



Universal Time from VLBI Single Baseline Observations during CONT08

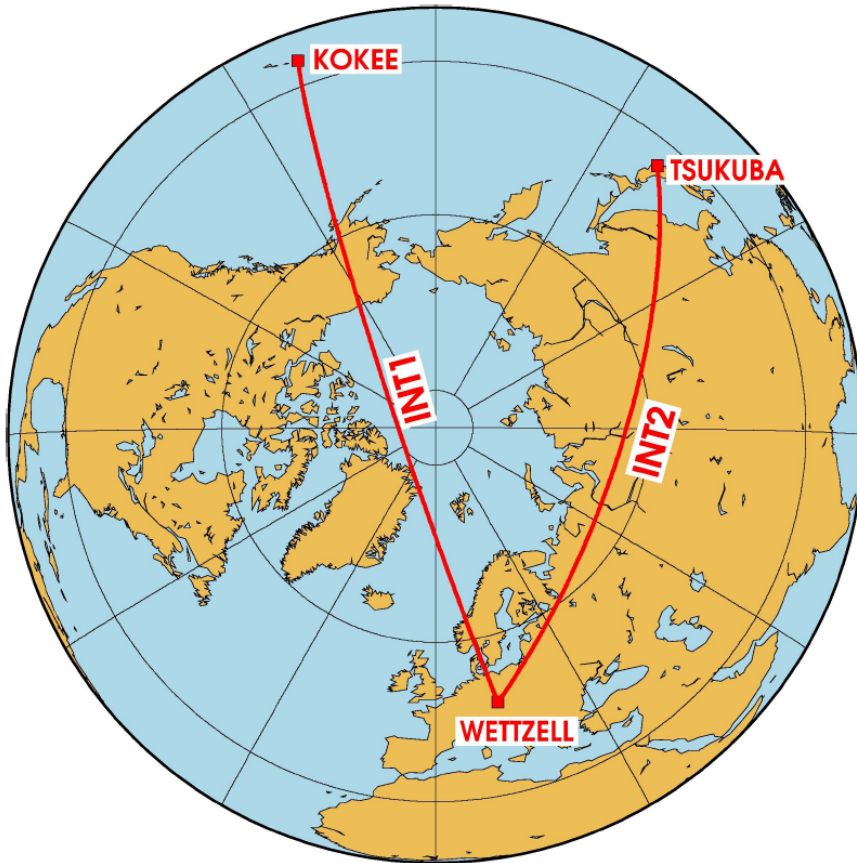
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6th IVS General Meeting, 7-13 Feb 2010, Hobart, Australia

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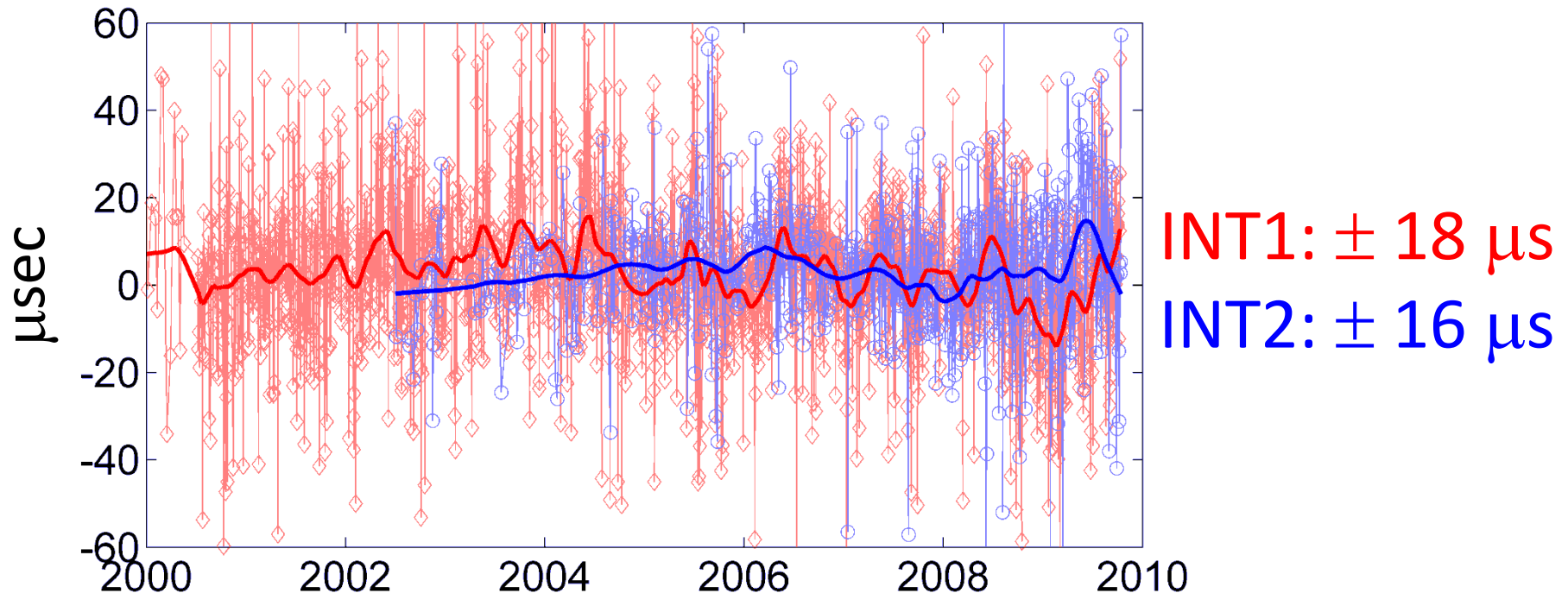
- Motivation
- Analysis options for VLBI Intensives
- Single baseline UT1 estimates during CONT08
- Outlook and conclusions

VLBI Intensive Sessions



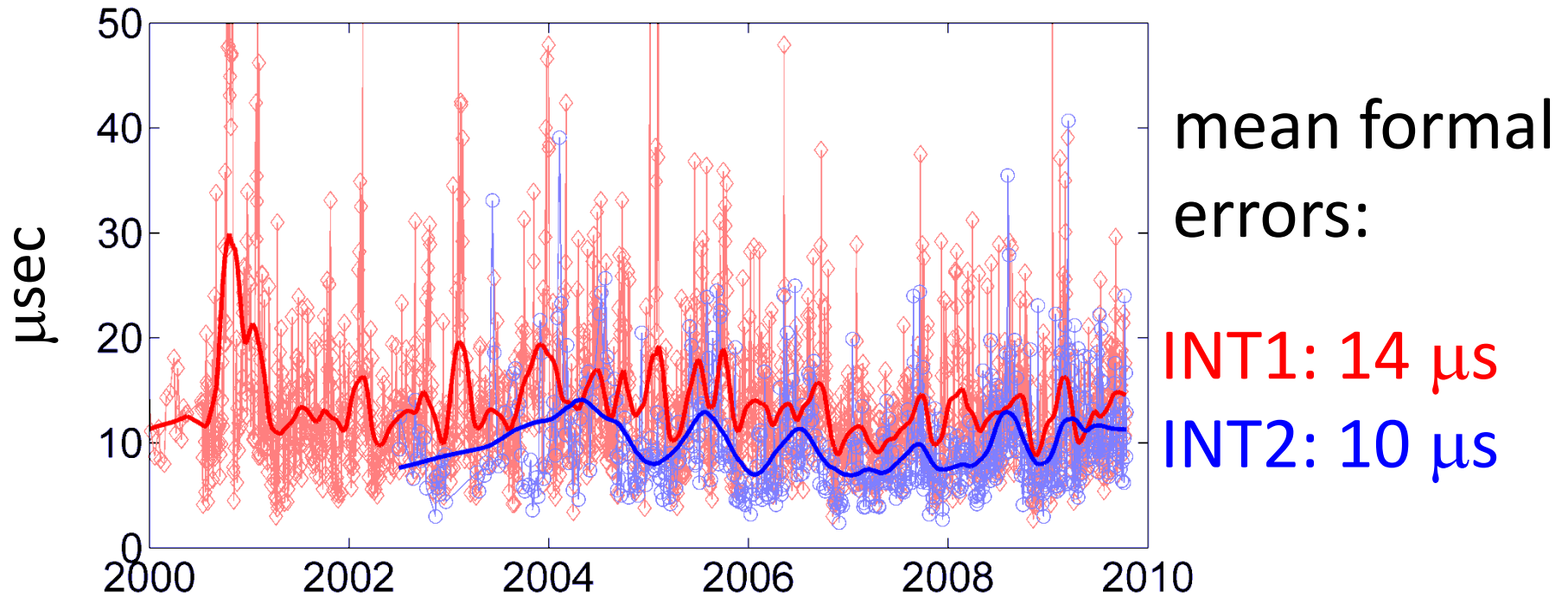
- INT1: (1 hour)
 - Kokee - Wettzell
 - Mo-Fr, 18:30
- INT2: (1 hour)
 - Tsukuba - Wettzell
 - Sa-So, 7:30
- INT3: (1 hour)
 - Tsukuba - Wettzell -
Ny Alesund, Mo, 7:00
 - since 2007

