EVGA-Meeting 2009

IVS' contribution to ITRF2008

- Status & Results -

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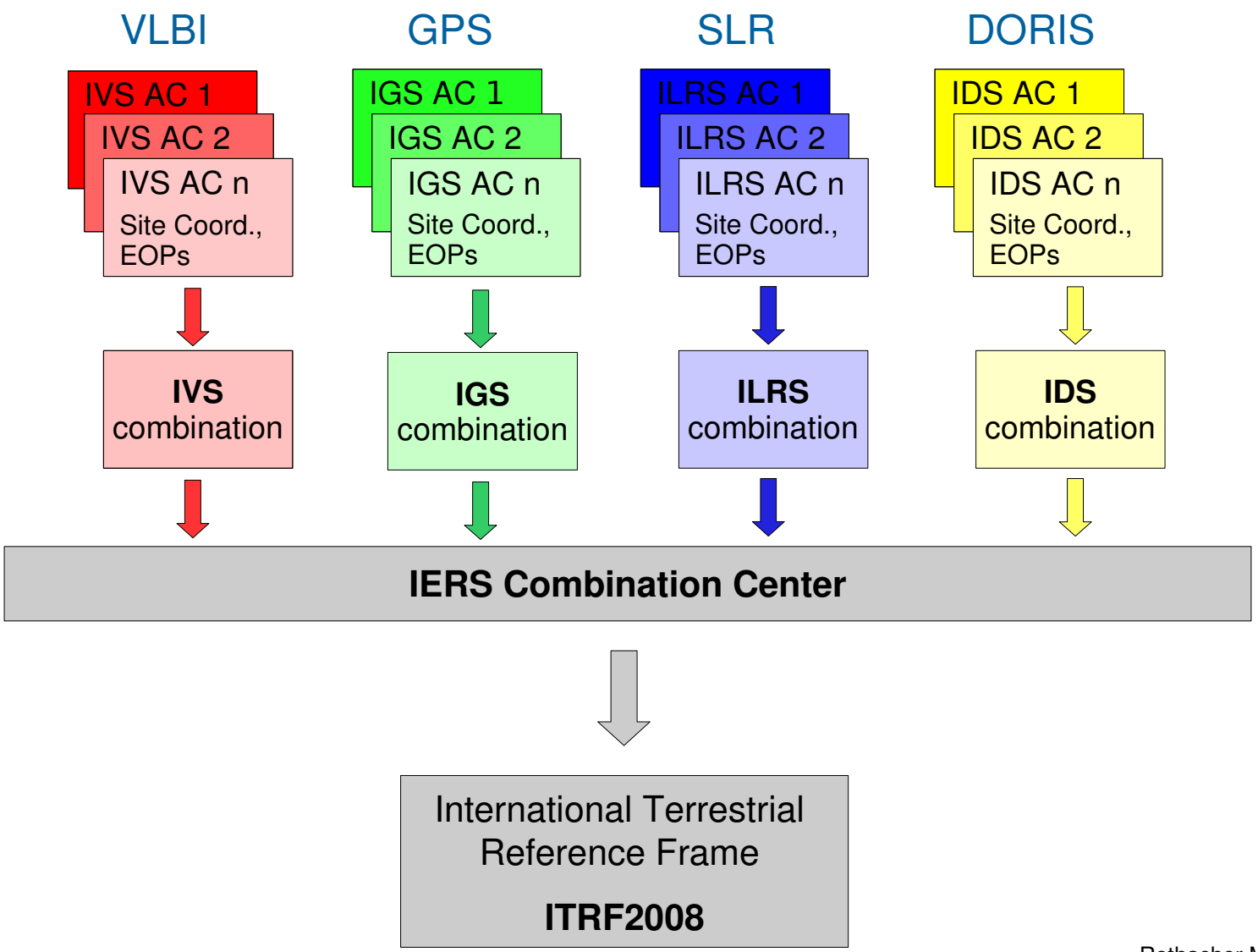
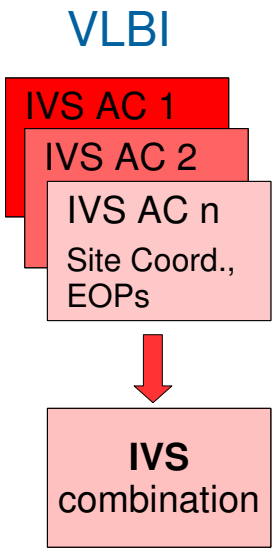
Introduction



Rothacher M. (2002), modified

Introduction



IVS Combination

1. Overview
   - Contributions
   - Solution setup
2. Results
   - 2.1 Station Positions
     - Internal comparisons
     - External comparisons w.r.t. ITRF2005
   - 2.2 Earth Orientation Parameter
     - Internal comparisons

Contributions

AC	Time span	Sessions	Software
BKG	1979 - 2008	4424	Calc/Solve
DGFI	1984 - 2008	3184	Occam (LSM)
GSFC	1979 - 2008	4592	Calc/Solve
OPA	1979 - 2008	4489	Calc/Solve
AUS	---	---	Occam
USNO	1979 - 2008	4250	Calc/Solve
IAA	---	---	Quasar ?
SHAO	---	---	Calc/Solve ?

IVS-COMB (prel.)	1979 - 2008	4539	Dogs_CS

Solution setup

Station coordinates / Sea surface heights

Solid Earth tides	IERS Conventions 2003
Ocean Loading	FES2004
Pole tides	IERS Conventions 2003
Atmospheric Loading	None

Earth Orientation Parameters

Tidal variations in x,y,dUT1	IERS Conventions 2003
Nutation	IAU2000A (w/o free core nutation)

Troposphere modeling

Mapping function	VMF1

Technique-specific effects

Thermal expansion	Nothnagel 2008
Antenna axis offsets	official IVS-table
Station eccentricities	official IVS-table

Solution setup

Differences between individual solutions

- outlier detection
- weighting
- CRF
- temporal resolution of troposphere parameters and gradients
- constraints for clock and troposhere parameters
- interpolation scheme to map daily a priori EOP values to observation epoch
- a priori gradients
- a priori model for troposphere dry & wet delay
- baseline clocks

