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DENSIFICATION OF THE ITRF VELOCITY FIELD THROUGH A COLLABORATIVE APPROACH

WORKING GROUP 1.3.1
INTEGRATION OF DENSE VELOCITY FIELDS INTO THE ITRF

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IAG SCIENTIFIC ASSEMBLY 2013

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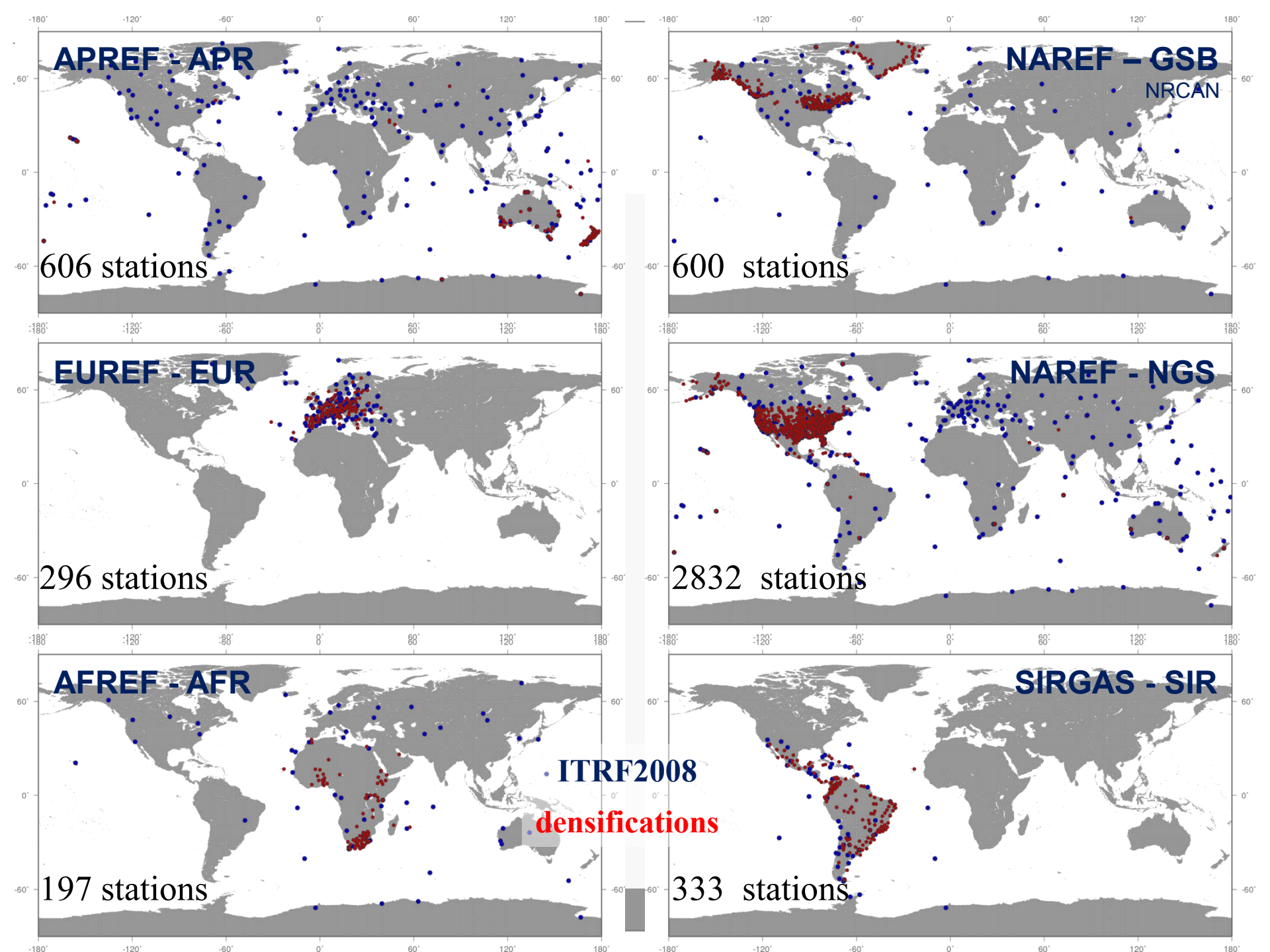
Session : 1.5 Regional Reference Frames


APREF - APR
606 stations
NAREF – GSB
NRCAN
600 stations
EUREF - EUR
296 stations
NAREF - NGS
2832 stations
AFREF - AFR
197 stations
SIRGAS - SIR
333 stations
ITRF2008
densifications

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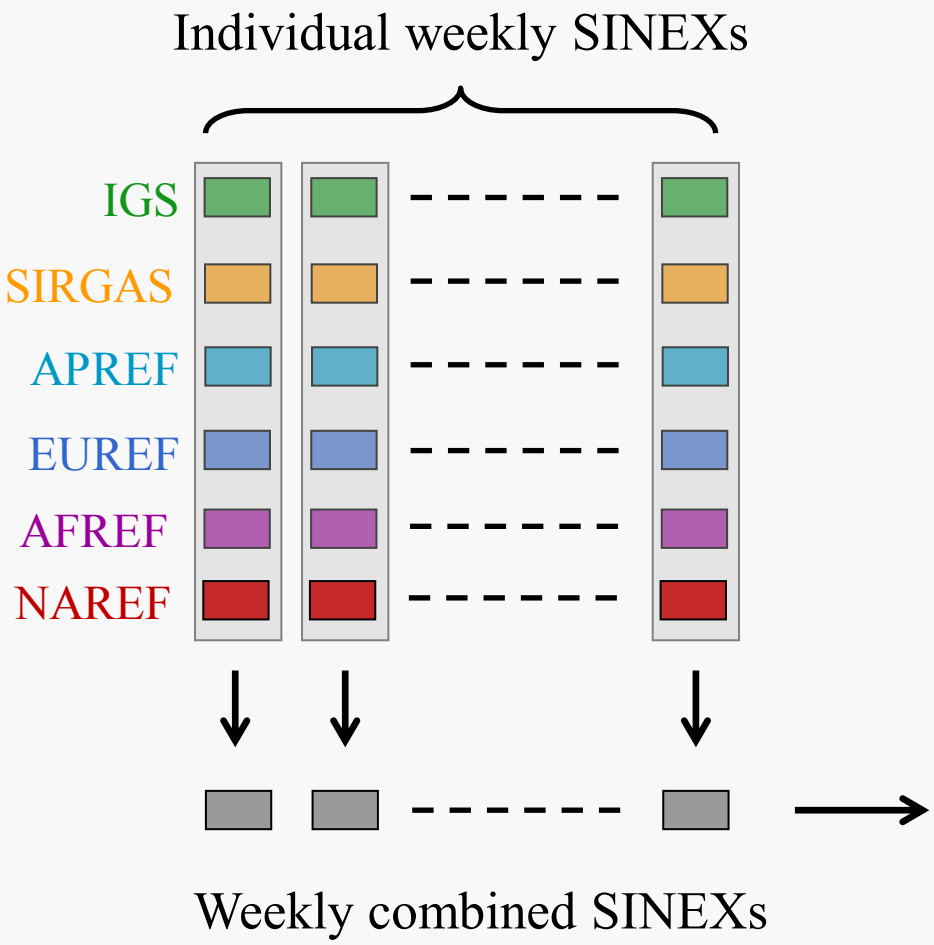
PRINCIPLE: WEEKLY COMBINATIONS



Individual ACs submit:

- cleaned weekly SINEXs
- cumulative solution and time series
- discontinuities
- station site logs (if available)

Cumulative solution aligned to ITRF
(Stacking of weekly combined SINEXs)

