Galileo Terrestrial Reference Frame (GTRF)- Status

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on behalf of the GGSP Consortium
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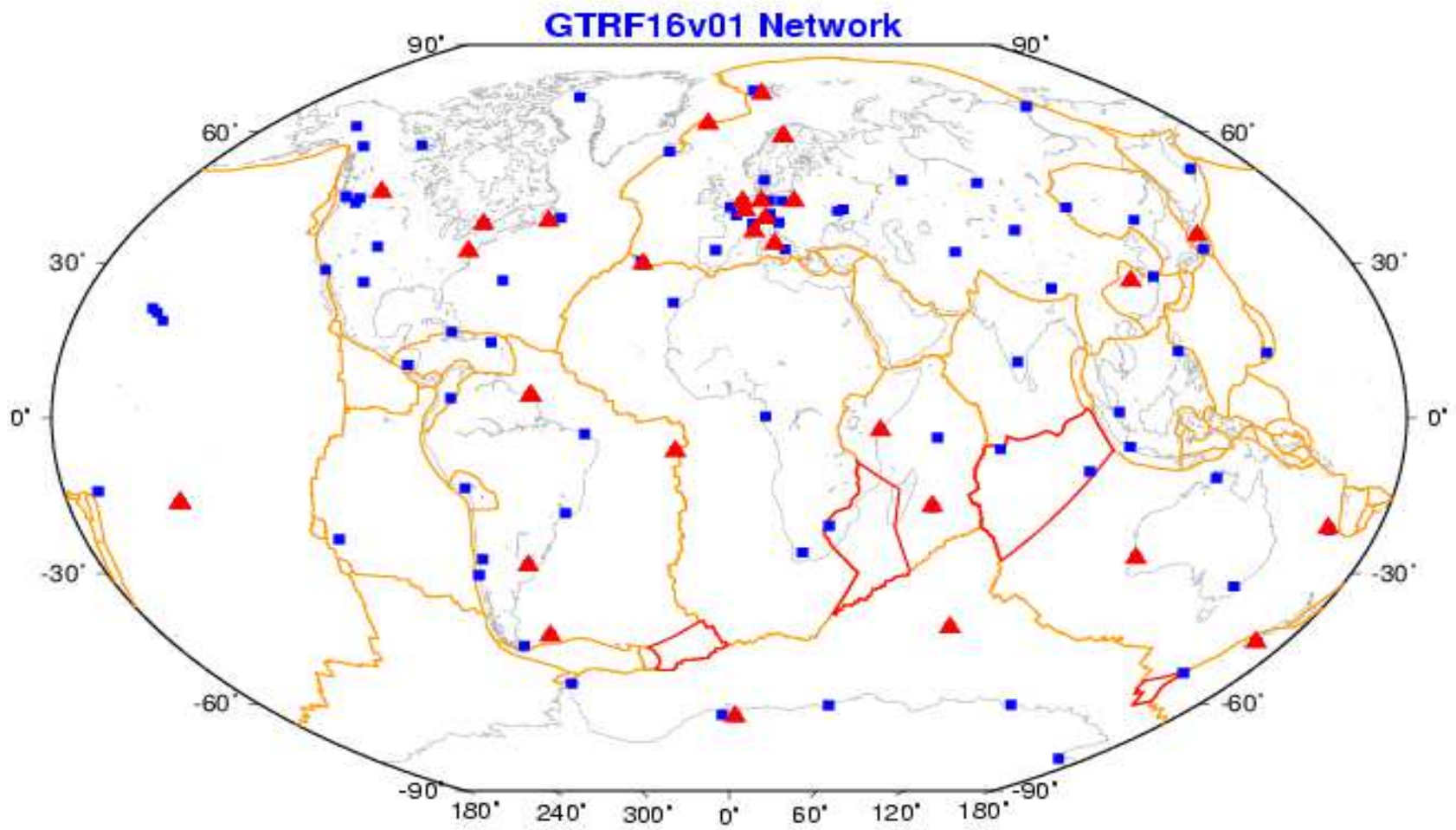
GTRF Generation
Latest realization: GTRF16v01

