POD Evaluation of 2014 TRF solutions by CNES/CLS
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TRF2014 SOLUTIONS EVALUATION

PROCESSING CONTEXT
Impact of the position and velocity coordinates of the DORIS stations from DPOD2008 (DPOD2008 v1.14), ITRF2014, DTRF2014 and JTRF2014
Orbits computed:
• DORIS TOPEX orbits (January 1993 to July 2004)
• DORIS Jason-1 orbits (July 2004 to October 2008)
• DORIS Jason-2 orbits (October 2008 to December 2014)

Evaluation of DORIS POST-FIT RMS RESIDUALS and orbit comparison / DPOD2008
• DORIS post-fit residuals global and per station
• DORIS-only orbit independent SLR RMS residuals
• RMS of radial differences between TRF2014 and DPOD2008
• Mean of Z orbit differences between TRF2014 and DPOD2008

IDS AWG May 2017
TRF2014 EVALUATION ON TOPEX POD

TOPEX DORIS post-fit residuals from DPOD2008 and TRF2014 solutions and differences with DPOD2008

<table>
<thead>
<tr>
<th>Solutions</th>
<th>DORIS stations Number</th>
<th>DORIS points</th>
<th>DORIS RMS residuals (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPOD2008</td>
<td>39.8</td>
<td>19339</td>
<td>0.454</td>
</tr>
<tr>
<td>ITRF2014</td>
<td>39.8</td>
<td>18718</td>
<td>0.455</td>
</tr>
<tr>
<td>DTRF2014</td>
<td>39.8</td>
<td>18765</td>
<td>0.456</td>
</tr>
<tr>
<td>JTRF2014</td>
<td>35.3</td>
<td>17226</td>
<td>0.452</td>
</tr>
</tbody>
</table>

Negative => improvement for TRF2014
Very small differences
Two periods for TOPEX:
- from 1993 to 1998 improvement with the 3 TRF2014 (JTRF better solution but less stations)
- from 1999 to mid-2004 degradation with all new TRF
TRF2014 EVALUATION ON TOPEX POD

TOPEX DORIS post-fit residuals differences (TFR2014-DPOD2008)

Negative => improvement for TRF2014
Very small differences
For theses stations clear improvement with JTRF2014
Significant improvement for ADEB for all the TRF2014s (no discontinuity change)
TRF2014 EVALUATION ON TOPEX POD

TOPEX DORIS post-fit residuals differences (TFR2014-DPOD2008)

Negative => improvement for TRF2014
Very small differences
For these stations degradation with TRF2014 except for JTRF2014
Stronger degradation for HELB (no discontinuity change in ITRF2014)
### TRF2014 EVALUATION ON JASON-1 POD

**Jason-1 DORIS post-fit residuals from DPOD2008 and TRF2014 solutions and differences with DPOD2008**

(DORIS data from Jul. 2004 to Oct. 2008)

<table>
<thead>
<tr>
<th>DPOD Solutions</th>
<th>DORIS stations Number</th>
<th>DORIS points</th>
<th>DORIS RMS residuals (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPOD2008</td>
<td>43.9</td>
<td>36952</td>
<td>0.304</td>
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<tr>
<td>ITRF2014</td>
<td>43.9</td>
<td>36270</td>
<td>0.307</td>
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<tr>
<td>DTRF2014</td>
<td>43.8</td>
<td>36106</td>
<td>0.307</td>
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<tr>
<td>JTRF2014</td>
<td>43.2</td>
<td>35913</td>
<td>0.307</td>
</tr>
</tbody>
</table>

**Negative => improvement for TRF2014**

**Very small differences**

For Jason-1 degradation for all TRF2014 from mid-2004 to 2008 but less measurements compared to DPOD2008
DPOD2014 EVALUATION ON JASON-1 POD

Jason-1 DORIS post-fit residuals differences (TFR2014-DPOD2008)
(DORIS data from Jul. 2004 to Oct. 2008)

Negative => improvement for TRF2014
Very small differences
For Jason-1 degradation for all TRF2014 from mid-2004 to 2008 except for ~6 stations
Stronger degradation for REUB with DTRF2014, ITRF2014 (consequence of discontinuity differences ?)
TRF2014 EVALUATION ON JASON-2 POD

Jason-2 DORIS post-fit residuals from DPOD2008 and TRF2014 solutions and differences with DPOD2008

