



Consistency of the IGS Contribution to ITRF2008

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Canada

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Contents

- Introduction
- Procedure
- Network
- Products
 - Coordinates
 - ERP's
 - Apparent Geocenter
- Summary



Introduction

- **Main Objective:**
 - Better meet users requirements by providing more consistent products.
- **Contributors (11 ACs):**
 - cod Center for orbit Determination in Europe, Bern, Switzerland
 - emr Natural Resources, Canada
 - esa European Space Operations Center, ESA, Germany
 - gfz GeoForschungsZentrum, Germany
 - gtz GeoForschungsZentrum – TIGA project, Germany
 - jpl Jet Propulsion Laboratory, USA
 - mit Massachusetts Institute of Technology, USA
 - ngs National Oceanic and Atmospheric Administration / NGS, USA
 - pdr GFZ Potsdam/IPG Dresden, Germany
 - sio Scripps Institution of Oceanography, USA
 - ulr Université de La Rochelle, France



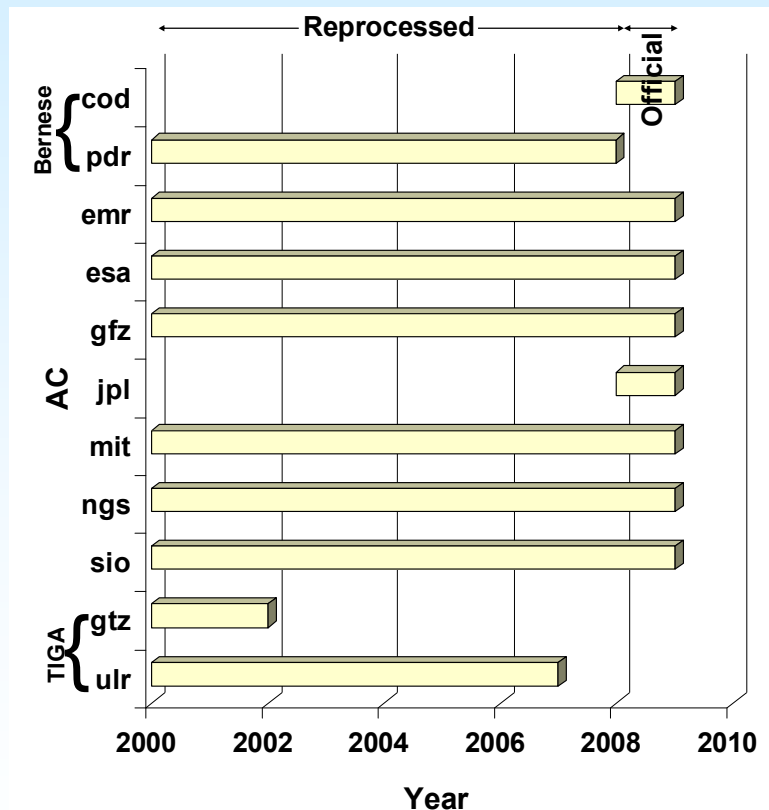
Procedure

- Rescale covariance information (w.r.t. Cumulative)
- Check for and remove significant inconsistencies between:
 - ACs
 - ACs & $igs_{(i-1)}$ Weekly
 - ACs & $IGS_{(i-1)}$ Cumulative
 - Threshold:
 - 8 sigmas & 8 cm for Reprocessing (2000-2007)
 - 5 sigmas & 5 cm for Official (2008)
- Combine using standard least-squares
- Remove stations not meeting IERS minimum requirements (DOME #, 2 years)



ACs Contribution Timeline

Comments

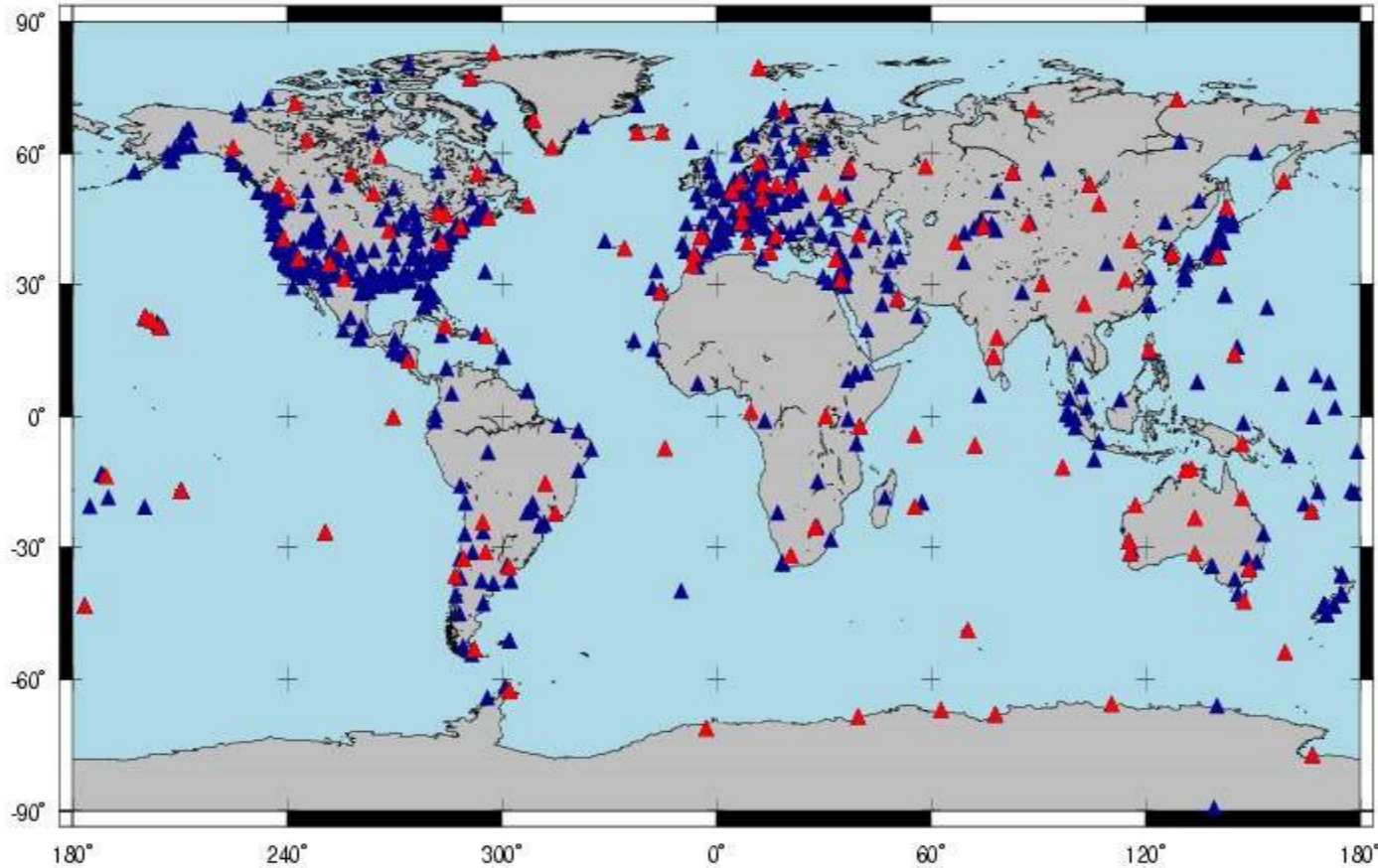


- cod - Excluded ERPs / Official Only
- pdr - Excluded ERPs
- emr - No exclusion
- esa - No exclusion
- gfz - Excluded Geocenter
- jpl - Official Only
- mit - No exclusion
- ngs - No exclusion
- sio - Excluded Pole Rates
- gtz - Excluded Geocenter
- ulr - Excluded Geocenter /No ERPs



Network Distribution

All stations / All ACs / (2000-2008)

