Quality control and bias analysis at DGFI-TUM

Horst Müller, Mathis Bloßfeld

Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)
Technische Universität München

20th Int. Workshop on Laser Ranging
Potsdam, October 09 - 14, 2016
Present QC at DGFI-TUM

Concept

Satellites used in processing
- Lageos1/2  Etalon1/2  Lares
- Ajisai  Starlette  Stella  Larets

Processing strategy
- Part of daily processing for ILRS products
- Every 4 hours as a background batch process
- Hardware Linux-PC (Intel I7, 64 Gbyte)
- Software DOGS-OC 5.4
- Station coordinates SLRF2008
- Alert: email to me if one or more bias parameters exceed certain thresholds
  - 15 cm range bias, 0.1 msec time bias
  - Contact with stations through ILRS/Rapid Service Mail (if required)

Results presented at the DGFI Webpage (http://ilrs.dgfi.tum.de/quality/weekly_biases)
- Weekly lists for each satellite (includes all stations)
- For each station a bias history (2015.0 to actual epoch) Lageos1/2 only
<table>
<thead>
<tr>
<th>Station</th>
<th>year mm dd</th>
<th>hh mm</th>
<th>range-bias [cm]</th>
<th>sigma [cm]</th>
<th>prec.est. [cm]</th>
<th>no of observations</th>
<th>edit. time-bias [microsec.]</th>
<th>sigma [cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herstmon</td>
<td>2016 9 20</td>
<td>22:02</td>
<td>0.79</td>
<td>0.53</td>
<td>0.16</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 21</td>
<td>13:35</td>
<td>0.57</td>
<td>0.39</td>
<td>0.18</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 22</td>
<td>19:13</td>
<td>-0.12</td>
<td>0.28</td>
<td>0.14</td>
<td>11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 22</td>
<td>22:39</td>
<td>0.59</td>
<td>0.25</td>
<td>0.18</td>
<td>20</td>
<td>0</td>
<td>-5.76</td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 23</td>
<td>02:09</td>
<td>-0.61</td>
<td>0.30</td>
<td>0.21</td>
<td>14</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 23</td>
<td>17:54</td>
<td>0.54</td>
<td>0.29</td>
<td>0.14</td>
<td>15</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 23</td>
<td>21:21</td>
<td>0.43</td>
<td>0.32</td>
<td>0.24</td>
<td>14</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 24</td>
<td>00:43</td>
<td>0.05</td>
<td>0.24</td>
<td>0.17</td>
<td>16</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Herstmon</td>
<td>2016 9 24</td>
<td>23:23</td>
<td>-0.17</td>
<td>0.32</td>
<td>0.15</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 19</td>
<td>19:47</td>
<td>0.65</td>
<td>0.36</td>
<td>0.18</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 21</td>
<td>17:04</td>
<td>-0.29</td>
<td>0.27</td>
<td>0.24</td>
<td>13</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 21</td>
<td>20:41</td>
<td>0.72</td>
<td>0.56</td>
<td>0.26</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 22</td>
<td>03:51</td>
<td>-1.89</td>
<td>0.52</td>
<td>0.16</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 22</td>
<td>19:09</td>
<td>0.16</td>
<td>0.34</td>
<td>0.27</td>
<td>13</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 22</td>
<td>22:41</td>
<td>0.50</td>
<td>0.28</td>
<td>0.65</td>
<td>11</td>
<td>0</td>
<td>-5.25</td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 23</td>
<td>17:59</td>
<td>0.17</td>
<td>0.37</td>
<td>0.22</td>
<td>8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 23</td>
<td>21:25</td>
<td>0.32</td>
<td>0.34</td>
<td>0.23</td>
<td>13</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 24</td>
<td>20:07</td>
<td>0.54</td>
<td>0.41</td>
<td>0.11</td>
<td>12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Potsdam</td>
<td>2016 9 24</td>
<td>23:28</td>
<td>-0.57</td>
<td>0.29</td>
<td>0.23</td>
<td>13</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Baikonur</td>
<td>2016 9 18</td>
<td>21:05</td>
<td>-17.02</td>
<td>0.68</td>
<td>0.28</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Baikonur</td>
<td>2016 9 19</td>
<td>16:07</td>
<td>-10.15</td>
<td>0.43</td>
<td>1.05</td>
<td>8</td>
<td>0</td>
<td>-19.90</td>
</tr>
<tr>
<td>Baikonur</td>
<td>2016 9 19</td>
<td>19:28</td>
<td>-10.01</td>
<td>0.39</td>
<td>0.97</td>
<td>6</td>
<td>0</td>
<td>-18.80</td>
</tr>
</tbody>
</table>
Examples of Web pages bias history
Examples of Web pages bias history

SLRF2008 Bias analysis: one per pass and running average of 60 passes
Herstmonceux (7840)

range bias [mm]

2015 2015.5 2016 2016.5

lageos1, mean: 1.88
lageos2, mean: 3.95
Examples of Web pages bias history

SLRF2008 Bias analysis: one per pass and running average of 60 passes
Washington (7105)

range bias [mm]

year

lag001, mean: -3.82
lag002, mean: -2.71
Additional informations and processing not yet published at Web pages

- 5 QC centres deliver report which are summarized at AIUB (presently 4 of them)
- Since ITRF2014 will be next reference station coordinate set we have processed all biases using ITRF2014
  - Few new or very old stations are missing in ITRF2014; new SLRF2014 is needed
- Lares will be the next satellite added to the standard ILRS products. Therefore we have added Lares in the bias analysis
  - Solving 4x4 low degree harmonics
- The mean values over the last 2 years are not zero for all stations
  - Problems in modelling, no geocenter motion applied
    - No atmosph.tidal loading (annual signal)
  - Station coordinates
    - Mean values are 10% smaller with ITRF2014
Lageos1 range bias comparison

Yarragadee range biases (Sep. 26 - Oct. 05 2016)
SLRF2008 Bias analysis: one per pass and running average of 60 passes
Yarragadee (7090)
ITRF2014 Bias analysis: one per pass and running average of 60 passes

Yarragadee (7090)
Examples of Web pages bias history

ITRF2014 Bias analysis: one per pass and running average of 60 passes

Potsdam (7841)
Examples of Web pages bias history

SLRF2008 Bias analysis: one per pass and running average of 60 passes
Shanghai (7821)

ITRF2014 Bias analysis: one per pass and running average of 60 passes
Shanghai (7821)
Examples of Web pages bias history

SLRF2008 Bias analysis: one per pass and running average of 60 passes
Arequipa (7403)

ITRF2014 Bias analysis: one per pass and running average of 60 passes
Arequipa (7403)
Thank you