SINCOM — THE NEW PROGRAM PACKAGE FOR COMBINED PROCESSING OF SPACE GEODETIC OBSERVATIONS

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ABSTRACT. The software SINCom realizing the combination of standardized SINEX-files is introduced. The program package is meant to work in the following two modes: a combined solution within one observational technique on the appointed time interval and an inter-technique combination of daily SINEX-files. The realization of stations velocities estimation is recounted. The mathematical model, algorithms and the special task-forming language are presented. The main features of developed software and the arising problems are discussed. The problem-oriented aspects and the requirements for the content of incoming SINEX-files are viewed. The extensive plans of the SINCom use to obtaining TRF combined solution are considered. The first experimental results of single-technique combination for VLBI, GPS and SLR observations are presented.

1. INTRODUCTION

The SINCom software package is developed for combined processing of different space geodesy observations. The main purpose of the software package is estimating EOPs and positions of stations carrying out observations by modern space geodesy techniques. As each technique has some advantages and weaknesses, more reliable estimation can be attained when combining all observational data. The international standardized SINEX format[1] is chosen as the basic form for solution representation.

2. SOFTWARE DESCRIPTION

The SINEX combine processing allows obtaining two types of solutions (Fig. 1):

— combined solution including observations of different techniques related to the same epoch ("vertical" scheme). The final solution provides more precise EOPs. Further iterative improvement of satellite orbit parameters is also possible

— single-technique combination ("horizontal" scheme) of daily solutions. The final solution can be used to obtain weekly solutions based on global networks observations.

The program SINCom analyzes input files and sorts the parameters in accordance with identification of type of parameter. The quadruple of fields in the SOLUTION blocks: Site Code, Point Code, Parameter Type and Solution ID (for local parameters) forms unique name of a variable. The MATRIX Row/Column Number correspond to the Estimated Parameters Index in the SOLUTION block. To guarantee solvability of the combined system we can apply free-network constraints (no-net-rotation and no-net-translation) and also eliminate or fix some parameters.

SINCom source code was written using Fortran 90 programming language. The LINPACK[2] mathematical library was widely used when developing the program. The program runs in batch mode under MS Windows XP or higher. User interface is implemented by means of special task-forming language.

When the program runs the following steps are executed:

— read the task using special language and input files;

— analyse task and SINEX files containing initial solutions;

— categorize common and local unknowns using SINEX parameter definition;

— adapt solution epochs;

— transform a priori values;

— combine normal systems using stacking technique (Thaller, 2008);

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[1]http://www.iers.org/IERS/EN/Organization/AnalysisCoordinator/SinexFormat/sinex.html
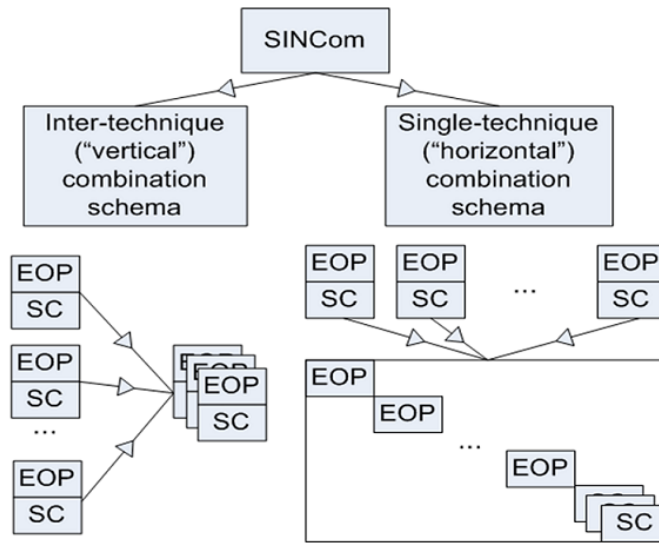[2]http://www.netlib.org/linpack/

Figure 1: SINCom flowchart.

— apply free-network constraints, fix parameters (Thaller, 2008);
— solve the combined normal system;
— create resulting SINEX file.

For sufficient solutions amount estimation of station velocities is available. Free network constraint should be also applied toward the stations velocities.

3. COMBINATION RESULTS

The horizontal combination scheme was applied to the SINEX files got from SLR observations during 2012–2013 years. Coordinates of SLR stations of the QUASAR network (SVEL, ZELL, BADL) and their velocities were estimated. The results are presented in the article (Gayazov et al., 2013).

4. REFERENCES

Gayazov, I., Rets, Ya., Brattseva, O., 2013, "Improvement of Geocentric Coordinates of SLR Stations at the "Quasar" Network Observatories", IAA Transactions, No. 27, pp. 408–413. (in Russian)

Thaller, D., 2008, "Inter-technique combination based on homogeneous normal equation systems including station coordinates, Earth orientation and troposphere parameters", Scientific Technical Report STR08/15, Deutsches GeoForschungsZentrum.