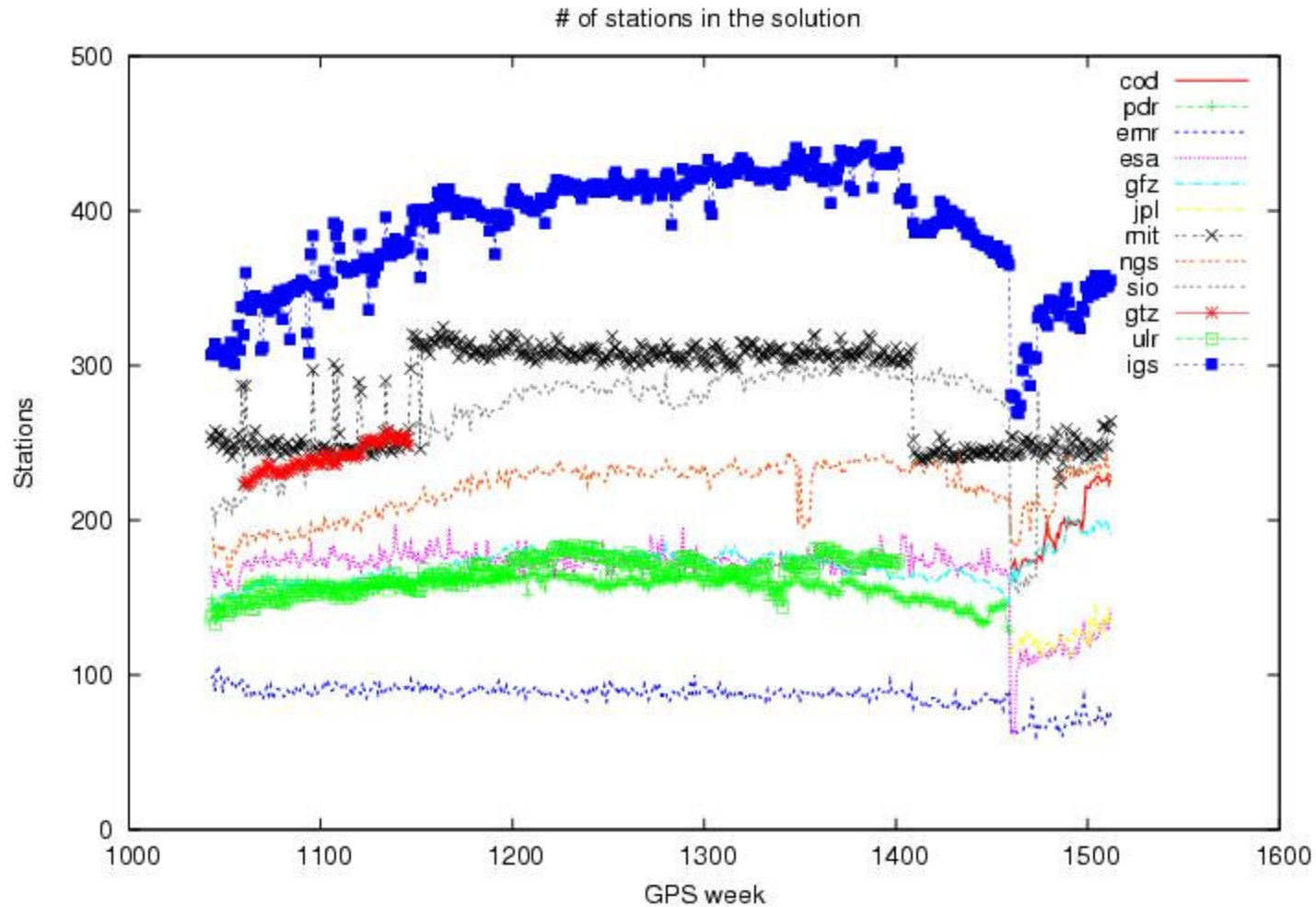


Total: 856 Stations

(In red) – IGS05 stations

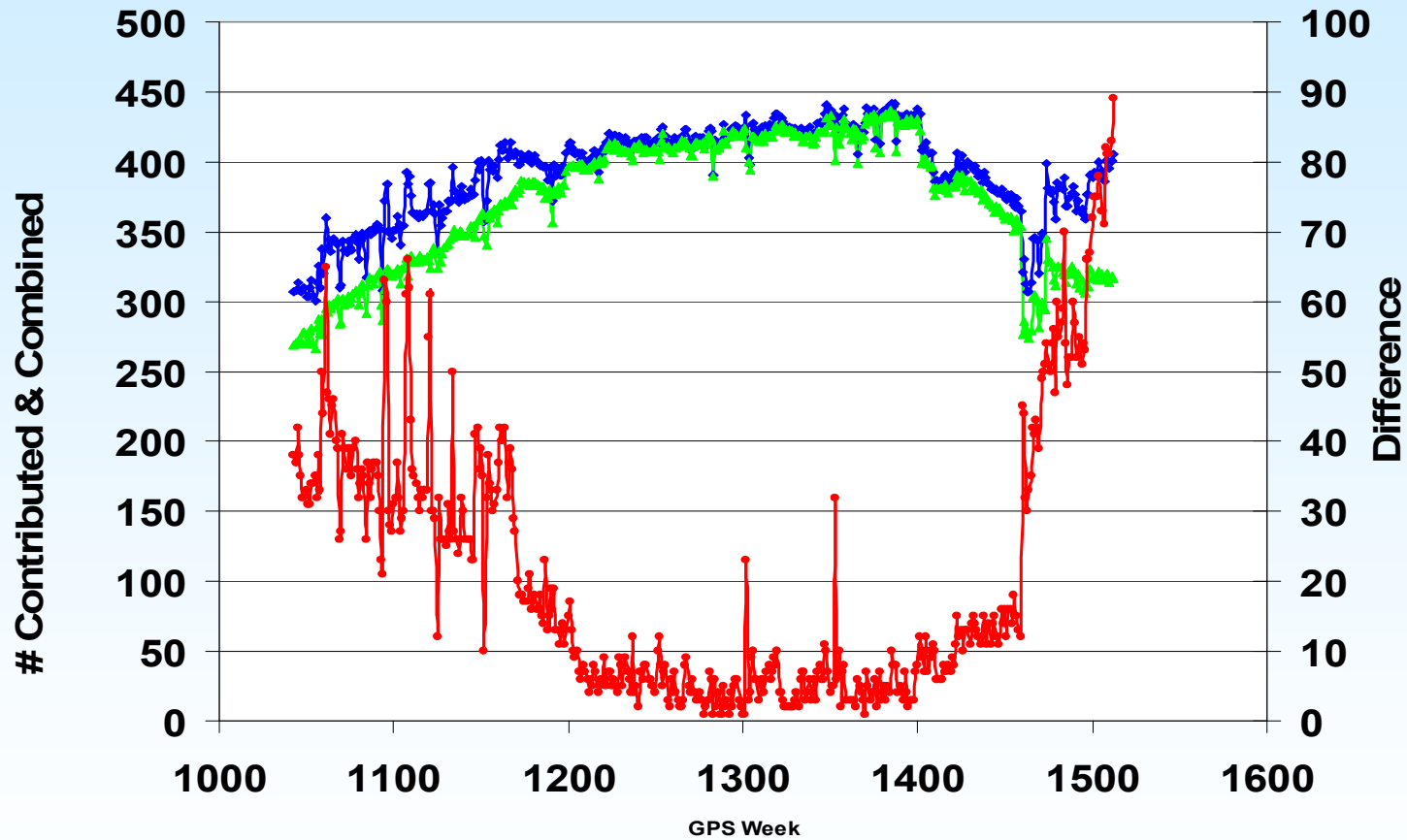


Stations in ACs & IGS Weekly Combined Solutions





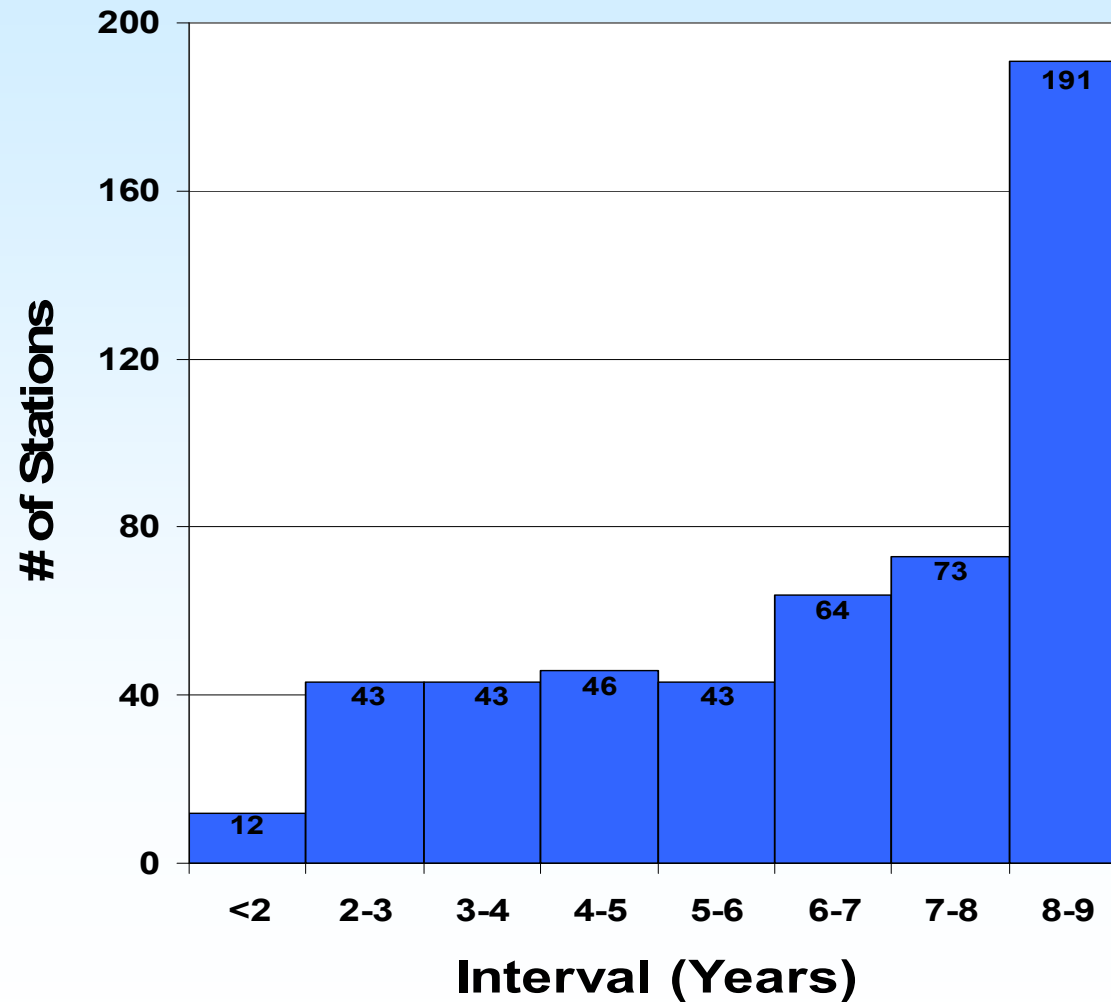
Stations in IGS Weekly Combined and Contributed



