Galileo Terrestrial Reference Frame (GTRF)- Status

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on behalf of the GGSP Consortium
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• 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
Latest GTRF Realisation: GTRF16v01
blue squares: ITRF/IGS stations
red triangles: GSS/GESS sites
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
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

![Graphs showing weekly WRMS accuracy for different stations](image-url)
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
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)
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_www7.sum)
- Example from summary file (vf_19157.sum)
- High quality, demonstrated by the RMS of Helmert-transformation (see table below)

<table>
<thead>
<tr>
<th></th>
<th>#sites</th>
<th>North [mm]</th>
<th>East [mm]</th>
<th>Up [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGb08 RMS / COMPONENT</td>
<td>48</td>
<td>3.02</td>
<td>2.76</td>
<td>7.33</td>
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<tr>
<td>IGb08week RMS / COMPONENT</td>
<td>109</td>
<td>2.03</td>
<td>1.85</td>
<td>4.31</td>
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<tr>
<td>GTRF16V01 RMS / COMPONENT</td>
<td>109</td>
<td>2.22</td>
<td>1.76</td>
<td>4.65</td>
</tr>
</tbody>
</table>
THANK YOU

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