IGS14/igs14.atx: a new framework for the IGS products

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The International GNSS Service (IGS) is about to switch to a new reference frame (IGS14), based on the latest release of the International Terrestrial Reference Frame (ITRF2014; Altamimi et al., 2015), as the basis for its products. An updated set of satellite and ground antenna calibrations (igs14.atx) will become effective at the same time. IGS14 and igs14.atx will then replace the previous IGS08/igs08.atx framework used in GIPs since GPS week 1632 (32 April 2012) and that applied for the second IGS repressuring campaign (nrsy2).

The official switch to the IGS14/igs14.atx framework is now expected by the end of January 2017.

What’s new in igs14.atx?

Ground antenna calibration updates

Compared to igs08.atx, igs14.atx includes robust calibrations for 17 additional ground antenna types, so that the percentage of stations with absolute calibrations in the IGS network will reach >90% after the switch (Table 1). 19 type-mean robust calibrations were also updated thanks to the availability of calibration results for additional antenna systems.

The impact of the ground antenna calibration updates on IGS station positions was assessed by means of differential PPP solutions. In general, the estimated position offsets are not negligible and can reach up to 2 mm in horizontal and 10 mm in vertical direction.

Satellite antenna calibration updates

Despite the negligible scale difference between ITRF2008 and ITRF2014 (0.02 ppb), the radial components of all GPS and GLONASS satellite antenna phase center offsets (ΔPCOs) had to be updated in igs14.atx, because of recent modeling changes affecting the scale of the IGS products (Earth radiation pressure, antennas drift). This was allowed by deriving time series of satellite antennas z-PCO values, consistent with the ITRF2014 scale, from the daily repro2 and latest operational SINEX solutions of seven IGS analysis centers (ACs). The z-PCO time series were then trend-corrected to epoch 2010.0 before computing weighted averages. From igs08.atx to igs14.atx, satellite antenna z-PCOs change by ~±6 cm on average, which induces a net scale change of the IGS terrestrial frame solutions by approximately ±0.5 ppb (~±3 mm; see Section E).

Table 1. Antenna calibration status of the 124 current IGS stations, based on either igs08.atx or igs14.atx.

<table>
<thead>
<tr>
<th>Antenna type</th>
<th>igs08.atx</th>
<th>igs14.atx</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>absolute</td>
<td>converted</td>
</tr>
<tr>
<td></td>
<td>calibration</td>
<td>field calibration</td>
</tr>
<tr>
<td></td>
<td>624 (94.5%)</td>
<td>31 (6.2%)</td>
</tr>
<tr>
<td></td>
<td>627 (70.7%)</td>
<td>11 (12.2%)</td>
</tr>
</tbody>
</table>

The mean scale of the IGS terrestrial frame solutions is conventionally defined by the adopted satellite antenna z-PCOs (e.g., Roy et al., 2013). The z-PCO values estimated for igs08.atx did not allow to access the ITRF2008 scale. However, due to recent orbit modeling changes, the mean scale of the repro and current IGS solutions differs from the ITRF2008 scale by about +0.3 ppb (see blue in Figure E, top). The igs14.atx z-PCO values, in contrast, give access to the ITRF2014 scale at epoch 2010.0 (Figure E, bottom).

The long-term scale rate of the IGS terrestrial frame solutions is determined by the use of constant z-PCO values and can be compared with the ITRF scale rate (Collilieux and Schmid, 2010; Figure F, top), Figure F, bottom, based on the daily repro2 solutions, that “this ‘intrinsically GNSS’ rate” differs from the ITRF2008 scale rate by +0.004 ppb/yr (±0.002 mm/yr), whereas it is significantly different from the ITRF scale by +0.026 ppb/yr (±0.017 mm/yr). The difference between the two values perfectly matches the differential scale rate of 0.3 ppb/yr between ITRF2014 and ITRF2008 (Altamimi et al., 2016).

The scale changes, from igs08.atx to igs14.atx, satellite antenna z-PCOs change by ~±6 cm on average, which induces a net scale change of the IGS terrestrial frame solutions by approximately ±0.5 ppb (~±3 mm; see Section E).

Impact on GNSS-derived geodetic parameters

In order to assess the impact of the switch from IGS08/igs08.atx to IGS14/igs14.atx on GNSS-derived geodetic parameters, the daily repro2 AC solutions were re-combined with two changes compared to the official daily repro2 SINEX combinations (Rebischung et al., 2014):

• Satellite PCOs were fixed in the igs14.atx values in the input AC solutions.
• The combined solutions were aligned to the IGS14 core network. (Note that non-located ITRF2014 coordinates were used as reference coordinates for the IGS14 core stations, since the AC repro2 solutions are consistent with the igs14.atx ground antenna calibrations.)

The impact on the ITRF scale of the switch from IGS08/igs08.atx to IGS14/igs14.atx is shown in Figure E, bottom, where the daily repro2 solutions were re-combined with two changes compared to the official daily repro2 SINEX combinations (Rebischung et al., 2014), and with satellite PCOs fixed in the igs14.atx z-PCO values in the input AC solutions.

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