<table>
<thead>
<tr>
<th>DPOD Solutions</th>
<th>DORIS stations Number</th>
<th>DORIS points</th>
<th>DORIS RMS residuals (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPOD2008</td>
<td>46.3</td>
<td>52038</td>
<td>0.314</td>
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<tr>
<td>ITRF2014</td>
<td>46.3</td>
<td>50934</td>
<td>0.313</td>
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<tr>
<td>DTRF2014</td>
<td>45.9</td>
<td>50498</td>
<td>0.313</td>
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<tr>
<td>JTRF2014</td>
<td>45.7</td>
<td>50458</td>
<td>0.312</td>
</tr>
</tbody>
</table>

Negative => improvement for TRF2014
Very small differences
For Jason-2, after 2010 improvement with all new TRF2014s
Less measurements compared to DPOD2008
TRF2014 EVALUATION ON JASON-2 POD

Jason-2 DORIS post-fit residuals differences (TFR2014-DPOD2008)

Negative => improvement for TRF2014
Very small differences
For Jason-2 improvement for all TRF2014 except for ~10 stations
Significant improvement for SAA stations HEMB, ARFB and SANB
TRF2014 EVALUATION

DORIS-only orbit independent SLR RMS residuals and differences with DPOD2008

<table>
<thead>
<tr>
<th>SATELLITE</th>
<th>TRF Solutions</th>
<th>SLR Points</th>
<th>SLR RMS residuals (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOPEX</td>
<td>DPOD2008</td>
<td>1662</td>
<td>4.65</td>
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<tr>
<td>3 Jan. 1993</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To</td>
<td>ITRF2014</td>
<td>1662</td>
<td>4.58</td>
</tr>
<tr>
<td>17 Jun. 2004</td>
<td>DTRF2014</td>
<td>1663</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td>JTRF2014</td>
<td>1665</td>
<td>4.69</td>
</tr>
<tr>
<td>JASON-1</td>
<td>DPOD2008</td>
<td>1464</td>
<td>2.58</td>
</tr>
<tr>
<td>18 Jul. 2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To</td>
<td>ITRF2014</td>
<td>1463</td>
<td>2.52</td>
</tr>
<tr>
<td>12 Jul. 2008</td>
<td>DTRF2014</td>
<td>1463</td>
<td>2.51</td>
</tr>
<tr>
<td></td>
<td>JTRF2014</td>
<td>1464</td>
<td>2.53</td>
</tr>
<tr>
<td>JASON-2</td>
<td>DPOD2008</td>
<td>1646</td>
<td>2.18</td>
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<tr>
<td>13 Jul. 2008</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>To</td>
<td>ITRF2014</td>
<td>1646</td>
<td>2.15</td>
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<tr>
<td>27 Dec. 2014</td>
<td>DTRF2014</td>
<td>1645</td>
<td>2.17</td>
</tr>
<tr>
<td></td>
<td>JTRF2014</td>
<td>1648</td>
<td>2.15</td>
</tr>
</tbody>
</table>

All new TRFs show an improvement except:
- JTRF2014 for TOPEX
- DTRF2014 for Jason-2 from 2010 to 2011
ITRF2014 shows the best improvement
TRF2014 EVALUATION

ORBIT COMPARISON / DPOD2008

RMS of radial differences and mean Z differences


Mean RMS of radial differences per arc

Mean of Z orbit differences per arc

Mean RMS radial differences:
- dispersion and level of RMS higher (and different) between 1993 and 2004 for 3 TRF2014
- important drift from 1993 to 2001 for DTRF2014
- a few mm I-D-JTRF2014 after 2004
- annual signal in JTRF2014
- correlated to the scale differences

Orbit centering difference in the Z direction:
- important drift from 1993 to 2001 for DTRF2014
- drift consistent between the 3 TRFs after 2002
- annual signal for JTRF2014 (weekly solution)
- different geocenter than those of DPOD2008
- correlated to the Tz parameter differences
**CONCLUSIONS**

**DORIS post-fit residuals differences global and per station / DPOD2008**

- Differences are at a very low level in particular for the Jason-1 and Jason-2 results.
- For the ITRF2014 and DTRF2014 solutions, the most significant improvements are obtained for years from 1992 to 1998 and from 2010 to 2014, probably due to the improvement of the estimation of the station velocities compared to those estimated in the DPOD2008 solution realization.
- The ITRF2014 realization is used for the DPOD2014 solution which will be used for the operational processing of DORIS data.

**Orbit Comparison wrt DPOD2008 orbit**

- The orbits are very close in particular before 2004.
- There is an important drift from 1993 to 2001 for DTRF2014.
- There is an annual signal for JTRF2014 (weekly solution).
- The geocenter is different than those of DPOD2008.
- The Z-offset is correlated to Tz Helmert parameter differences.