COMBINATION OF ILRS STATION COORDINATES AND ERP SOLUTIONS AT UNIVERSITY OF NEWCASTLE
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Introduction

The TANYA software, developed for the IGS Global Network Associate Analysis Centre (GNAAC) at University of Newcastle upon Tyne, UK, allows to check, compare and combine the IGS AC SINEX solutions (A-networks) for station coordinates. It has been updated to be able to combine Earth Rotation Parameters (ERP – Xp, Yp, LOD) obtained from IGS and ILRS ACs. NCL GNAAC submits combined GPS ERP starting May 2002.

Input data

1. The ILRS OPS project’s 7-days solutions (with loose constraints) from ASI, DGF, GFZ, NERC, JCET obtained from observations on the interval starting GPS week 1244 (9 Nov 2003) to 1266 (17 April 2004).
2. ILRS CB Sinex files for SITE/ID and SITE/ECCENTRICITY blocks (to create SLR catalogue file).

Analysis procedure

1. Validation - SINEX V1.0, 2.0; (http://ucscgi2.ncl.ac.uk/~nkn3 - on-line Sinex checker).
2. Deconstraining to get AC’s loose solutions AC(loo).
4. Helmert transformation AC(loo) - GNET to get postresiduals.
5. Outlier removal (from analysis of postresiduals).
6. Variance component estimation - to balance influence of ACs, to calibrate the outlier hypothesis test; iterate steps 3-4-5-6, if necessary.
8. Reporting to CDDIS or to ILRS AWG.

Combination results

1. ERP – daily Xp, Yp, LOD for whole the interval.
2. Coordinates of stations (from 10 to 20 on each of 7-days intervals).

Comparisons

1. Station coordinates. Helmert parameters have been computed between combined NCL, AC(loo) solutions and ITRF-2000 and shown in the first 6 figures below. RMS of combined Tx, Ty, Tz is on 10 mm level (spoiled by unstable solutions from JCET). RMS for combined rotational parameters are on the 7*10^{-8} radians (45 cm) level for Rx, Ry and 25*10^{-8} radians (150 cm) for Rz. Scale is stable on the 0.8*10^{-9} (5 mm) level. Weighted RMS between solutions is 30-40 mm in comparisons wrt ITRF-2000 and 4-15 mm in comparisons wrt NCL.
2. ERP. Combined NCL and other ACs solutions have been compared with combined IGS (IGS03P) weekly solutions for ERP. The horizontal axes on figures for ERP represent day numbers counted from 9 Nov 2003. Seven weeks of ERP data have been used to create the figures. In the expressions of the kind (Xp(AC) - mean(AC)) – (Xp(IGS) - mean(IGS)) the mean values are computed for the each individual GPS week.
Excess of length of day

Day numbers from 9 Nov 2003

LOD, ms

ASI  NERC  DGF  ASIcomb  GFZ  DGFcomb  NCL  IGS
LOD differences

\[ (\text{LOD}(\text{AC}) - \text{mean}(\text{AC})) - (\text{LOD}(\text{IGS}) - \text{mean}(\text{IGS})), \text{ms} \]

Day numbers from 9 Nov 2003

LOD differences - combinations

\[ (\text{LOD}(\text{AC}) - \text{mean}(\text{AC})) - (\text{LOD}(\text{IGS}) - \text{mean}(\text{IGS})), \text{ms} \]

Day numbers from 9 Nov 2003
Weekly RMS for (LOD(AC)-mean(AC)) - (LOD(IGS)-mean(IGS))

Analysis centre

ASIcomb DGFcomb GFZcomb NCLcomb

Weekly RMS for (LOD(AC) -mean(AC)) - (LOD(IGS)-mean(IGS)) combinations

Analysis centre

ASIcomb DGFcomb NCLcomb
(Xp(AC)-mean(AC)) - (Xp(IGS)-mean(IGS)), mas

Day numbers from 9 Nov 2003

ASI DGF GFZ NERC

(Xp(AC)-mean(AC)) - (Xp(IGS)-mean(IGS)), mas, mas

Day numbers from 9 Nov 2003

ASIcomb DGFcomb NCL
Weekly RMS for \((Xp(AC) - \text{mean}(AC)) - (Xp(IGS) - \text{mean}(IGS))\)

**Analysis centre**

- **RMS, mas**

Weekly RMS for \((Xp(AC) - \text{mean}(AC)) - (Xp(IGS) - \text{mean}(IGS))\) - combinations

**Analysis centre**

- **RMS, mas**

**Analysis centre**

- **ASIcomb**
- **DGFcomb**
- **GFZ**
- **NERC**
Pole coordinate \( Y_p \)

Day numbers from 9 Nov 2003

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(Yp(AC)-mean(AC))-(Yp(IGS)-mean(IGS)), mas

Day numbers from 9 Nov 2003

Yp differences

ASIcomb  DGFcomb  GFZ    NERC

Yp differences - combinations

ASI   DGF  GFZ  NCL