Results

Station Positions

Internal Comparisons
- Station position time series
- TRF

External Comparisons
- VLBI combined TRF w.r.t. ITRF2005
- Scale w.r.t. ITRF2005

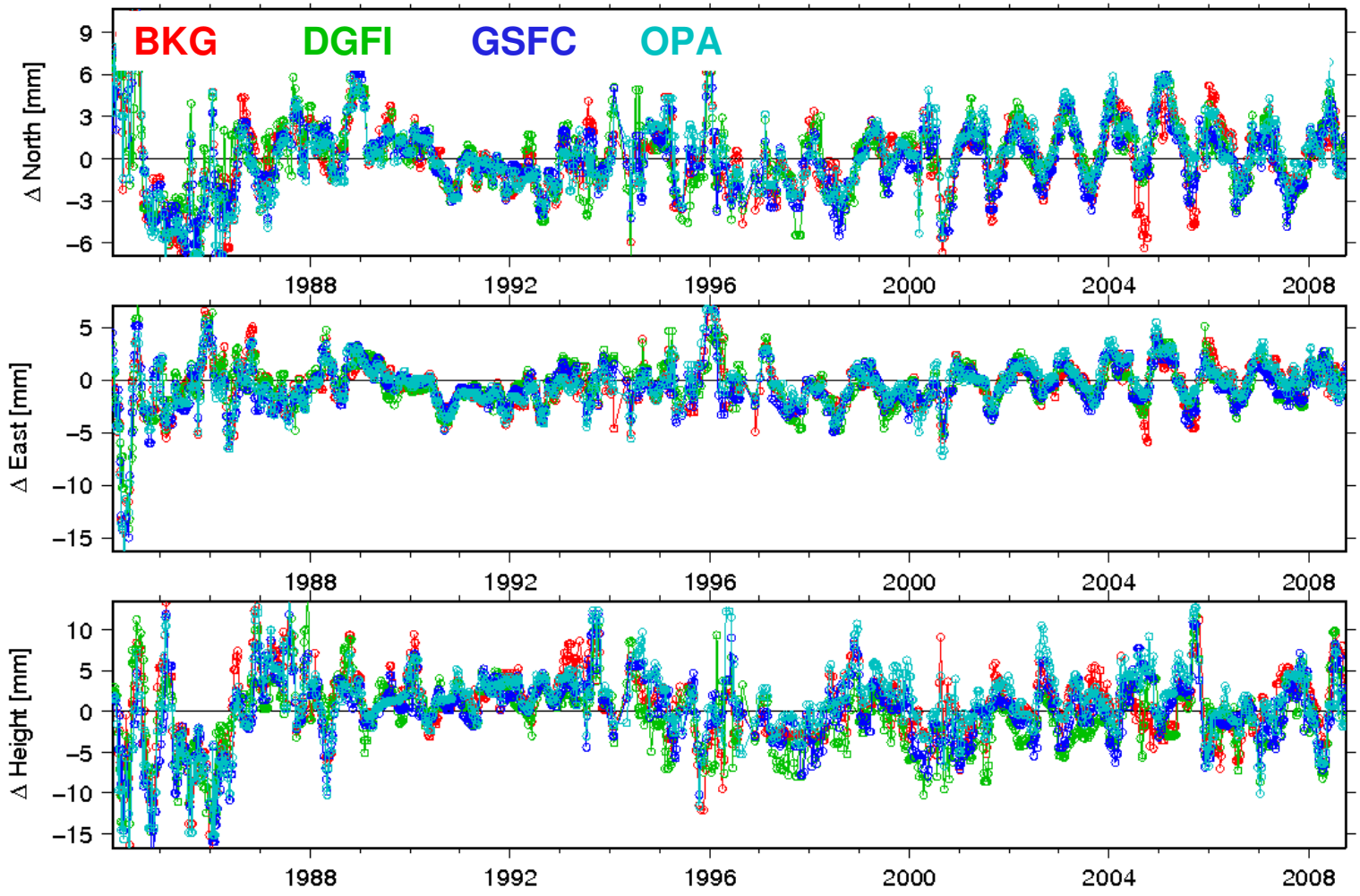
Earth Orientation Parameters

Internal Comparisons
- indivdual solution vs. combined solution

Station Position Time Series

Individual solutions

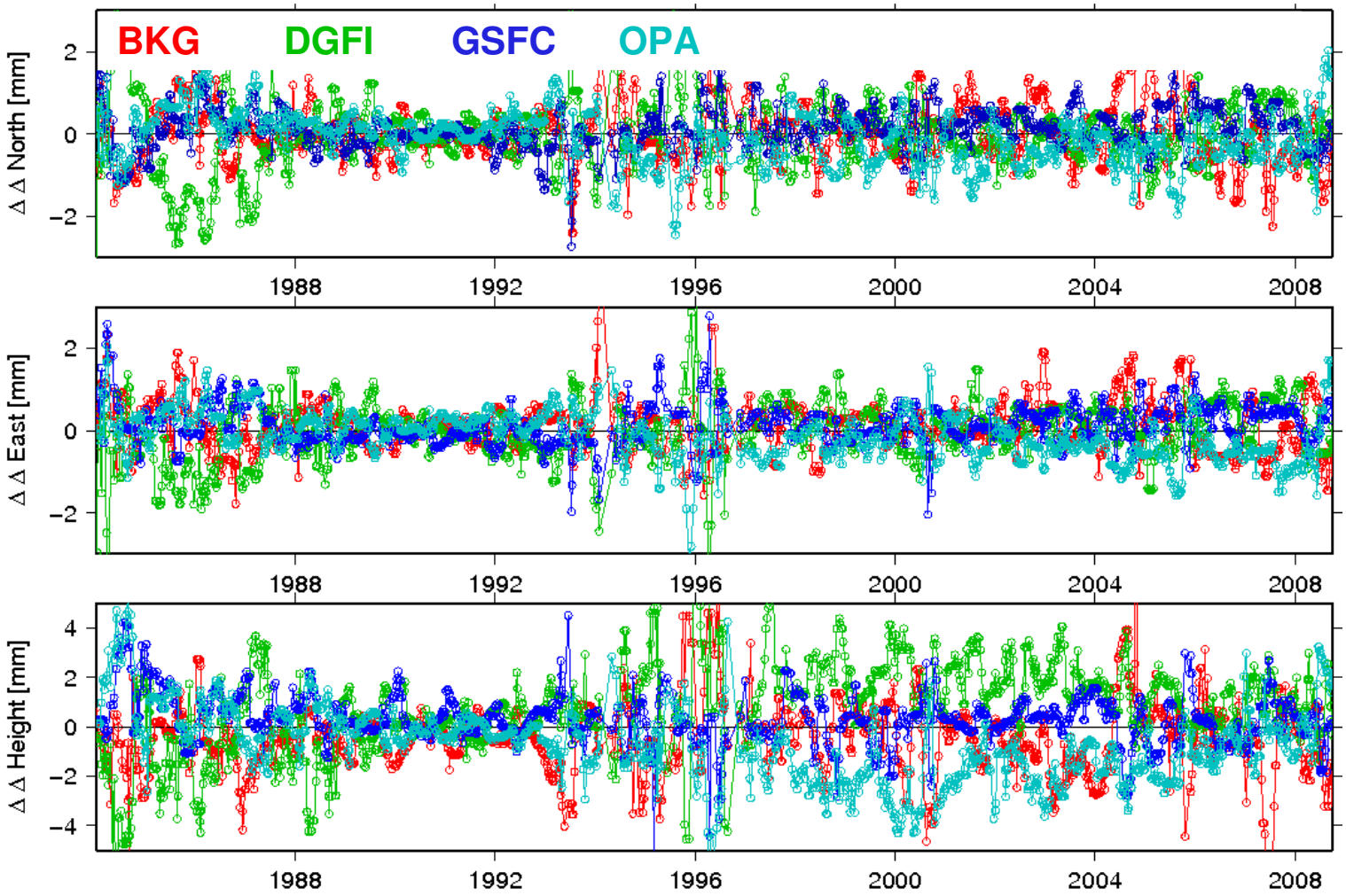
Westford (70 day smoothed)



Station Position Time Series

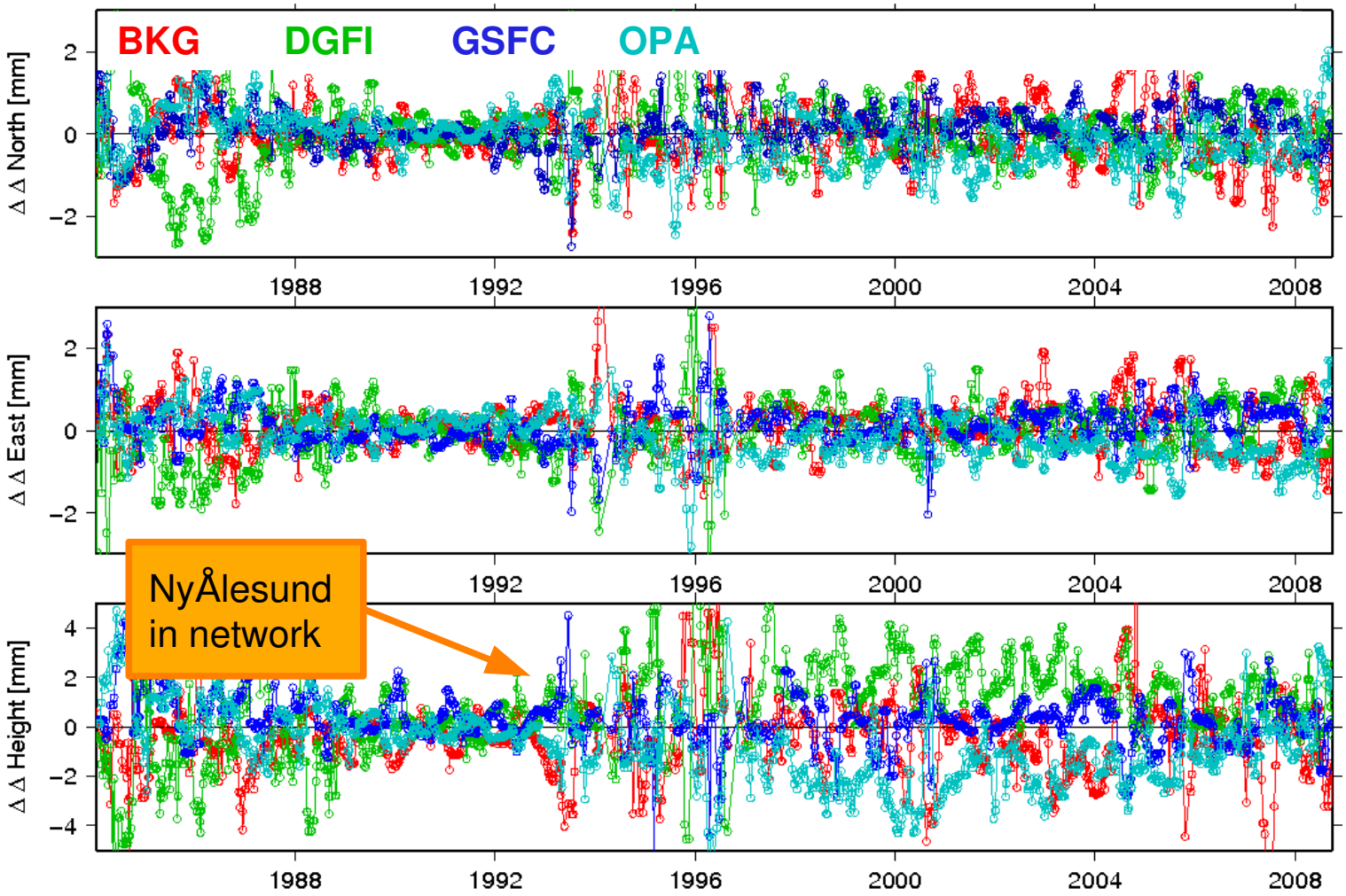
Individual – Combined solution

Westford (70 day smoothed)



