GOP Repro1+: assessment of EUREF repro1

individual AC contributions

impact of IGS08 models

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EUREF Symposium, Paris
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outline

- Description of GOP Repro1+ (full EPN)
- Comparison with ITRF2008 and its EPN densification
- Assessment of individual LAC's Repro1 contributions, historical archive and other Repro1 experiences
- Impact of IGS05 x IGS08 reprocessing
- Summary (and considerations for Repro2)

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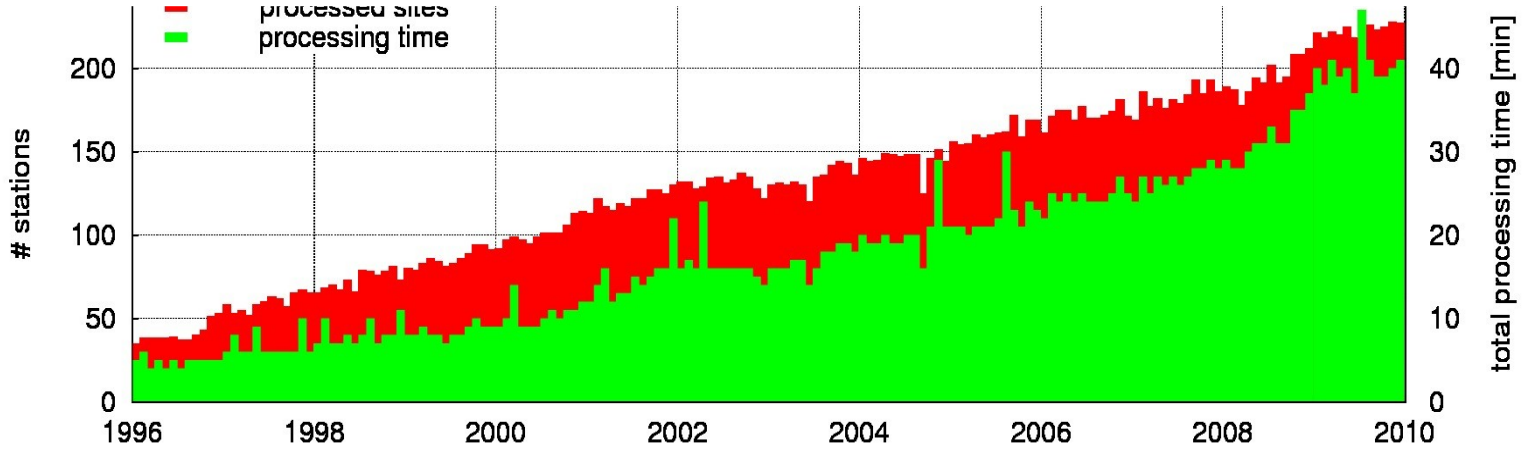
GOP Repro1+

Solution of all EUREF stations

GOP Repro1+ - Basic description

OP Repro1+

- the same strategy as GOP Repro1 (only small changes applied)
- higher efficiency and better robustness
- lower criteria for exclusions on daily basis, more tight exclusion on weekly
- daily results solutions also in ETRF2000 – raw time series
- used mirror EPNCB (ROB) historical database
- some days re-processed twice with exclusion of really bad data!
  - We realized some problems only after the combination process (based on net residuals)!
  - E.g. full day data, but only 2 satellite or missing L2 !!!



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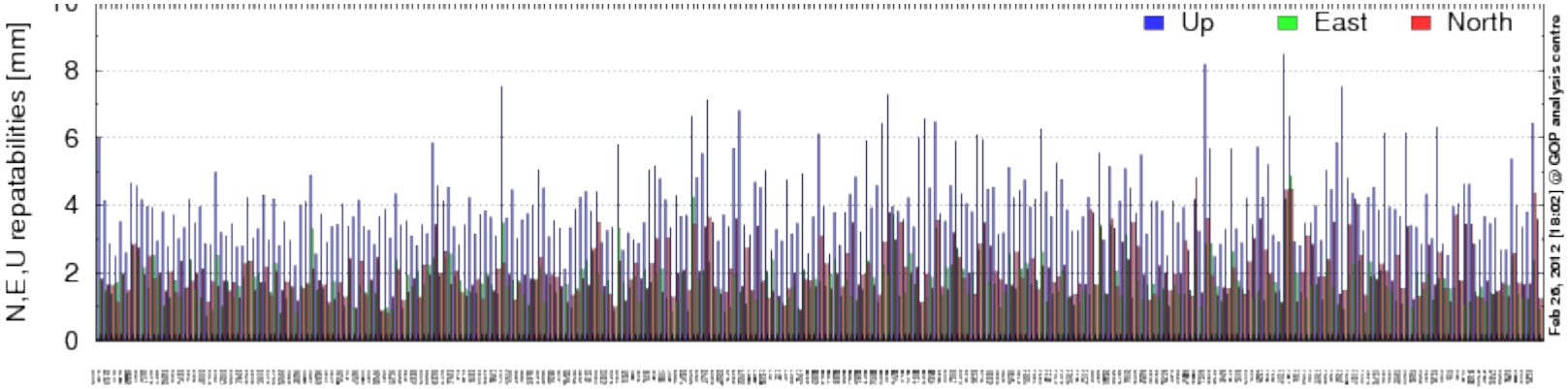
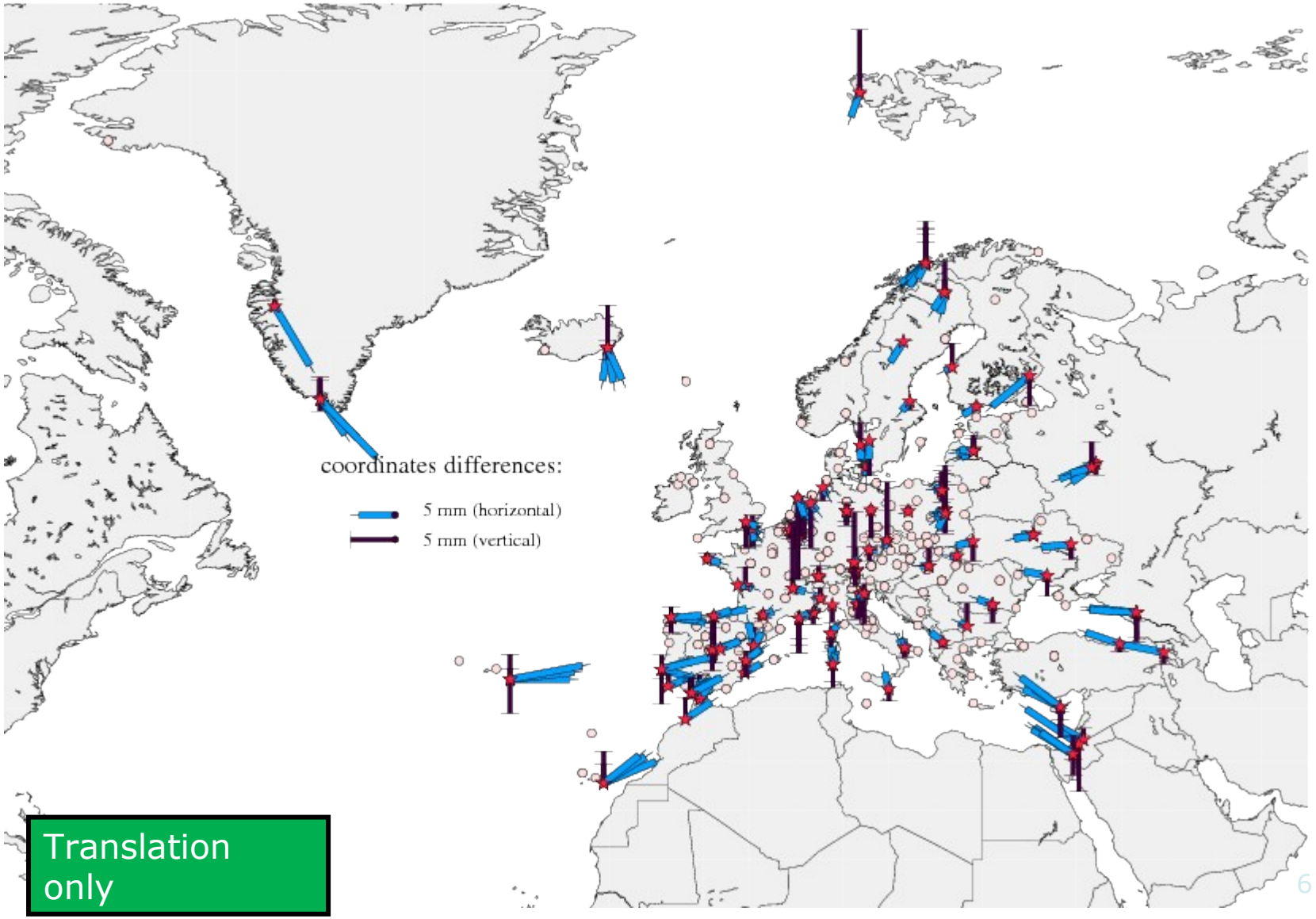
GOP Repro1+ - Weekly combination

- Minimum constraints – **NNT**, *NNT+NNS, NNT+NNR+NNS (problems)*
- All common stations to ITRF2008 *a priori* as fiducial, iteratively selected
- Finally 86 stations (159 soln) applied as fiducials
- ITRF2008 "" soln changed to the soln corresponding to the GOP combi
- Keeping *a priori* discontinuities from EPN ITRF2008 densification
- Some minor changes with discontinuities: TUBI, ...?
- Except REYK, ISTA, TUBI (affected by EQs) all velocities relativ. Constrained
- Various tools created for SNX extraction, SOLN exctractions, coordinates and velocity differences or residuals plotting → directly on web-page:
- http://www.pecny.cz/WWW_IMG/EUR_REP1.I05-A (B, C, I08,...)