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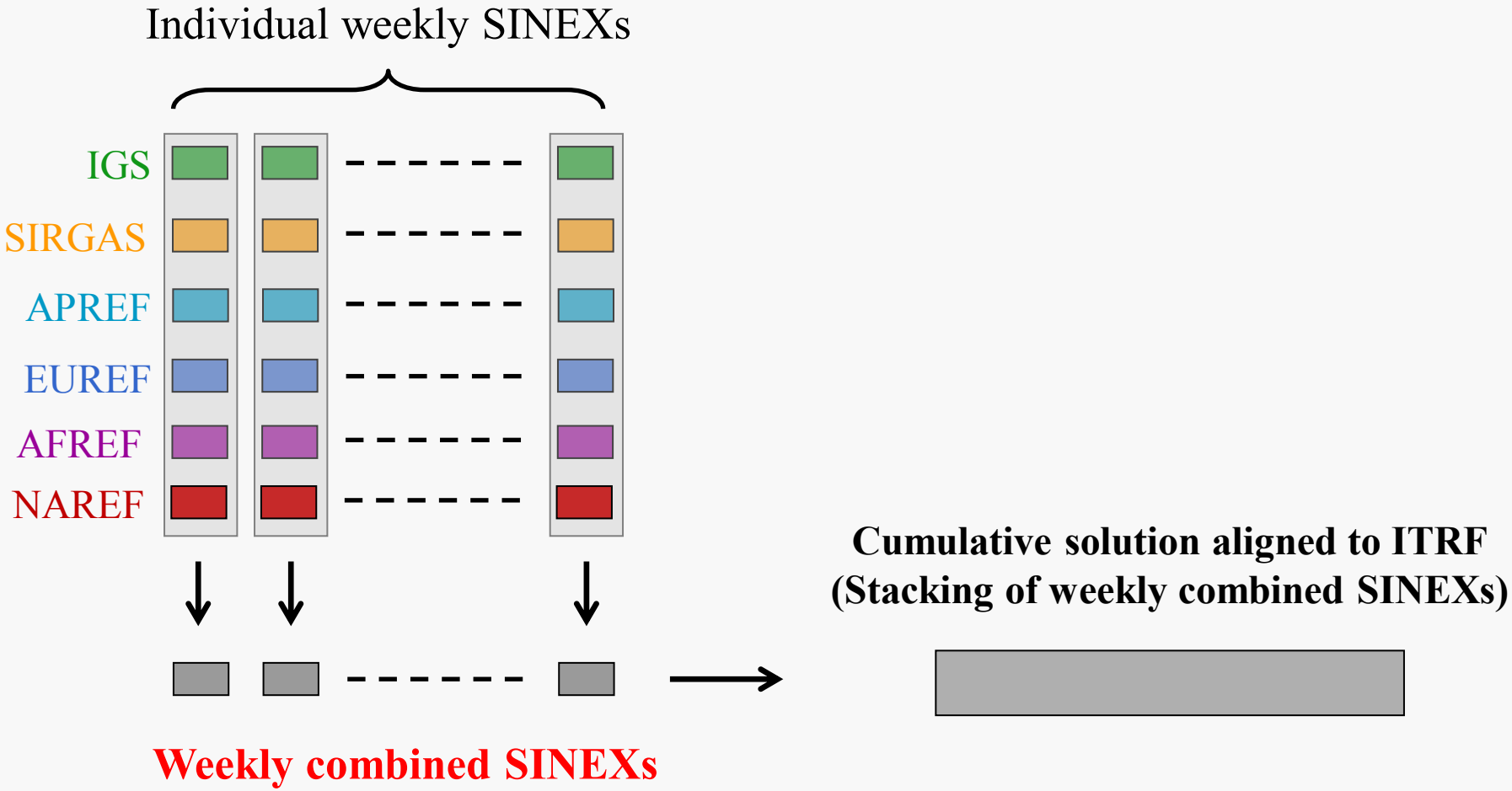
PRINCIPLE: WEEKLY COMBINATIONS



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WEEKLY COMBINATIONS

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WEEKLY COMBINATIONS

Data cleaning

rejection of the "incorrect" solution

- inconsistent antenna modeling (igs05.atx / igs08.atx)
- incorrect metadata (antenna/radome type, eccentricities)

(sub-network: stations in at least 2 solutions)

Covariance matrix re-scaling

2-step approach:

- harmonization of the position formal errors prior to combination
- re-scaling by the estimated variance factor

(sub-network: stations in at least 2 solutions)

Computation of transformation parameters

(sub-network: stations in at least 2 solutions)

Final weekly combination

- matrix re-scaling
- transformation parameters fixed

(Full network)

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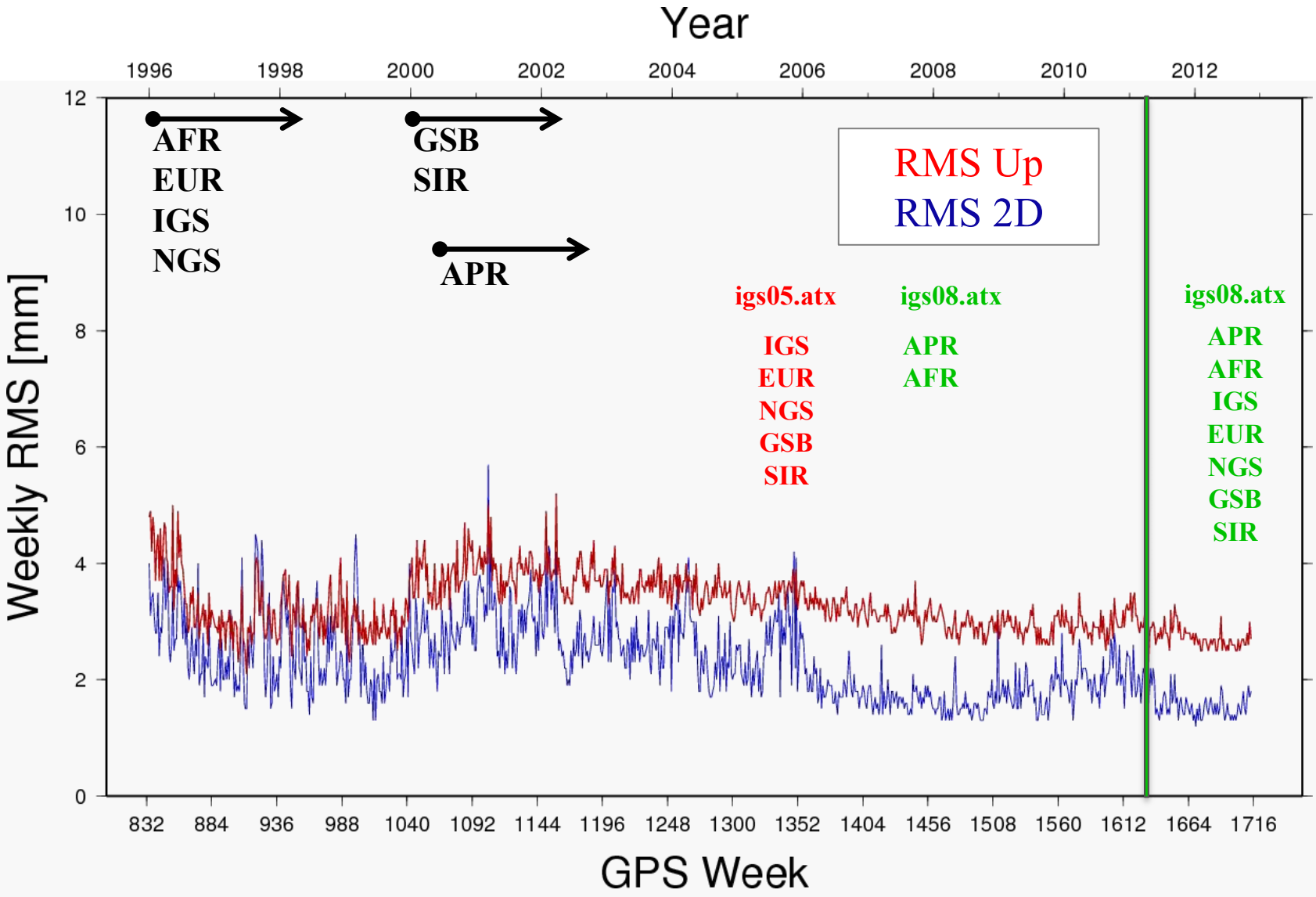
WEEKLY COMBINATION RMS



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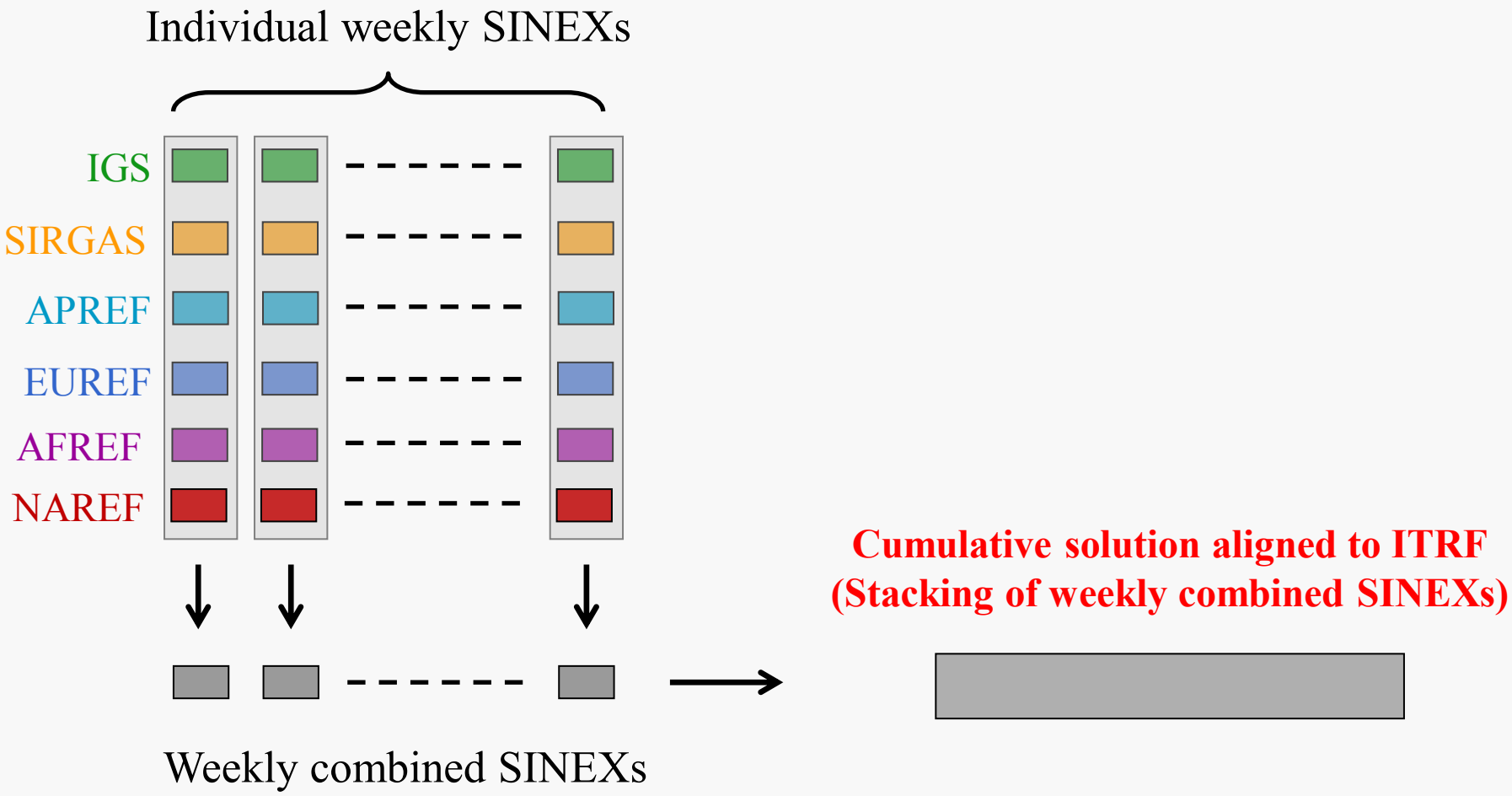
PRINCIPLE: WEEKLY COMBINATIONS