GSFC #23 Intensives vs. IERS 05 C04

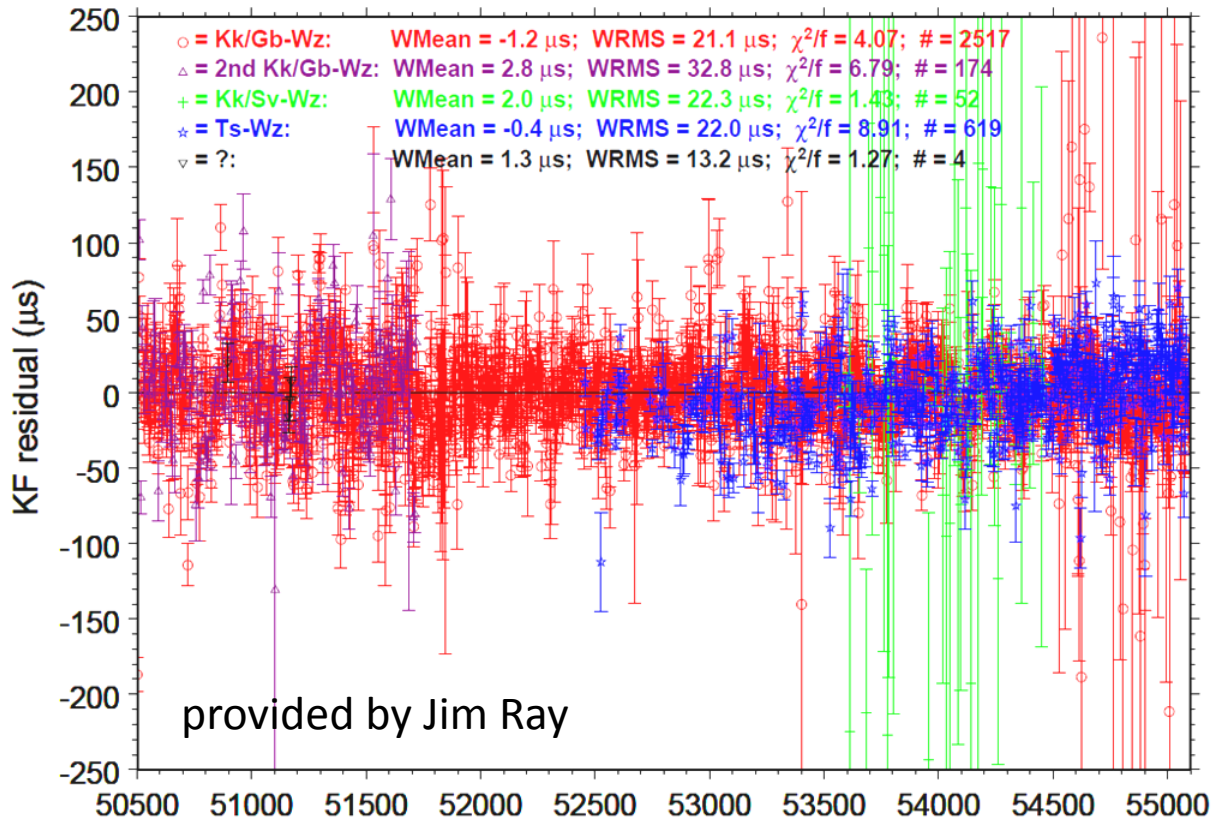


- **bold** lines are 60 days averages
- IERS 05 C04 includes information from Intensives

GSFC #23 Intensives formal errors



GSFC #23 Intensives vs. Kalman Filter



INT1: $\pm 21 \mu\text{s}$

INT2: $\pm 22 \mu\text{s}$

- Filter does not include information from Intensives

Consequences

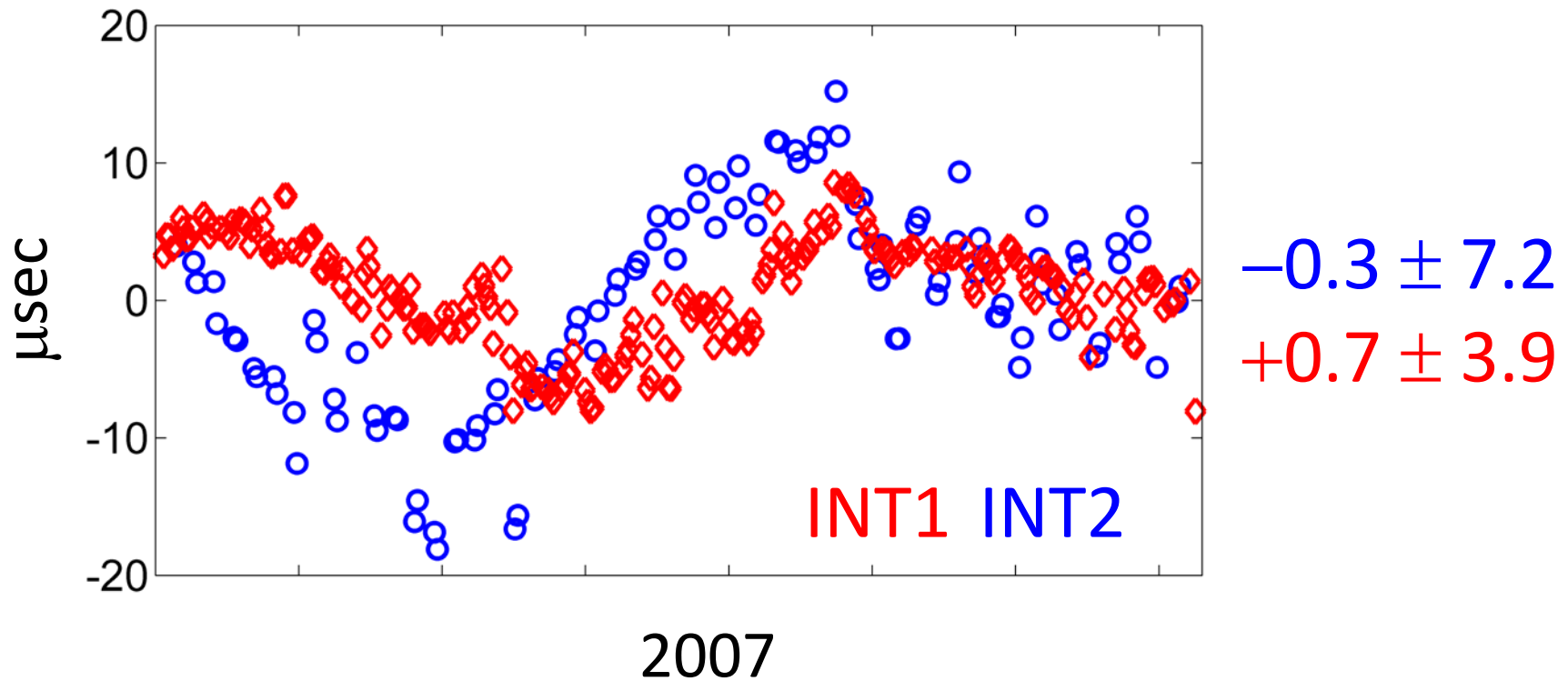
- Formal uncertainties are too optimistic by a factor of about 1.5 to 2.
- Investigation of the possible error sources and possible improvements.
- Step 1: Test effect of different analysis options
 - all INT1 and INT2 sessions in 2007

VLBI State-of-the-art solution

- Vienna VLBI Software VieVS
- 5 unknowns (clock offset + rate, 2 ZWDs, UT1)
- ITRF2005 and ICRF2
- EOP: IAU2000 + IERS 05 C04
- IERS 2003 high-frequency model (Eanes)
- No gradients, neither a priori nor estimated
- no down-weighting

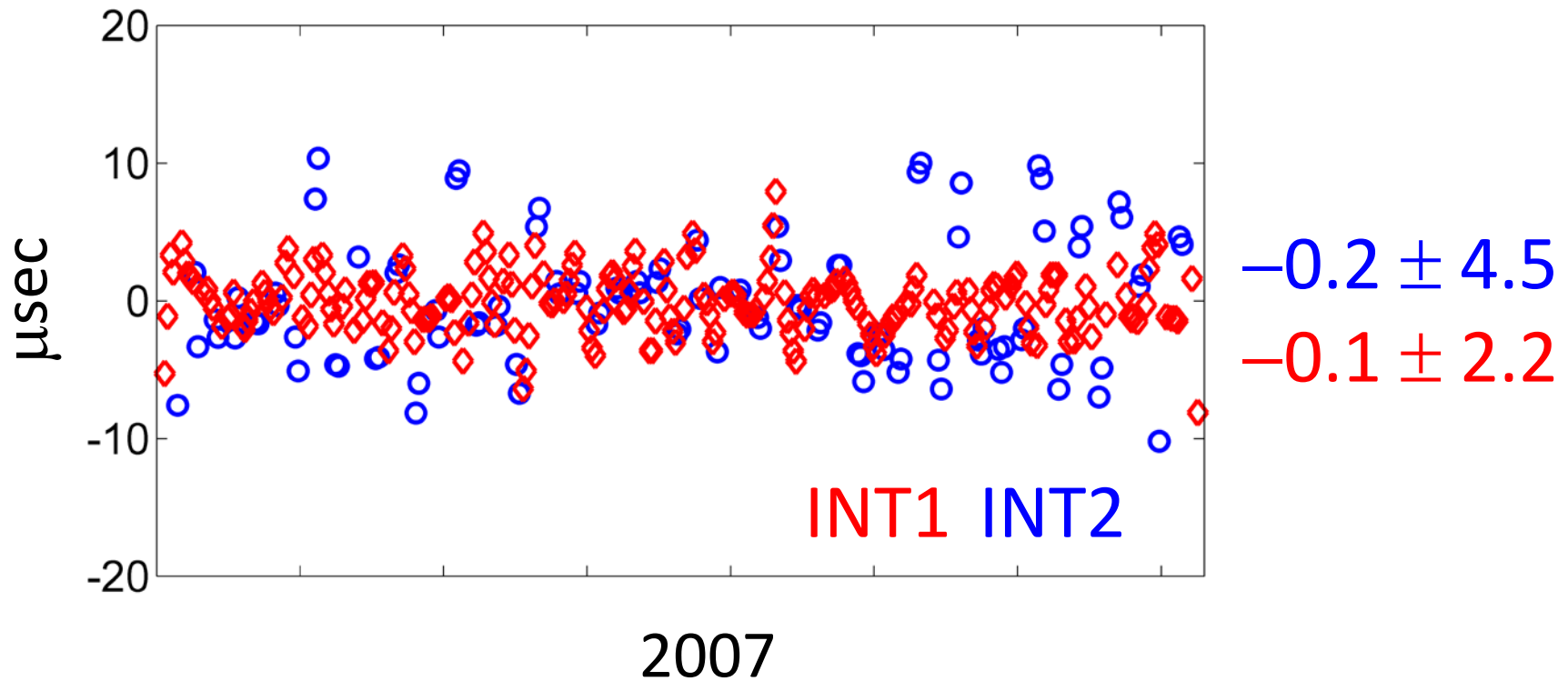
Nutation:

IAU2000A \leftrightarrow IAU2000A + IERS05C04

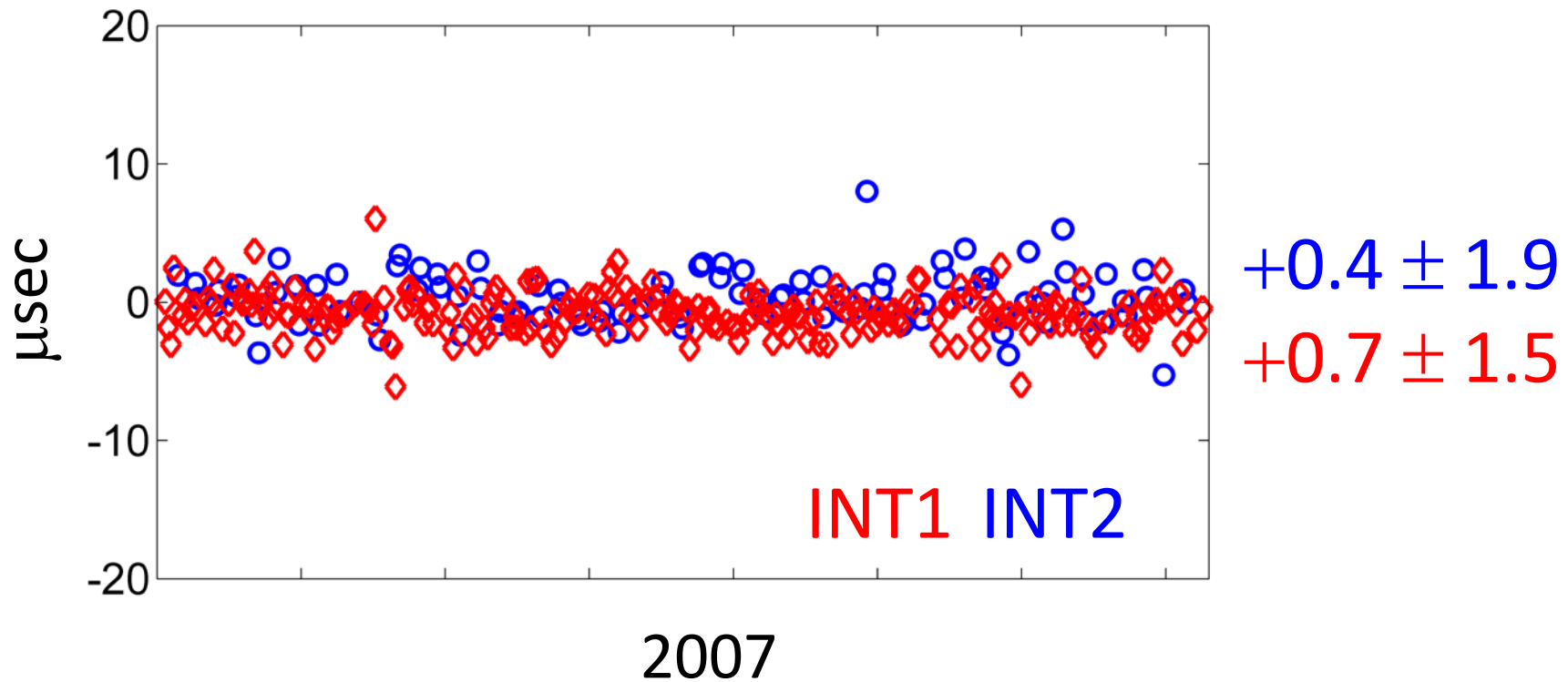


Nutation:

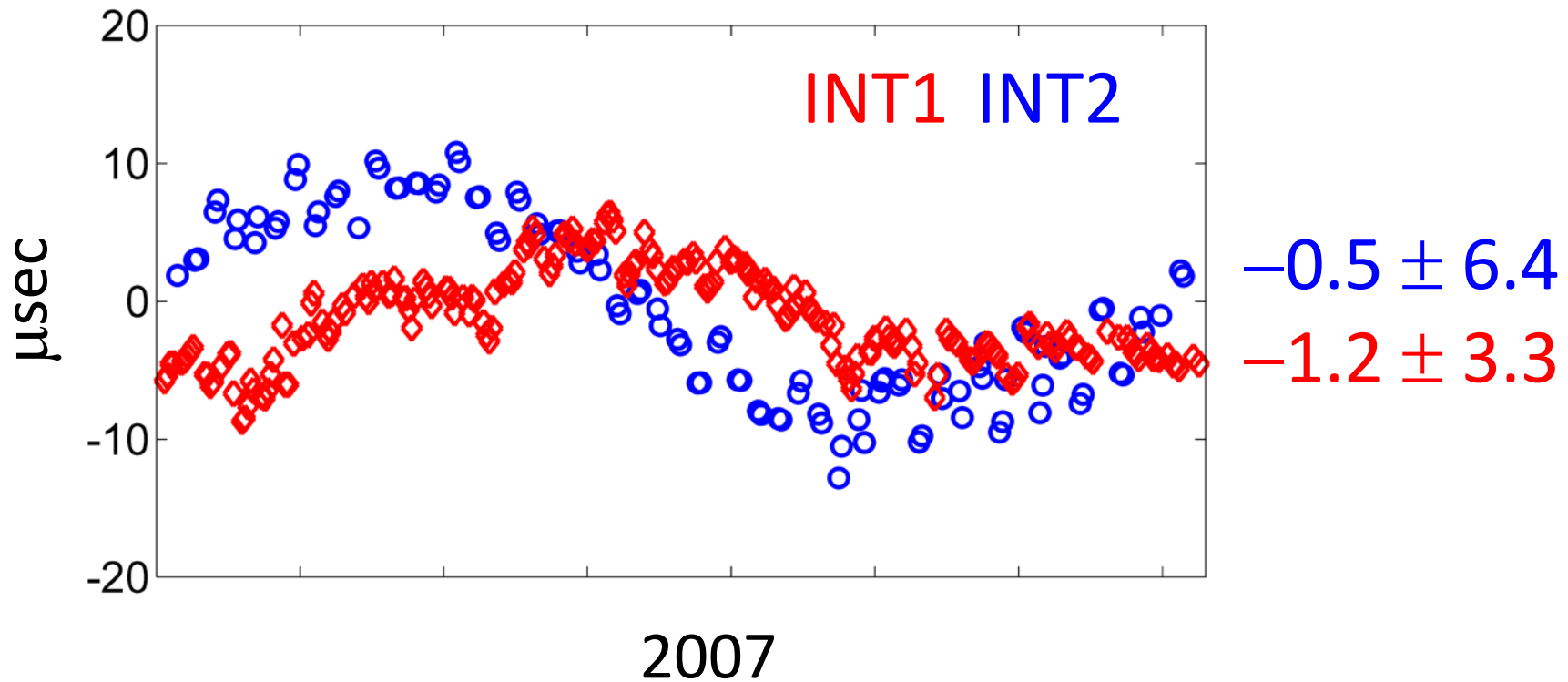
1-week-old IERS05C04 \leftrightarrow IERS05C04