GOP Repro1+ (Helmert residuals)

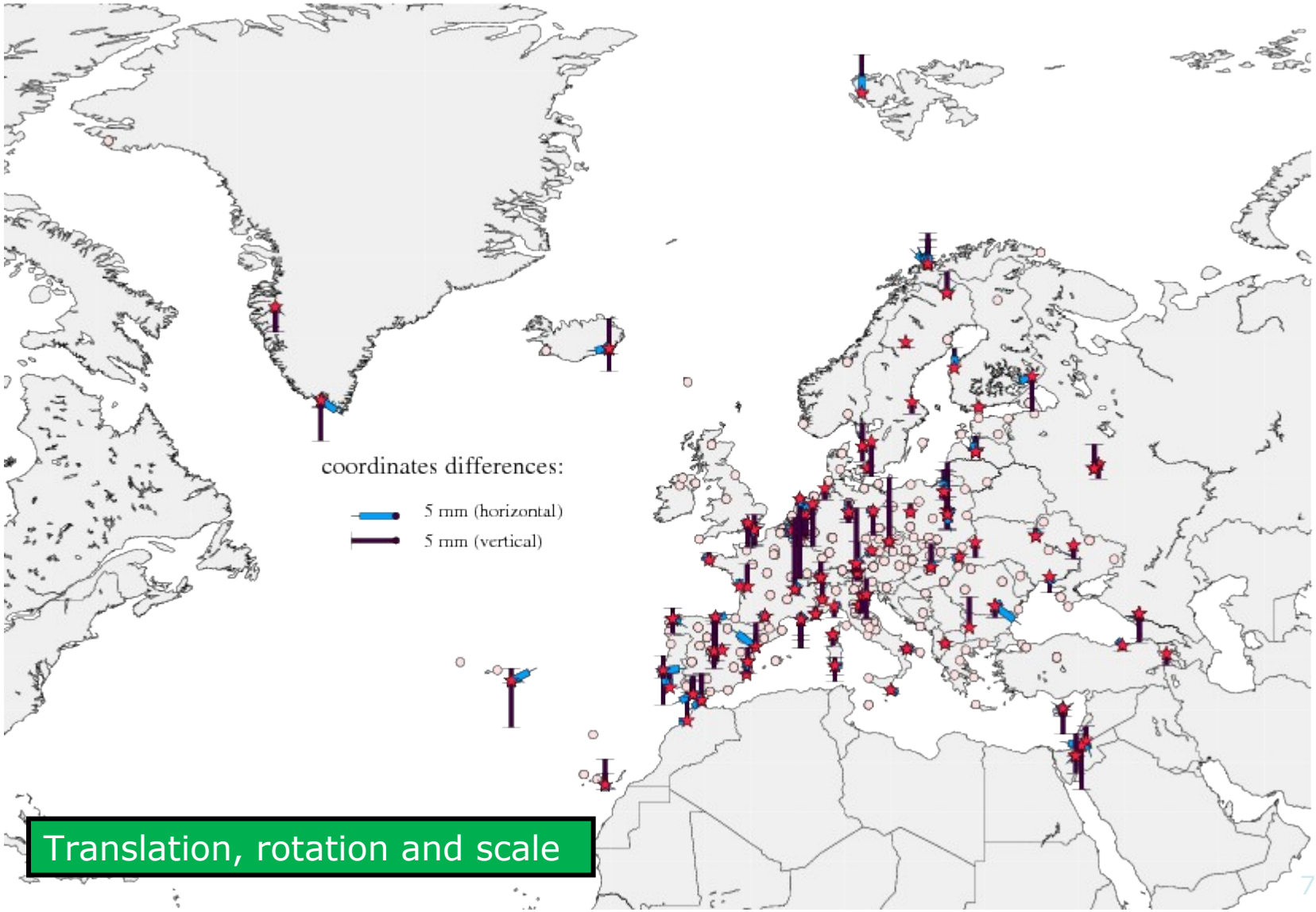
Fiducial stations with residuals from Helmert transformation @ 2005.0



Translation only

GOP Repro1+ (Helmert residuals)

Fiducial stations with residuals from Helmert transformation @ 2005.0



Translation, rotation and scale

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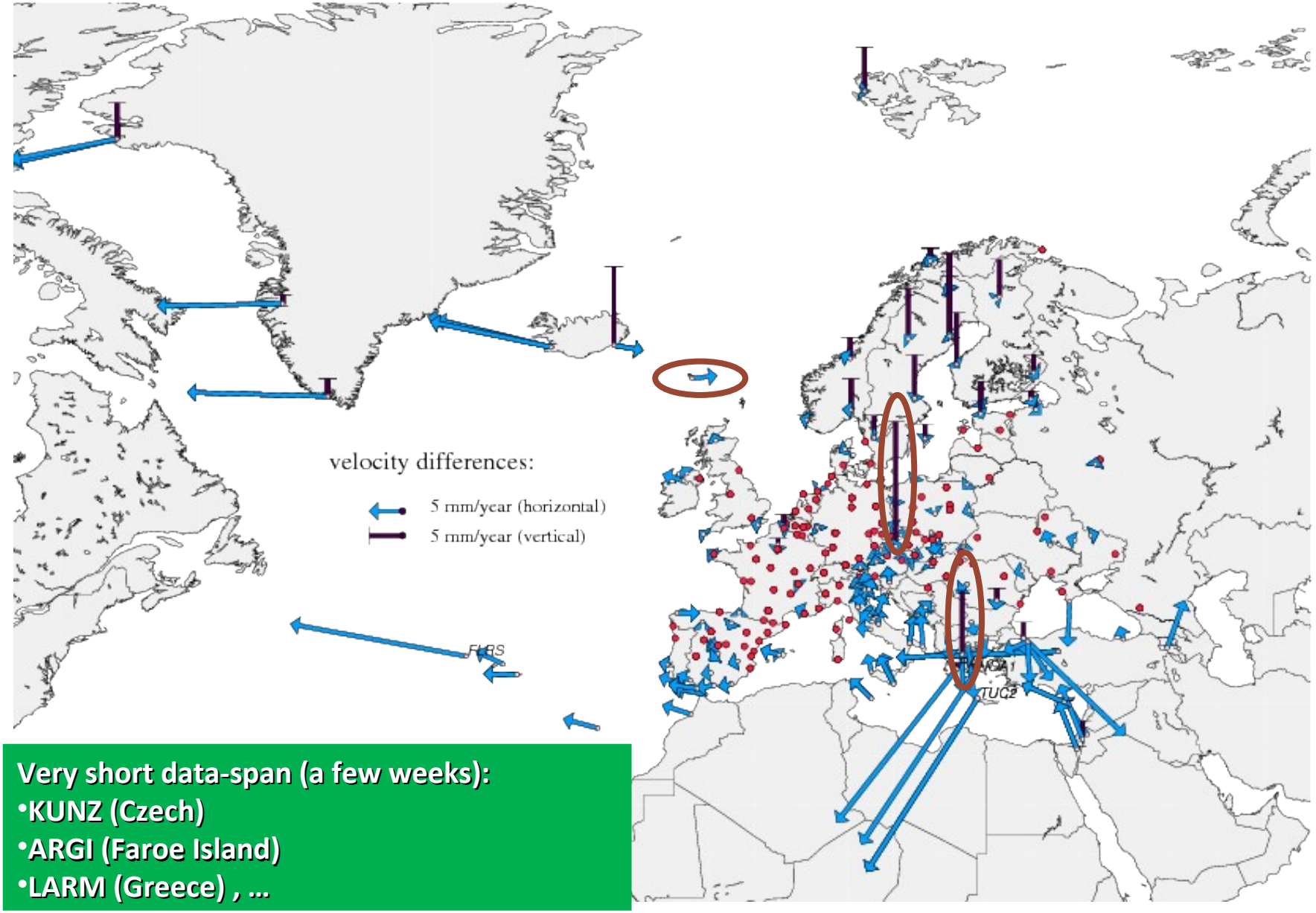
Velocities with respect to Eurasian plate

– *Complete EUREF Permanent network GOP solution*



Very short data-span (a few weeks):
- **KUNZ (Czech)**
- **ARGI (Faroe Island)**
- **LARM (Greece) , …**