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CUMULATIVE SOLUTION

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CUMULATIVE SOLUTION: DISCONTINUITIES

- Discontinuities coming from individual solutions
  - majority of common stations have different discontinuities
    e.g. EPN vs IGS: 40% stations in full agreement, 60% with differences!
  - reasons: different analyst, different data span, approximate date, problem of metadata or antenna modeling
- Harmonization for ~1200 stations in at least 2 solutions
  - keep only required discontinuities
  - check all available site logs (material change: date of installation)
- Iterative process, still in progress. Next steps:
  - check also the dates of displacements linked to earthquakes
  - feedback to contributors

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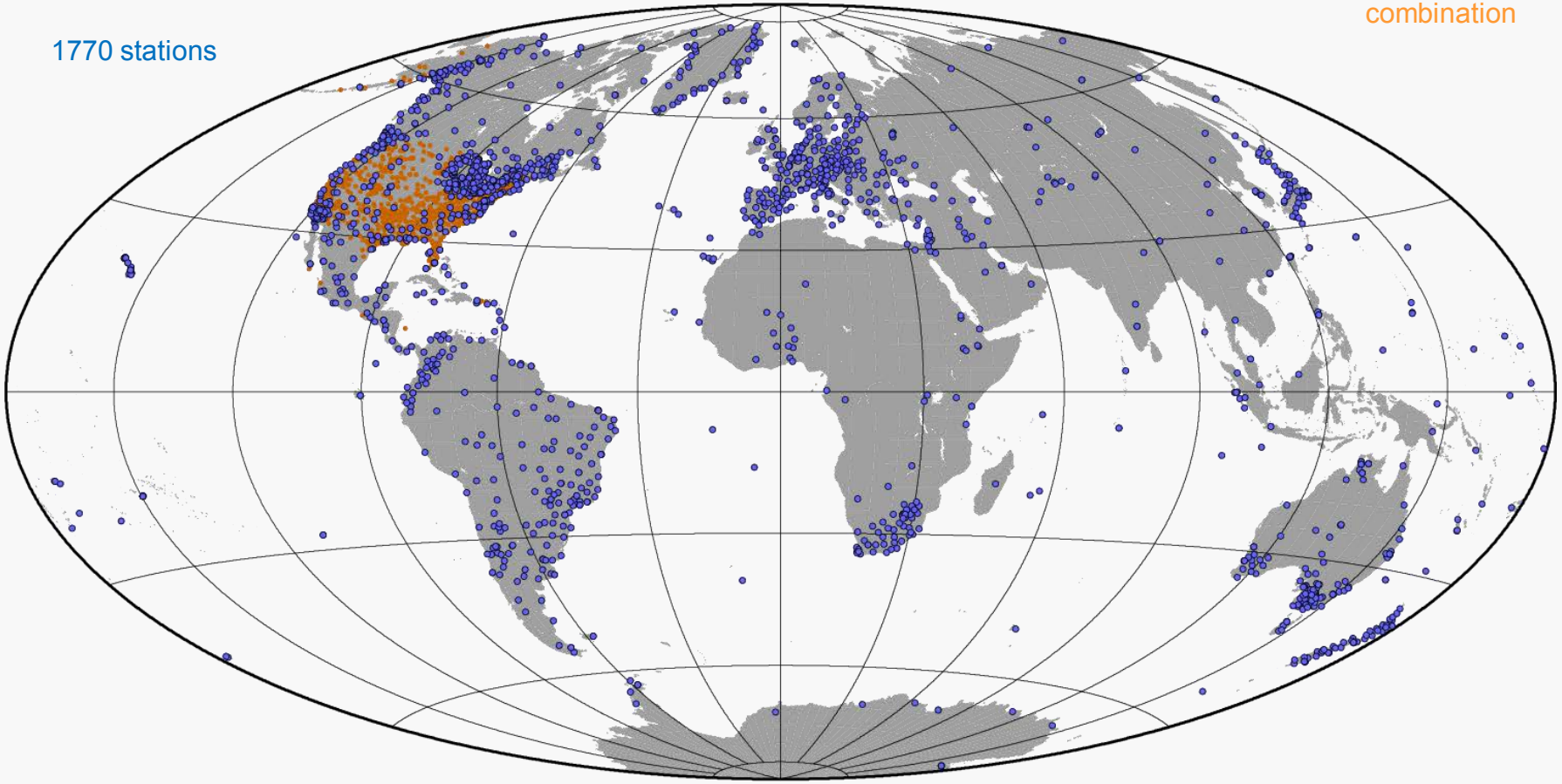
CUMULATIVE SOLUTION: NETWORK

Stations available in the current combination

1770 stations

~ 1000 NGS stations not yet included in the combination



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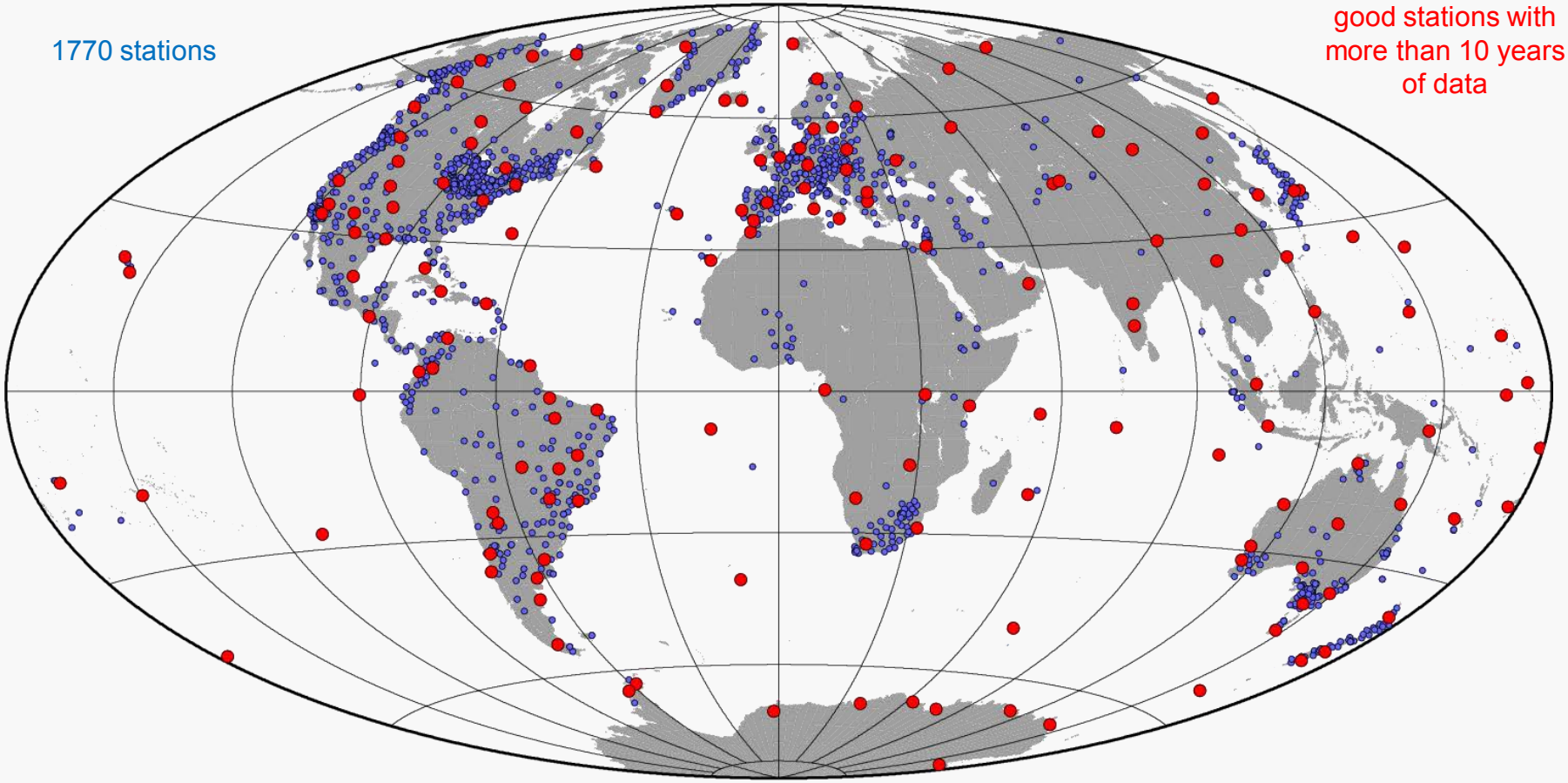
CUMULATIVE SOLUTION: NETWORK