—●— Combined —●— Contributed —●— Difference

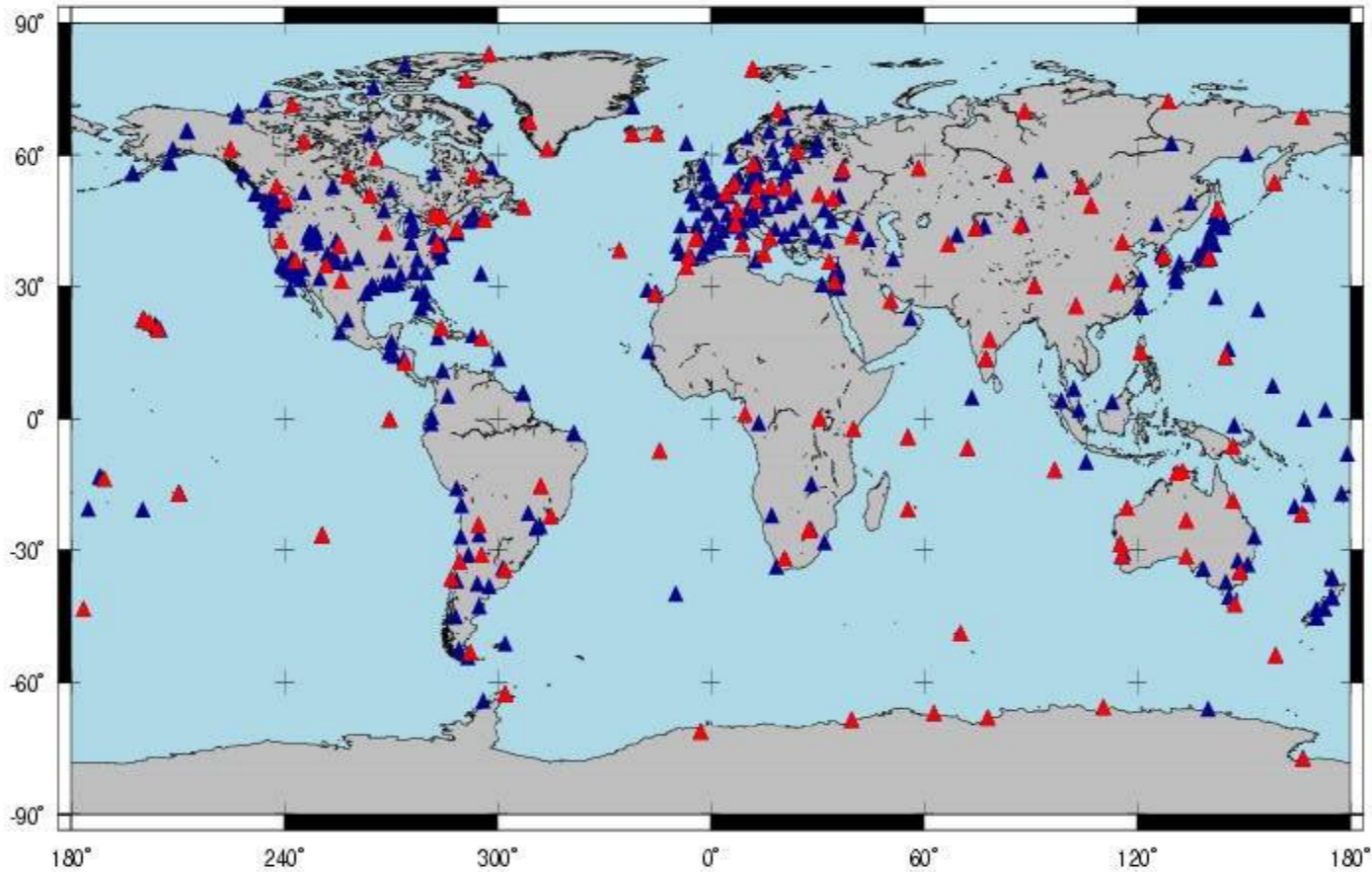


Stations Usage Interval





Contributed Stations Distribution

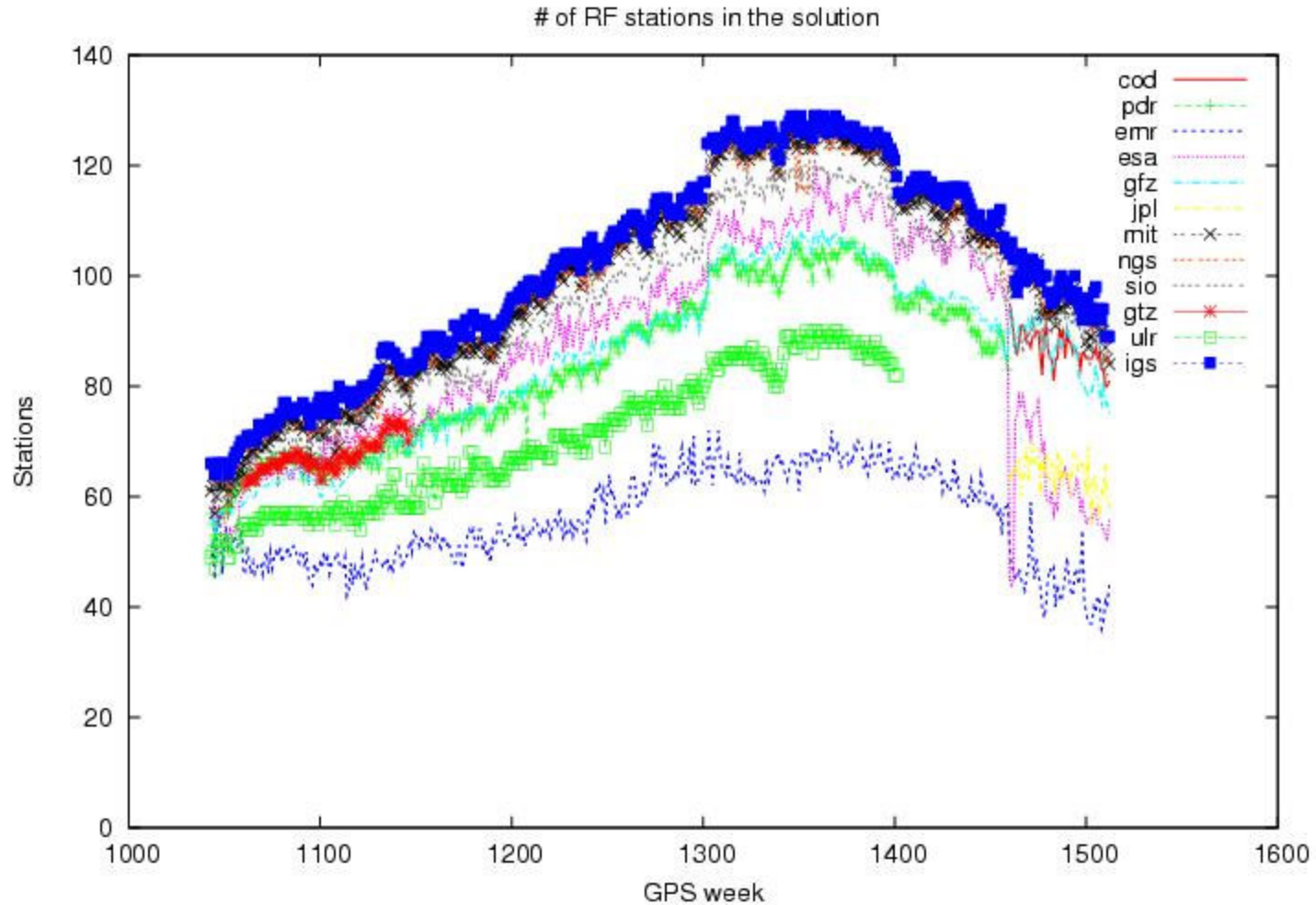