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GOP Repro1+

Comparisons to ITRF2008

and

EPN ITRF2008 Densification

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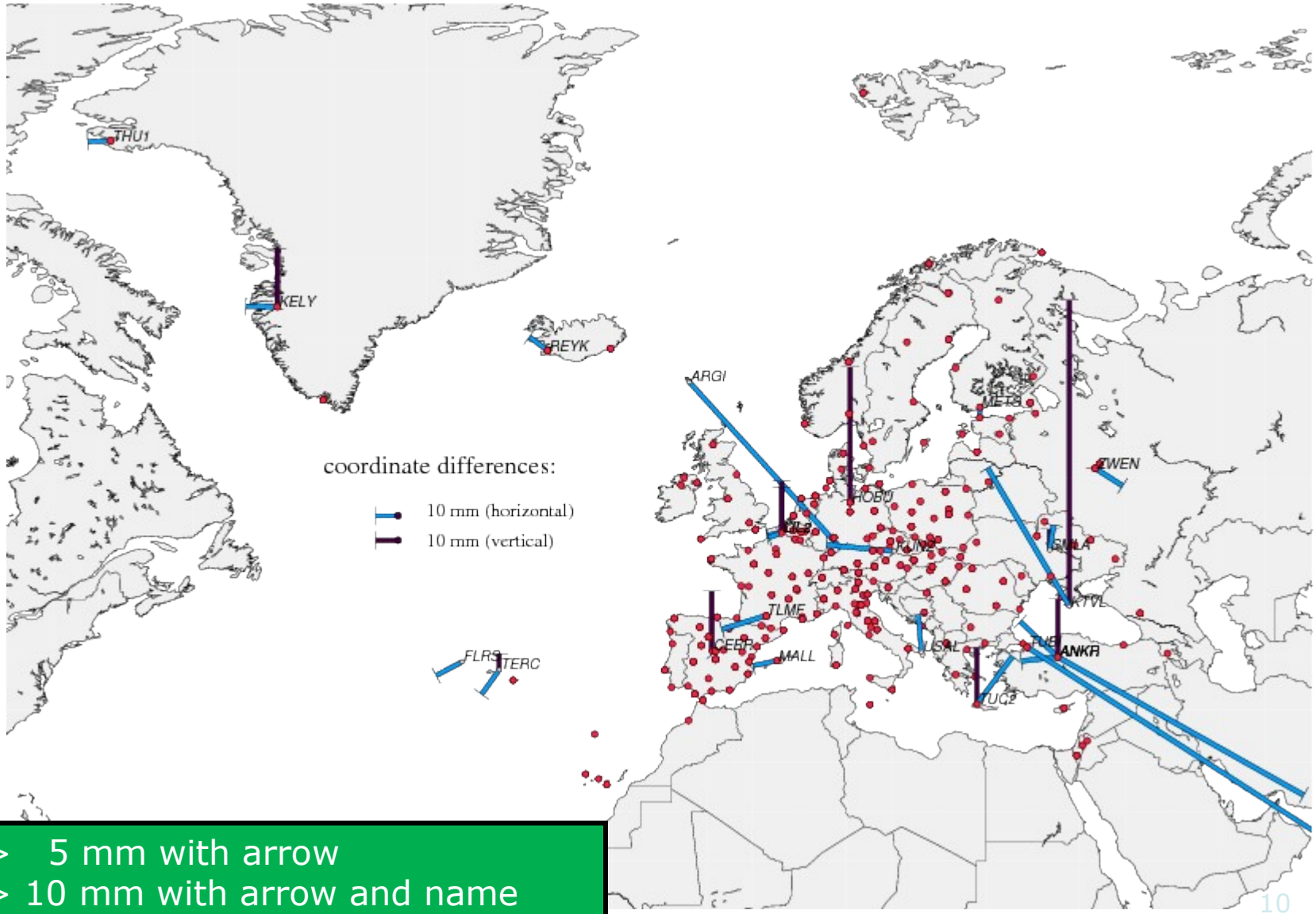
GOP Repro1+ (Coordinates)

GOP x EPN ITRF2008 densification (applying solution numbers)



> 5 mm with arrow
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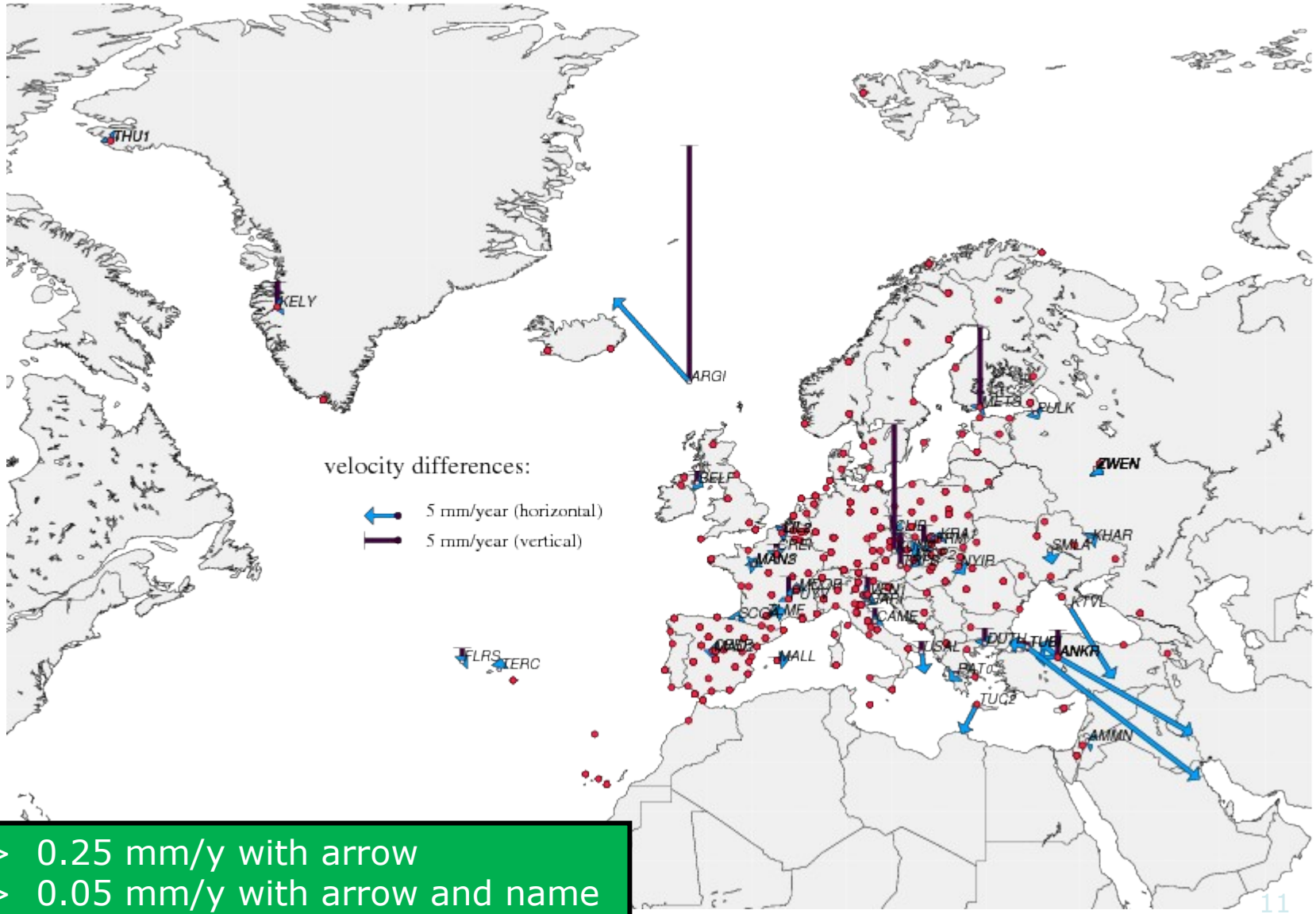
GOP Repro1+ (Velocities)

GOP x EPN ITRF2008 densification (applying solution numbers)



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GOP Repro1+ (velocities)

GOP vs. to EPN ITRF2008 densification

White: unknown problem !!!

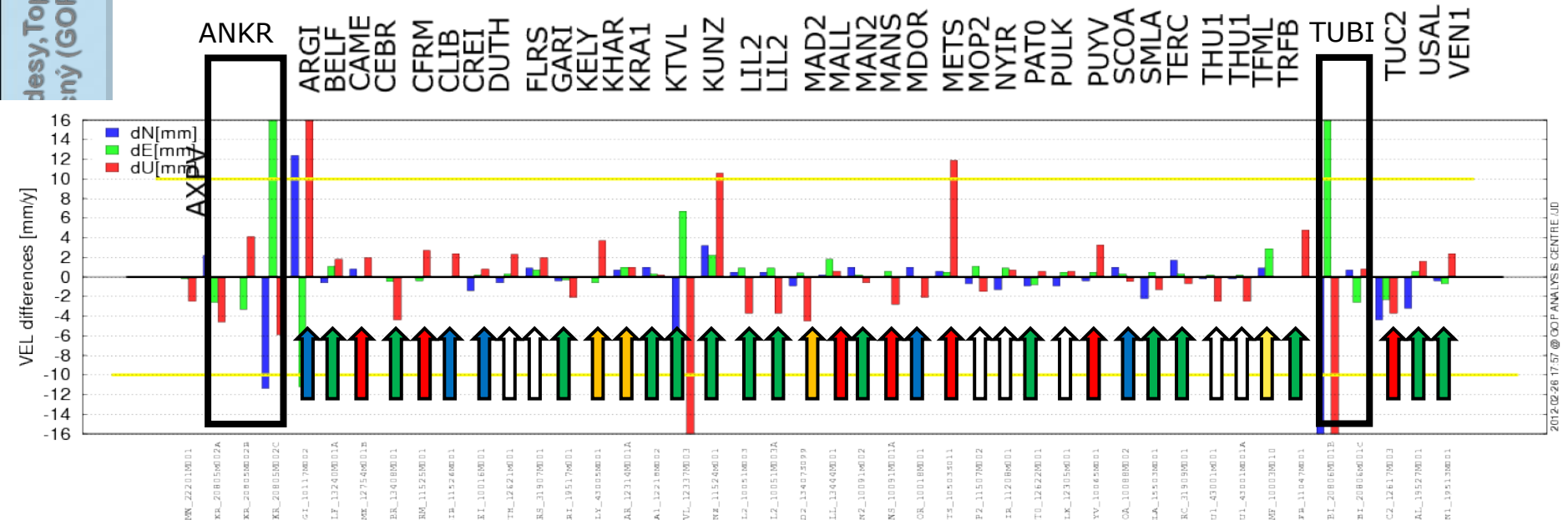
Red: different offsets estimated within discontinuities !!!

Yellow: significantly different data time-span !!!

Blue: different data time-span (and only 1 or 2 LACs contribution only) !!!

