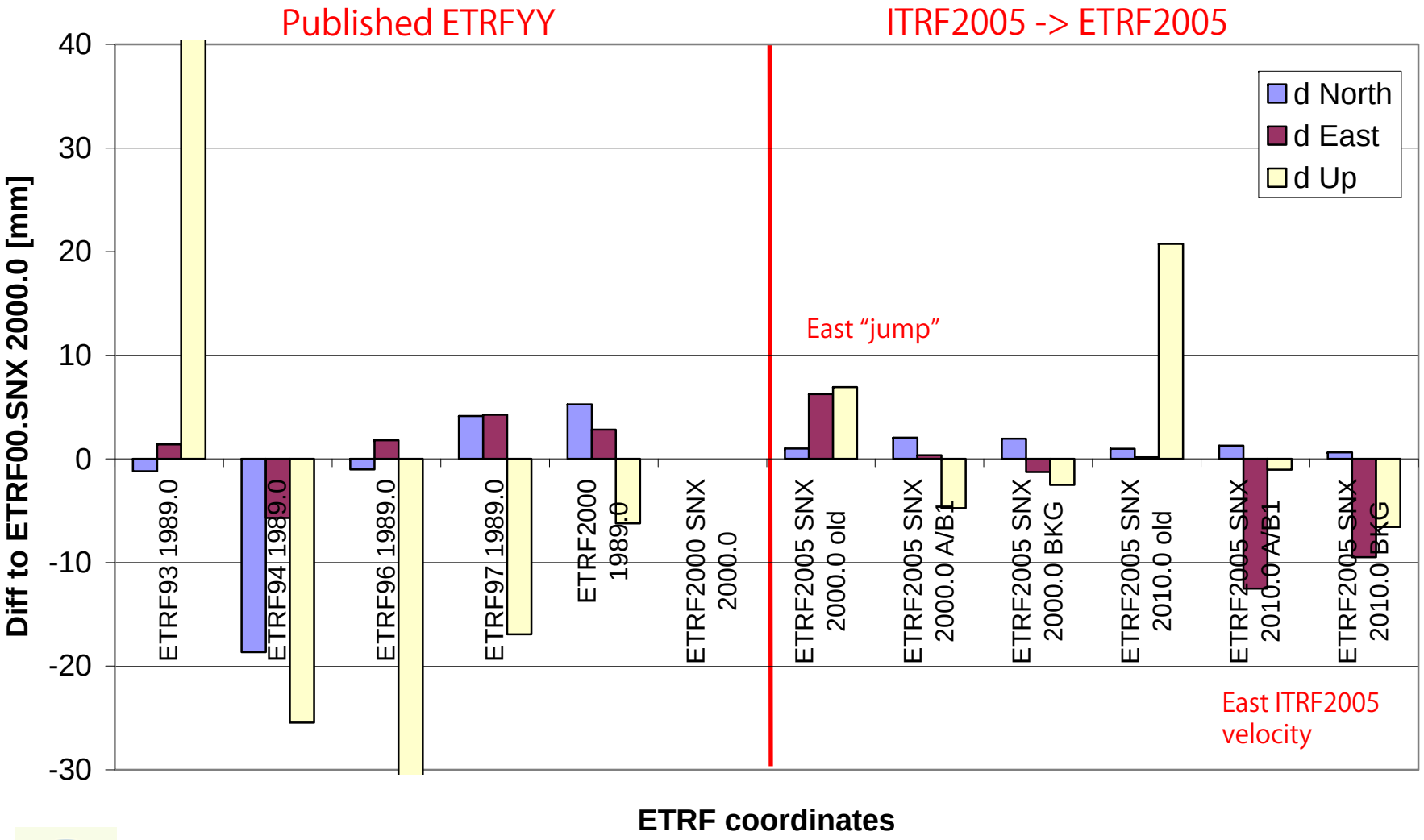


# Approach A/B1 versus “old” Memo all 35 stations



# ETRF coordinate series: BRUS

**Brussels ETRF coordinates**



# ETRF coordinate series: ZIMM

**Zimmerwald (before 1998, doy 312)**