515 Stations contributed to ITRF

(In red) – IGS05 stations

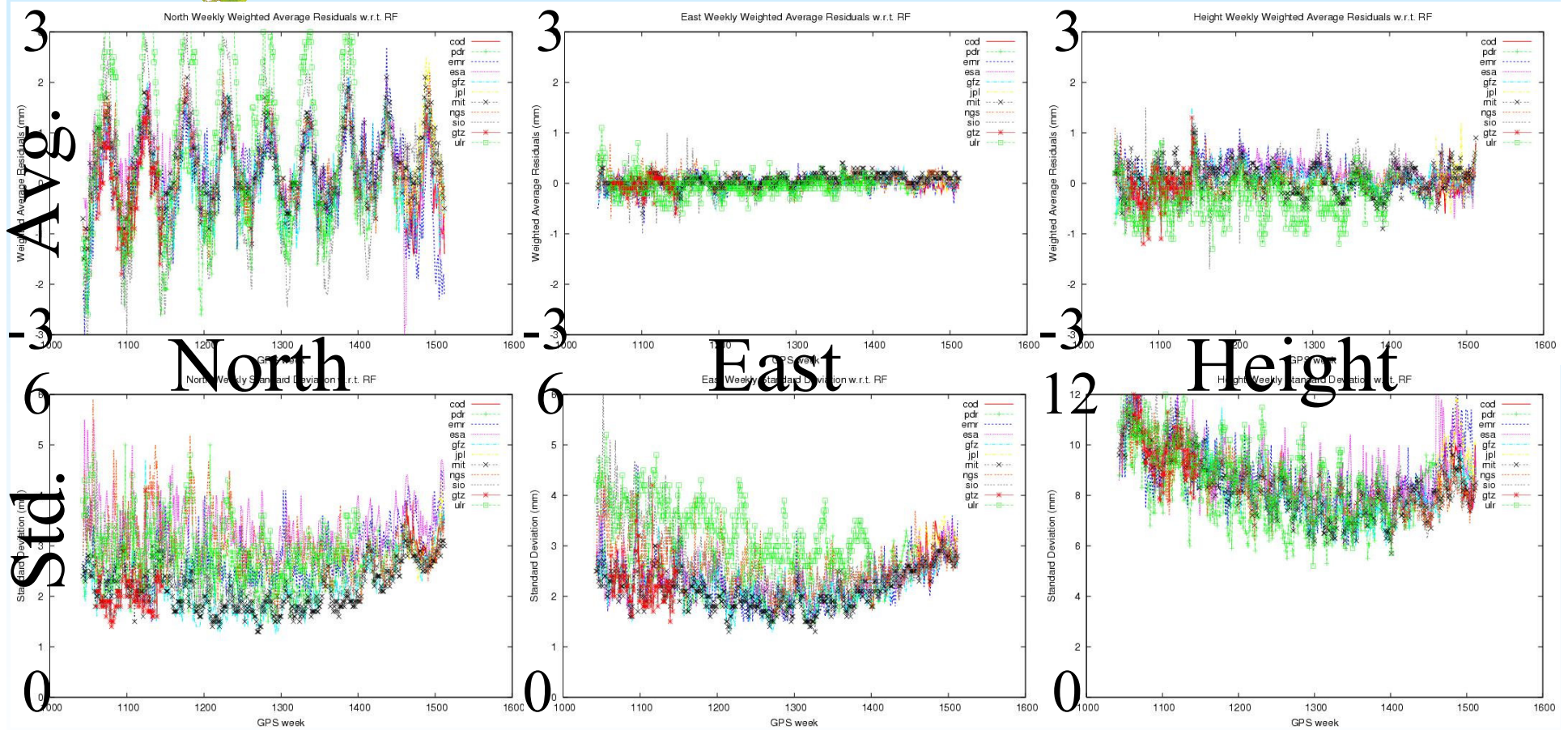


IGS05 Usage





Avg. & Std. of Residuals w.r.t. IGS05 (in mm)