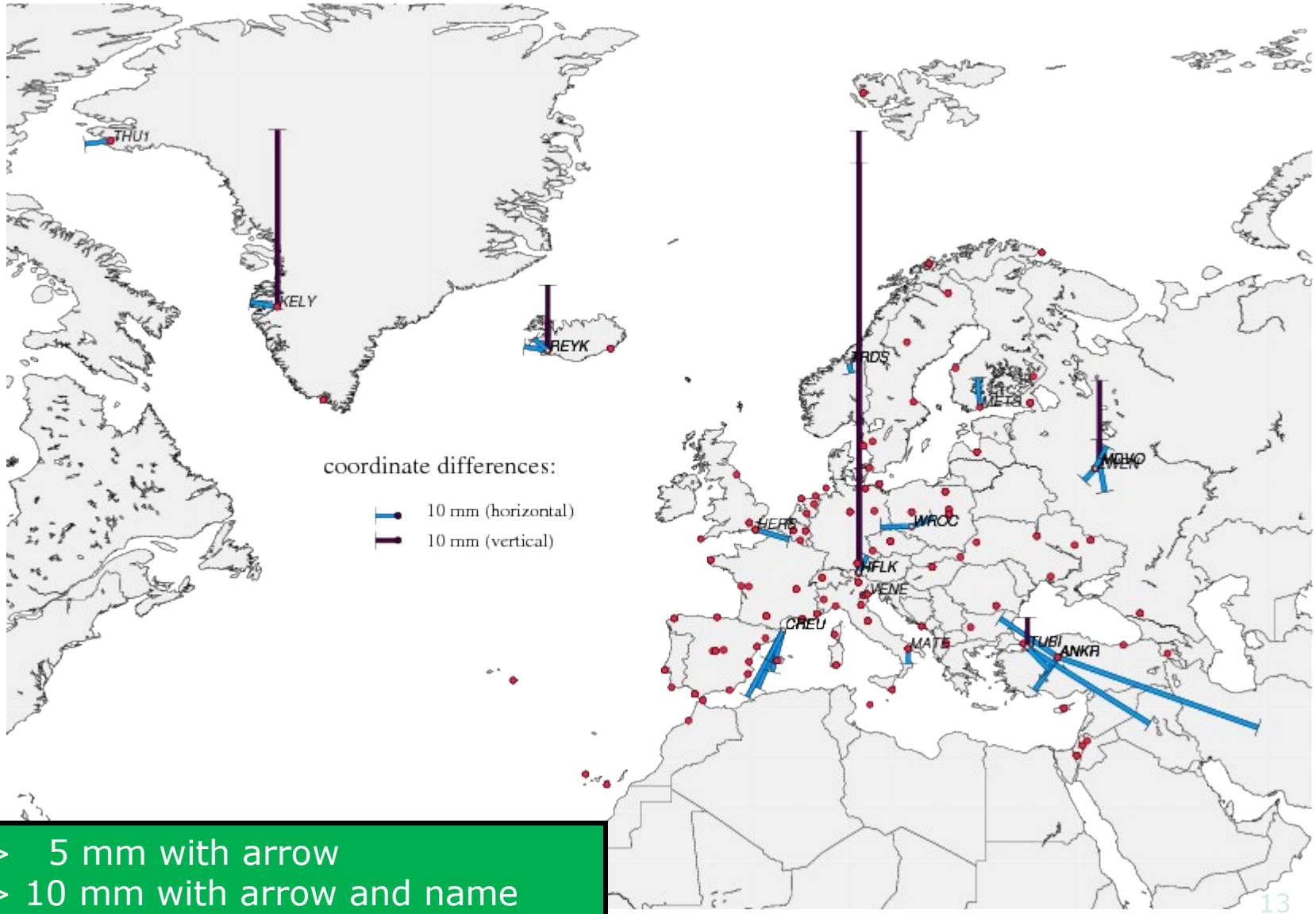
Green: very short data time-span (and slightly different)

Boxes: different discontinuities or relative constrain settings



GOP Repro1+ (Coordinates)

GOP x ITRF2008 solutions (applying solution numbers)



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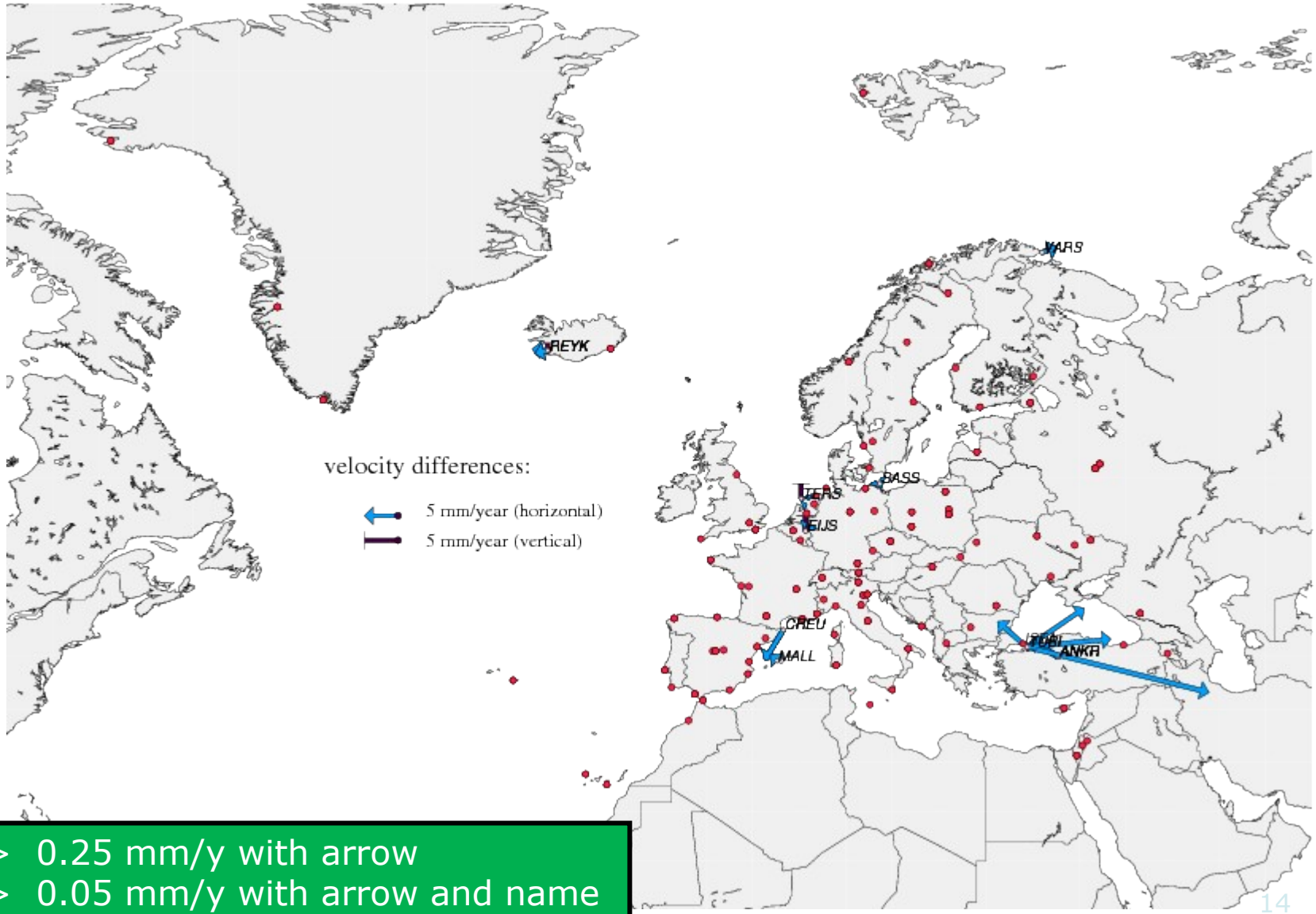
GOP Repro1+ (Velocities)

GOP x ITRF2008 solutions (applying solution numbers)



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> 0.05 mm/y with arrow and name

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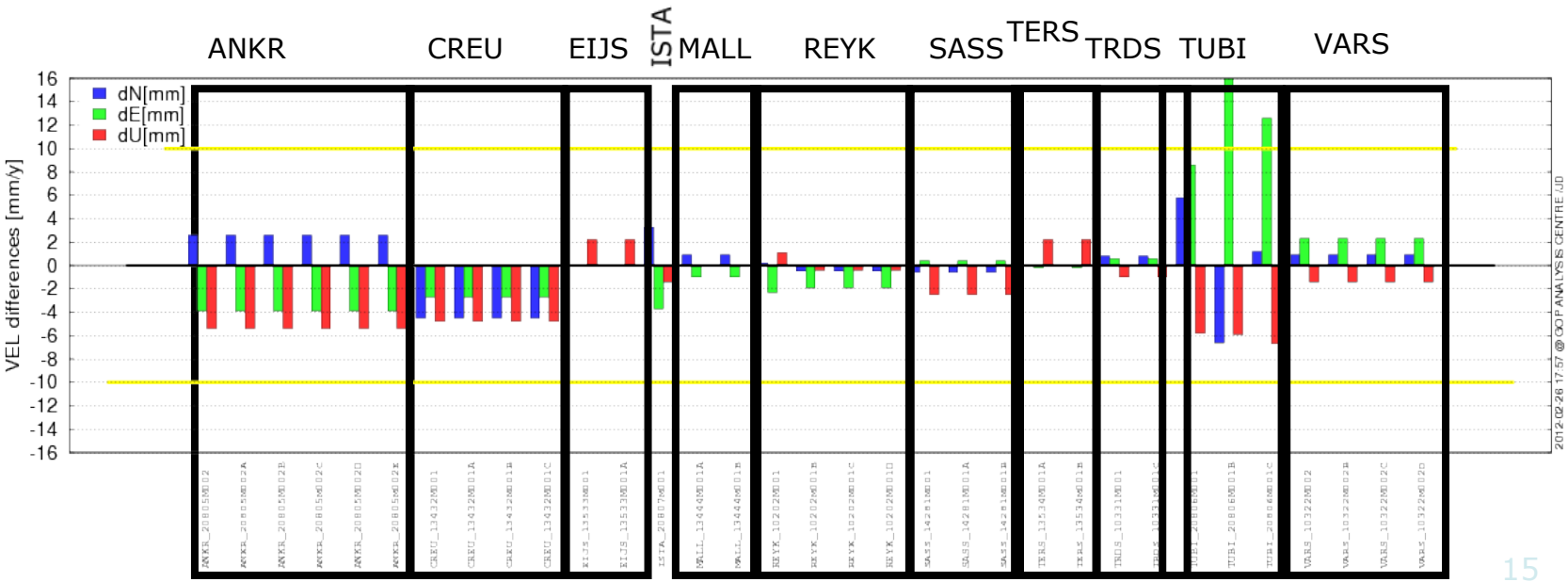
GOP Repro1+ (velocities)