Stations available in the current combination

1770 stations

Sub-network used to mitigate the aliasing effect [Collilieux et al. 2011]

igs08 core network
+
good stations with more than 10 years of data



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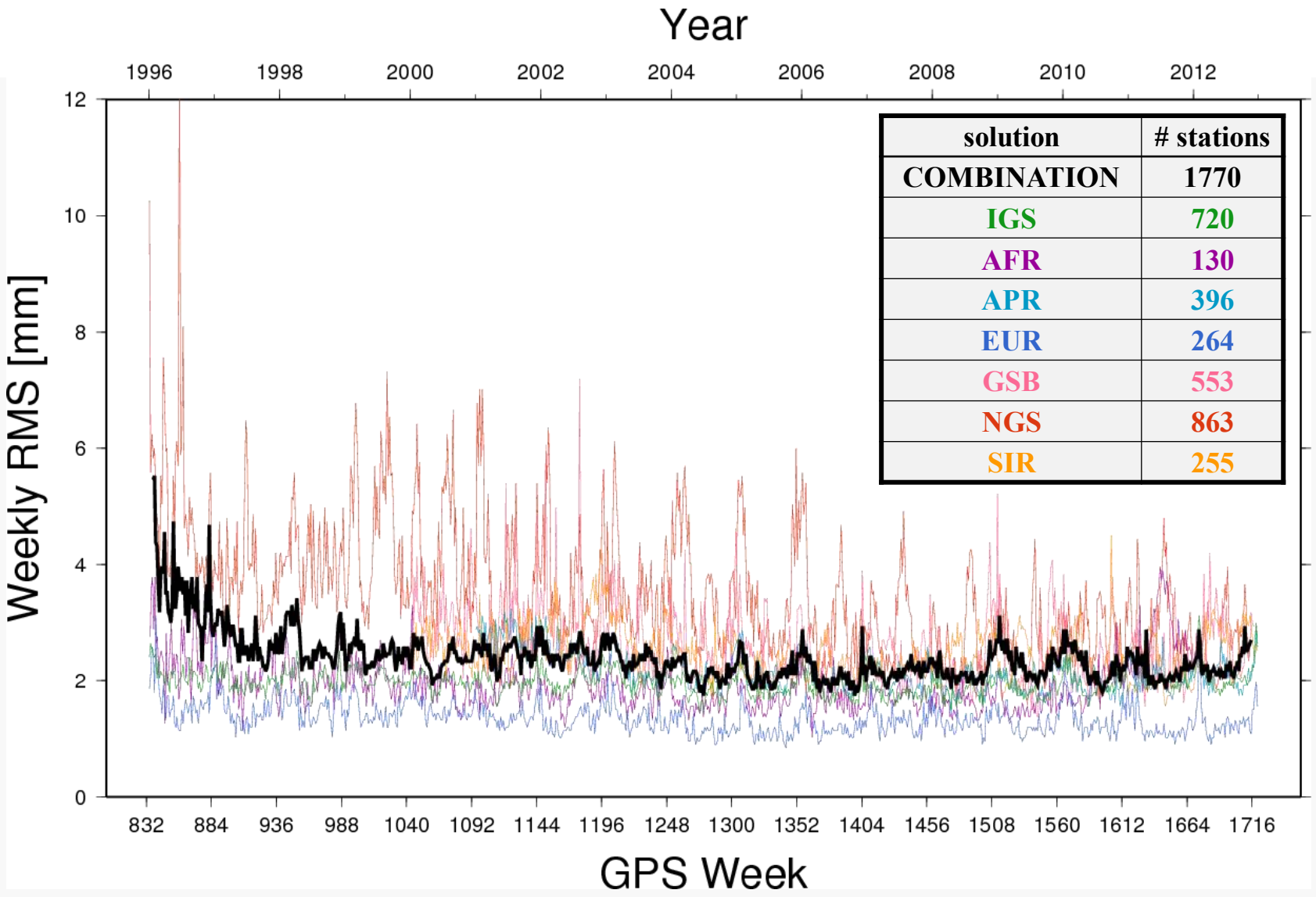
CUMULATIVE SOLUTION: WEEKLY RMS



solution	# stations
COMBINATION	1770
IGS	720
AFR	130
APR	396
EUR	264
GSB	553
NGS	863
SIR	255

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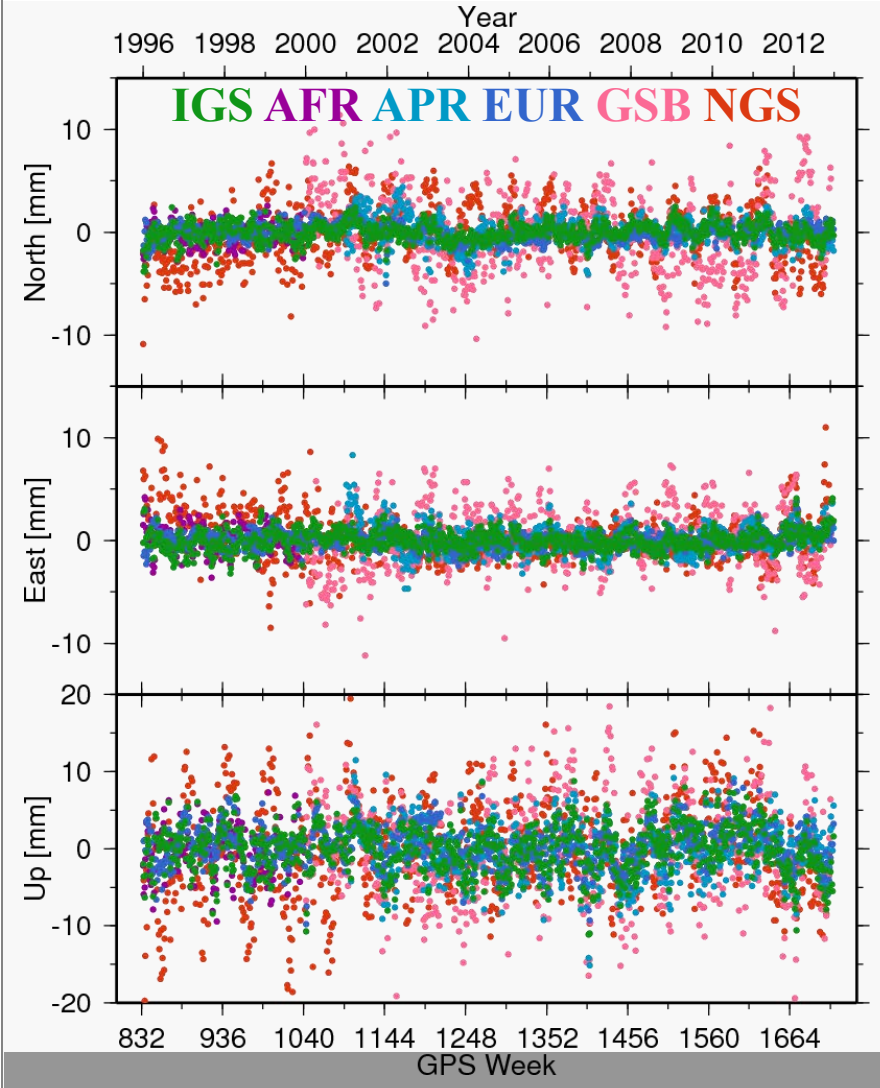
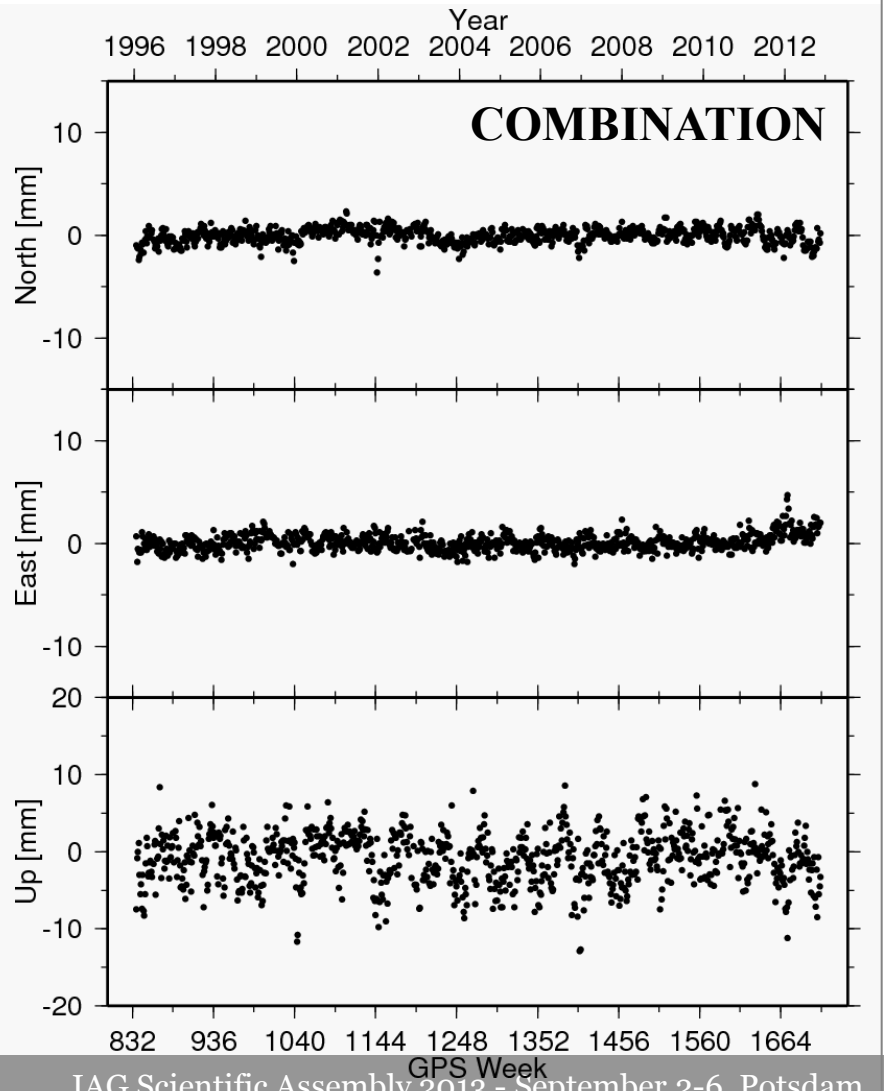
CUMULATIVE SOLUTION: TIME SERIES