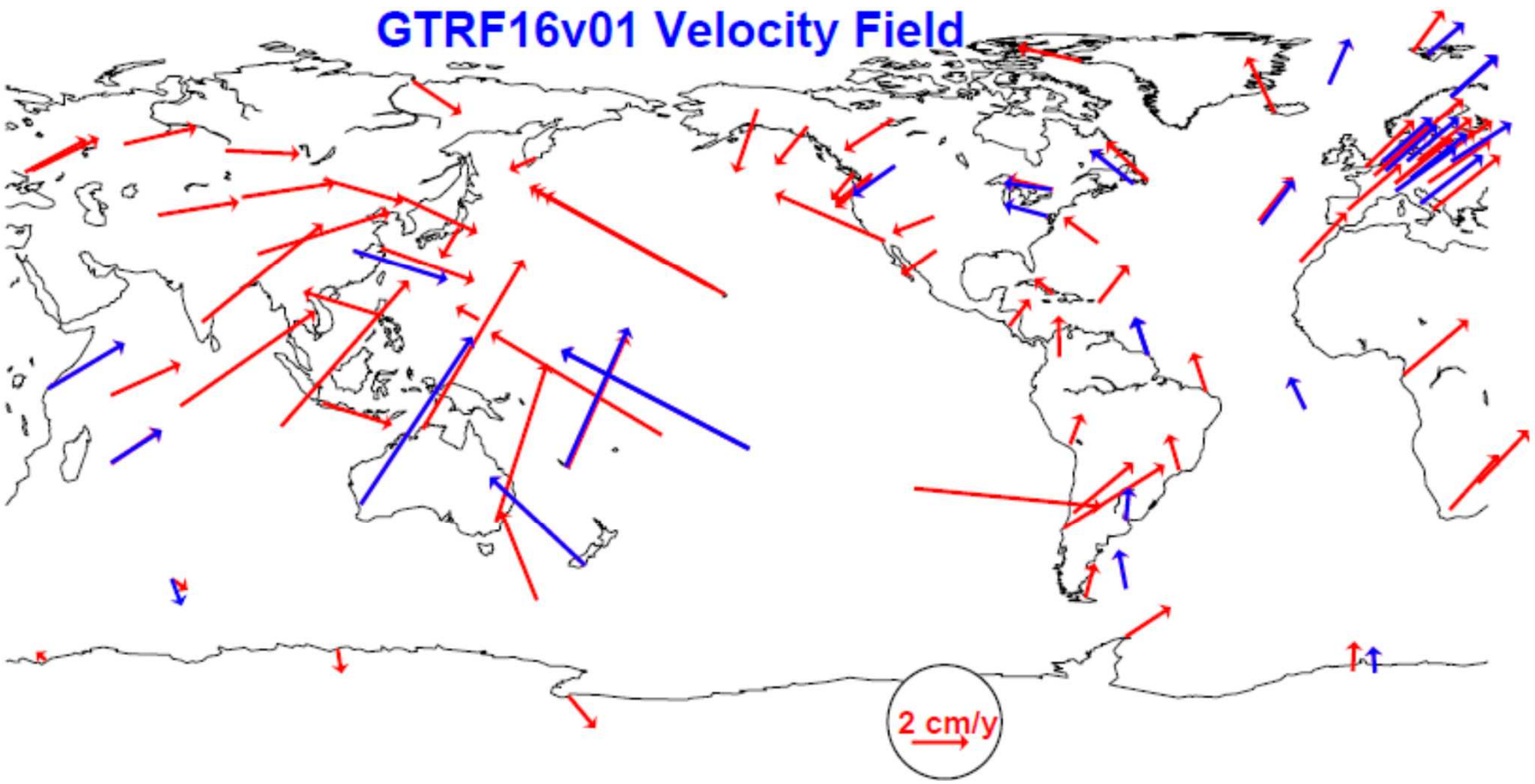
- Accumulating (rigorously stacking) all the weekly GTRF combined solutions since 2006
  - 278 weeks spanning 9.2 years
- Contains 163 stations located in 111 sites
- Using minimum constraint approach
  - the GTRF16v01 solution is aligned to the IGb08 (ITRF2008) frame over a set of 83 IGS/ITRF stations
  - located in 59 sites
    - 41 in the northern hemisphere
    - 18 in the southern hemisphere

Tracking Network for the GTRF – All stations



Latest GTRF Realisation: GTRF16v01
blue squares: ITRF/IGS stations
red triangles: GSS/GESS sites

GTRF Velocity Field



GTRF16v01 Velocity Field.
Red: IGS/ITRF site
Blue: GESS/GSS site.