Polar motion: IGS Ultra Rapid \leftrightarrow IERS05C04

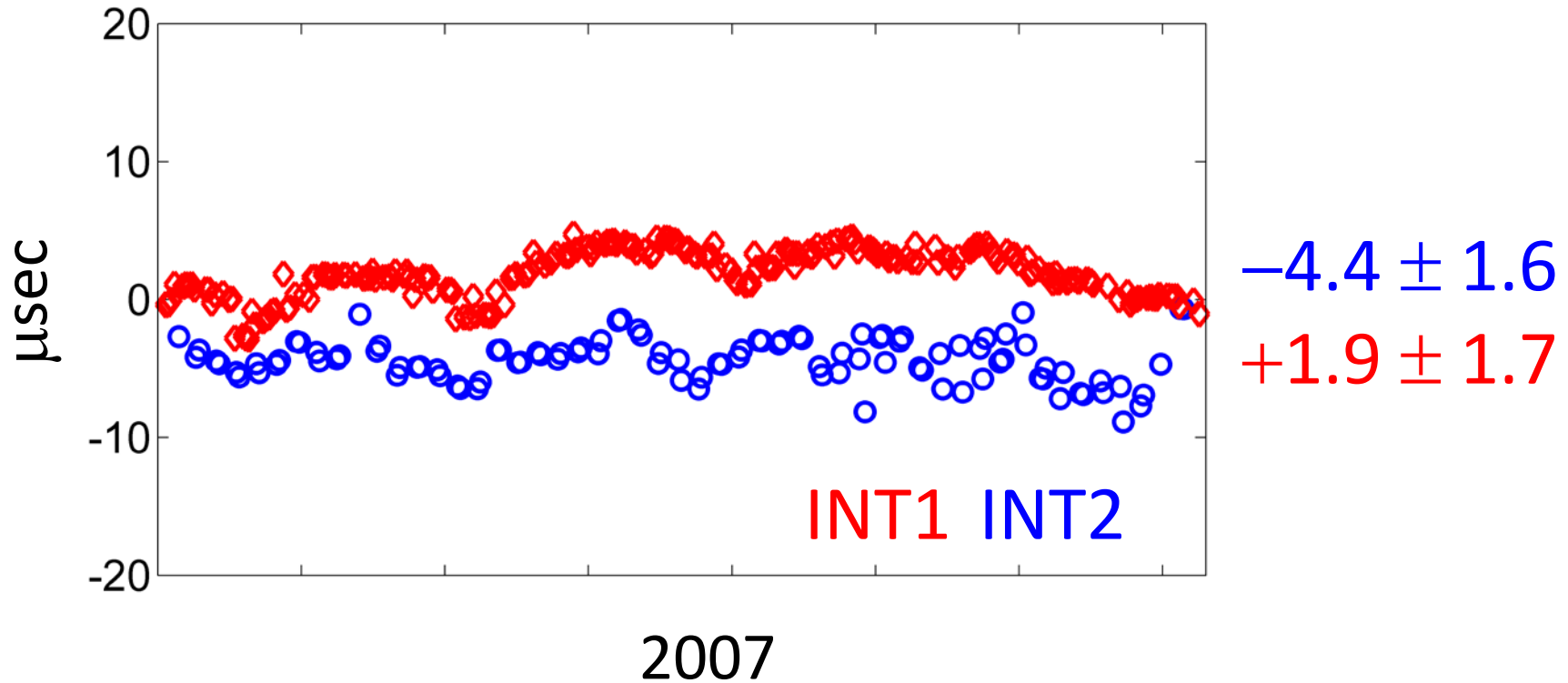


High-frequency polar motion: IERS2003 \leftrightarrow Empirical model*

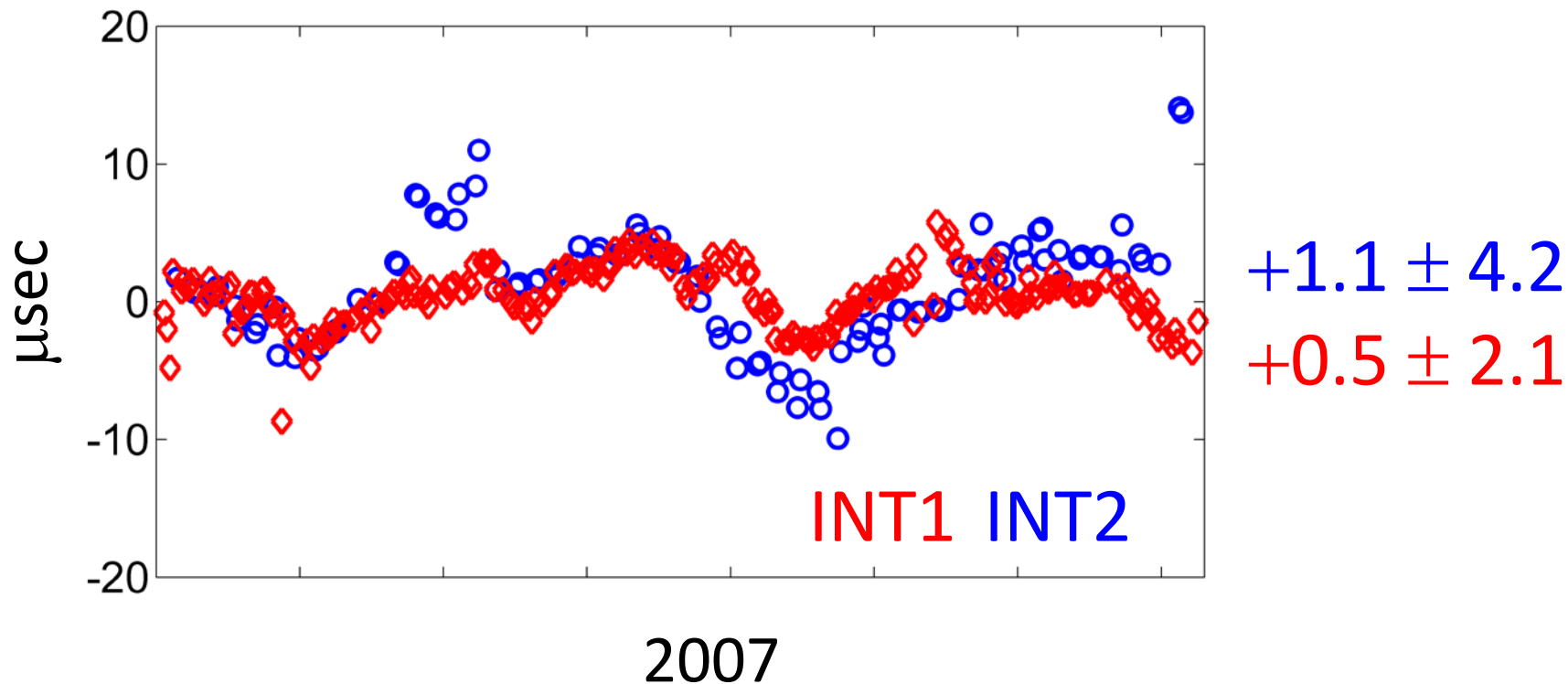


* Sigrid Böhm (IVS GM 2008)

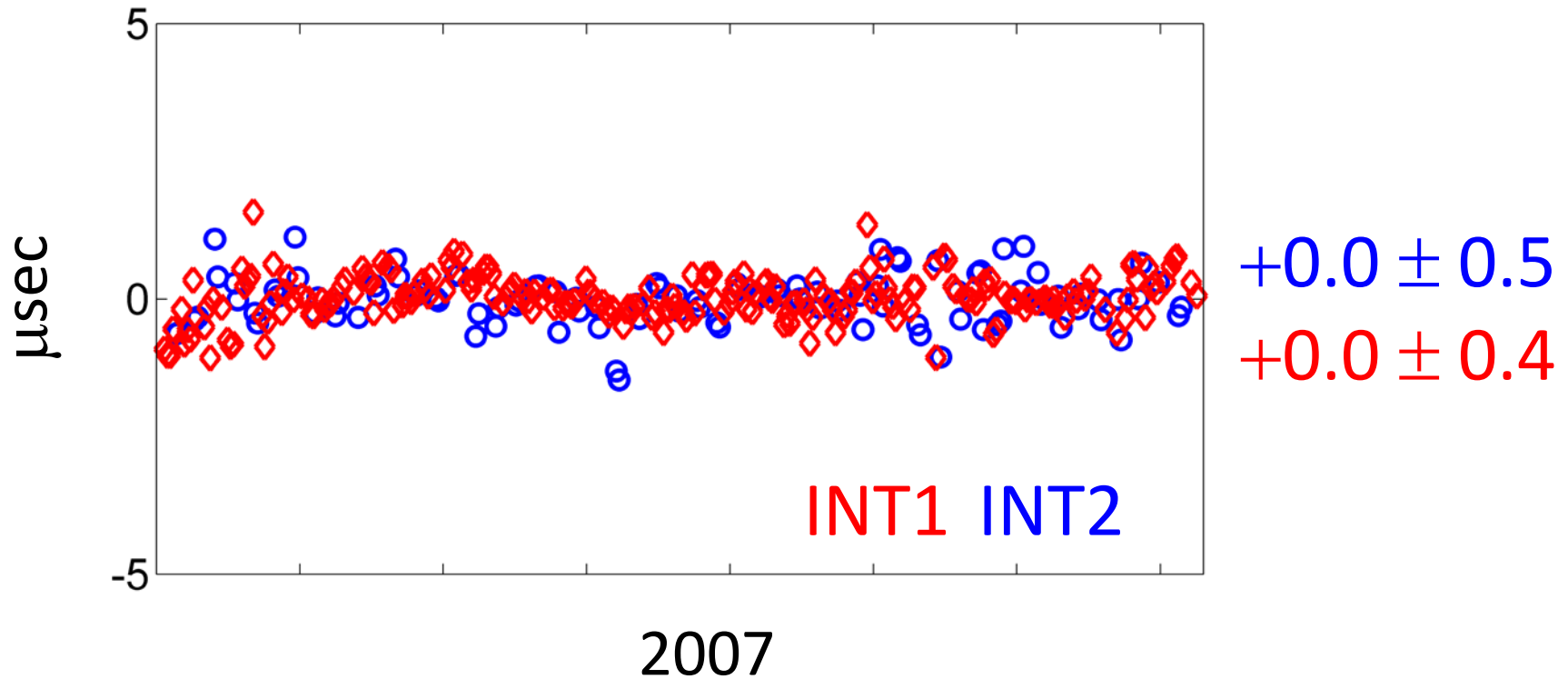
Terrestrial Reference Frame: ITRF2005 \leftrightarrow VTRF2005