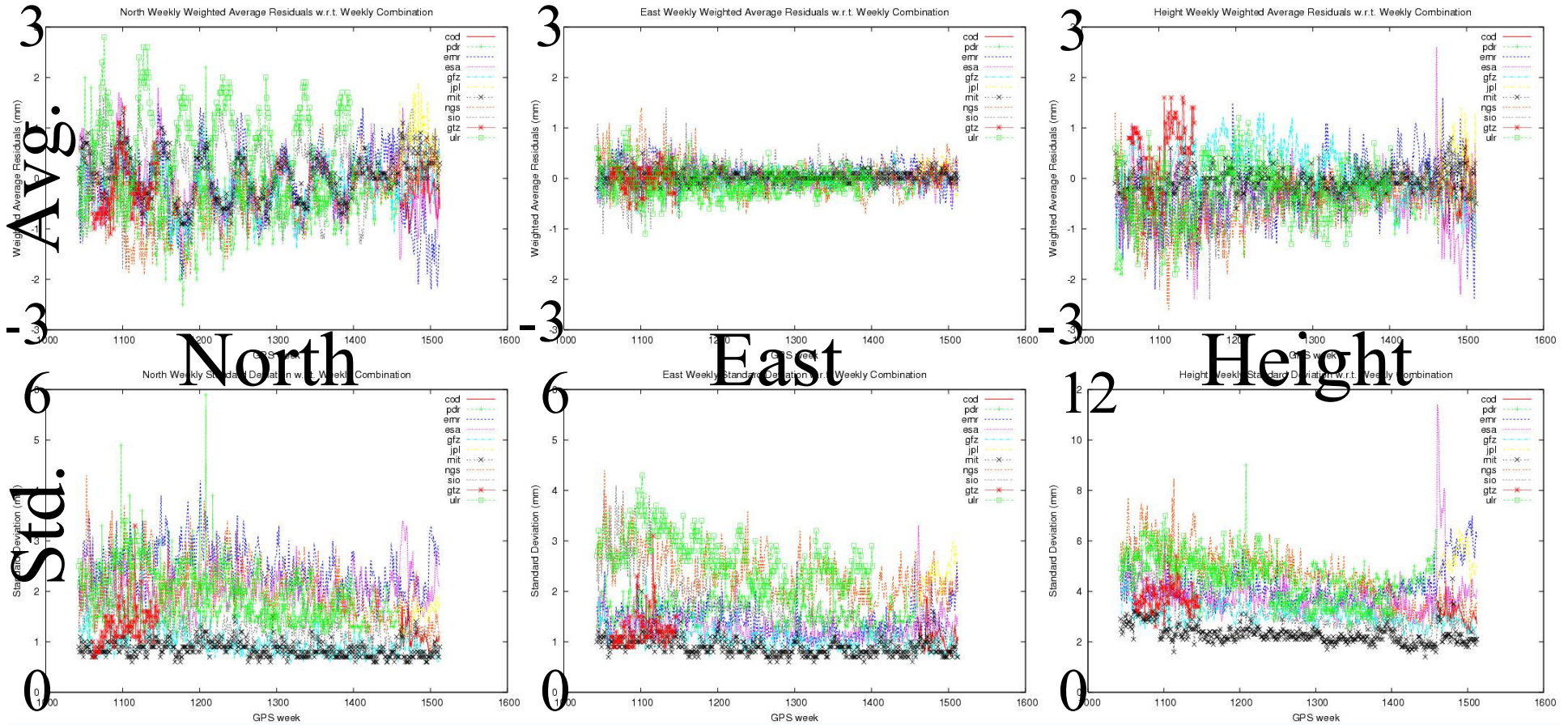


$$\sigma_N = 2.7 \text{ mm}$$

$$\sigma_E = 2.4 \text{ mm}$$

$$\sigma_H = 8.5 \text{ mm}$$

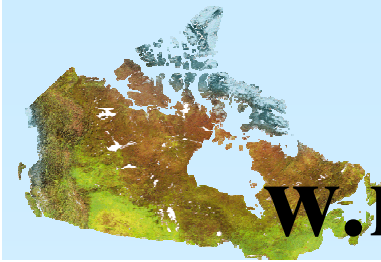
Avg. & Std. of Residuals w.r.t. Combined Weekly Solutions (in mm)



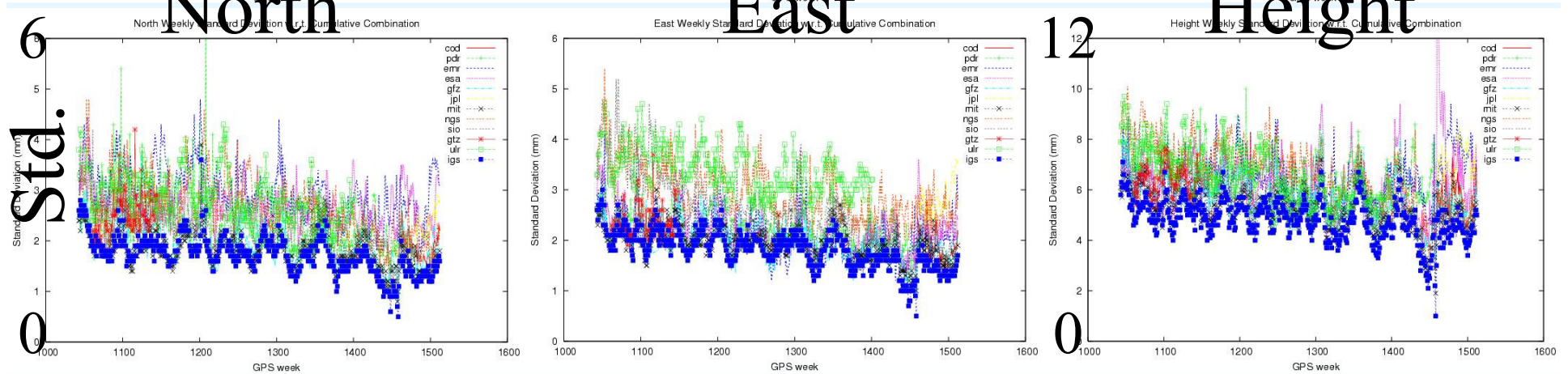
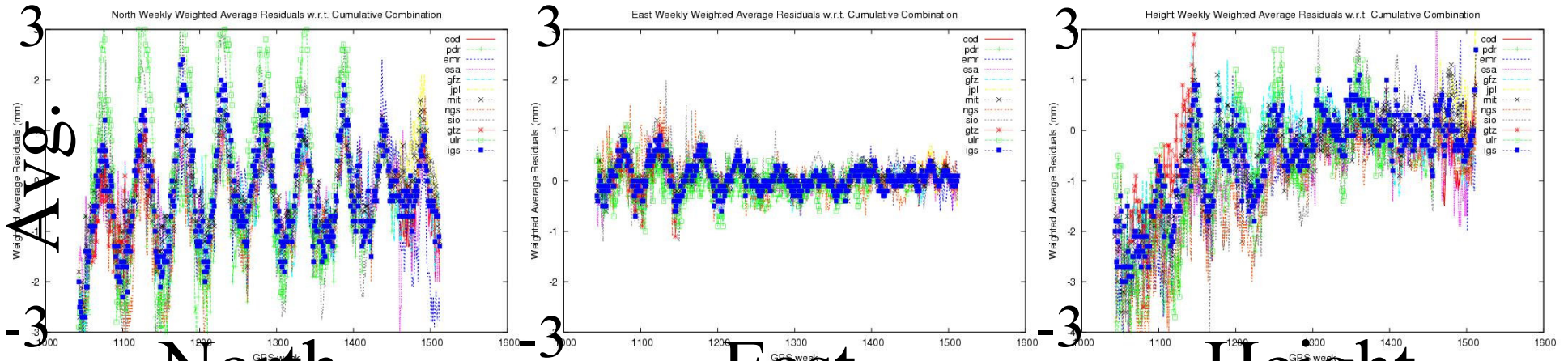
$$\sigma_N = 1.6 \text{ mm}$$

$$\sigma_E = 1.6 \text{ mm}$$

$$\sigma_H = 3.7 \text{ mm}$$



Avg. & Std. of Residuals w.r.t. Cumulative Solution (in mm)