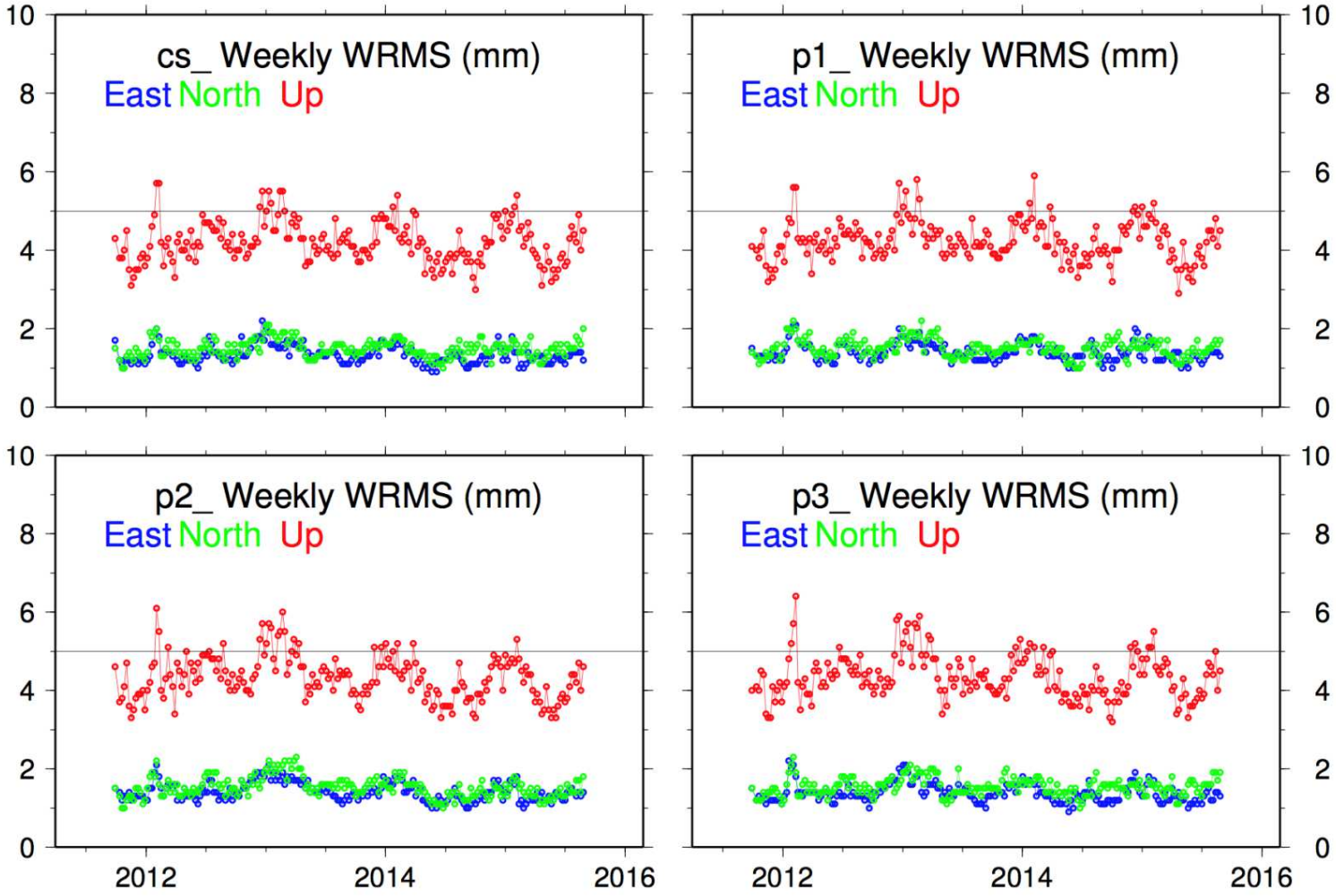
GTRF Releases in 2016

- GTRF16v01
  - Released January 2016
  - Rigorously aligned to ITRF2008
  - In use by Galileo system
  - Next update is expected in 2017