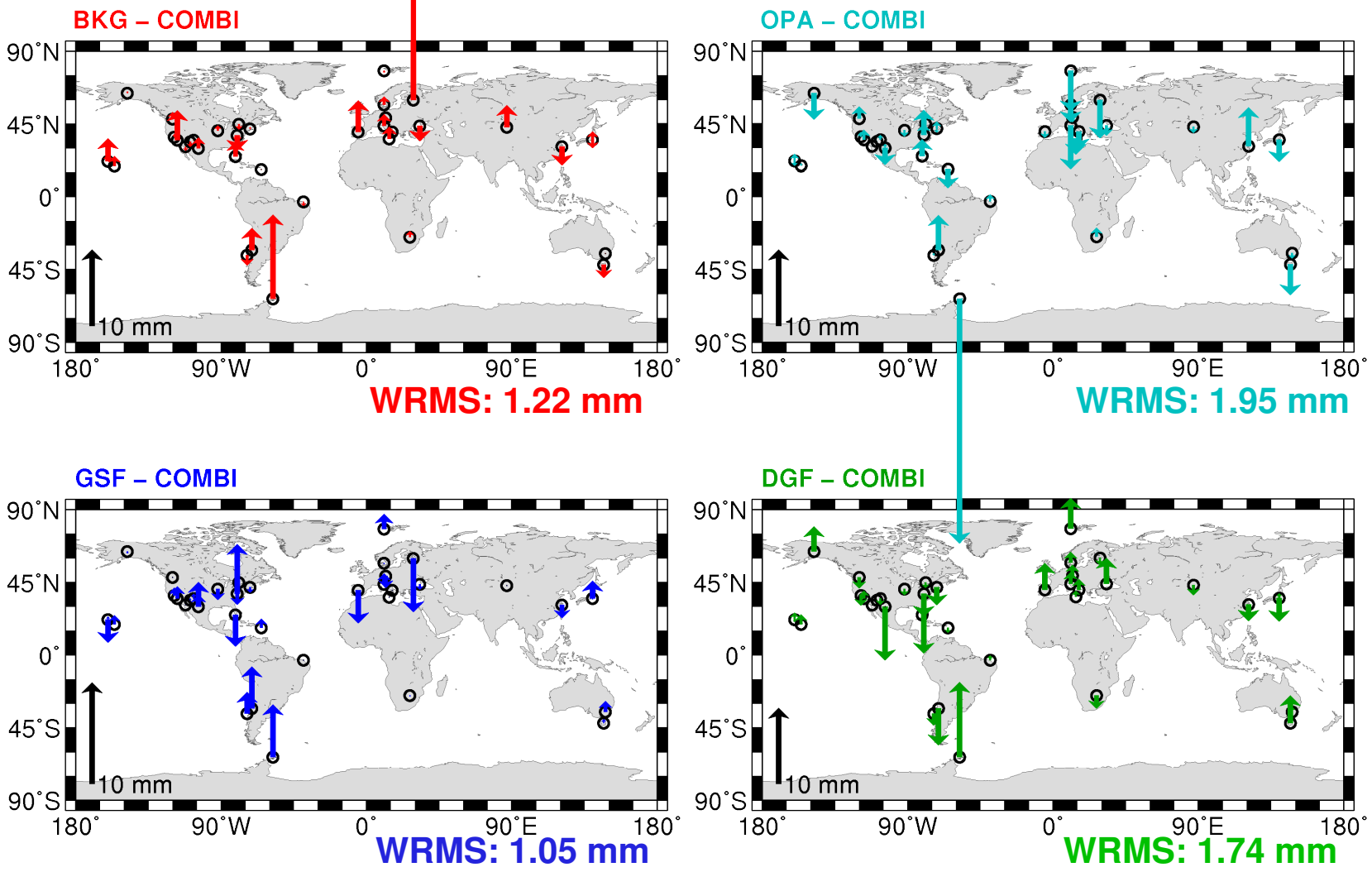
Individual – Combined solution

Westford (70 day smoothed)