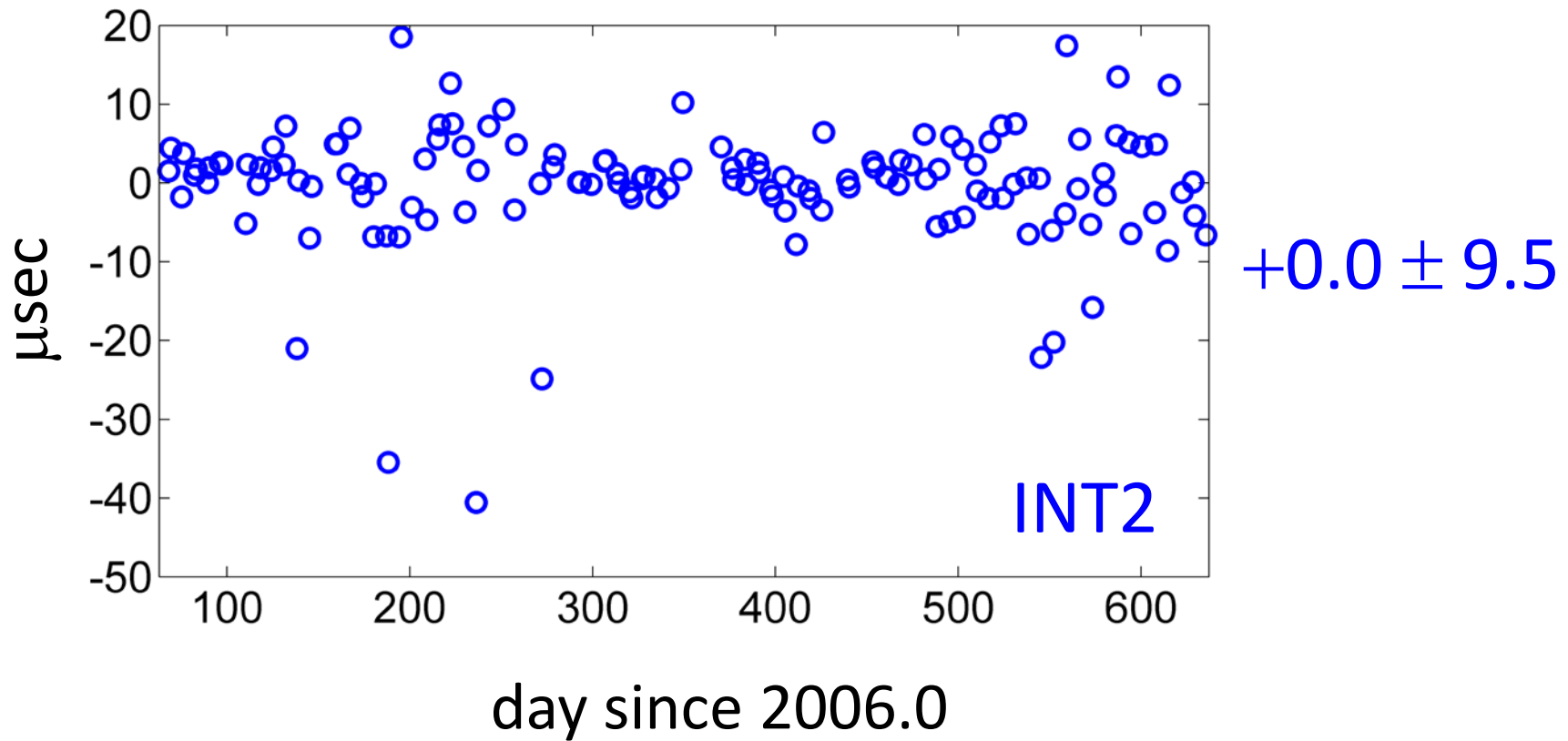
Celestial Reference Frame: ICRF2 \leftrightarrow ICRF Ext. 2



Mapping Function: VMF1 \leftrightarrow GMF

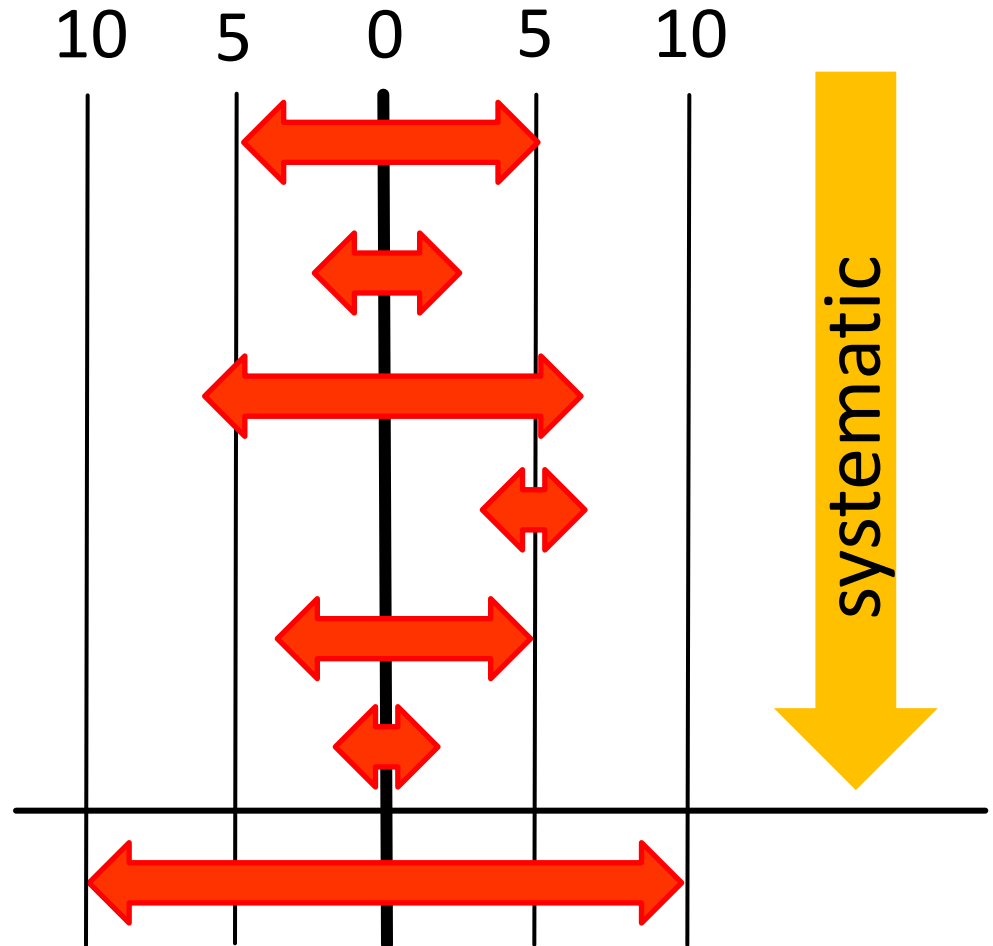


A priori gradients: No \leftrightarrow KARAT at Tsukuba



Analysis options on UT1 in μsec

Analysis option
Nutation
Polar motion PM
High-freq. PM
Terrestrial RF
Celestial RF
Mapping function
Trop. asymmetry



Idea of the present work

CONT08 Analysis



'quasi-true' values

nutration offsets and polar motion

zenith wet delays

tropospheric gradients

**Universal Time
(reference)**

Idea of the present work

CONT08 Analysis



'quasi-true' values

nutration offsets and polar motion

zenith wet delays

tropospheric gradients

**Universal Time
(reference)**

Extract 2-hour single baseline sessions (>10 scans)

fixed

fixed | a priori | estimated

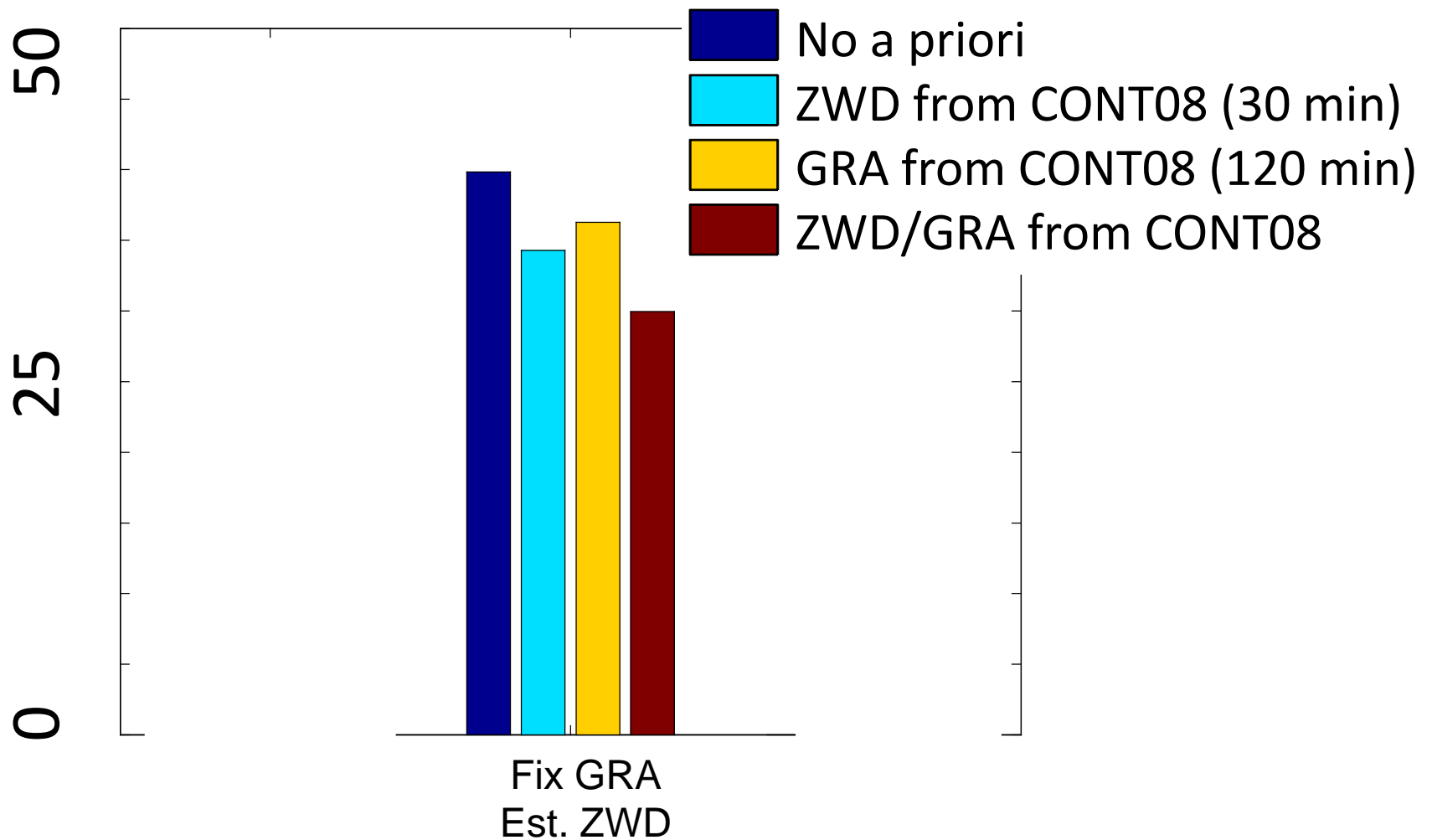
UT1 RMS error

2-hour sessions with more than 10 scans during CONT08

Baseline	# '2-h sessions' (>10 scans)	avg. # scans
Wettzell - Tsukuba	125	15.6
Wettzell - Kokee	93	11.8
Wettzell - Westford	162	18.5
Onsala - Tsukuba	140	16.2
Wettzell - Tsukuba - Ny Alesund	113	14.0