ONSA A 10402M004 (Onsala, Sweden)





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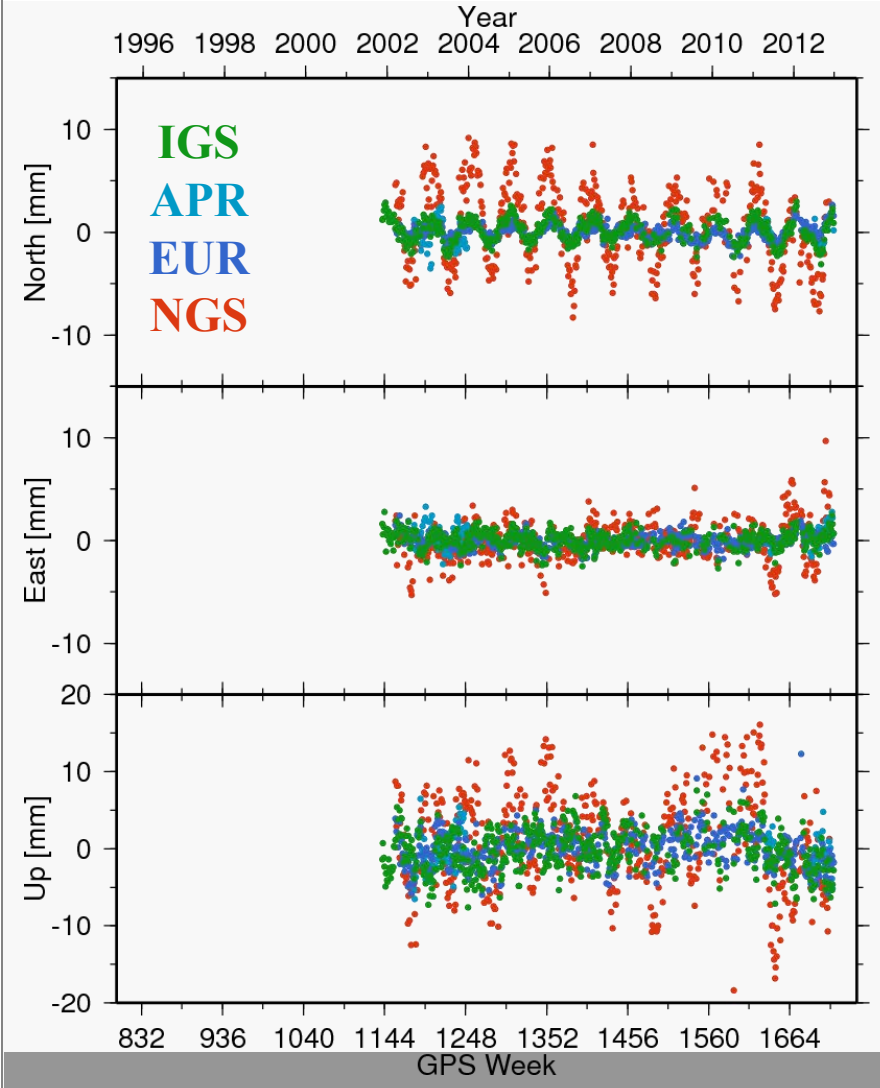
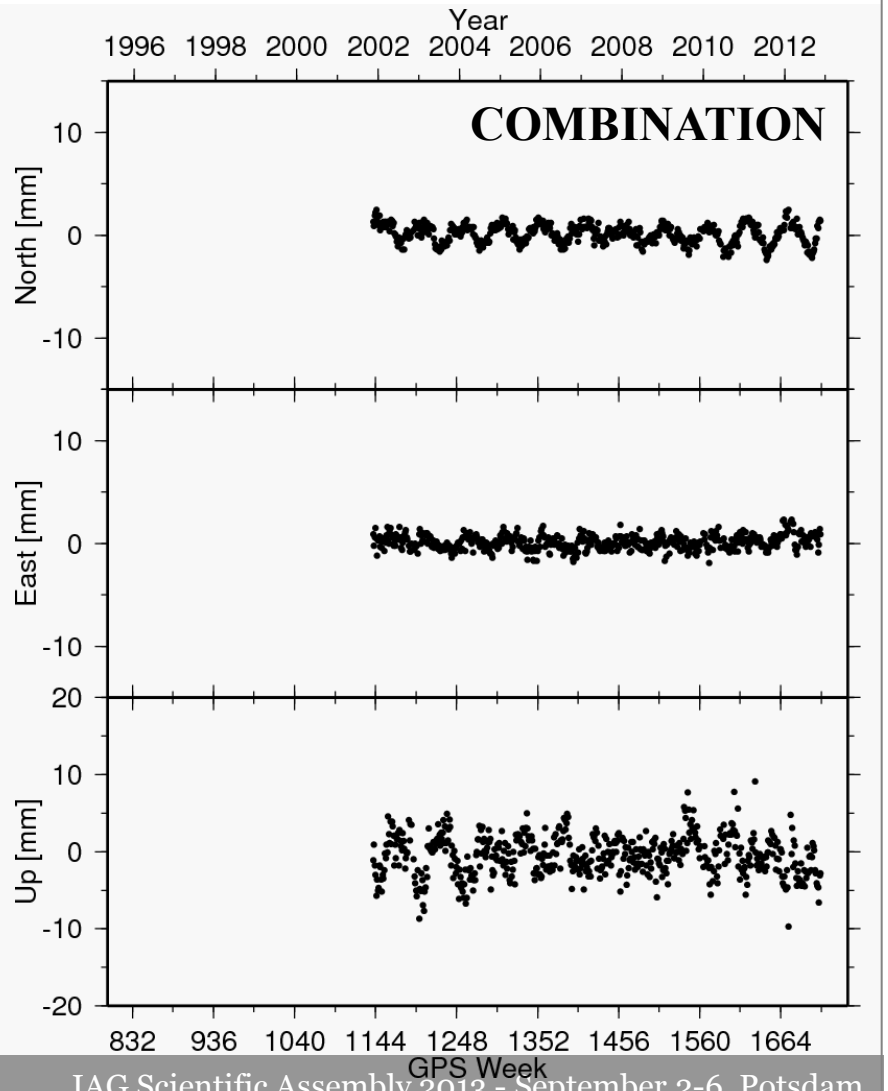
CUMULATIVE SOLUTION: TIME SERIES

LROC A 10023M001 (La Rochelle, France)