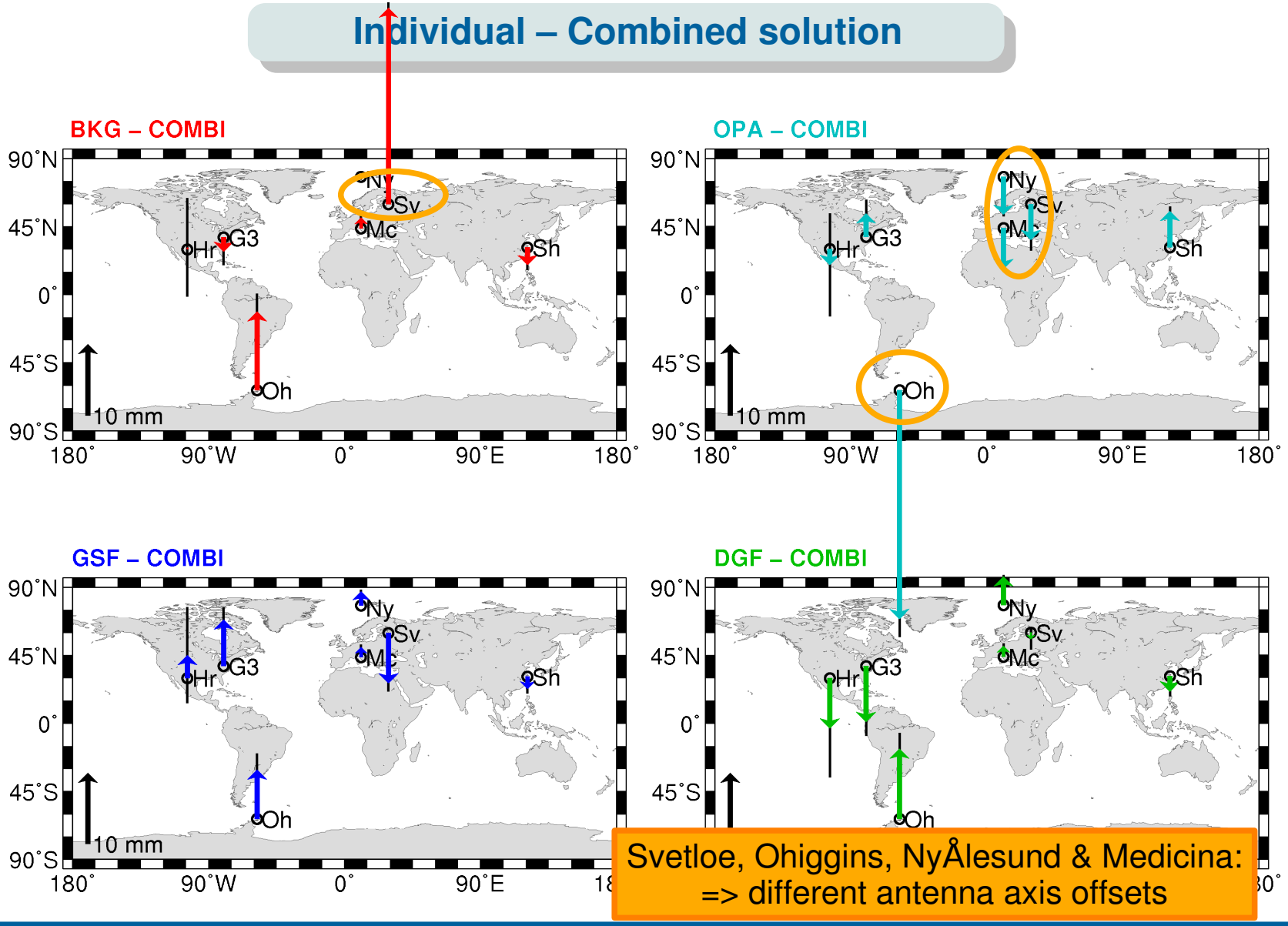
Height Offsets

Individual – Combined solution



Height Offsets > 5mm

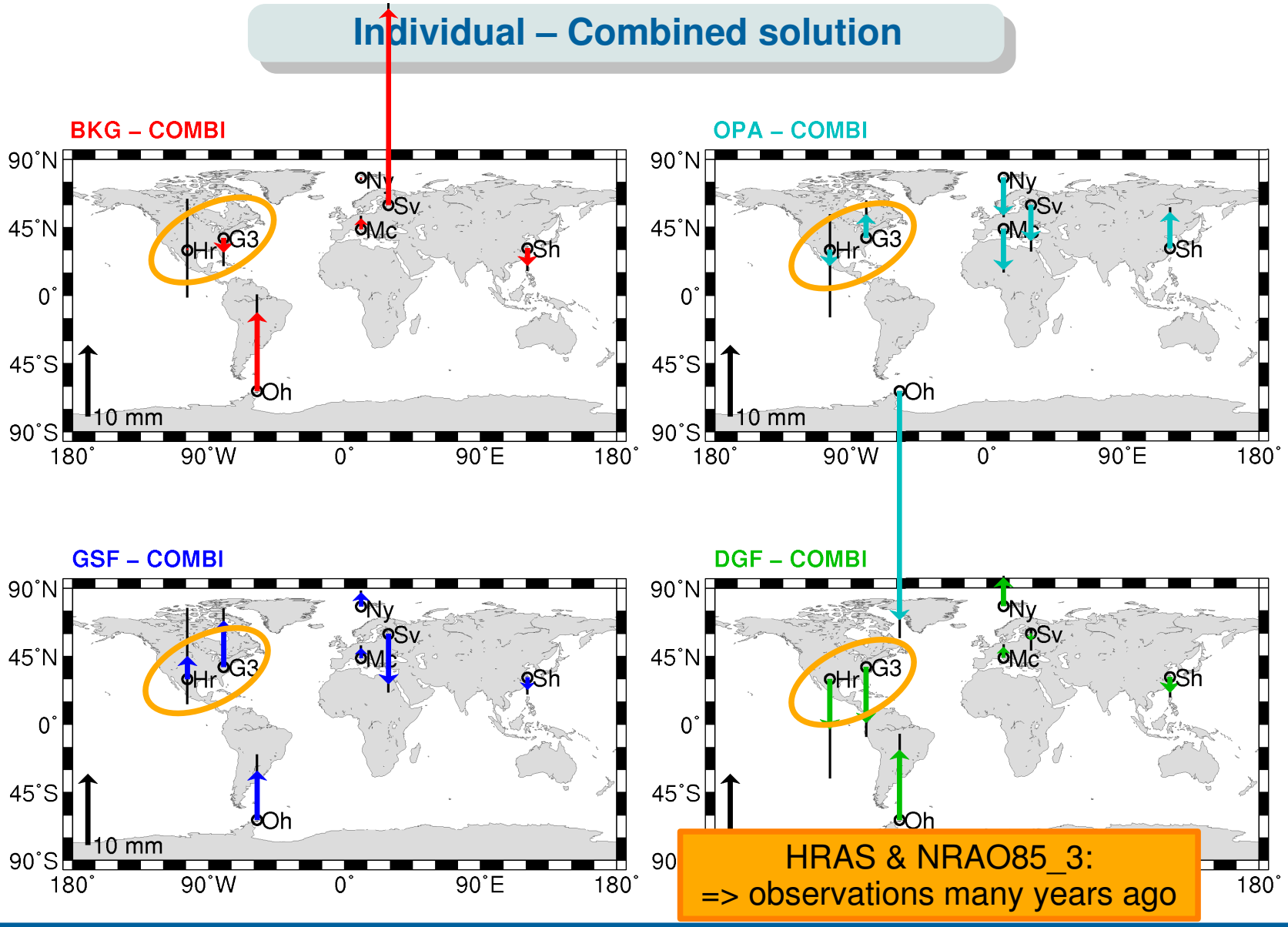
Individual – Combined solution



Svetloe, Ohiggins, NyÅlesund & Medicina:
=> different antenna axis offsets

Height Offsets > 5mm

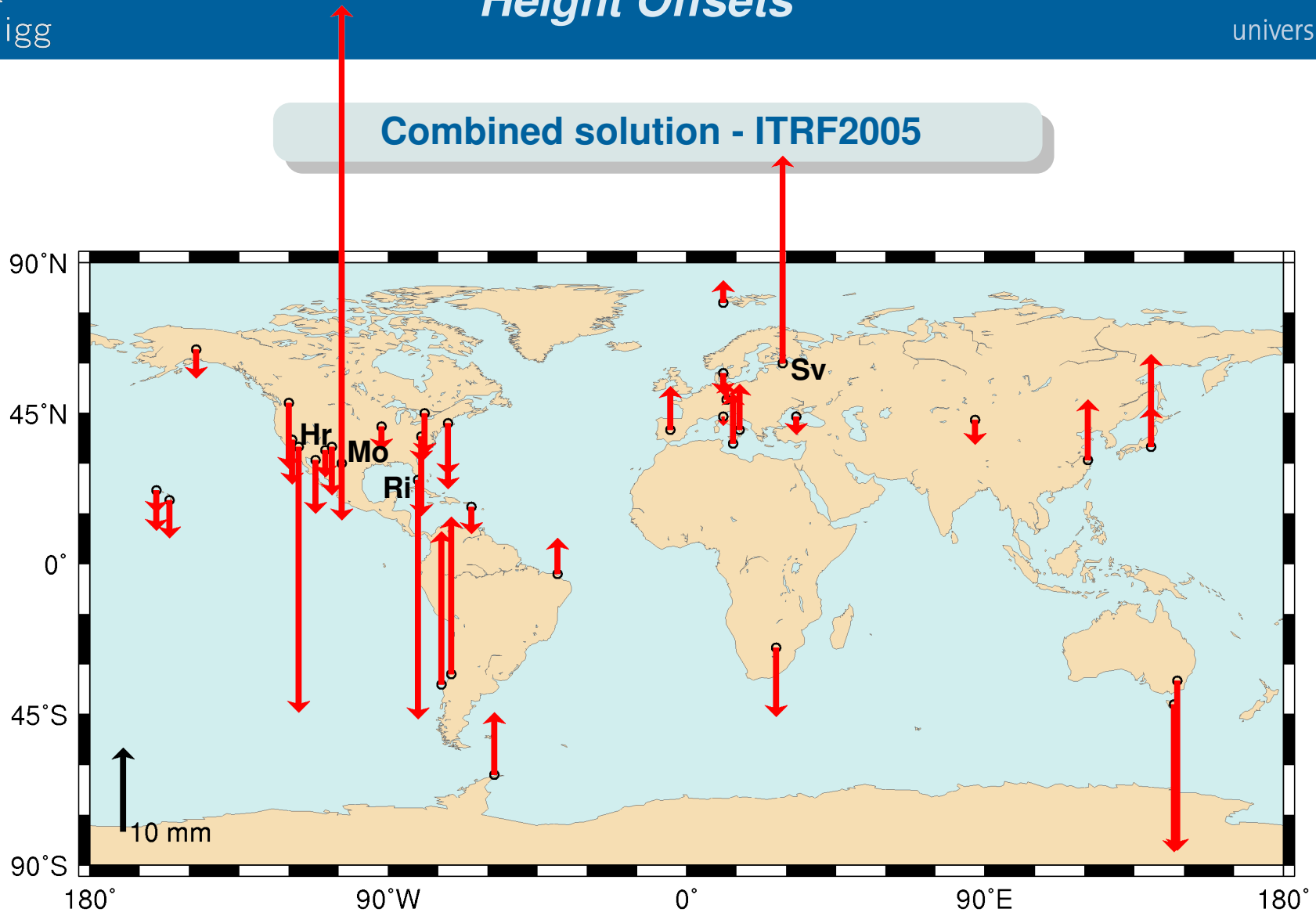
Individual – Combined solution