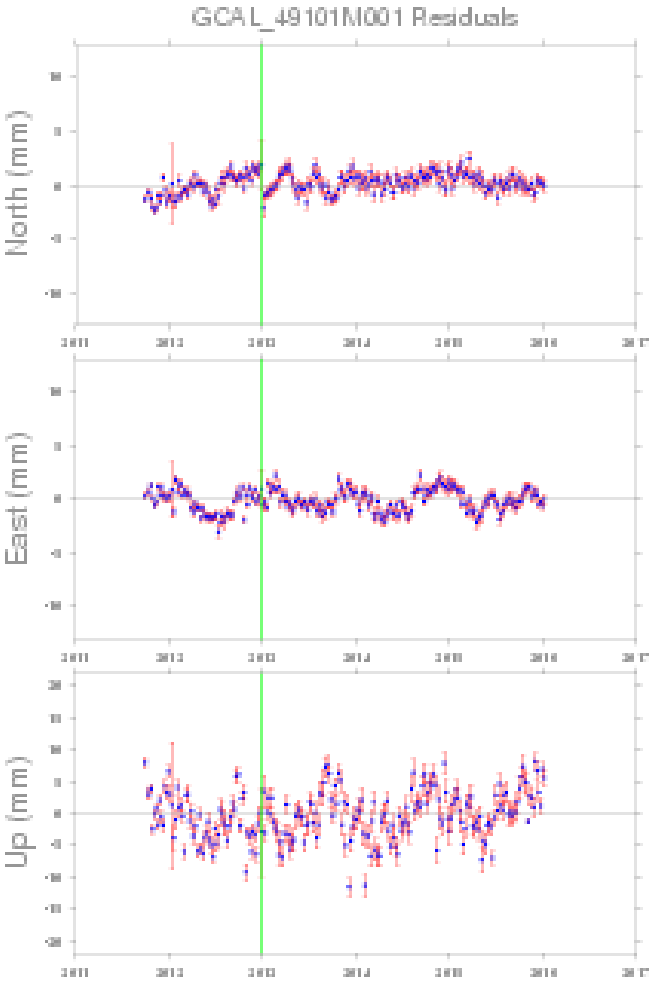
GTRF - Station Coordinates

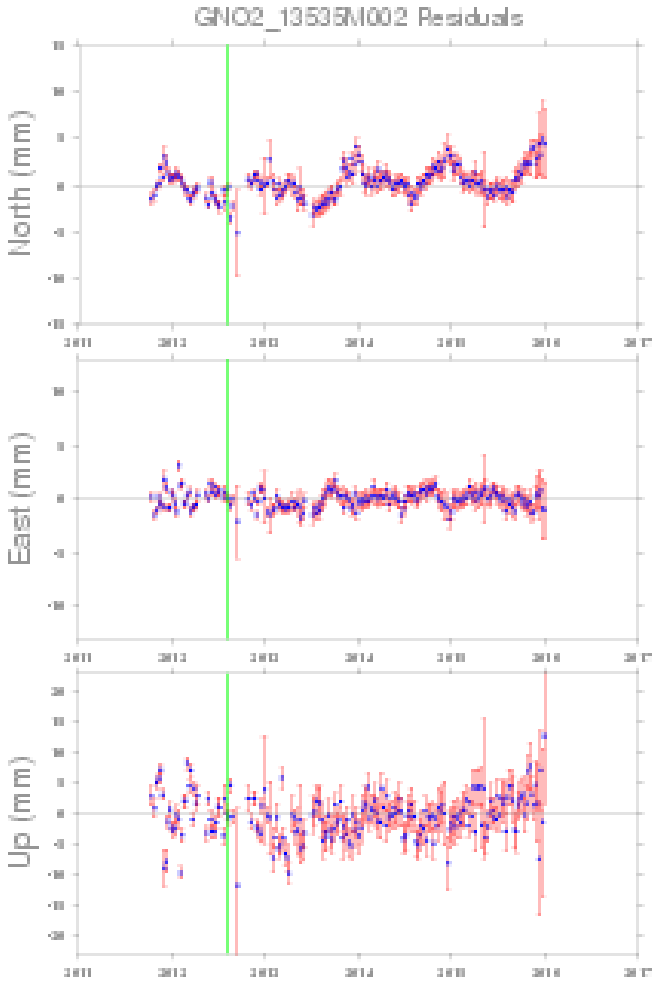
Weekly WRMS accuracy of all PF's and Combined Solutions station positions is at the level of