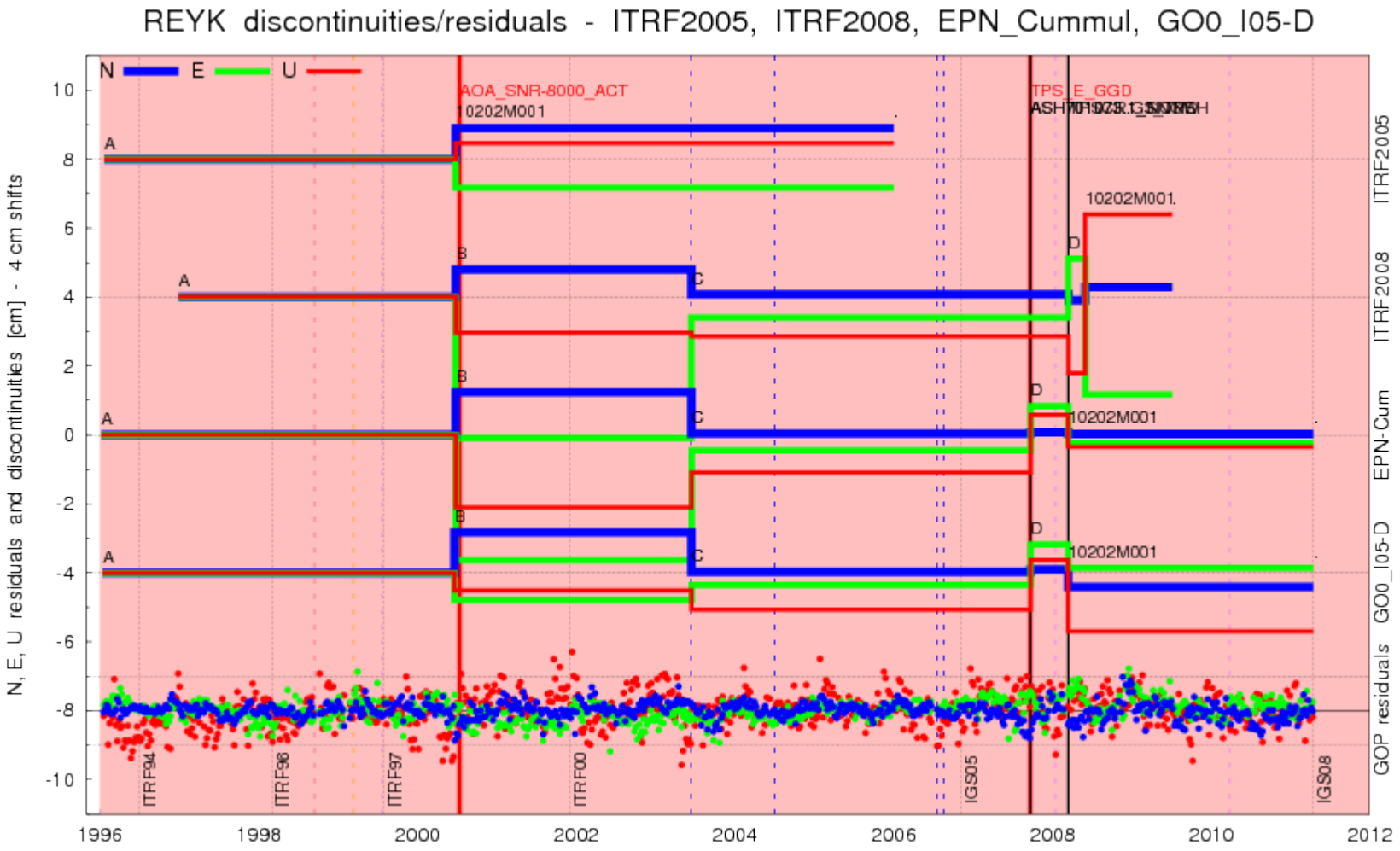
GOP vs. to EPN ITRF2008 densification

REYK, TUBI - different velocities solution numbers estimated
ANKR – different discontinuities
CREU – very short data span in ITRF2008, missing/different discontinuities
SAAS – short data span in ITRF2008, missing/different discontinuities
EIJS – very short data time-span in ITRF2008
ISTA – different discontinuity (GOP problem ?)
MALL – different discontinuities and short data time span in ITRF2008
VARS – different offsets in discontinuities
TRDS – different discontinuity and offsets btw. solution numbers
TESR – very short data time span



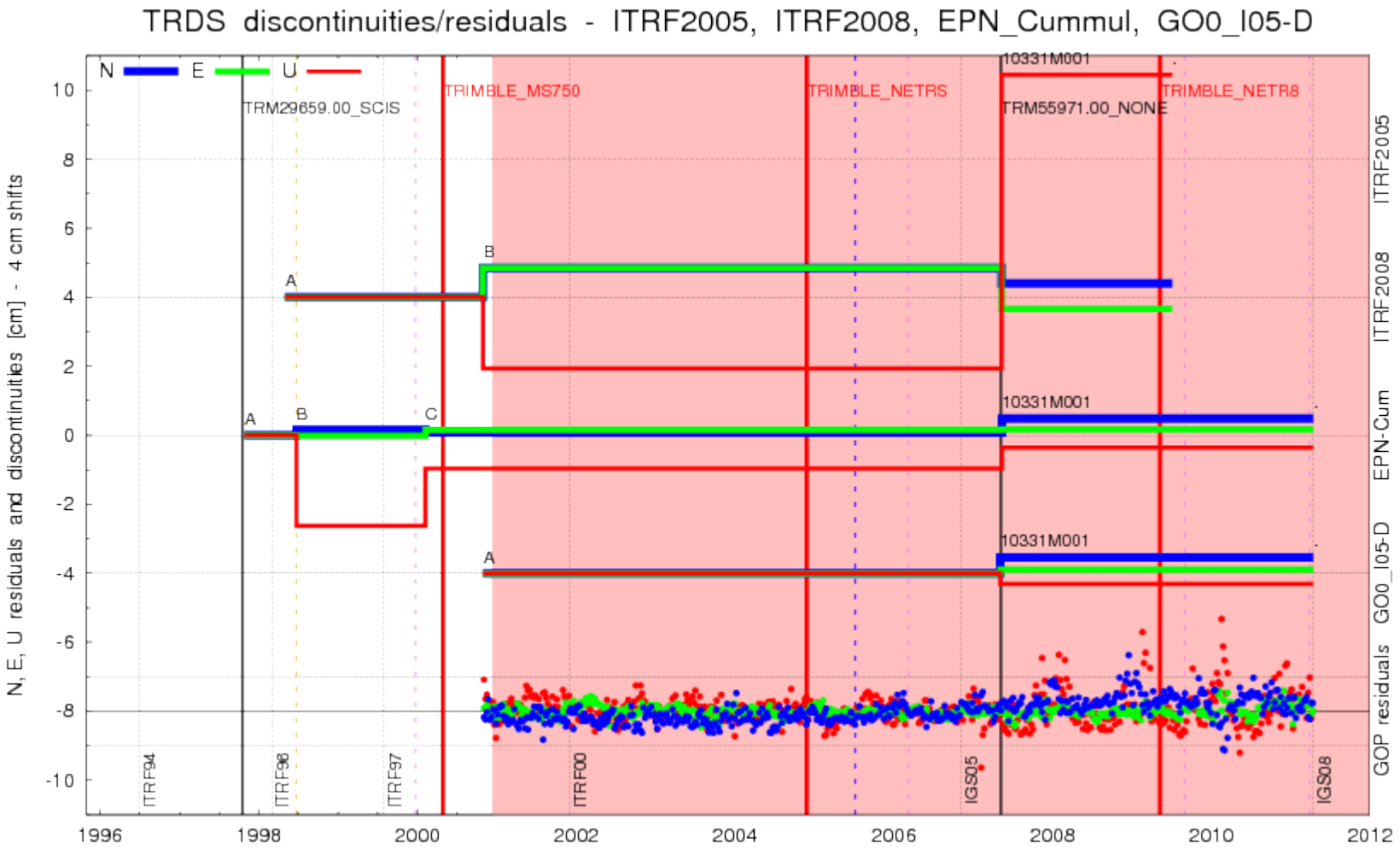
Discontinuities and residuals

Not new VEL in 2008:150 ??, different discontinuity setting for EPNC/ITRF



Discontinuities and residuals

TRDS very different from EPNC/GOP Repro1+, bu also ITRF2008 !!



Assessment of individual Repro1 contributions

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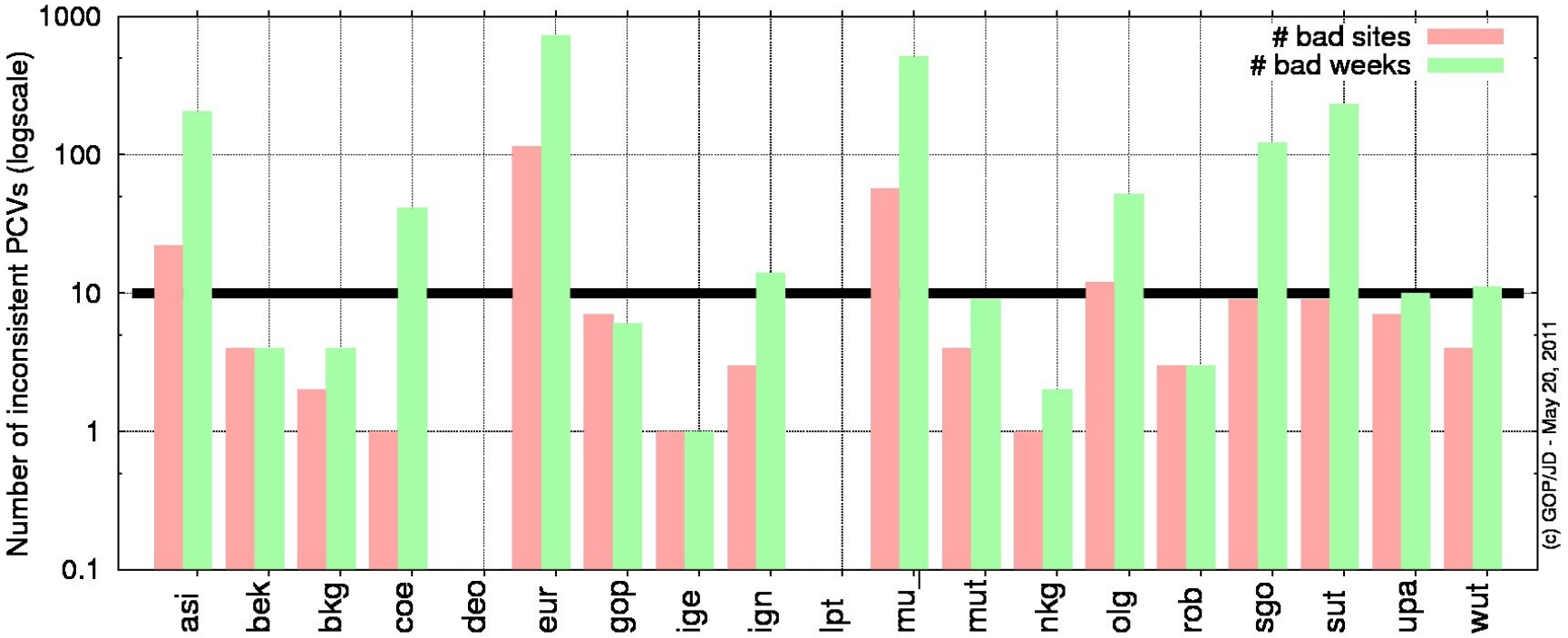
Checking individual SINEX information