HRAS & NRAO85_3:
=> observations many years ago

Height Offsets

Combined solution - ITRF2005

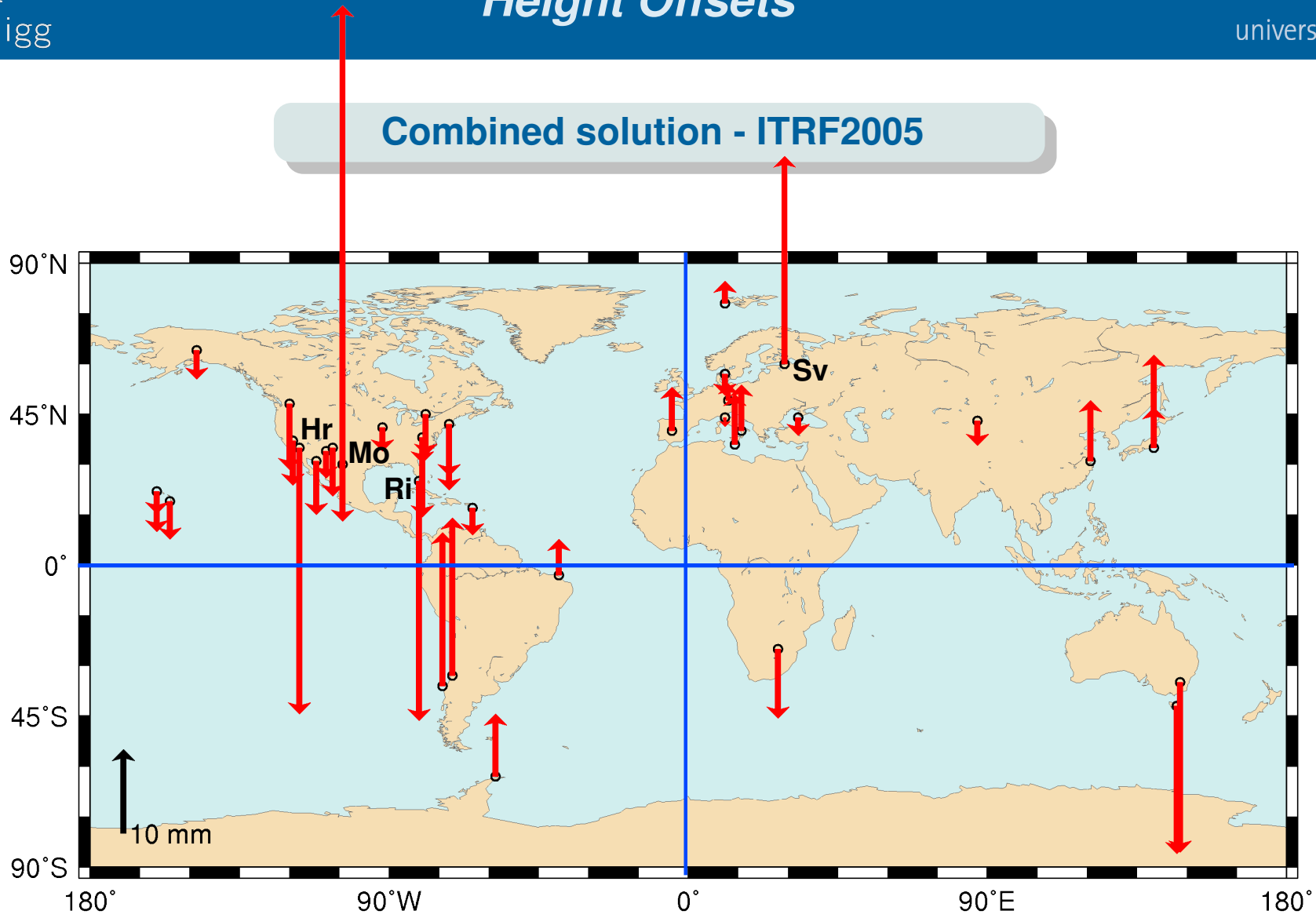


WRMS: 6.05 mm

=> bigger differences at stations with observations many years ago (Hr, Ri, Mo)

Height Offsets

Combined solution - ITRF2005

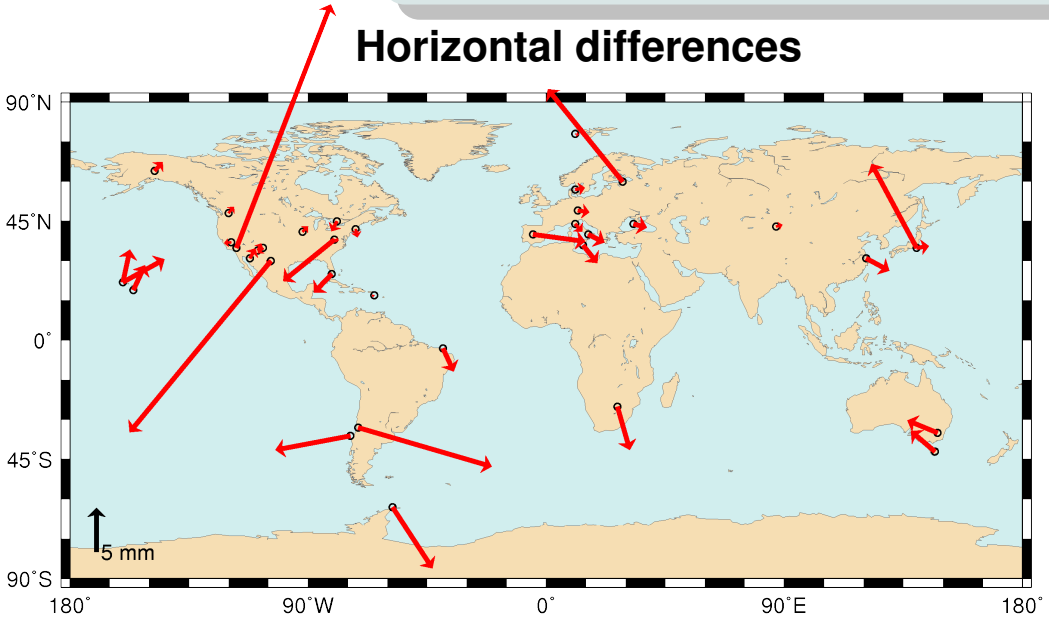


=> Systematics differences due to Pole Tide Effect!