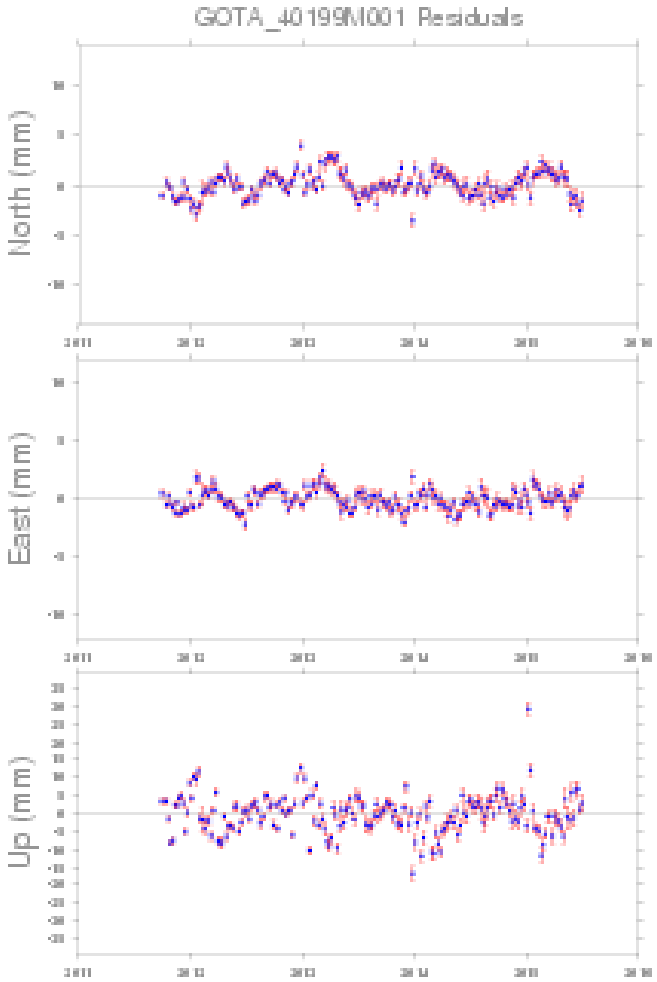
- **1 to 2 mm for horizontal components and 3 to 6 mm for the height**