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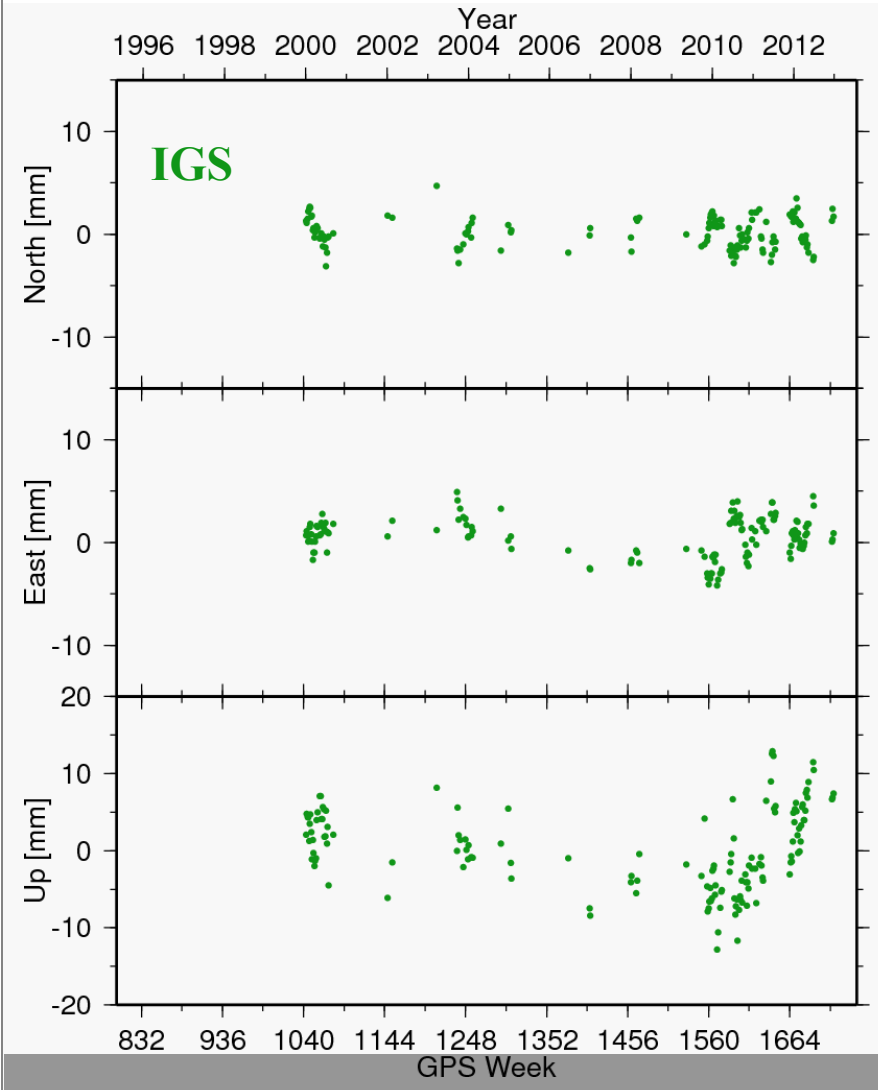
CUMULATIVE SOLUTION: TIME SERIES

COT1 A 49469M001 (Tucson, Arizona, USA)



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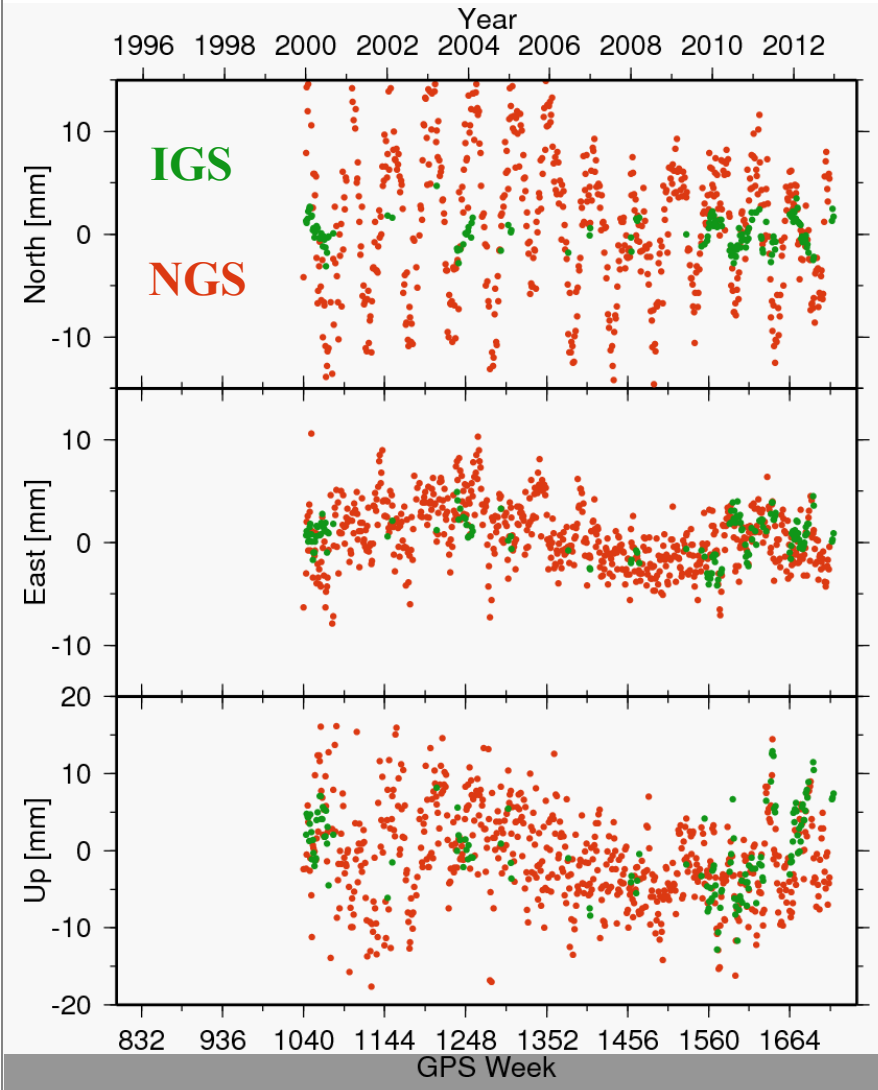

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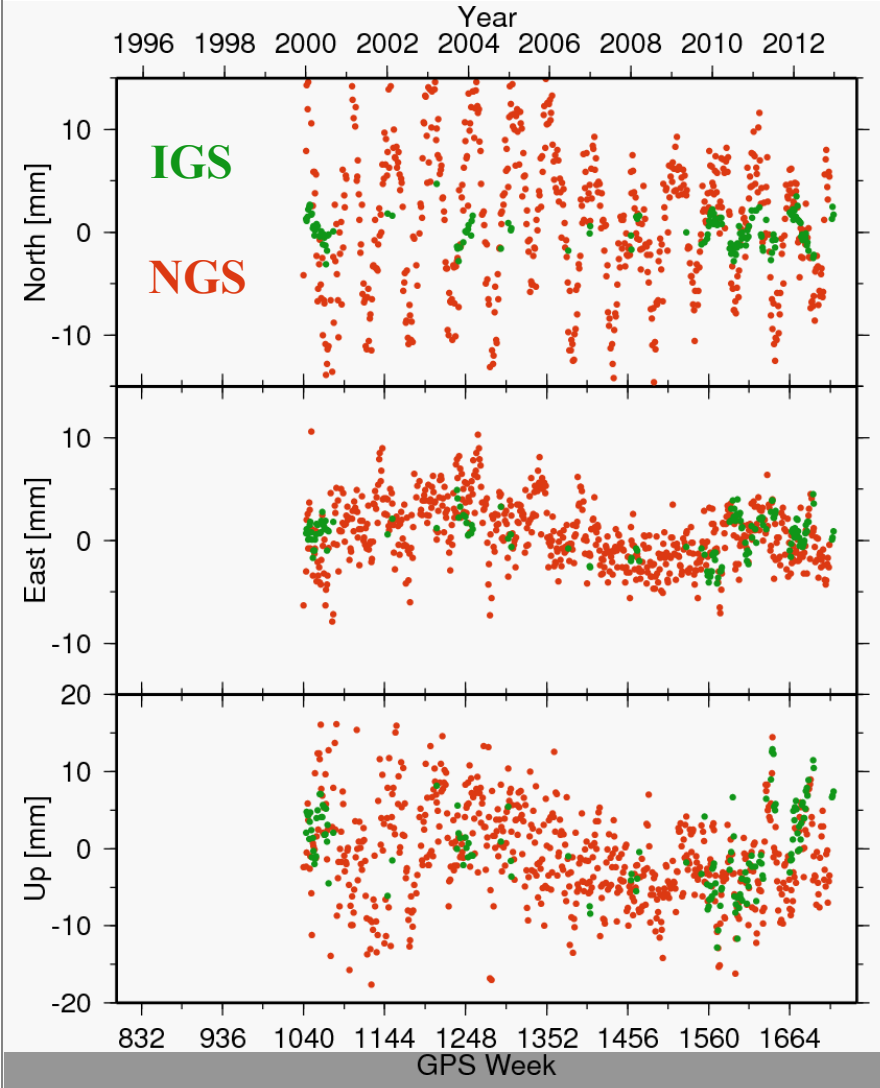