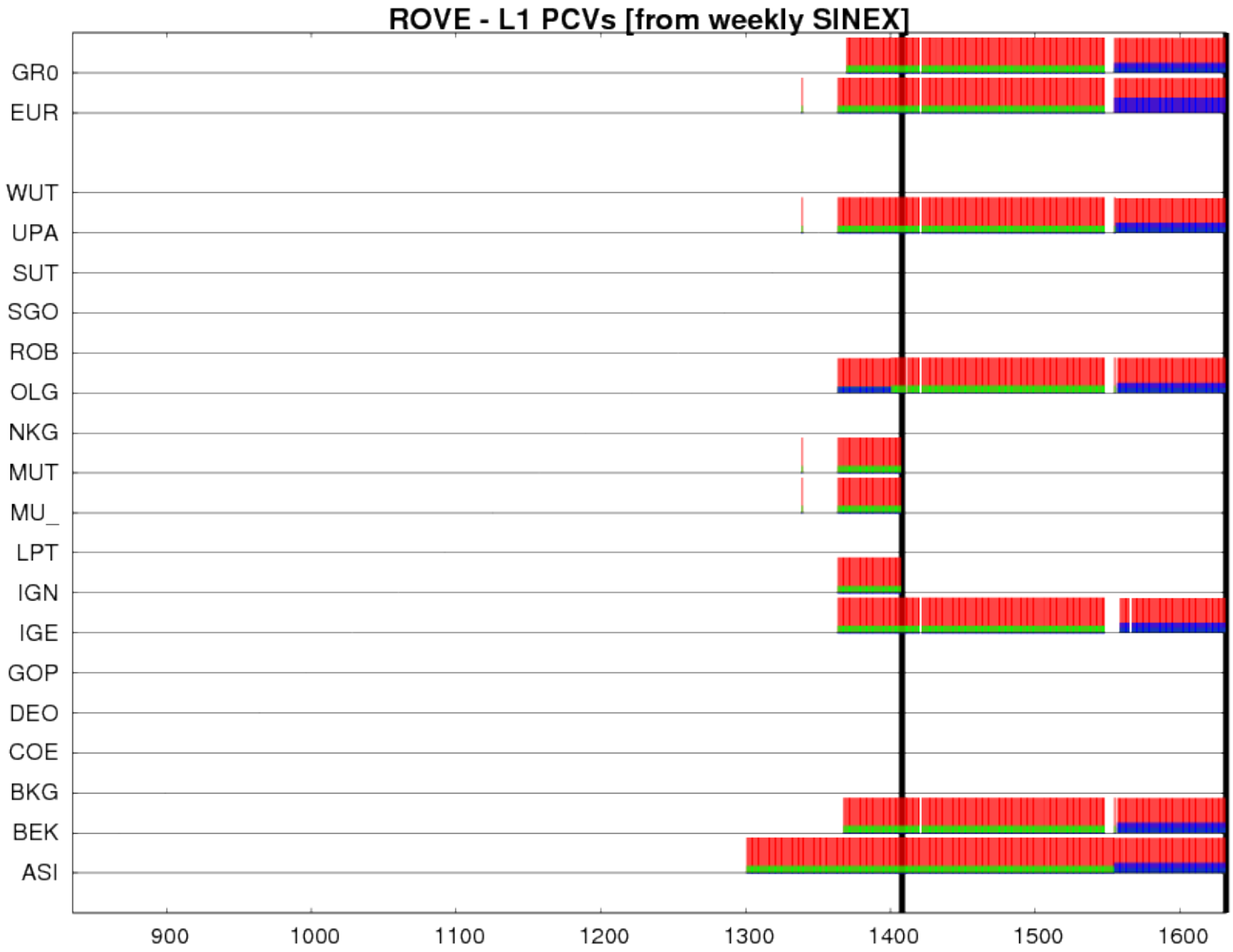
- Extracting weekly individual SNX contributions (and EUR combined)
- Identifying individual solution problem (considered as bad values)
- Figures for L1, L2 PCO and monumentation eccentricities
- Figures show various other information (LACs contribution, data-spans ...)
- http://www.pecny.cz/WWW_IMG/EPN-REPRO1_IMG/ (images)

Bellow is a summary of identifications 'bad' PCV values in LACs' contributions



Checking individual SINEX information

- http://www.pecny.cz/WWW_IMG/EPN-REPRO1_IMG/ (images)



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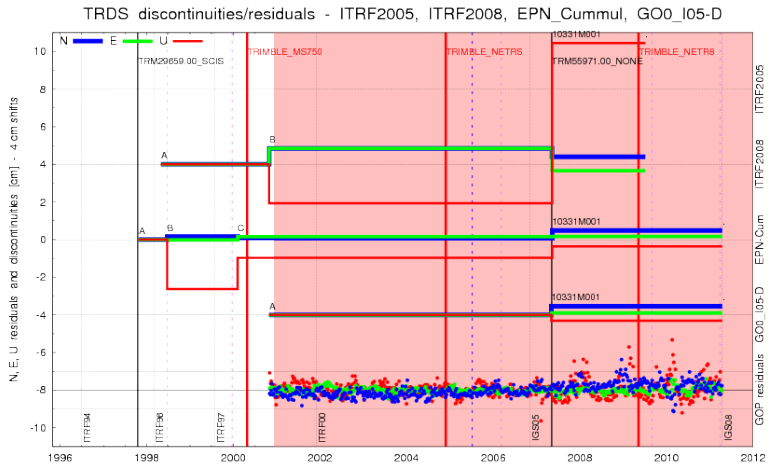
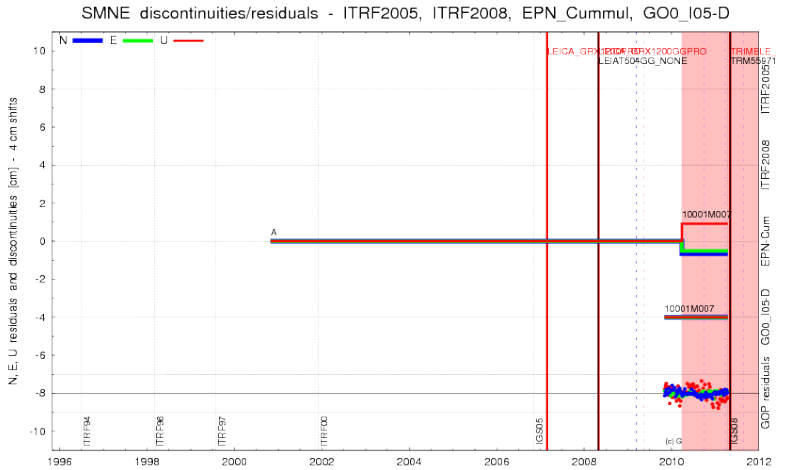
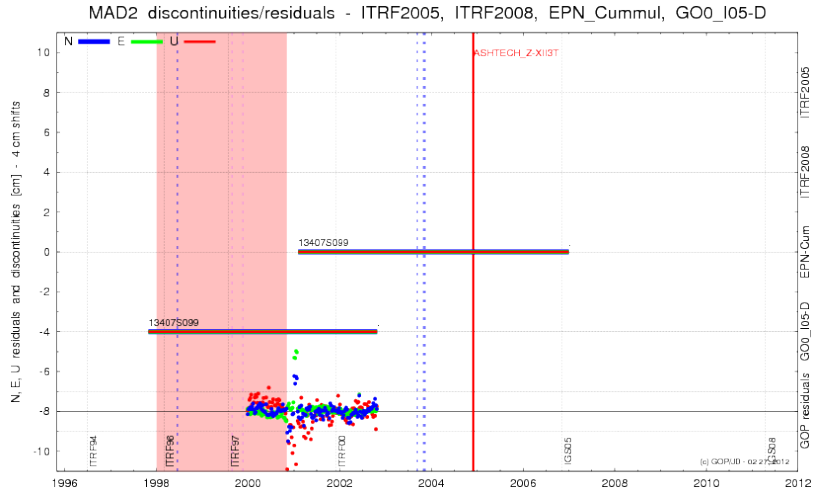
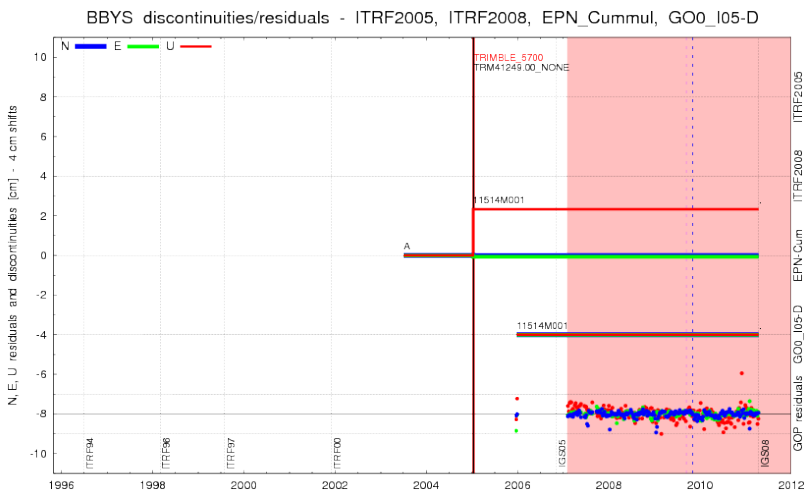
Different periods in EPN inclusion & DB

AXPV, BBYS, BADH, BSCN, CAEN, CEUT, COBA, CREI, EGLT, EVPA, GUIP, KHAR, KUNZ, LILL, M0SE, MAD2, MAN2, MDOR, MILO, MOPS, NEWL, OSLS, ROVE, SAAS, SCOA, SMNE, STAS, SUUR, TERC, TLFM, TRDS, TRFB, TROM, TUBI, UPAD, VARS, VCHM, VLNS, WARN, ZOUF,… (some really small)?