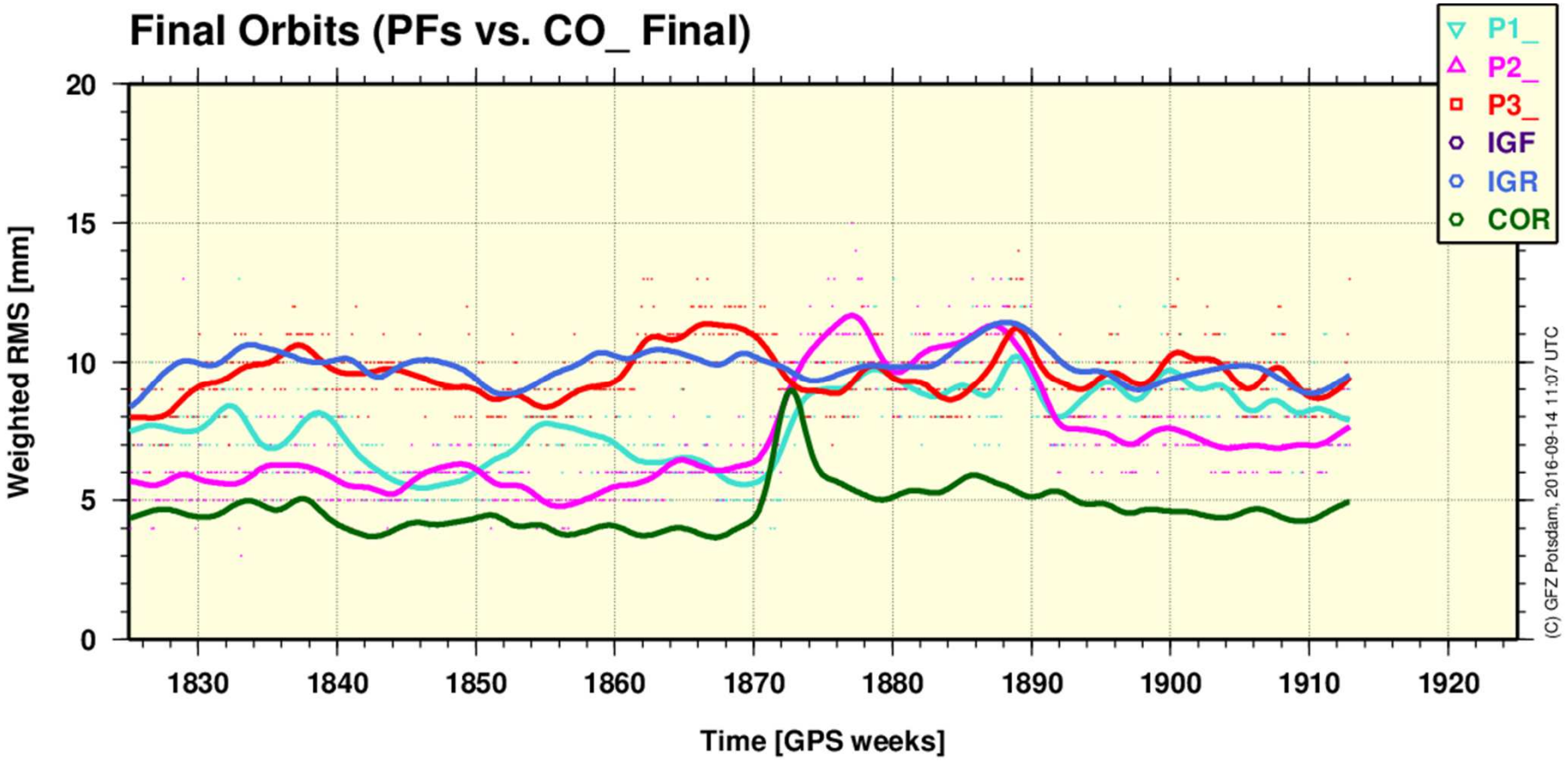
GESS station time series - Examples





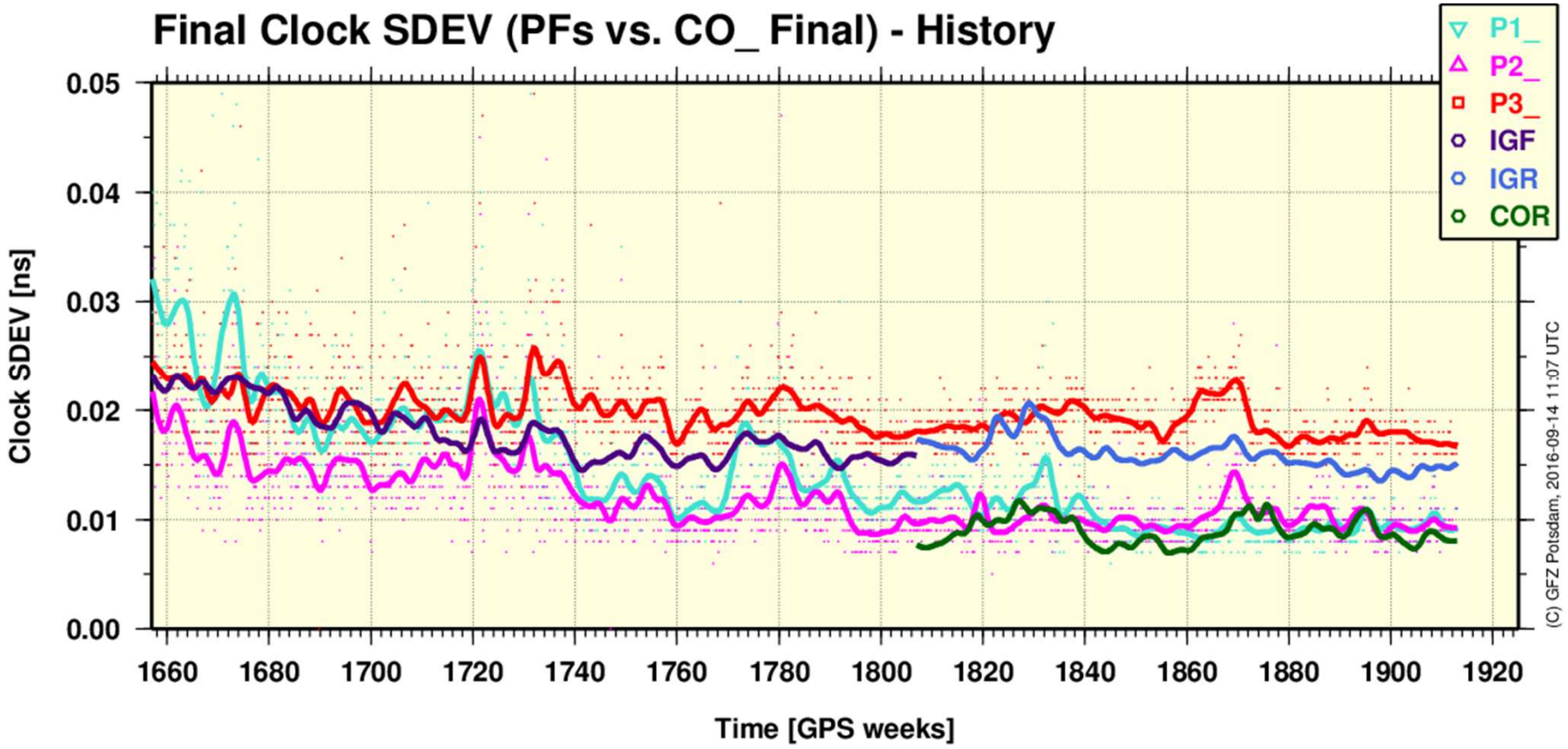


Orbit Combination (recent weeks)