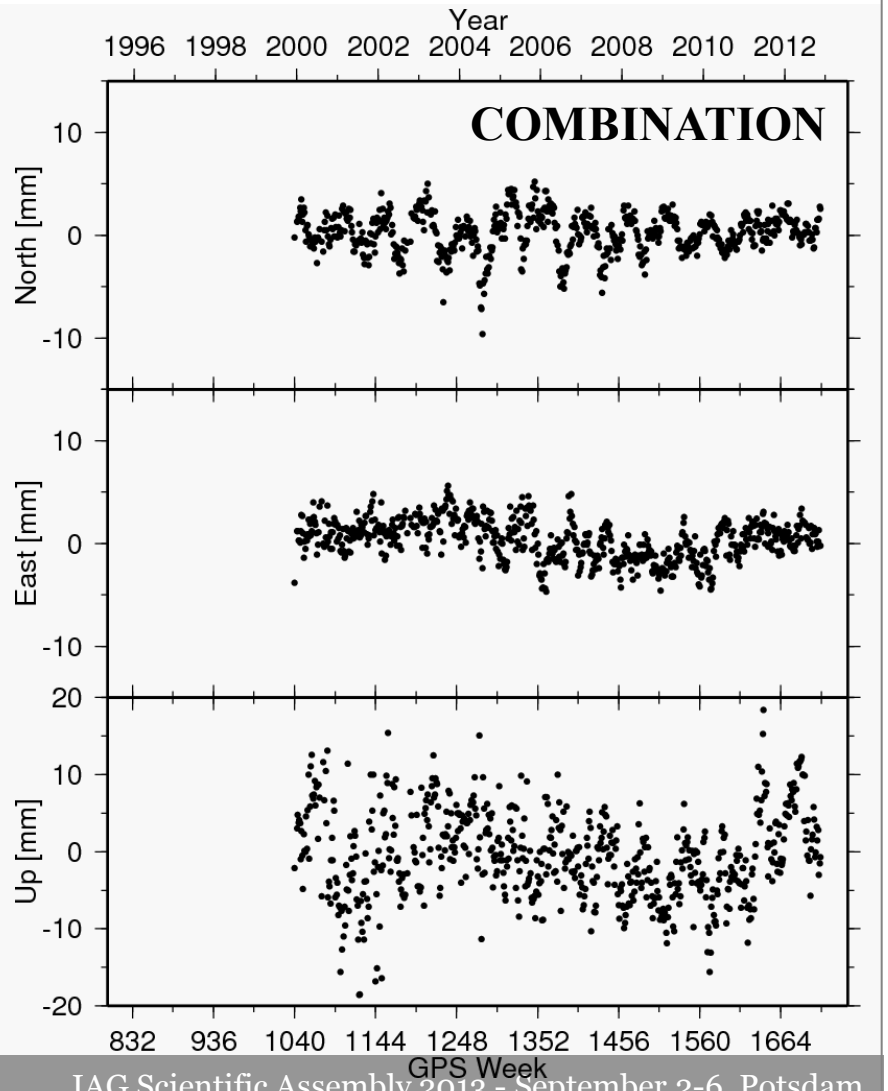

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VELOCITY FIELD

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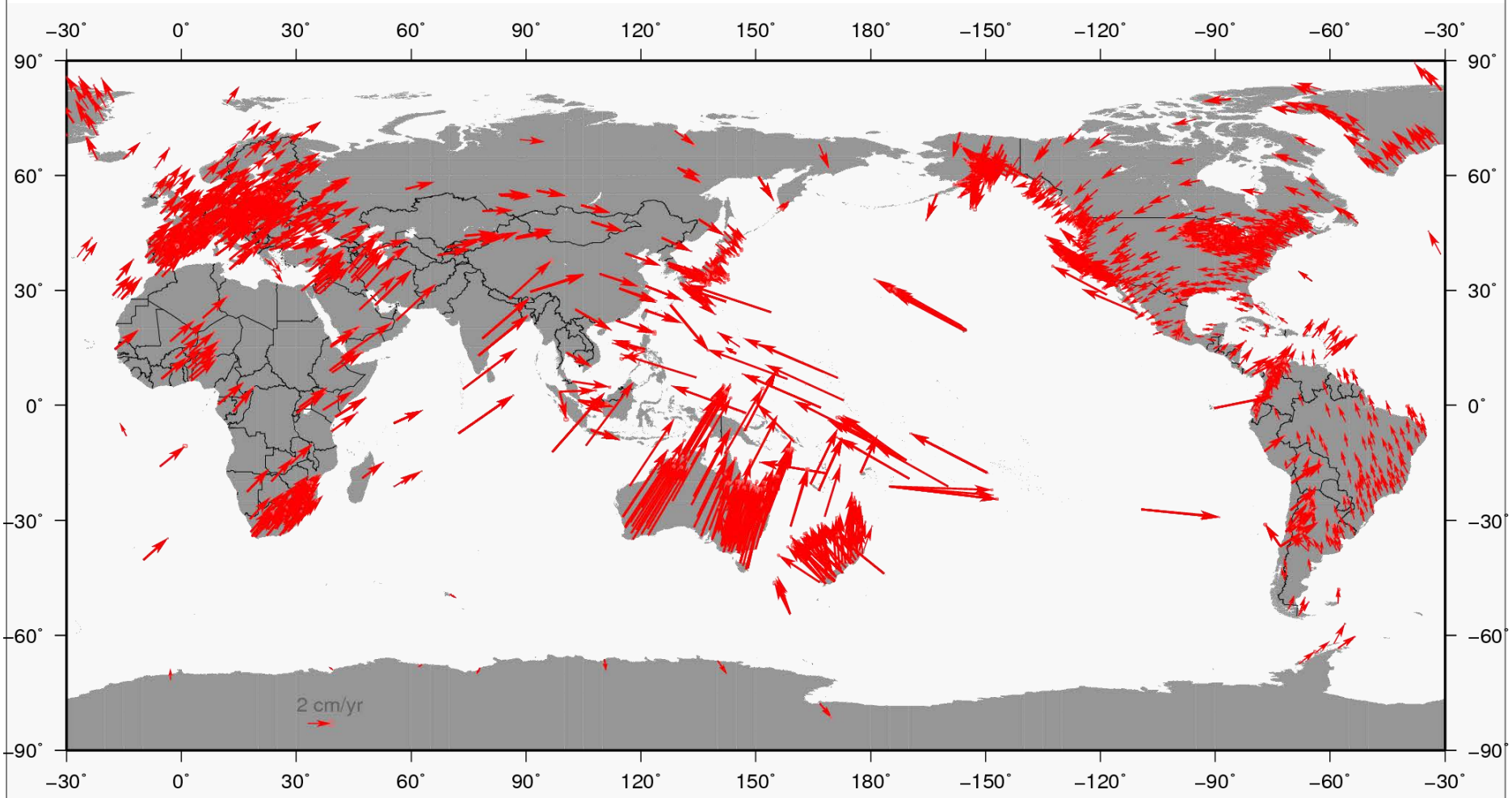
Horizontal Velocity Field (Preliminary combination)



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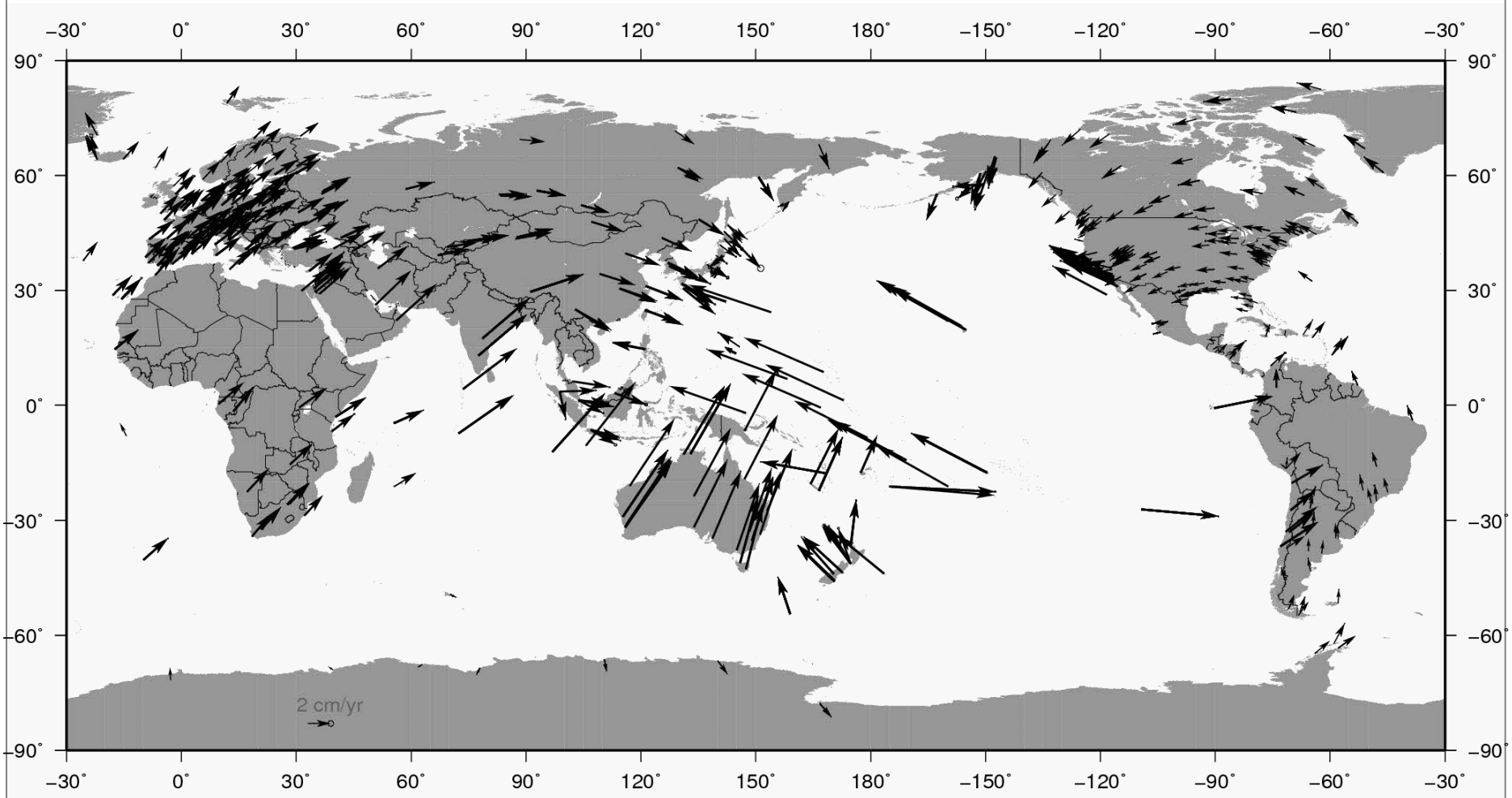
HORIZONTAL VELOCITY FIELD (ITRF2008 ONLY)