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Checking station historical data quality

- From GOP Repro1+ combination we identified additional data problems:
  - ACOR, ANKR, BOGI, BYDG, CPAR, DRAG, GRAZ, GWWL, LROC, KIRU, MADR, MDVO, OBER, REDZ, SFER, SNEC, SWKI, TOIL, TRO1, USDL, VLNS
- --> Checking content of data (two phase and code measurements)
- Could be automatically handled in daily processing, however, e.g. KIRU has a full daily data, but only 2 satellites collected during most of the day …
- Thus in GOP mirrored historical archive we remove data (added extensions) and recomputed daily solution due to affecting the combination

```
Sum: 2001-10-27 00:00:00 - 2001-10-27 23:59:30  Tot: 2880  Ok: 2879  Mis:    0  Bad:    0   Sat: 28  GPS: 28  GLO:  0  GAL:  0
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Sum: 2001-10-30 00:00:00 - 2001-10-30 23:59:30  Tot: 2880  Ok: 2879  Mis:    0  Bad:    0   Sat: 28  GPS: 28  GLO:  0  GAL:  0
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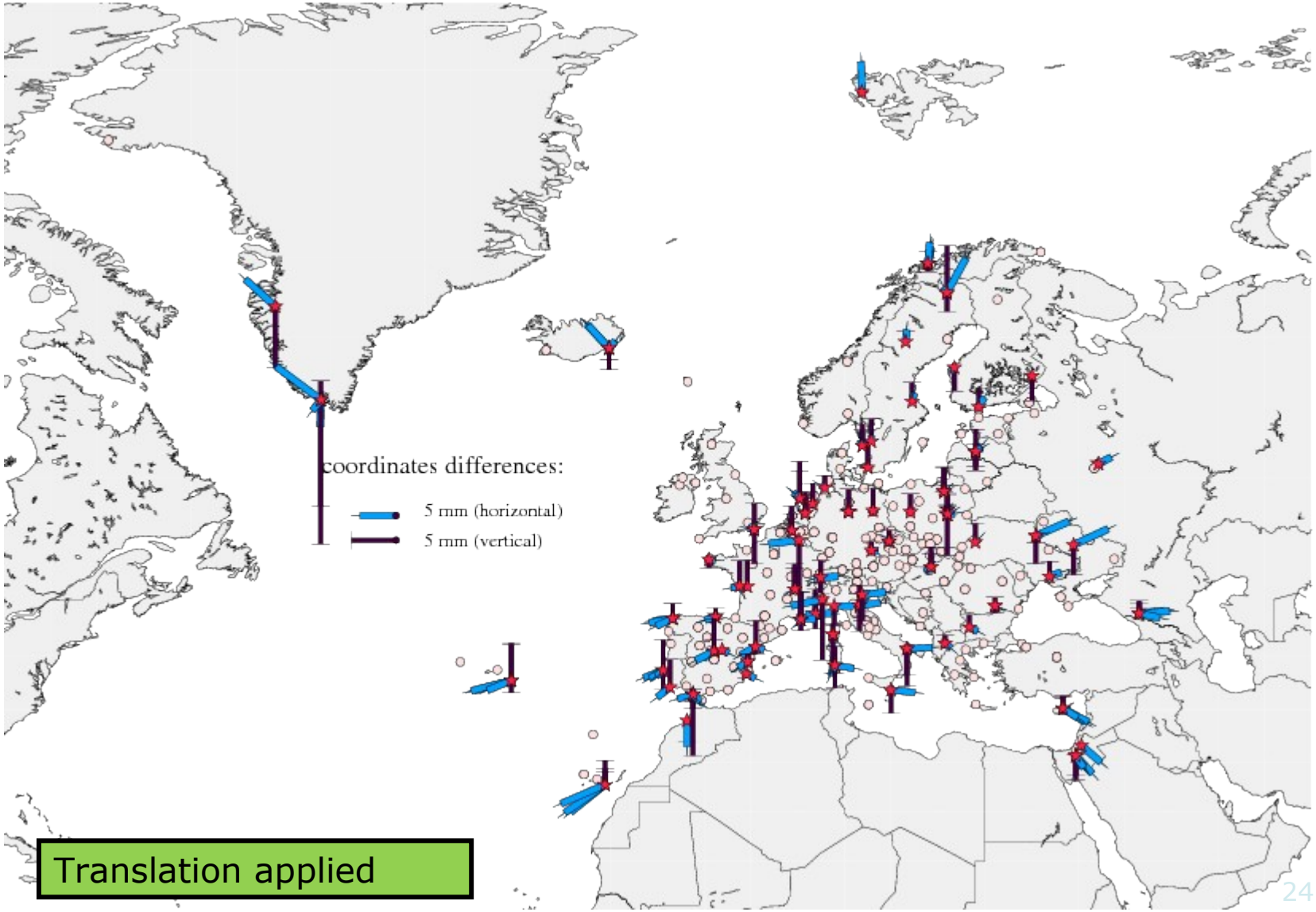
GOP Repro 1+

IGS05 vs. IGS08

GOP Repro1+ I05 x I08 (combination)

Helmert residuals btw GOP IGS05 and IGS08 models (0836-1631), 2005.0



Translation applied

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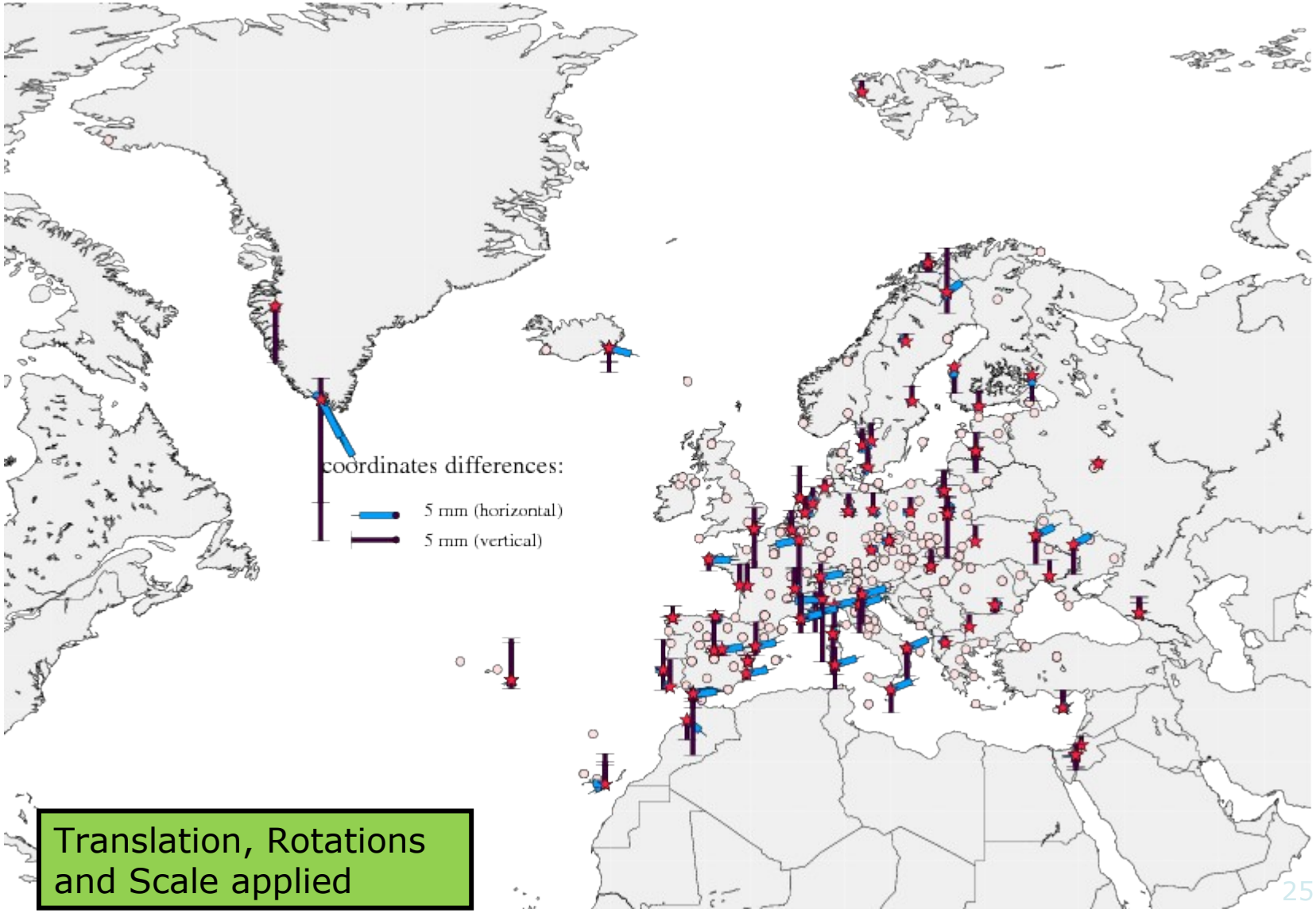
GOP Repro1+ I05 x I08 (combination)

Helmert residuals btw GOP IGS05 and IGS08 models (0836-1631), 2005.0



Translation, Rotations and Scale applied

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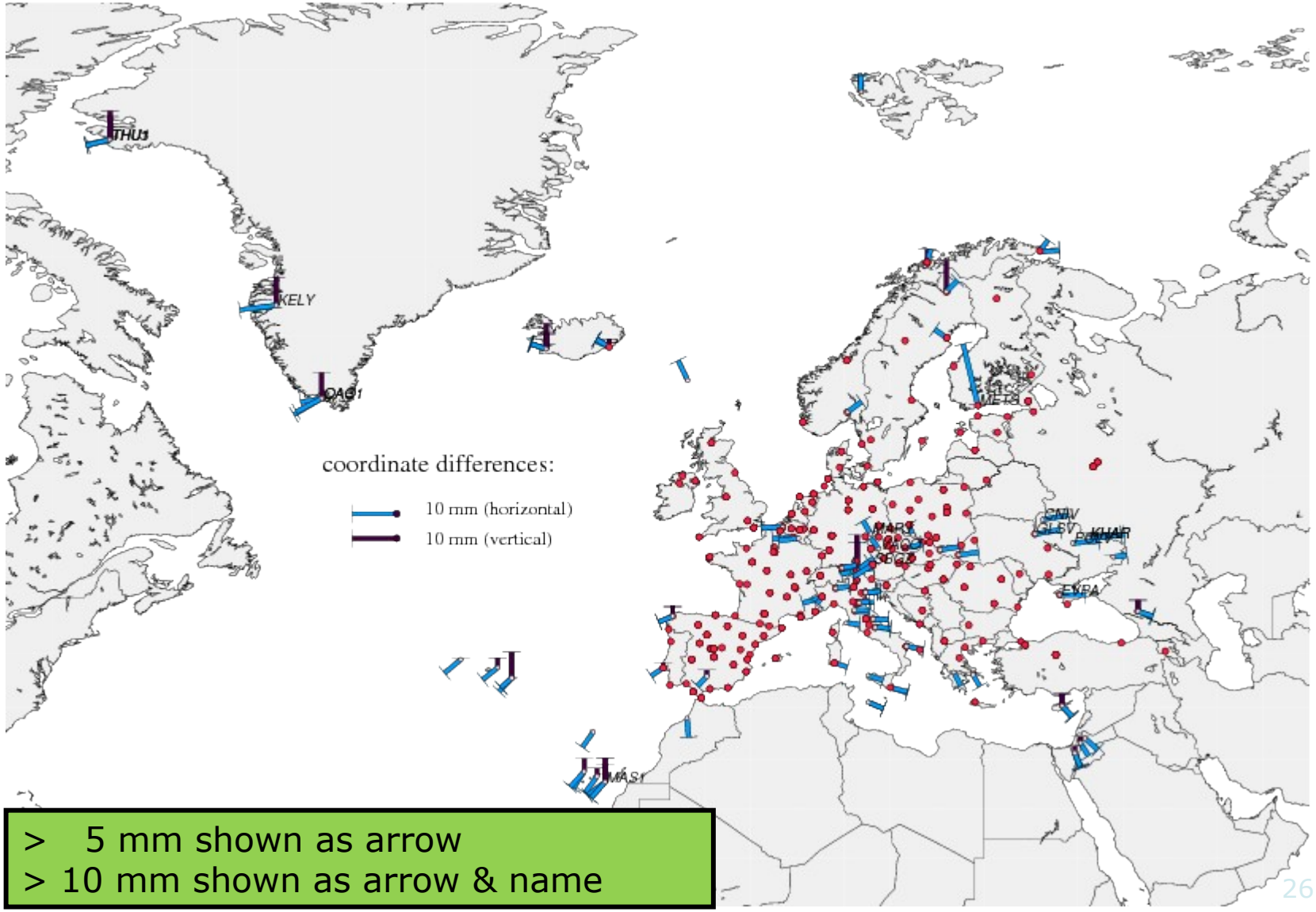
GOP Repro1+ I05 x I08 (combination)

Coordinates differences of GOP IGS05 x IGS08 models (0836-1631) 2005.0



> 5 mm shown as arrow
> 10 mm shown as arrow & name

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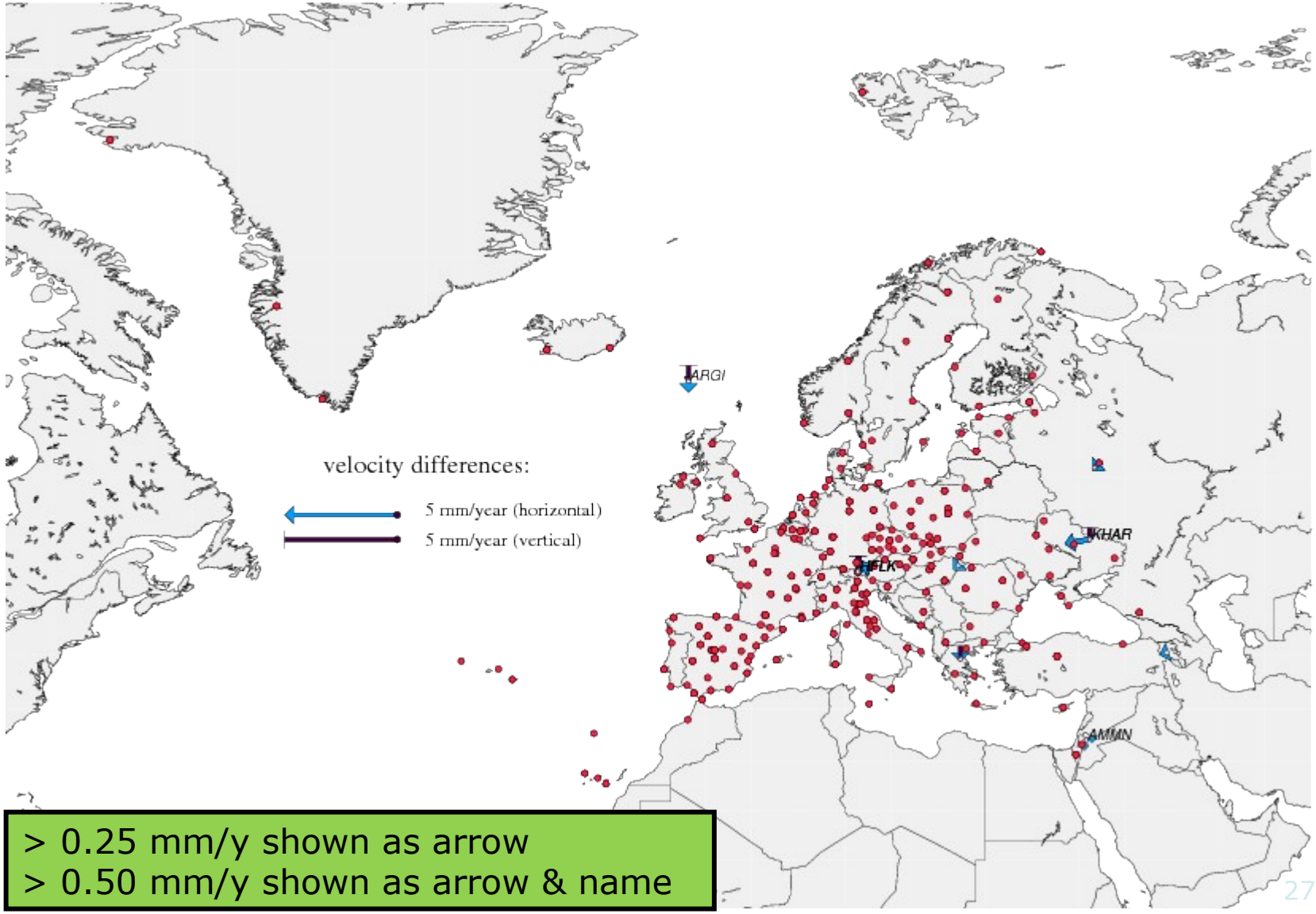
GOP Repro1+ I05 x I08 (combination)

Velocities differences of GOP IGS05 and IGS08 models (0836-1631)



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> 0.50 mm/y shown as arrow & name

