Combination of Terrestrial Reference Frames and ERP 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, to compare and to combine the IGS AC SINEX solutions (A-networks) for station coordinates. It has been updated to be able to combine Earth Rotation Parameters (ERP – x_p, y_p, LOD) obtained from IGS and ILRS ACs. The new ability has been tested for GPS data on four weeks interval. NCL GNAAC submits combined ERP starting May 2002.

Input data

- GPS SINEX weekly data from 7 ACs: COD, EMR, GFZ, JPL, NGS, SIO (4 weeks – 1108, 1109, 1110, 1111).
- IGS.SNX catalog file from IGS CB.
- CDDISA FTP data (to create SLR catalog file).
- SLR data for the year 1999 from ILRS Pilot Project.

Analysis procedure

The usual procedure consists of several steps as follows.
1. Validation. All Sinex files have been checked with TANYA for consistency with SINEX V1.0 format requirements. (On-line Sinex checker could be found on ***http://ucscgi2.ncl.ac.uk/~nkn3/*** web site). JPL and GFZ submit LODR – values of LOD with pole tides effects removed. We added that effects back to obtain LOD. No LOD bias correction has been made.
2. Deconstraining has been made to obtain AC's loose solutions.
3. Estimating the loose combined solution GNET (full covariance matrix used) consisted of non-global station exclusion, re-scaling of covariance matrices, combination of AC solutions.
4. Helmert transformation from AC loose solutions to GNET solution has been made to compute post-residuals of station coordinates in one coordinate frame.
5. Outlier removal has been made from analysis of the post-residuals.
6. Variance component estimation – to balance influence of ACs, to calibrate the outlier hypothesis test; Steps 3-4-5-6 are repeated, if necessary.
7. Product generation. Product consists of constrained solution G; Helmert parameters between AC loose, GNET and CORE (IGS2000, ITRF2000) solutions.
8. Reporting to CDDIS.

Combination results

Unfortunately, the SLR data can't be used for analysis because of number of data and format problems and reporting UT1 rather than LOD. We've made combination of **IGS station coordinates** and **ERP** – daily values of x_p, y_p, LOD for GPS weeks 1108, 1109, 1110, 1111 using GPS data from seven ACs.

Comparisons

The comparison of the following solutions for GPS weeks 1108, 1109, 1110, 1111 has been made:

- combined NCL solution with IGS AC (COD, EMR, GFZ, JPL, NGS, SIO) solutions.
- combined NCL solution with combined MIT GNAAC, IGS combined (EMR) and P01 (EOP IERC(PC) 97 P01).

Figures 1 and 2 represent RMS of the solution differencies for ERP. No Helmert transformation parameters have been applied to ERP values in comparison.

Conclusions and recommendations

- TANYA software is able to combine station coordinates and ERP simultaneously.
- NCL combined ERP solution for GPS data is the most close to the IGS combined solution.
- GNAAC at University of Newcastle upon Tyne, UK is able now to submit combined ERP to the IGS.
- ILRS ACs have to submit LOD rather than UT1 for the Combination Research Project.

Future Contributions

- Regular submission of combined ERP to IGS.
- Taking part in the ILRS AWG Pilot Project and IERS SINEX Combination Campaign.
- Combination of pole rates.
- Study of the influence of constraints, number of stations and station distribution on the combined solution (especially, for SLR).
- Combination of solutions from different space techniques.