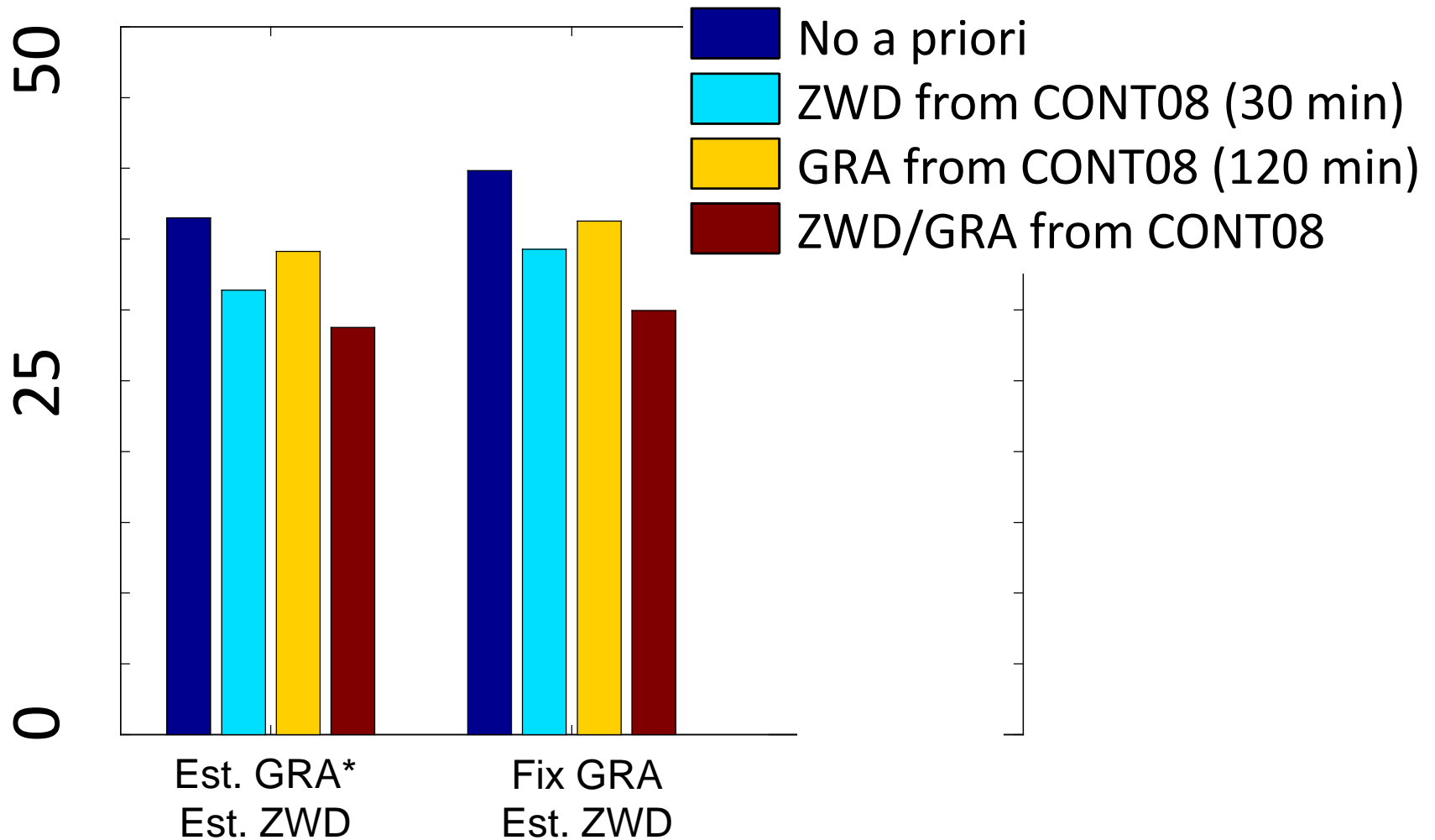
Wettzell - Kokee

UT1 RMS error [μs]



Wettzell - Kokee

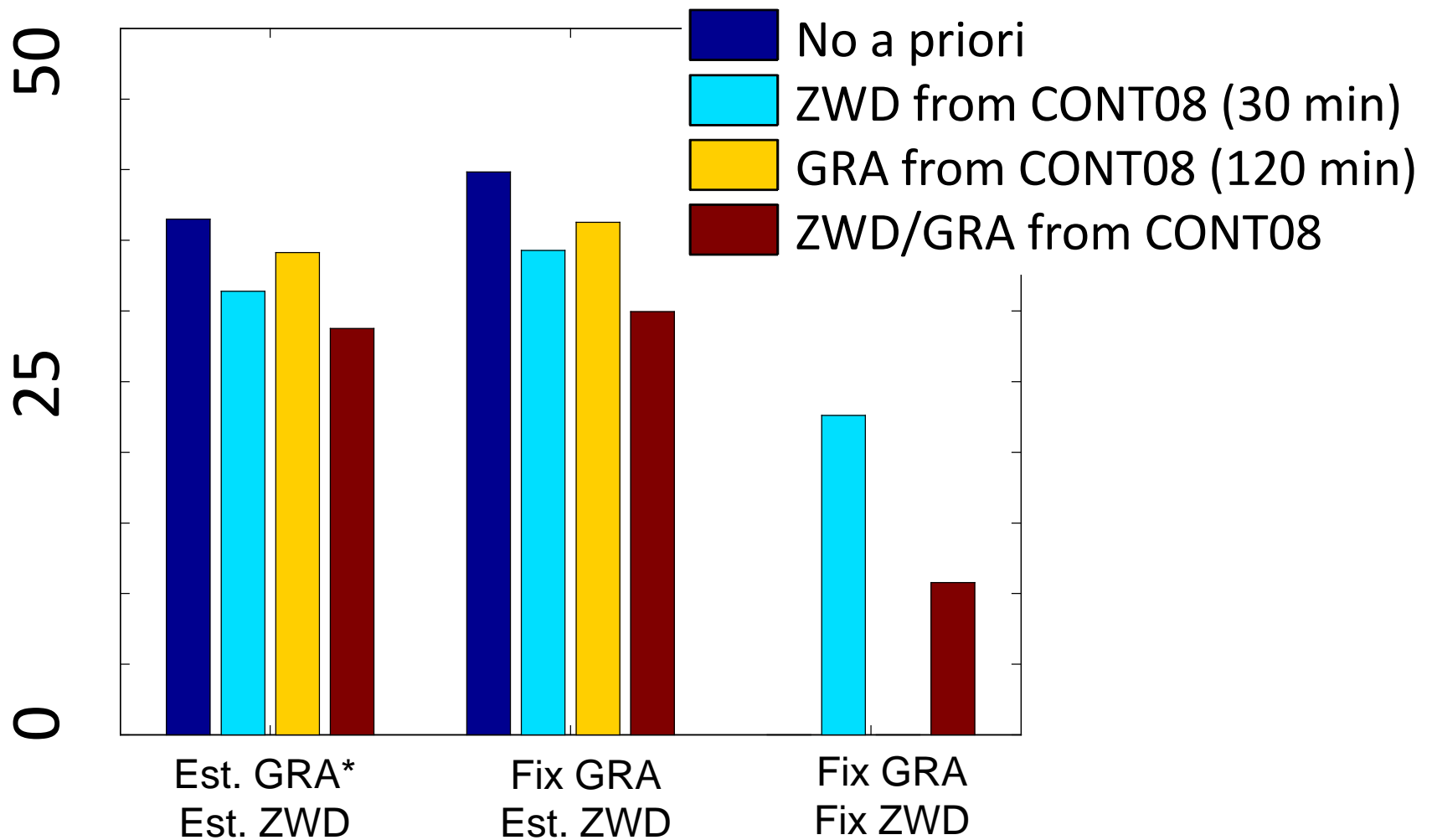
UT1 RMS error [μs]