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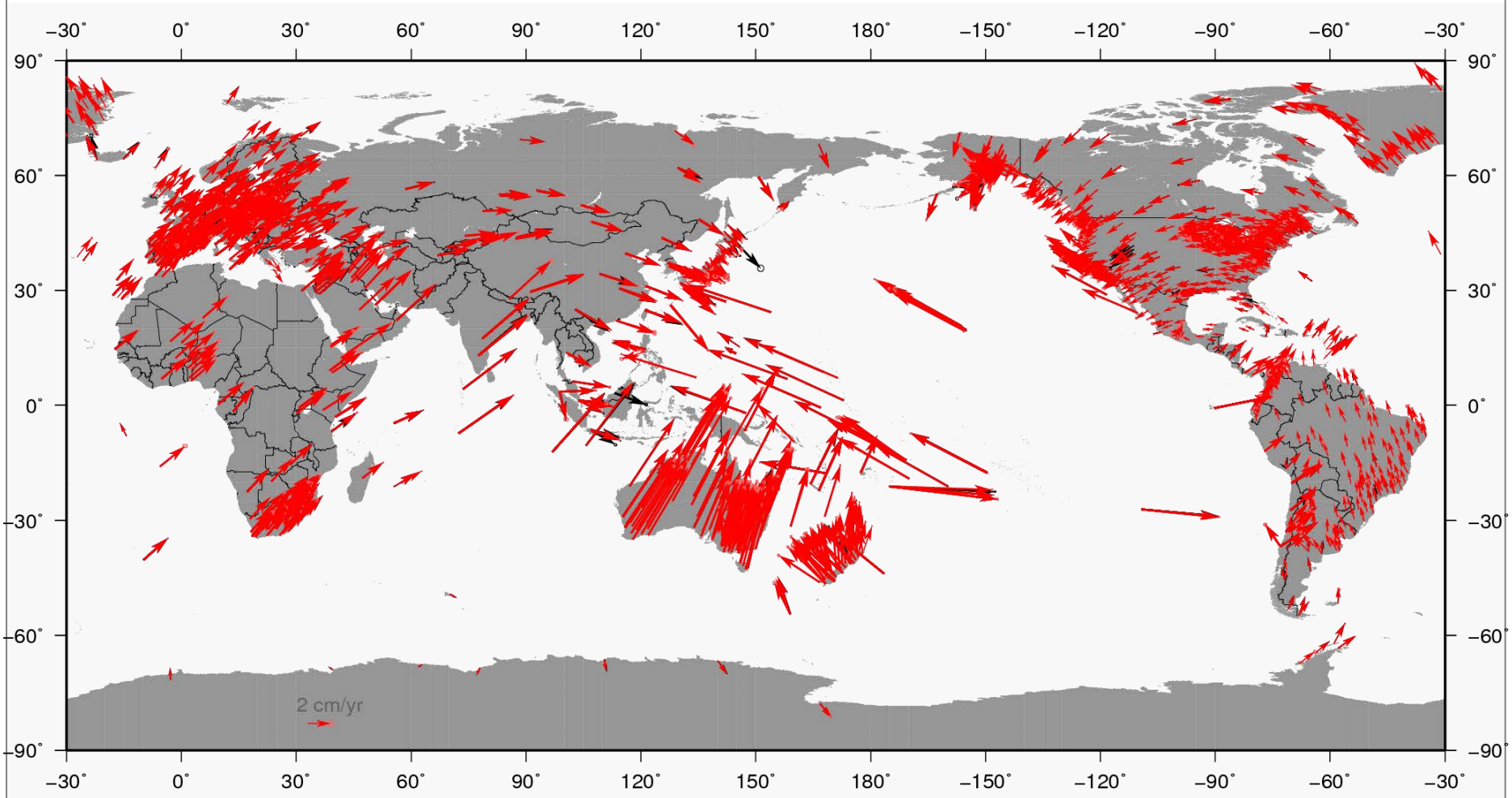
Horizontal Velocity Field (Preliminary combination)



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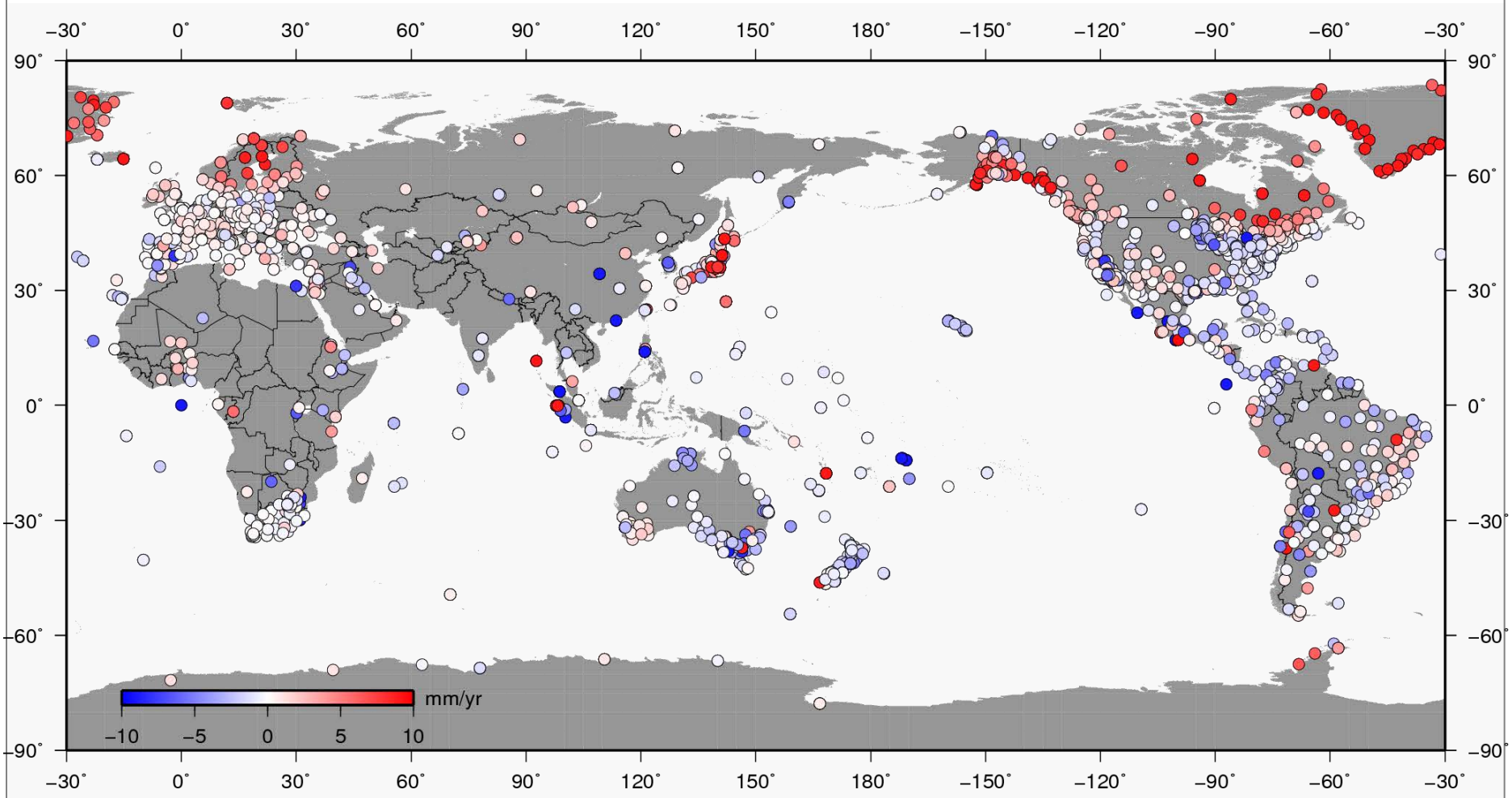
Vertical Velocity Field (Preliminary combination)



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CONCLUSIONS

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CONCLUSIONS/PERSPECTIVES

- Successful combination
  - No degradation, improvement of individual solutions
    - Comparison of solutions: more reliability
    - More populated and longer time series
    - SIRGAS/EUREF regional solutions
- Finish this combination (+ ~1000 stations, discontinuities)
- Main drawback: mix of igs05.atx and igs08.atx models

⇒ Next year(s), new combination using:

- IGS Repro 2
- new densifications (IGS Repro2 compliant)