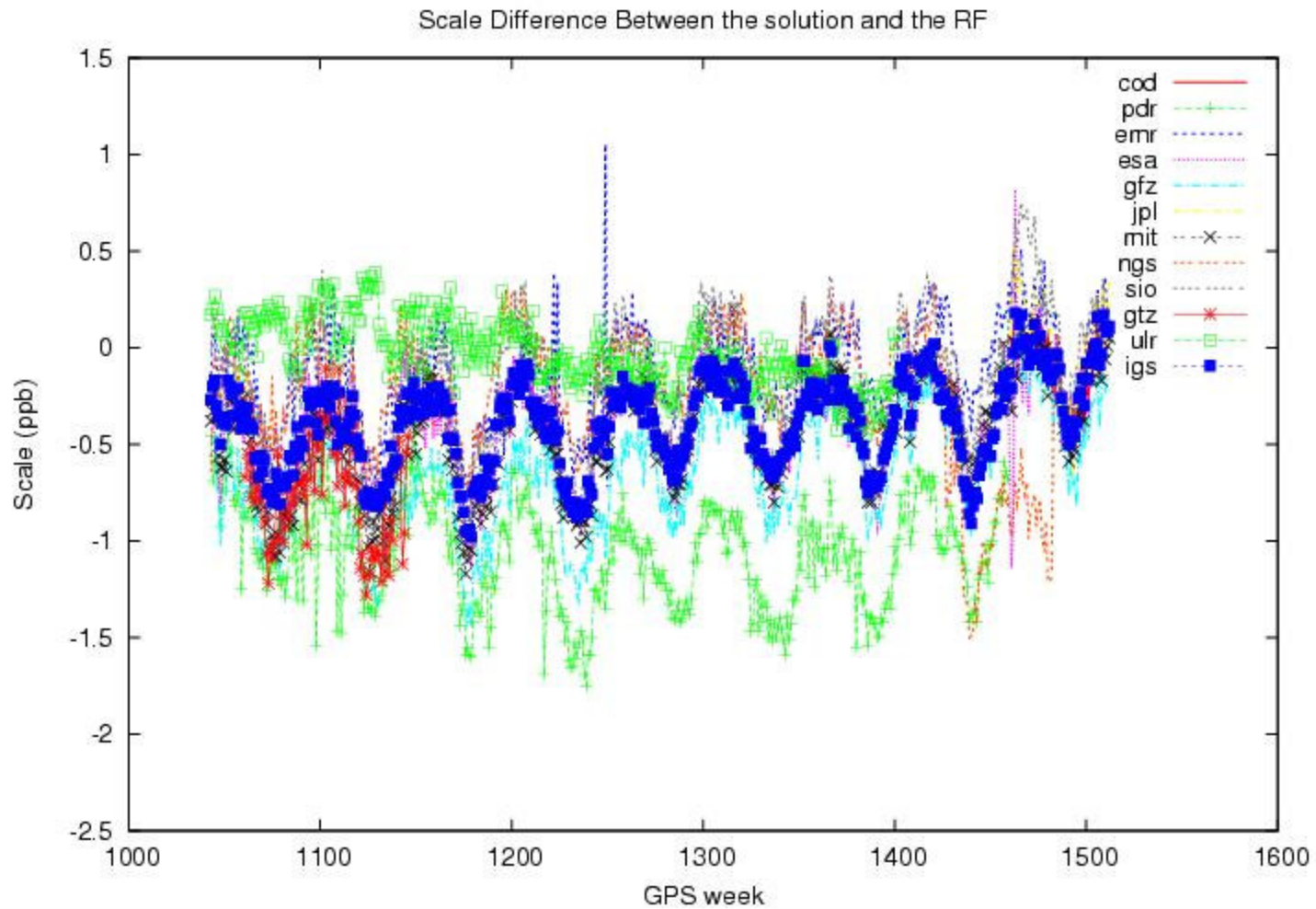
$\sigma_N = 2.4\text{mm}$

$\sigma_E = 2.4\text{mm}$

$\sigma_H = 6.1\text{mm}$



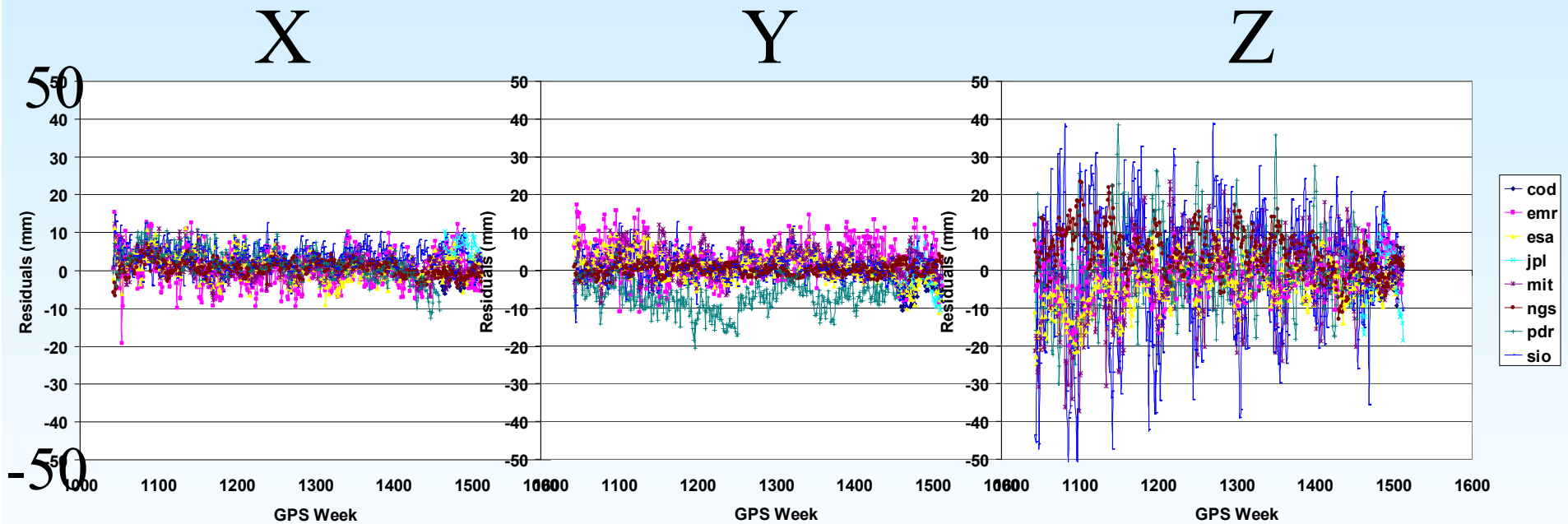
Scale offset w.r.t. IGS05



Annual amplitude $\sim 0.25\text{ppb} \sim (1.5\text{mm})$



ACs Apparent Geocenter Residuals w.r.t. IGS Combined (in mm)