Horizontal differences

Combined solution - ITRF2005

Horizontal differences



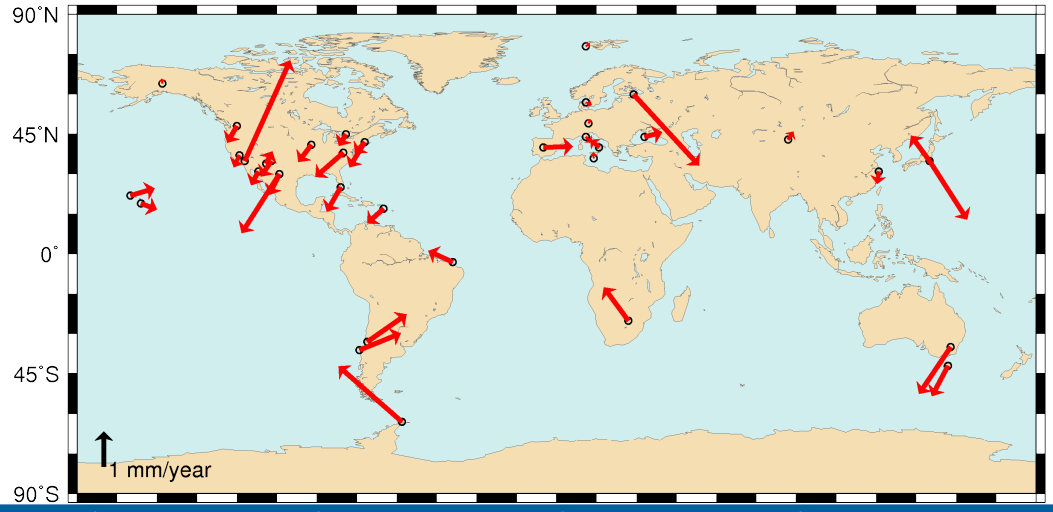
WRMS

North: 3.77 mm
East: 2.72 mm

WRMS

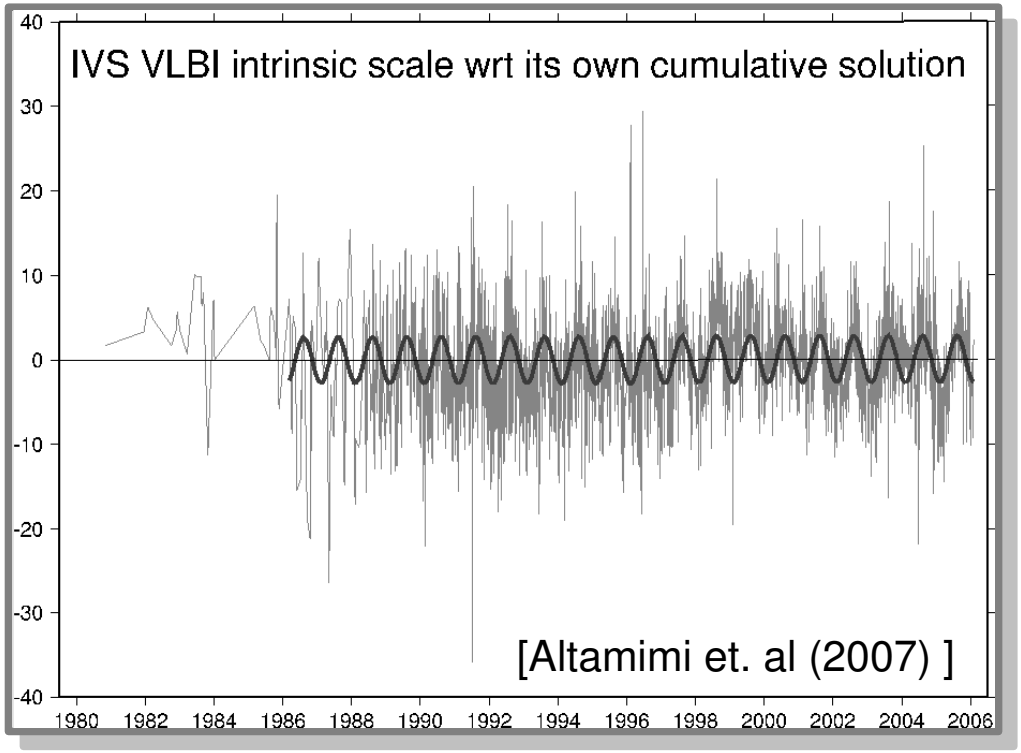
North: 0.65 mm/yr
East: 0.42 mm/yr

Velocity differences



Scale w.r.t. ITRF2005

Combined solution w.r.t ITRF2005

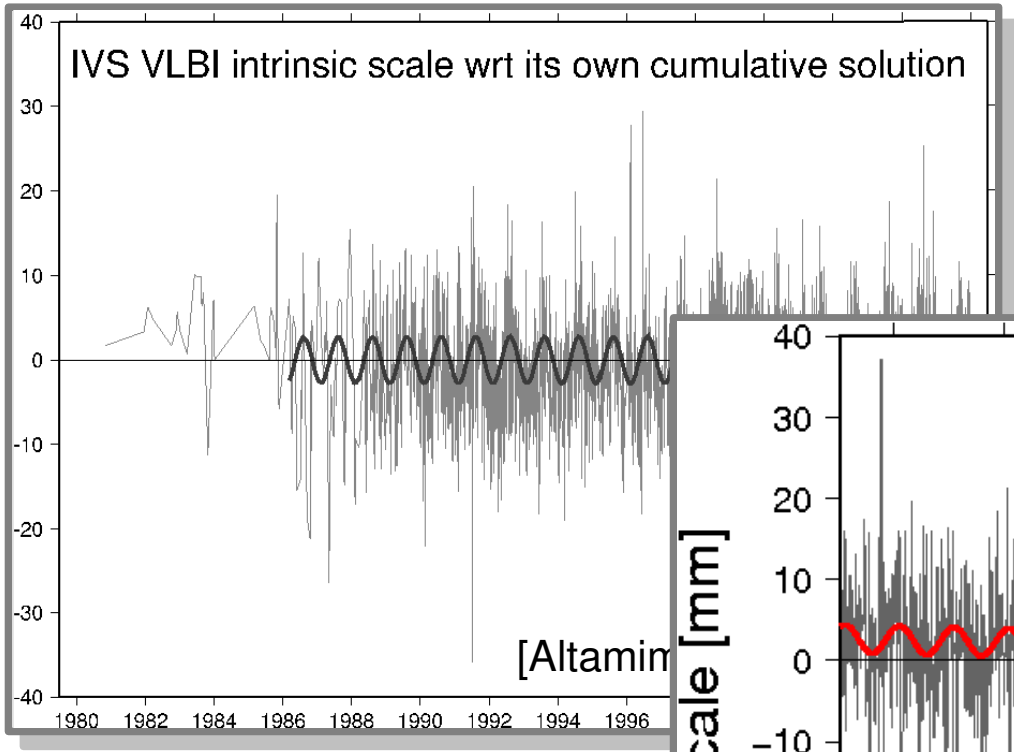


Contribution to ITRF2005

Amplitude: 2.7+/-0.1 mm
=> thermal expansion **NOT** taken into account

Scale w.r.t. ITRF2005

Combined solution w.r.t ITRF2005



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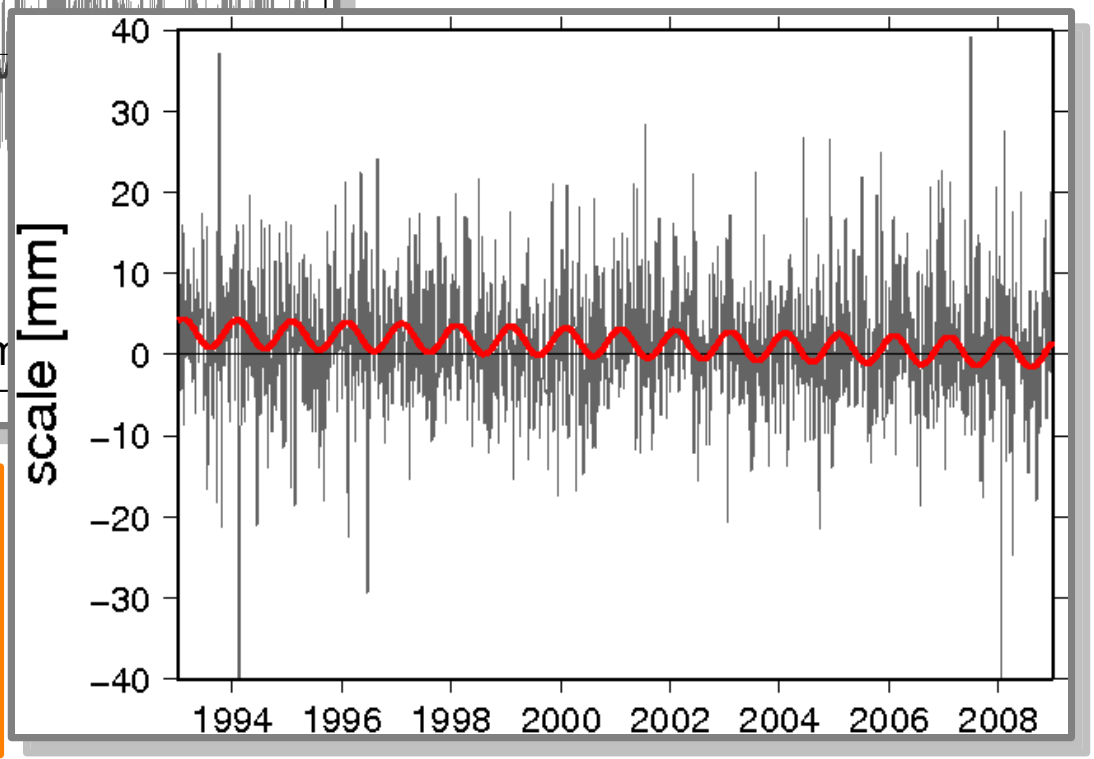


Now

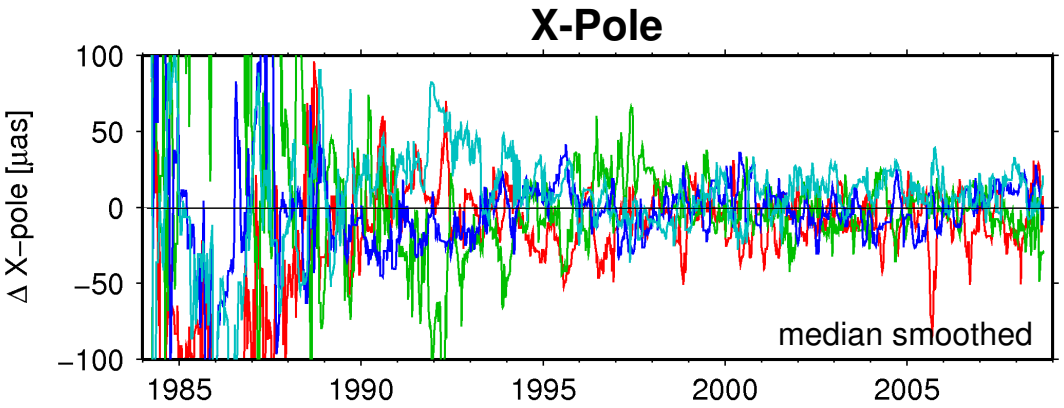
Amplitude: 1.7+/-0.2 mm
=> thermal expansion taken into account