Acknowledgements

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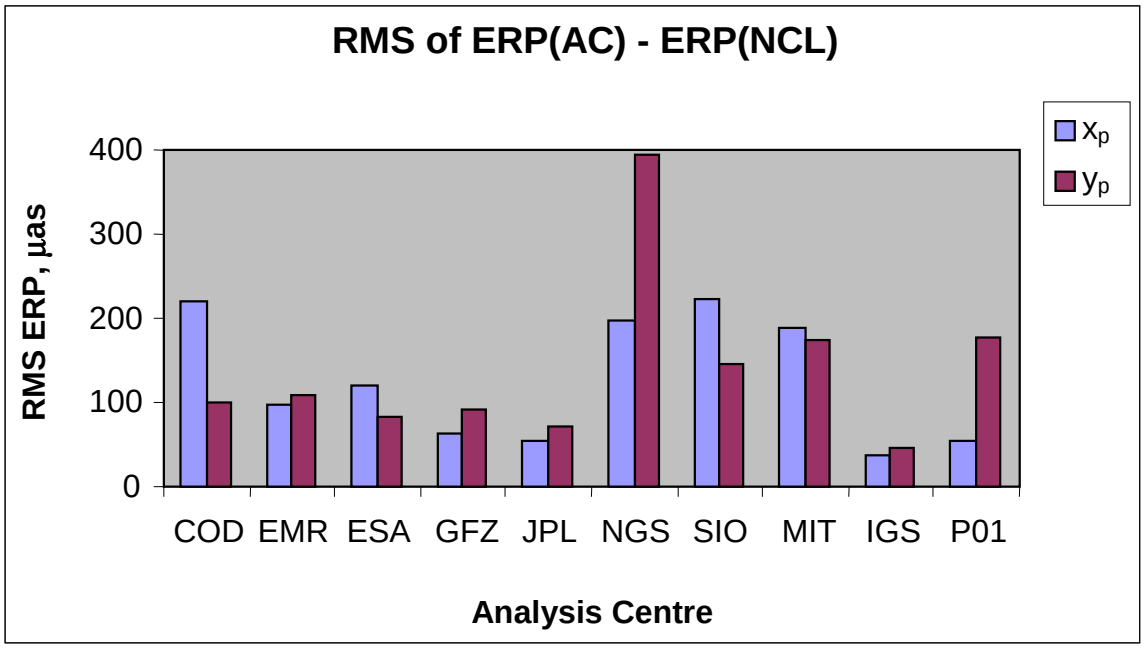

Fig. 1 RMS of solution differences for pole coordinates

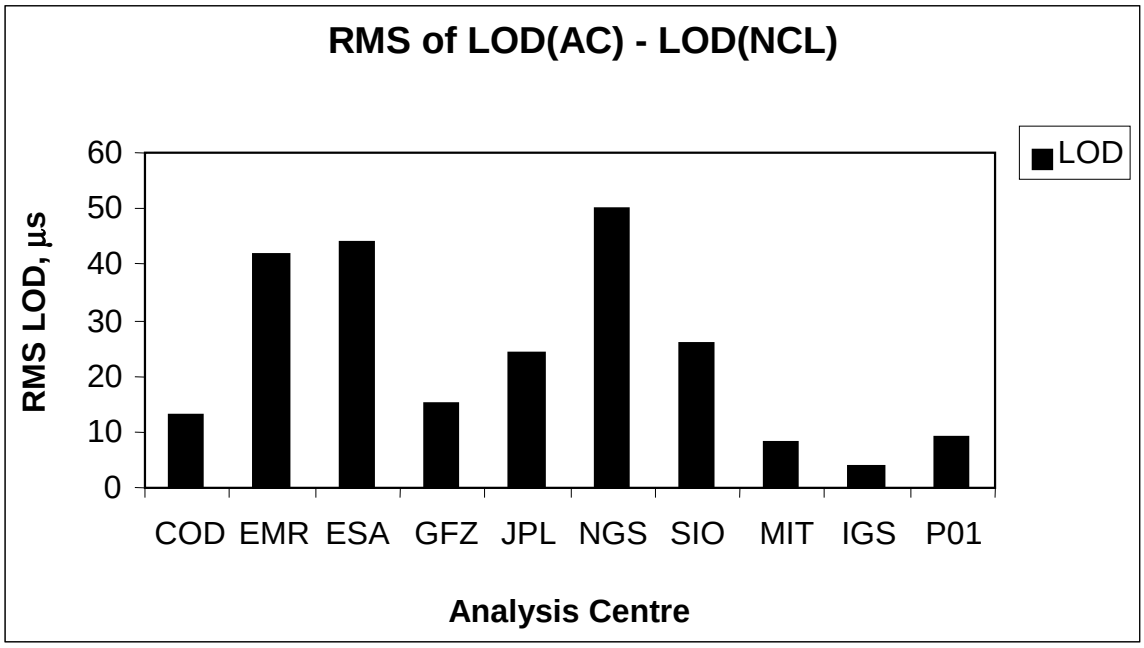

Fig. 2 RMS of solution differences for LOD