$$\sigma_X = 3.6 \text{ mm}$$

$$\sigma_Y = 4.9 \text{ mm}$$

$$\sigma_Z = 10.1 \text{ mm}$$

- GFZ, GTZ, ULR excluded

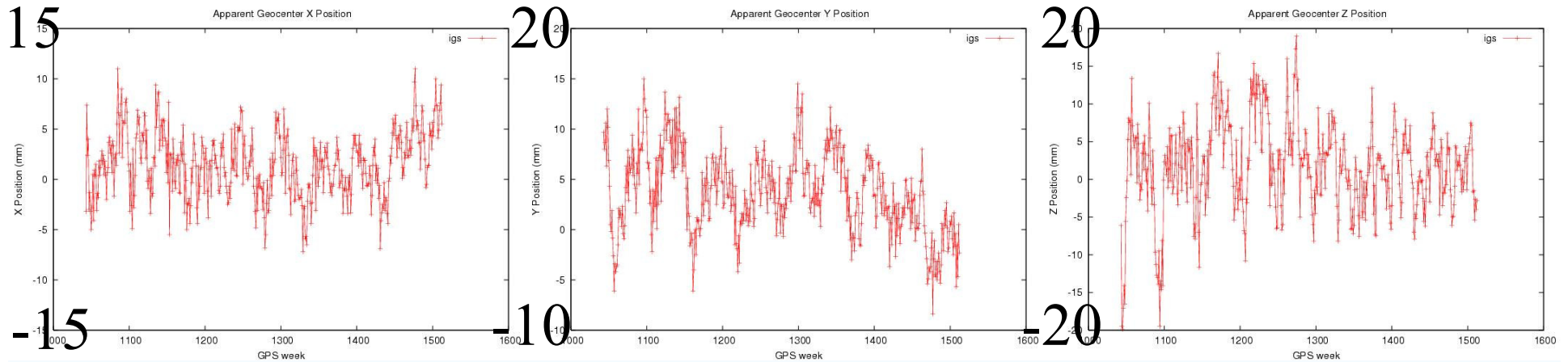


IGS Apparent Geocenter Position w.r.t. ITRF2005

X

Y

Z



$1.6 \pm 3 \text{ mm}$

$3.7 \pm 4 \text{ mm}$

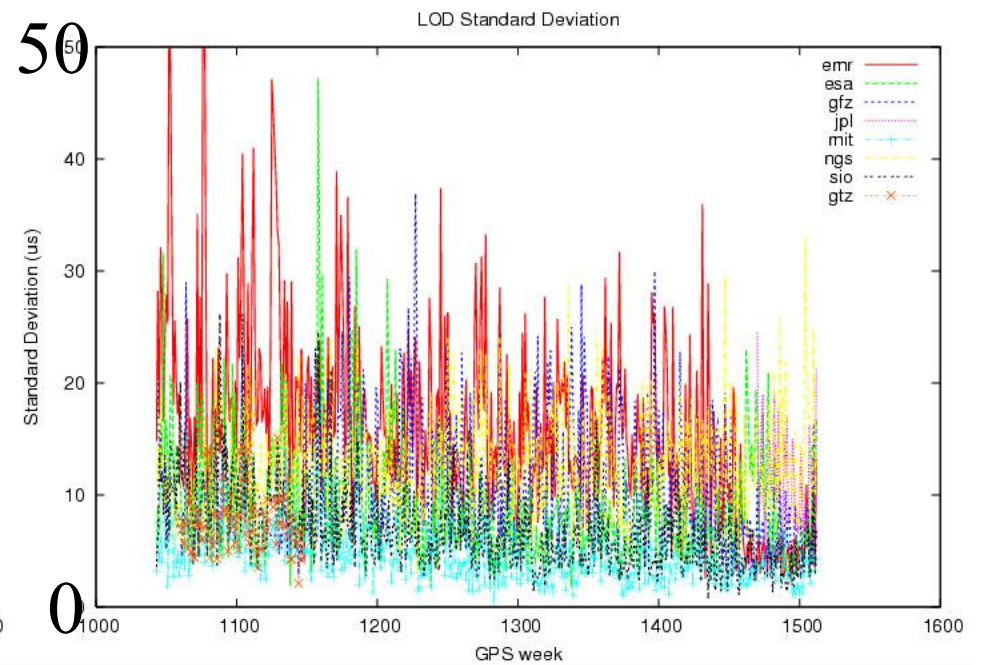
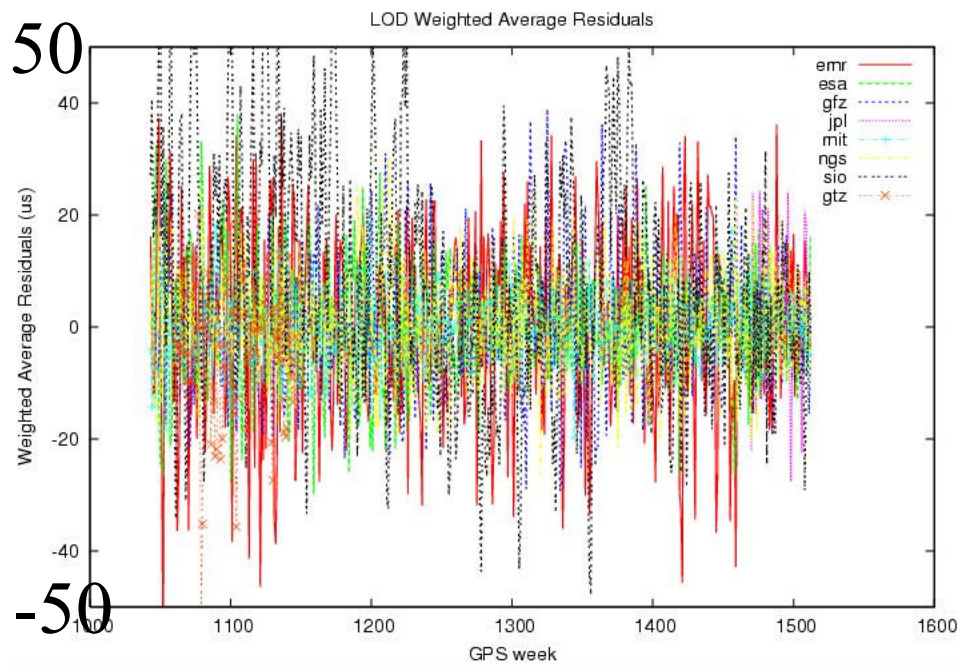
$1.7 \pm 6 \text{ mm}$



LOD Weekly Avg. & Std. w.r.t. IGS Weekly Combination

Avg.

Std.



$$\sigma_{\text{LOD}} = 14 \mu\text{s}$$

- COD, PDR excluded; ULR no LOD

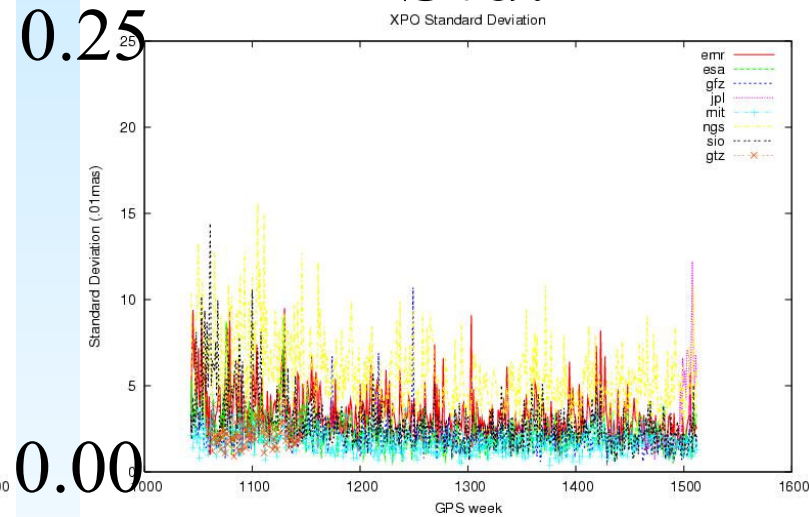
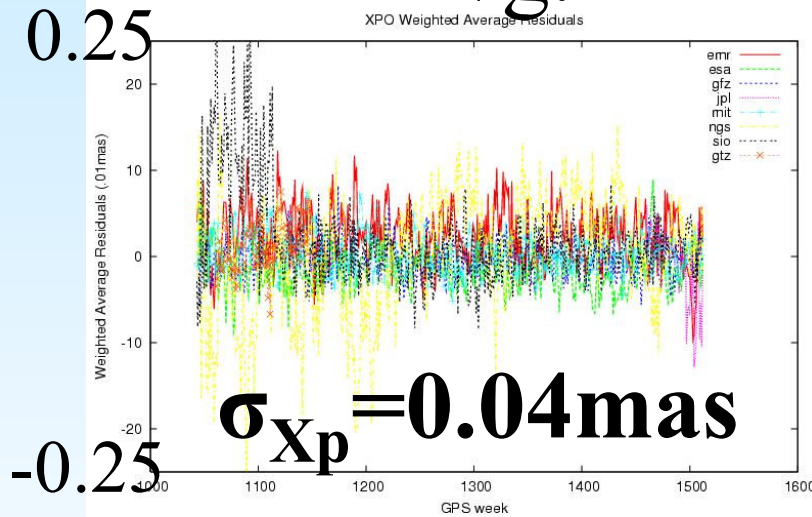