Drift: 0.2+/-0.03 mm/yr

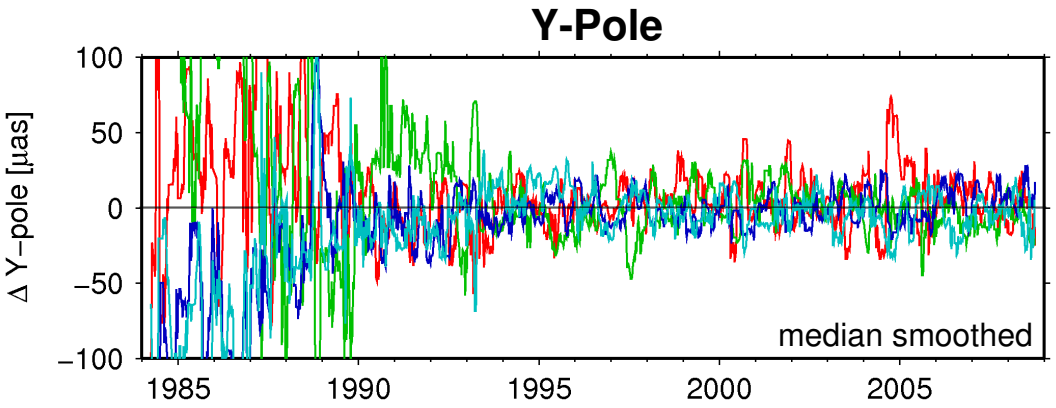
Earth Orientation Parameters

Individual - Combined Solution

BKG-COMBI **DGFI-COMBI** **GSFC-COMBI** **OPA-COMBI**



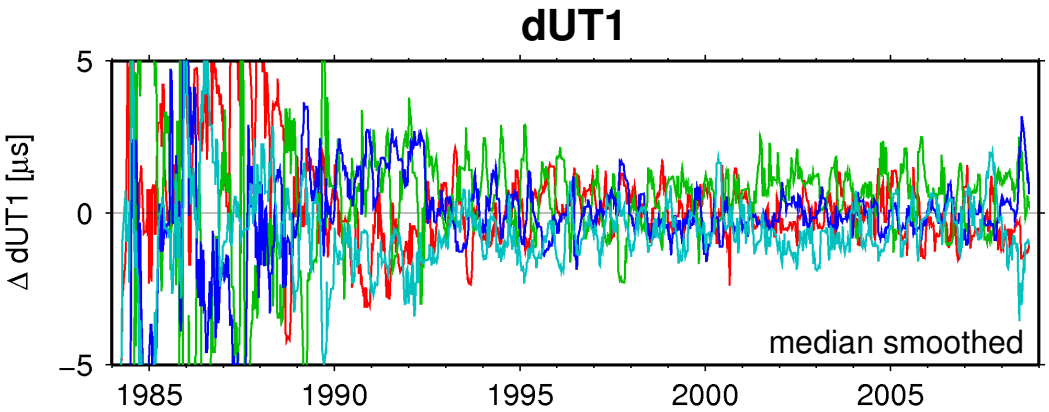
WRMS (overall):
48.8 µas

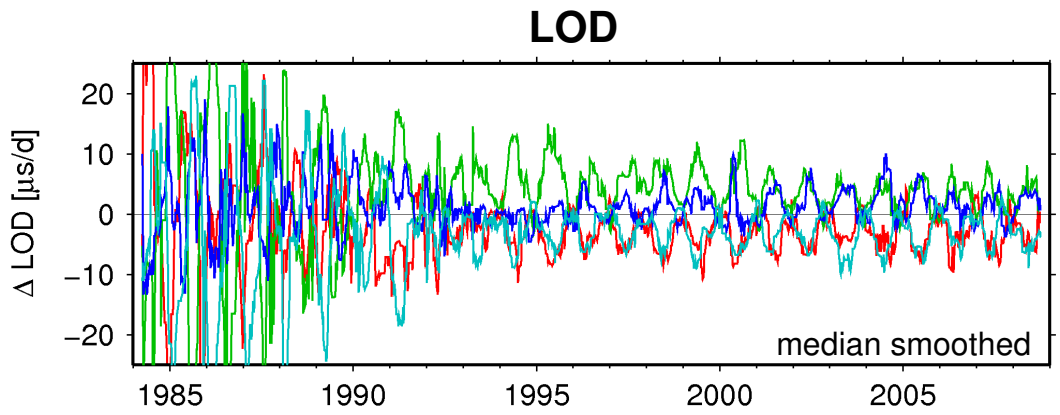


WRMS (overall):
44.3 µas

Individual - Combined Solution

BKG-COMBI **DGFI-COMBI** **GSFC-COMBI** **OPA-COMBI**





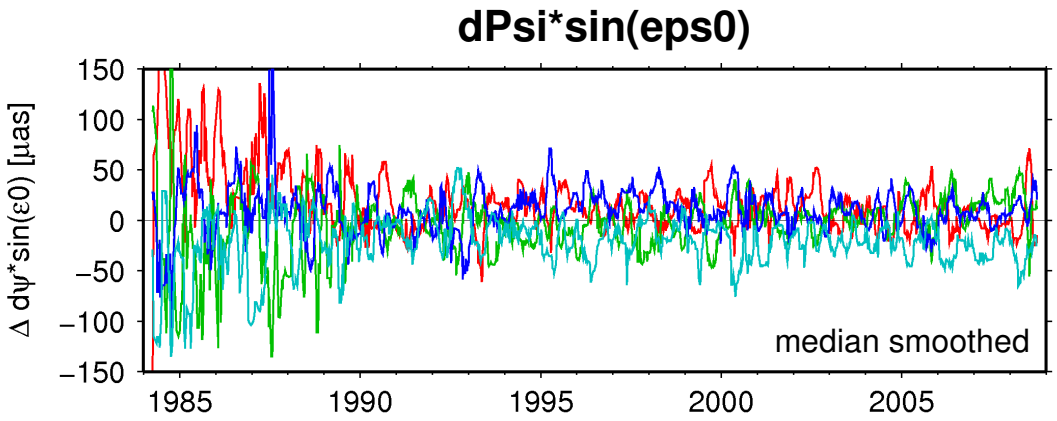
Systematic variations:

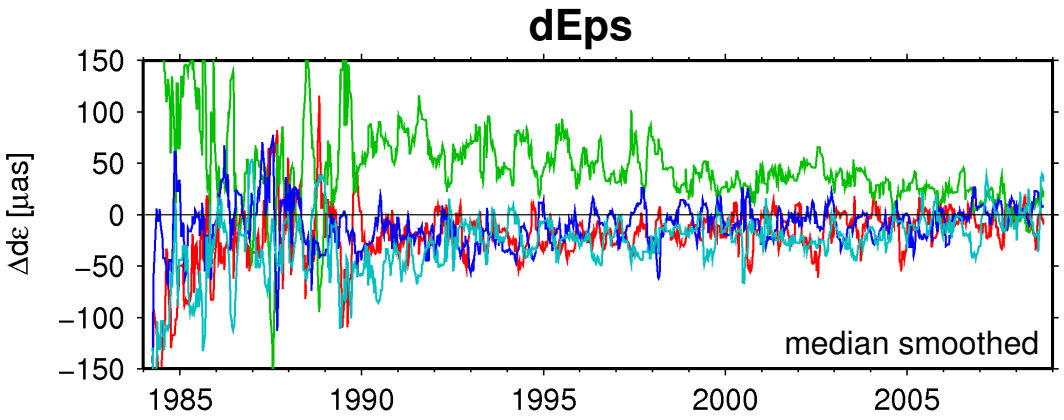
- different interpolation?
- different HF-EOP model?
  -> DGFI & GSFC: IERS
  -> OPA & BKG: hf1102a

Earth Orientation Parameters

Individual - Combined Solution

BKG-COMBI DGFI-COMBI GSFC-COMBI OPA-COMBI





Occam vs. Calc/Solve

Rate: 3.0 +/- 0.2 µas/yr
=> reason unknown

Summary I

Station Positions

Internal comparisons

- Generally good internal agreement
- Significant height offsets due to different antenna axis offset
  => **solutions reprocessed with official IVS table**

External comparisons

- Systematic height offsets w.r.t. ITRF2005
  -> different mean pole in Pole Tide Model used
- Reduced annual variations (~1mm) in scale w.r.t ITRF2005
  -> thermal expansion