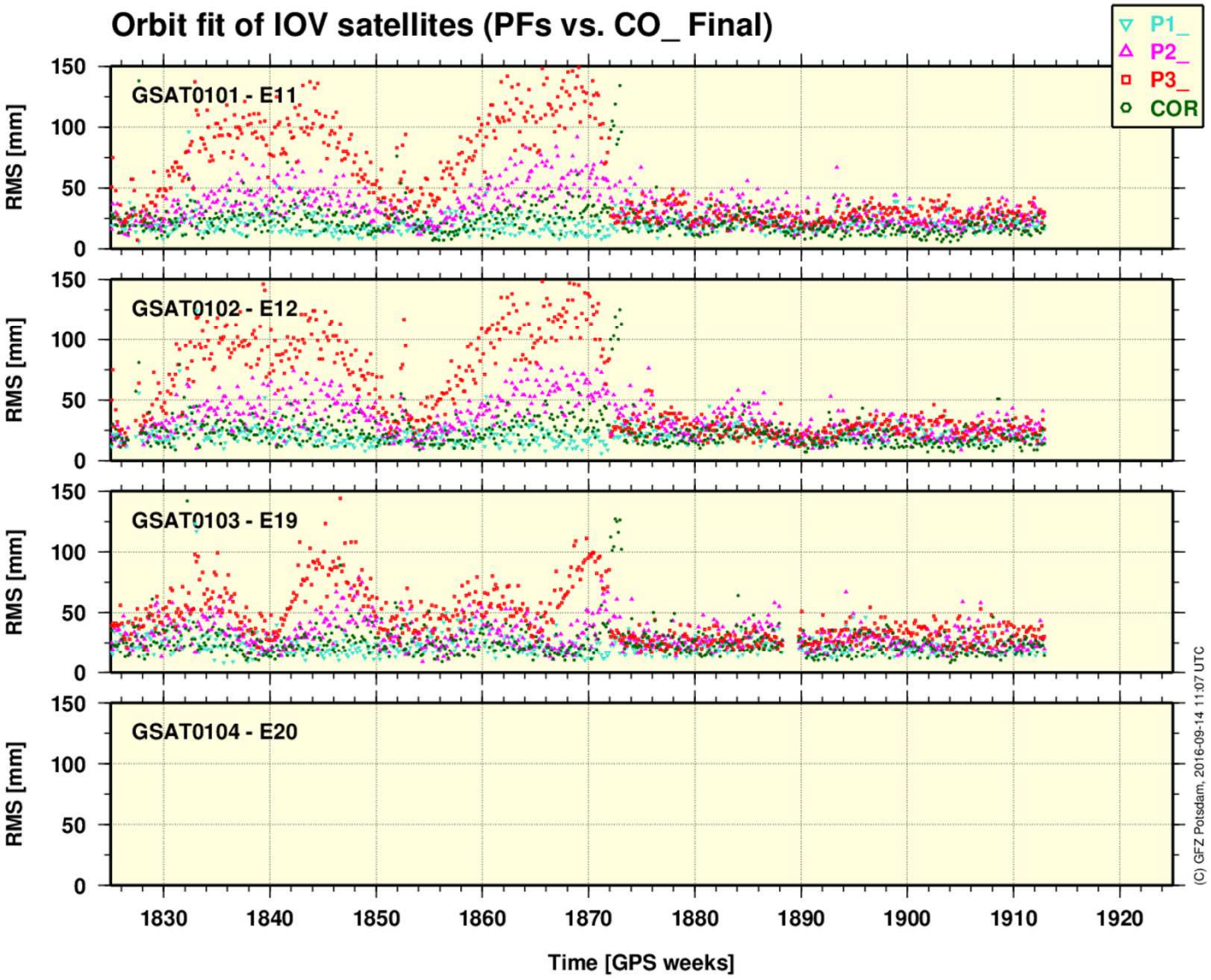
- **Orbit RMS agreement btw PFs and combined (co_) orbits for GPS satellites**
  - **COR is combined rapid product (within 12 hours after end of the day)**
  - **Agreement mostly at the level of 5-10 mm**
  - **Combination difference to the IGS Final (IGF) and IGS Rapid (IGR) is at the same level**

Clock Combination (full history)