Pole Position Weekly Avg. & Std. Residuals w.r.t. IGS Weekly Combination

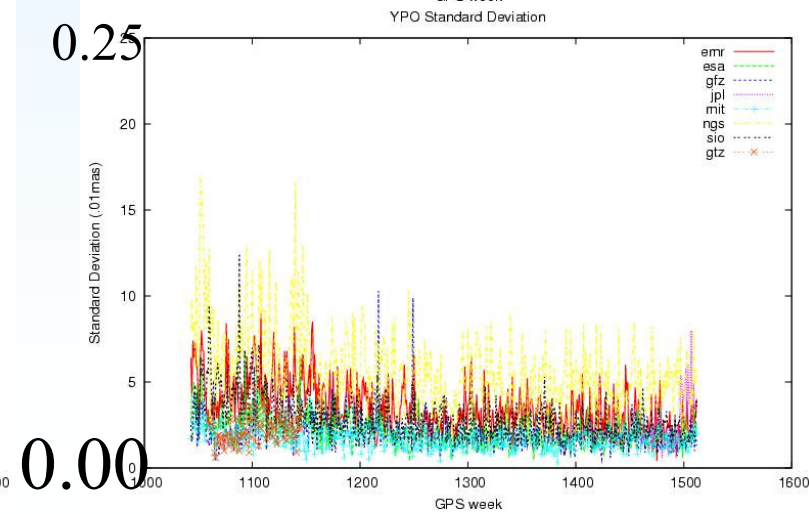
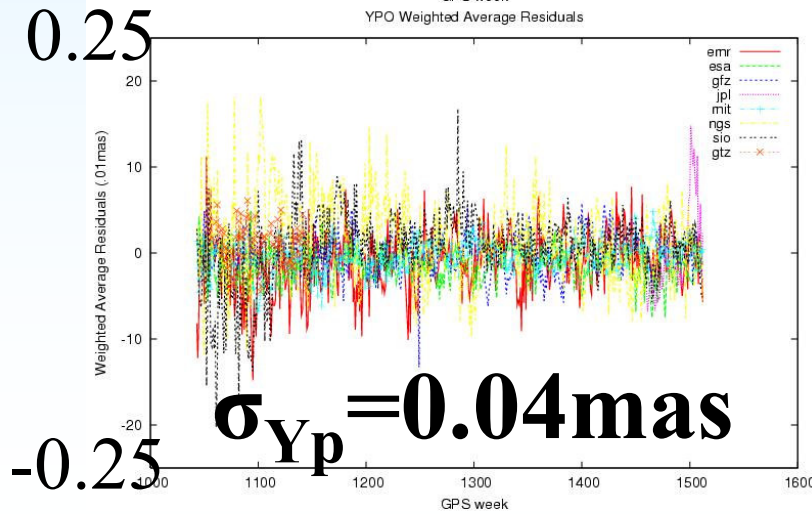
Avg.

Std.

X



Y



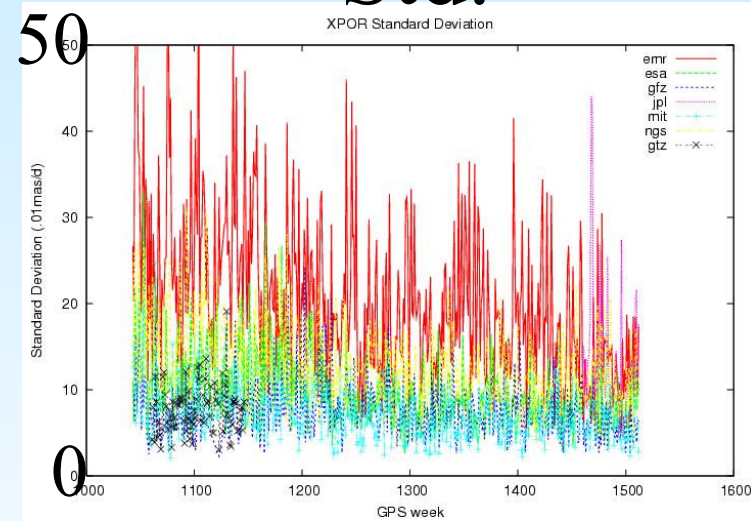
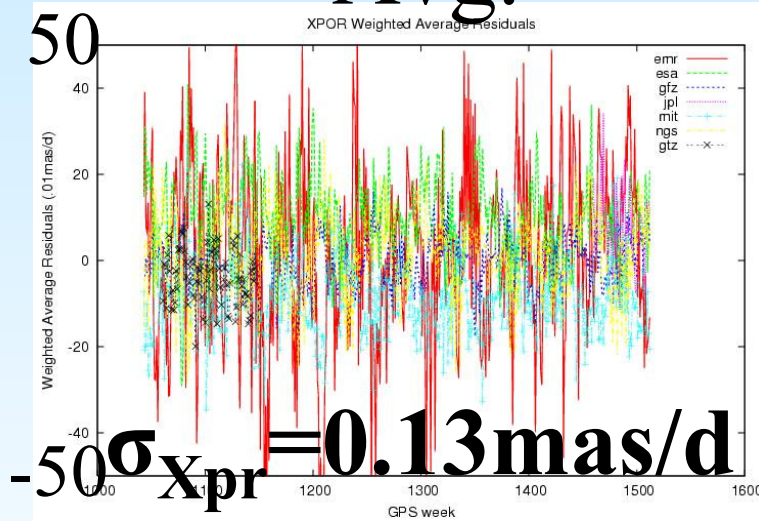


Pole Rate Weekly Avg. & Std. Residuals w.r.t. IGS Weekly Combination

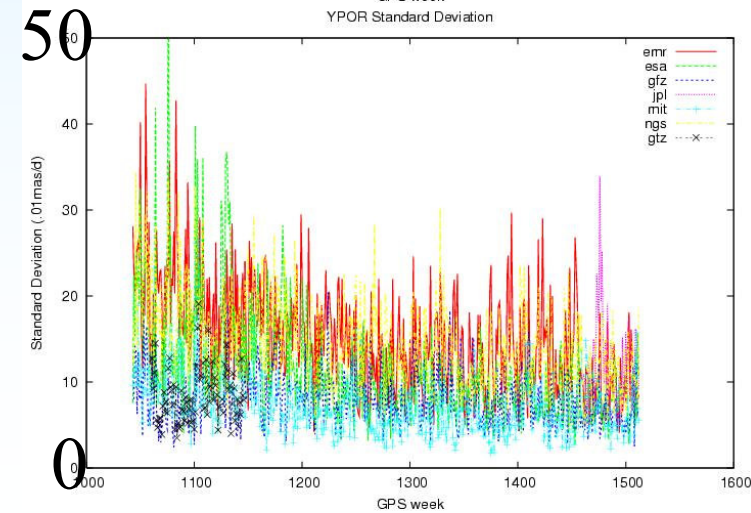
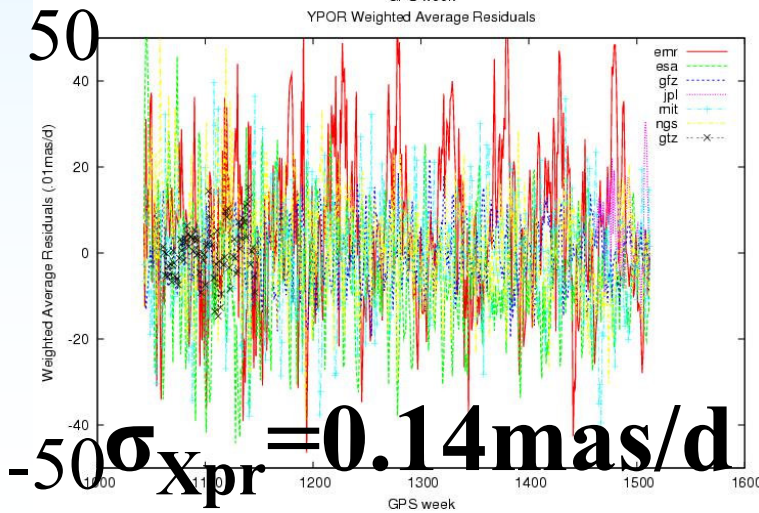
Avg.

Std.

X



Y





Summary (1/2)

- **Combination:**
 - 11 ACs
 - 1 – 9 years
 - ~100 – 300 stations
- **Network (2000-2008):**
 - Reference Frame Stations: ~ 60 - 125
 - Stations in weekly combination:
 - Combined: ~300 – 440
 - Excluded: ~1 - 80
 - Contributed: ~265 – 435



Summary (2/2)

- ACs Coordinates Consistency w.r.t.:
 - IGS05 (N-E ~ 3 mm, H ~ 9 mm)
 - IGS Weekly (N-E ~ 2 mm, H ~ 4 mm)
 - IGS Cumulative (N-E ~ 3 mm, H ~ 6 mm)
- ACs ERPs Consistency:
 - LOD ~ 14 μ s
 - ([XY]_p ~ 0.04 mas; [XY]_{pr} ~ 0.13mas/d)
- ACs Geocenter:
 - Consistency : X & Y ~4 mm Z ~ 10mm
 - Agreement with ITRF2005 origin < 4mm