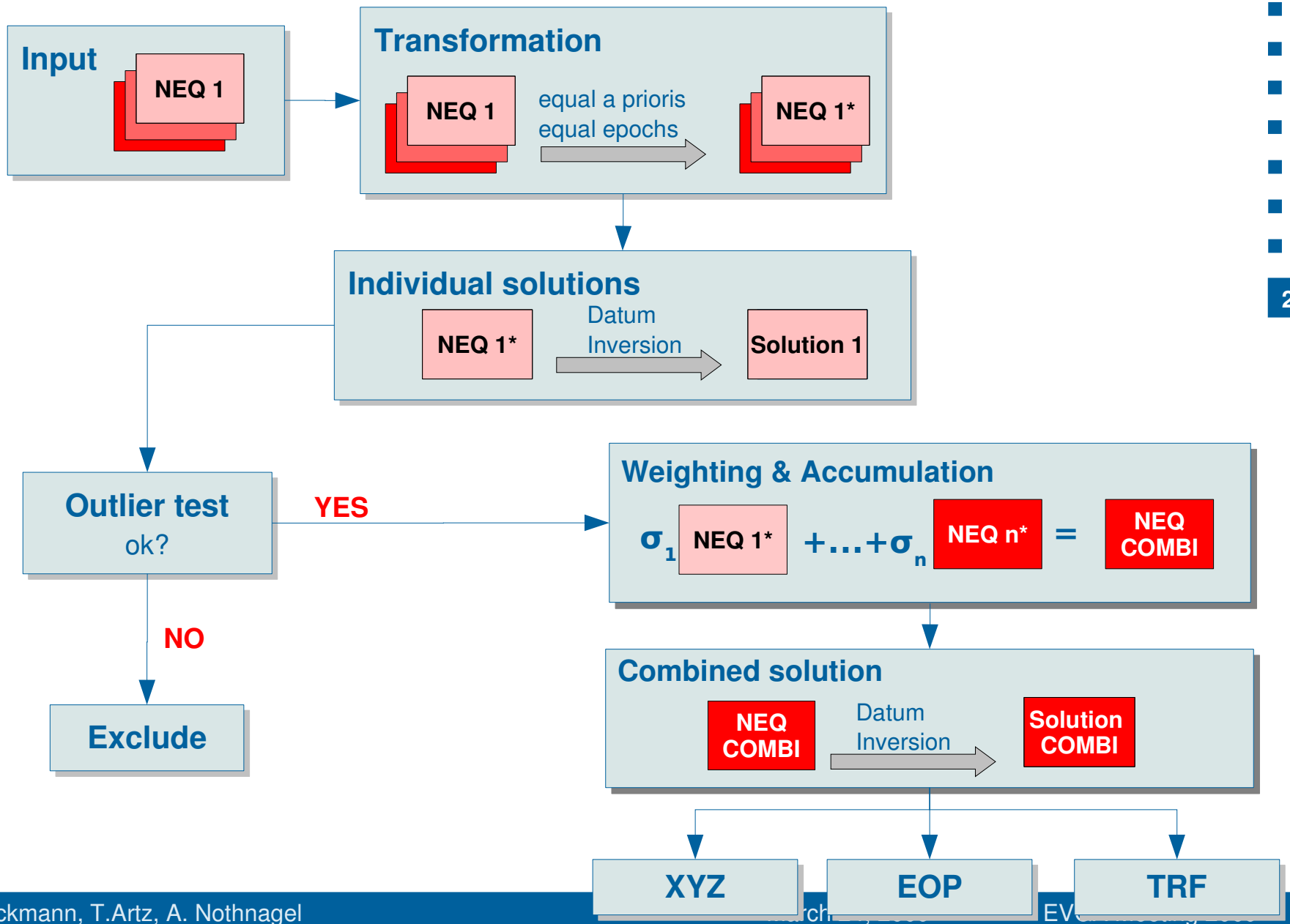
Summary II

Earth Orientation Parameters

Internal comparisons

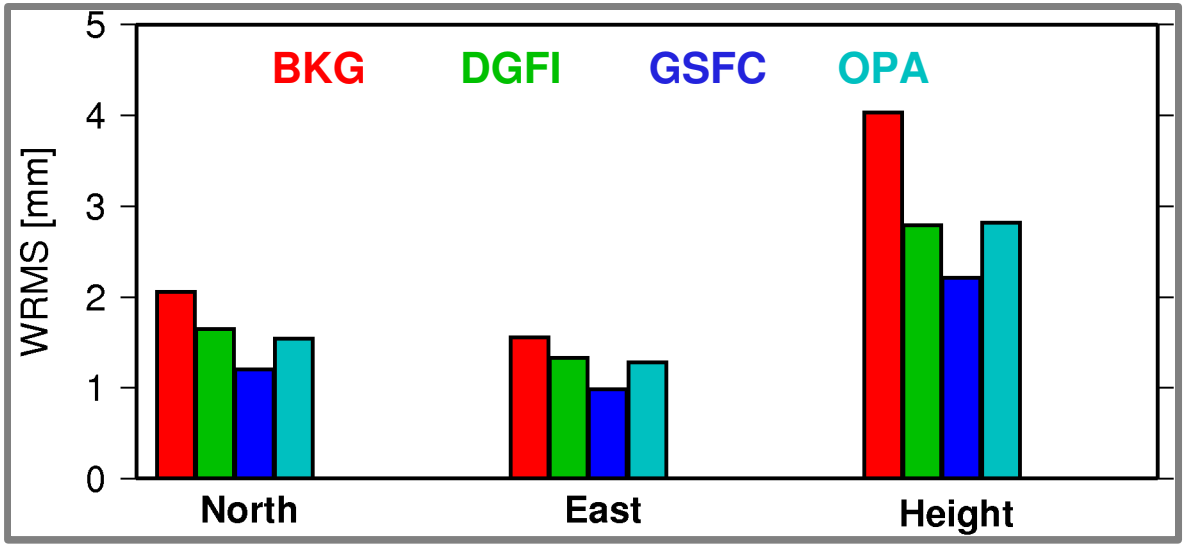
- Polar motion: WRMS < 50 µas
- Systematic differences in LOD
  => different HF model?
  => contributions reprocessed with same HF model
- Systematic differences in dEps
  => reason unknown

IVS Combination Methodology



Station Position Repetabilities

WRMS AC – COMBI (over all stations)

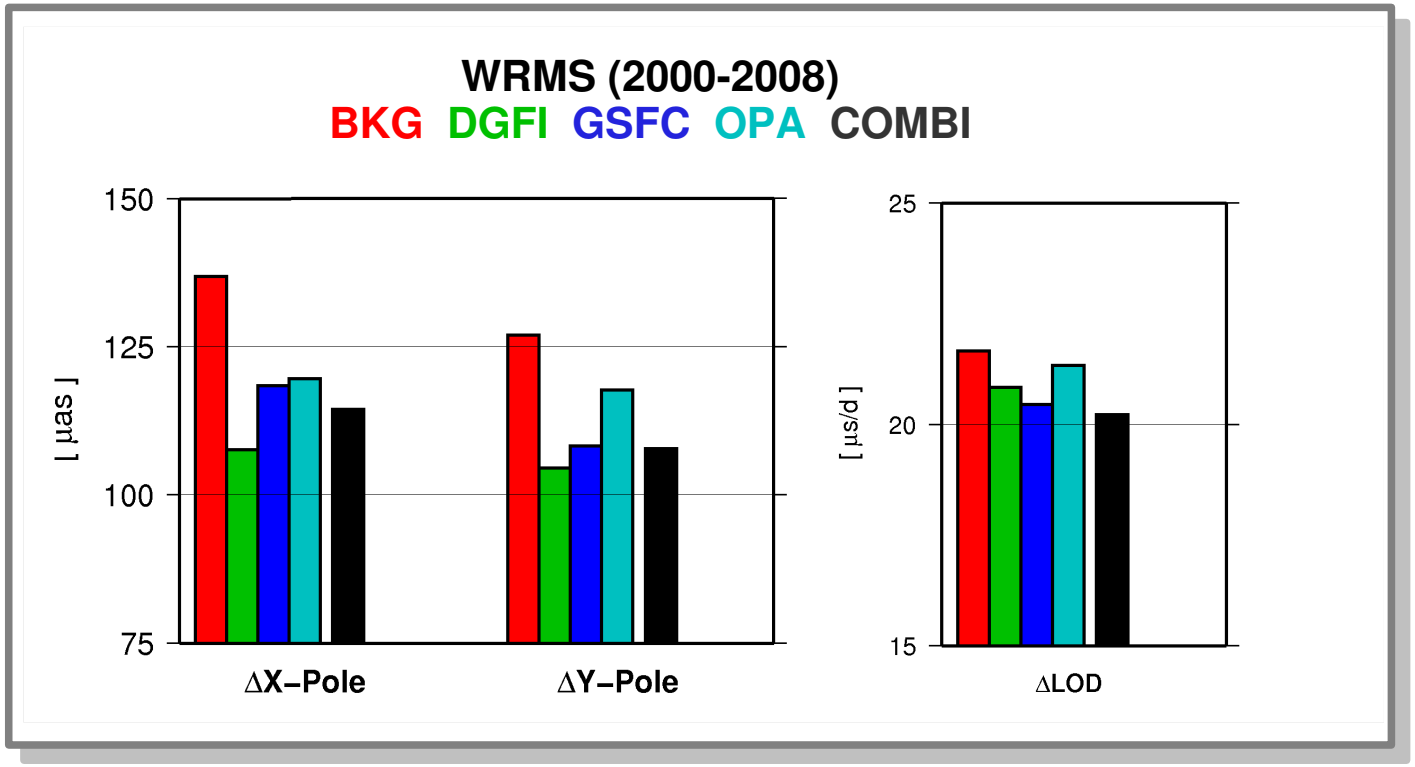


Horizontal components: < 2 mm

Vertical component: 3-4 mm

Earth Orientation Parameters

Individual & Combined solution vs. IGS



=> Pole: ~120 µas
LOD: ~ 20 µs/d