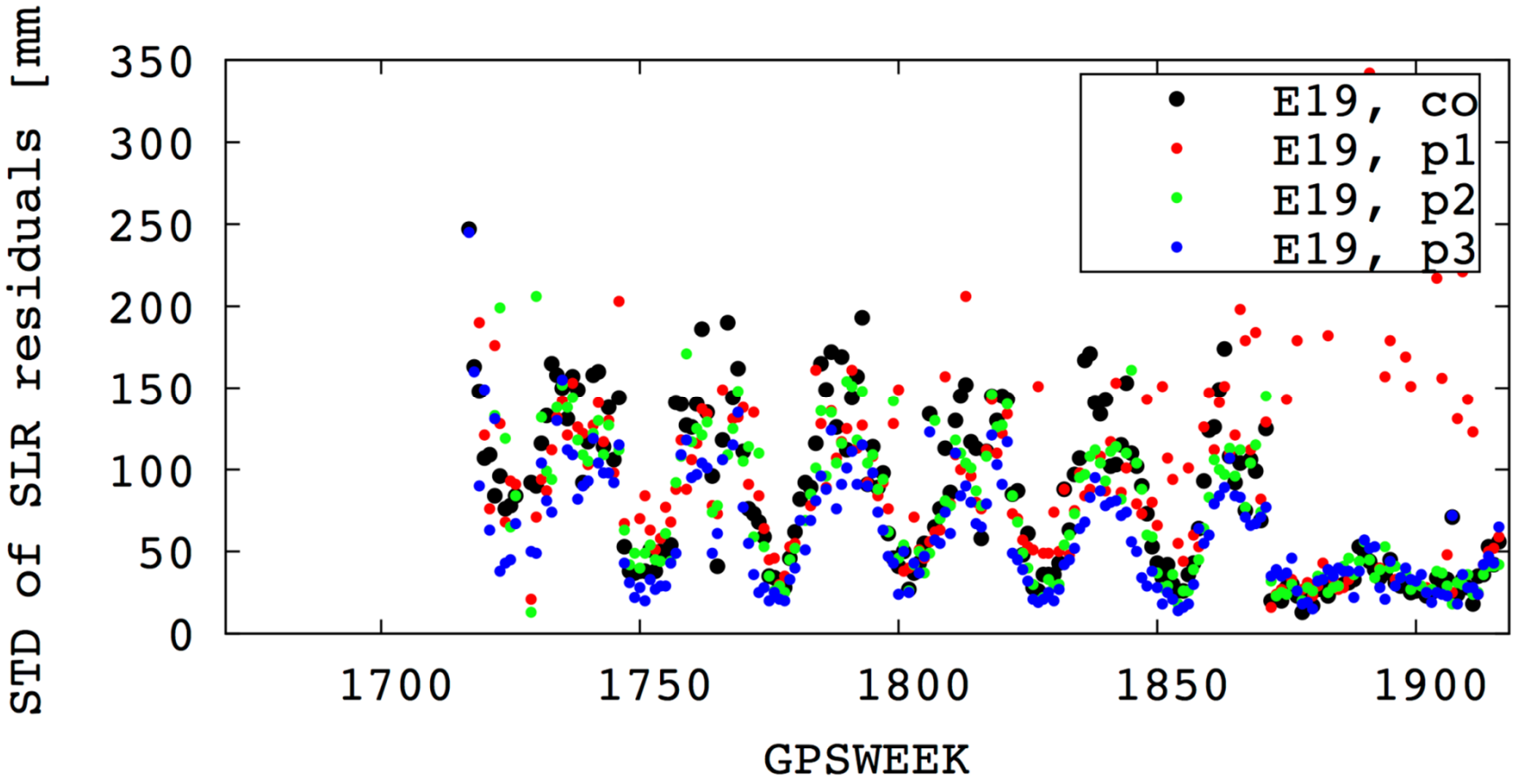
- **Agreement for the clocks shows RMS of about 15 to 25 ps**
  - **all biases subtracted**

Galileo final PF and OVF rapid orbit solutions compared to OVF final (IOV)



- Difference between PF and co_ Galileo orbits are in the range of 5 to 15 cm (with outliers in case of data problems)
- Week 1873: Improved modeling with ECOM2 (PF1 and PF3) and Box-Wing (PF2)

SLR Residuals
Standard deviation



The SLR residuals are confirming the overall orbit accuracy (3D – 1 Sigma) of 10 – 20 cm

Notice improvement thanks to improved modelling starting week 1873

Validation

- Validation is carried out on a weekly basis when the last reference product is available (in general, the IGS troposphere solution)
- Validation result is a weekly summary file (vf_wwww7.sum)
- Example from summary file (vf_19157.sum)
- High quality, demonstrated by the RMS of Helmert-transformation (see table below)

			RMS		
		#sites	North [mm]	East [mm]	Up [mm]
IGb08	RMS / COMPONENT	48	3.02	2.76	7.33
IGb08week	RMS / COMPONENT	109	2.03	1.85	4.31
GTRF16V01	RMS / COMPONENT	109	2.22	1.76	4.65

THANK YOU

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