GOP repro1+

Summary and suggestions for future Repro

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GOP Repro1+ - comparison summary

roblem with datasets identified (in various solutions)

ITRF2008 – total 38 stations with shorten periods (9 significantly)

ITRF2008 densification – 22 stations with shorten periods (3 significantly)

- a few stations missing in solution (former EPN stations)
- some data gaps not well handled and shifted discontinuity definitions

GOP Repro1+ - 35 stations with shorten periods (20 significantly)

- missing in ROB historical archive, which was mirrored to GOP data centre
- some stations additional to ETRF2008 solution (usually former stations)
- some data gaps due to missing or excluded data (some different from ETRF2008)

roblems with individual LACs contributions identified

- Various data time-span applied (sometimes single solution contribution)
- Various PCO+PCV models applied

roblems with weekly combination identified

- Incorrect PCV information (even in routine solutions)

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Suggestions for Repro2 based on Repro1

- **Repro2 should be controlled for PCV, EPN station time-span, …**
  - Strictly follow EPN station validity interval (see recommended revision)!
  - Common PCV and control in SINEX while generating weekly combination ?
  - Contribution of smaller number of well interest AC's giving a full EPN reprocessing?
  - Promote and solve inclusion of other software (Bernese, GAMIT, NAPEOS, GIPSY) ?
  - Avoid combination of reprocessing + routine solutions ?

- **EPN station interval validity review**
  - Accessible official table in ASCII format (already existing ☺ at EPNCB)
  - Add stations with longer period with good quality data ?
  - Remove stations with a very few historical data ?
  - If longer interval and bad data quality , temporarily remove ?

…

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