*constrained to zero with ± 1 mm

Wettzell - Kokee

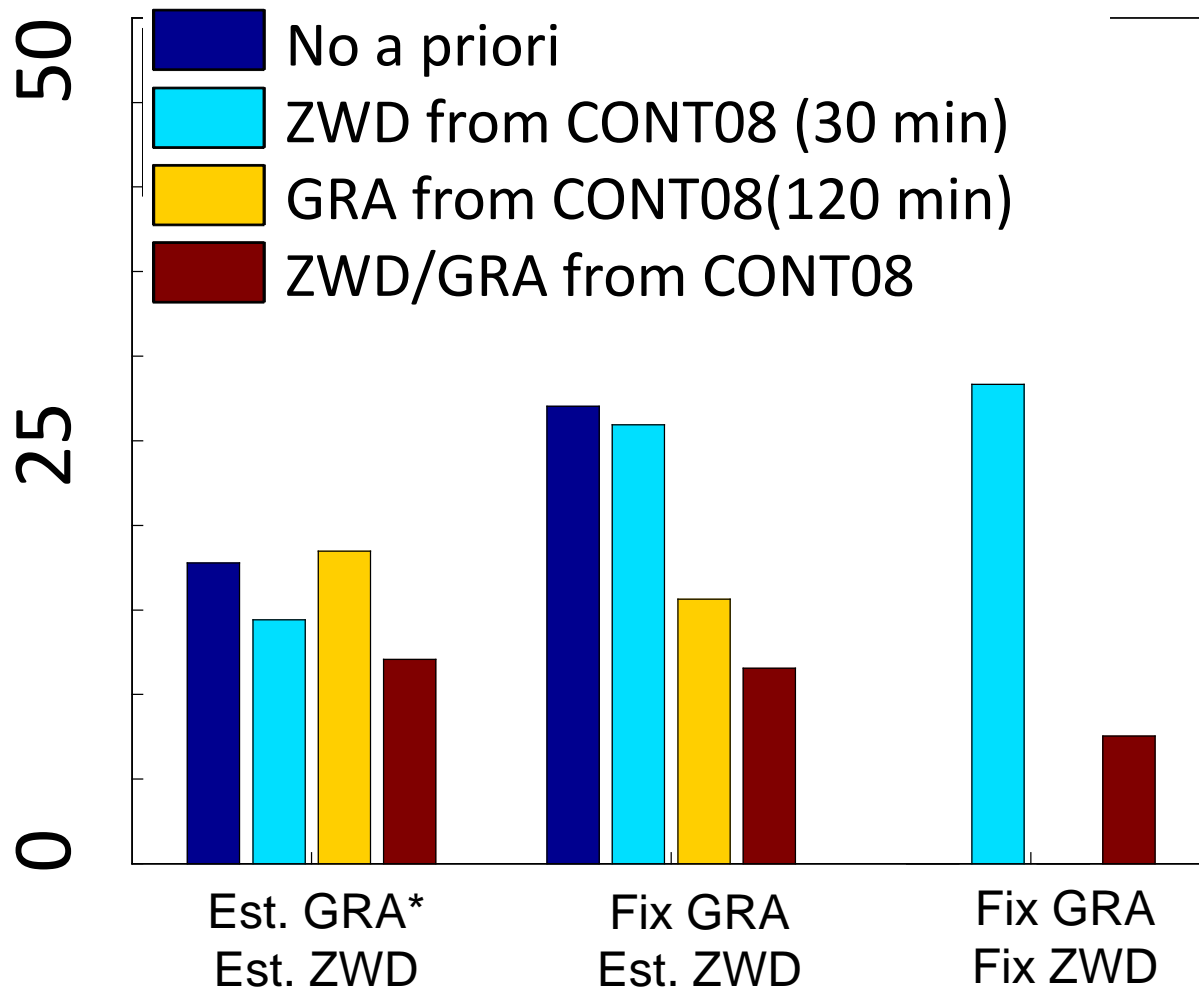
UT1 RMS error [μs]



*constrained to zero with ± 1 mm

Wettzell - Tsukuba

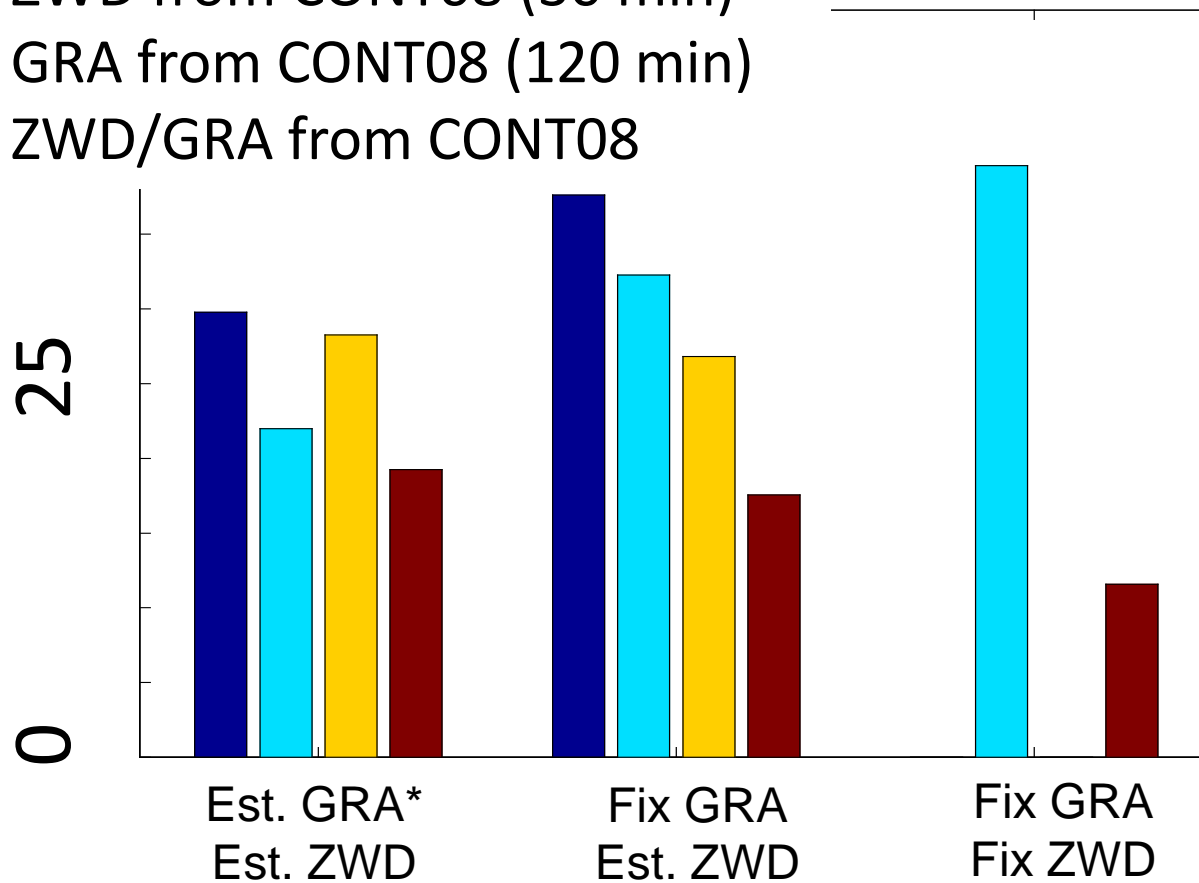
UT1 RMS error [μs]



*constrained to zero with ± 1 mm

Wettzell - Westford UT1 RMS error [μs]

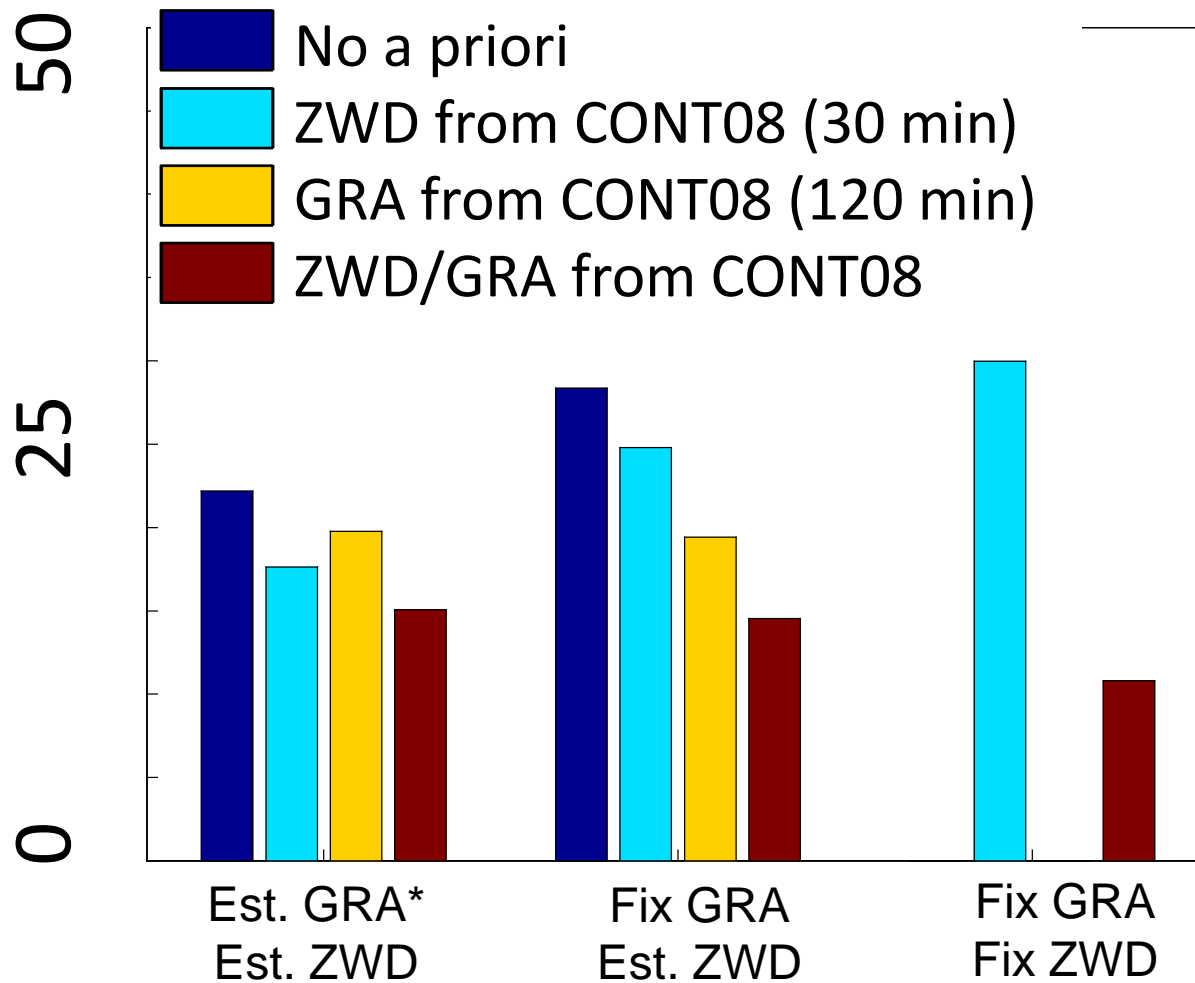
- No a priori
- ZWD from CONT08 (30 min)
- GRA from CONT08 (120 min)
- ZWD/GRA from CONT08



*constrained to zero with ± 1 mm

Onsala - Tsukuba

UT1 RMS error [μs]



*constrained to zero with ± 1 mm

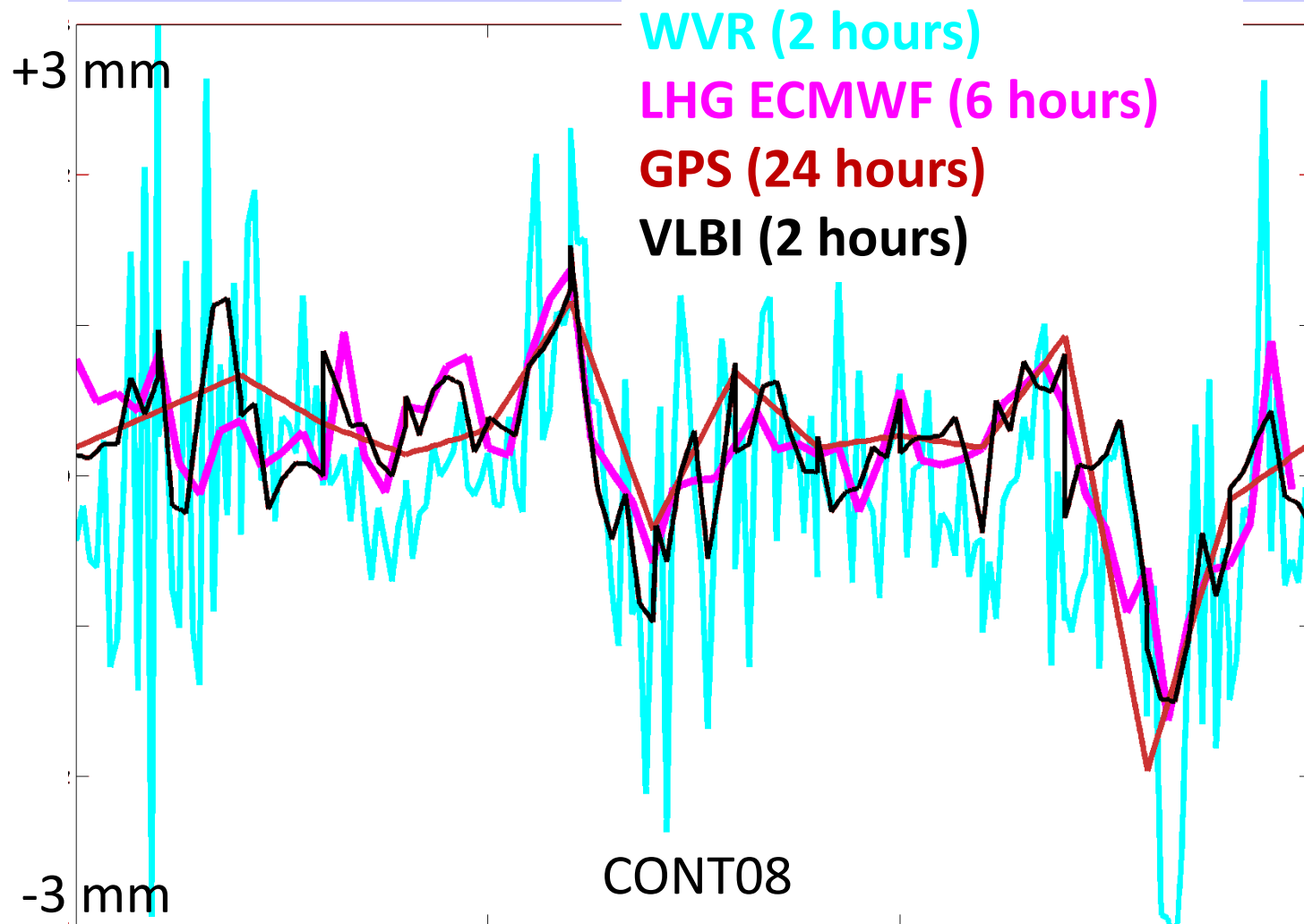
Conclusions

- *CONT08 zenith wet delays plus gradients* improve the solution, especially when they are fixed in these "Intensives".
- Estimating gradients improves these "Intensives".
- In particular, fixing *CONT08 gradients* at Tsukuba improves results.

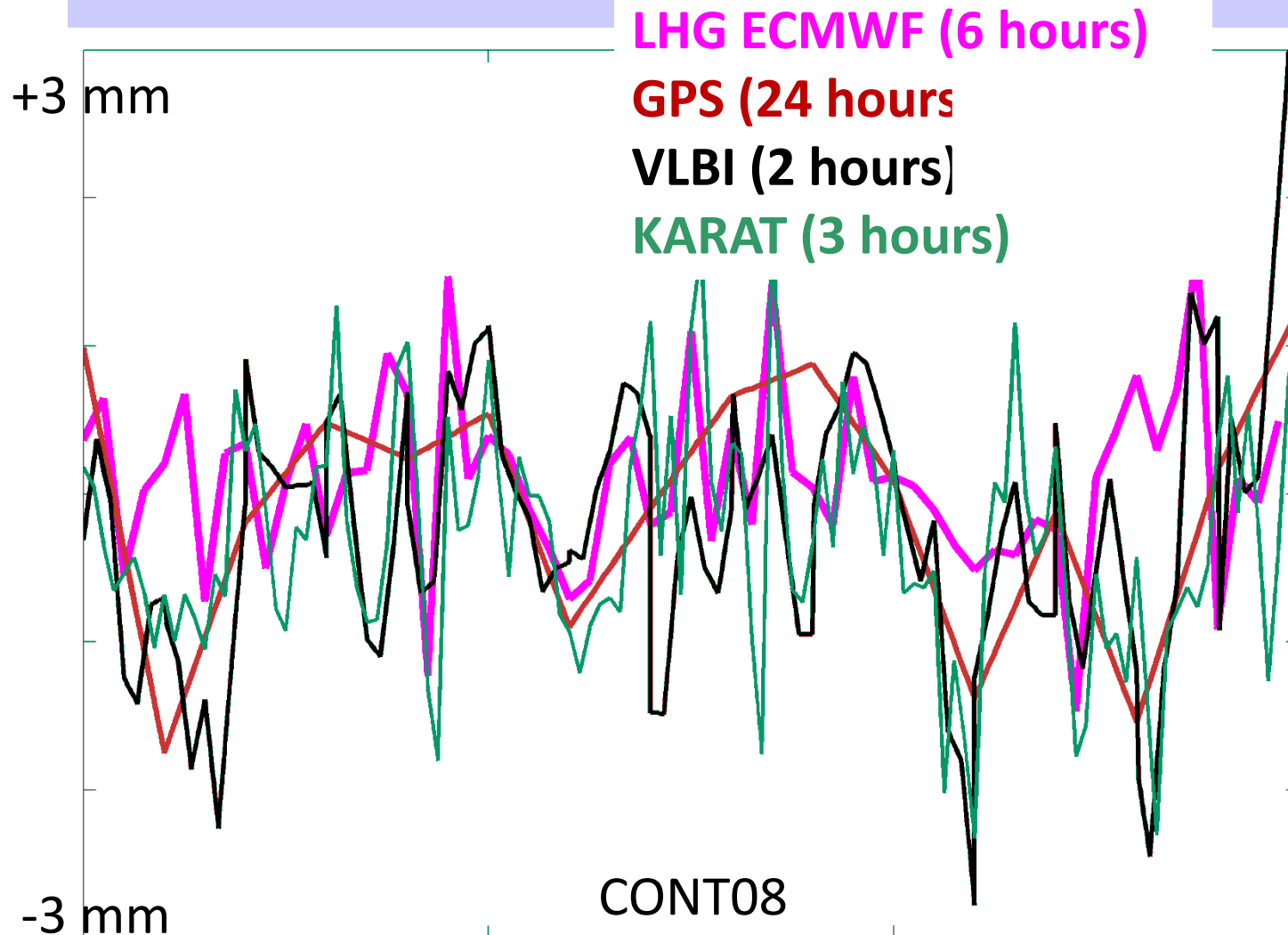
Next steps

- Estimate gradients in real Intensives.
- Using external information about zenith wet delays and gradients.
- Nilsson et al. at EGU2010 in Vienna.

East gradients at Onsala



East gradients at Tsukuba



Conclusions

- Intensives, in particular if correlated and analyzed in near real-time, are essential for UT1 prediction.
- Intensives results can be further improved by
 - using external information about the troposphere,
 - estimation of troposphere gradient parameters.

Thanks for your attention!

Adding a third station

