

Sinex output implementation in the VLBI Analysis software system Calc/Solve

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Abstract:

This document describes the way how Calc/Solve writes down a listing of a VLBI solution in Sinex format.

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1 Overview

SINEX stands for "Solution INdependent EXchange format". This format was developed by Blewitt et al. (1994)

<http://www.dgfi.badw-muenchen.de/gps/sinex.html> and
http://alpha.fesg.tu-muenchen.de/iers/sinex/sinex_v2_appendix1.pdf
for facilitating the task of combining several GPS solutions. Original design of Sinex format was made for solving this specific task. However, later this format evolved towards to a common machine-readable form of solution listings for other space geodesy techniques, VLBI and SLR, and attempts were made for overcoming flaws of the original design. This process of evolution is not yet completed, therefore, different software systems implement a little bit different flavors of Sinex format.

Listings in Sinex format produced by Solve contain information about stations, sources, estimates of the parameters, their covariance matrix, constraint equation, right-hand side of constraint equations and weight matrix of constraint equations. In addition to these results, a portion of the decomposed normal matrix and normal vector can be included in the listing as well. A user has control which blocks should be included in the listing. The current implementation of the Sinex format does not allow to include in the listing any parameter which was solved for. Only some type of parameters, like station position, EOP, etc can be included. However, a user has total control which parameters among the parameters of the supported type are to be included or not included in the listing.

2 Deviations from the SINEX 1.00 standard

Solve currently writes listing either in Sinex 2.10 format or in Sinex 2.20 format. Deviations from the Sinex 1.00 standard are as follows:

1) Eight new blocks were added:

```
SOLUTION/CONSTRAINT_EQUATION_INFO  
SOLUTION/CONSTRAINT_EQUATION_MATRIX  
SOLUTION/CONSTRAINT_EQUATION_VECTOR  
SOLUTION/CONSTRAINT_WEIGHT_MATRIX
```

The purpose of these four blocks is to overcome the flaw of original design of Sinex format and provide complete information about all constraints used in the solution.

```
SOLUTION/DECOMPOSED_NORMAL_MATRIX  
SOLUTION/DECOMPOSED_NORMAL_VECTOR
```

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The purpose of these blocks is to provide information about transformed normal equations before applying constraints. NB: one of the three items: covariance matrix, constraint equations and decomposed normal equations is redundant: having two of them one can derive the third one.

NUTATION/DATA
PRECESSION/DATA

The purpose of this section is to provide information about used nutation/precession model and to define parameter "estimates of nutation angles".

2) SOLUTION/STATISTICS block has new items:

WEIGHTED SQUARE SUM OF O-C $\sum \{ y(T) * w * y \}$

WRMS OF POSTFIT RESIDUALS $\sum \{ (A * e - y)(T) * w * (A * e - y) \} / \text{Sp}(w)$

where y -- the difference between the observed time delay and theoretical;

A -- matrix of equations of conditions;

e -- vector of the parameter adjustments;

w -- weight matrix;

Sp -- stands for the mathematical operation of computing trace of a matrix: the sum of diagonal elements.

Summing is done over all observations used in parameter estimation.

Comment: field WEIGHTED SQUARE SUM OF O-C is not computed in global mode.

Meaning of other parameters:

NUMBER OF OBSERVATIONS total number of used observables

NUMBER OF UNKNOWNNS total number of unknowns, including those,
which are not shown in the Sinex listing

SQUARE SUM OF RESIDUALS (VTPV) $\sum \{ (A * e - y)(T) * w * (A * e - y) \}$

VARIANCE FACTOR $\sum \{ (A * e - y)(T) * w * (A * e - y) \} /$
 $(N - M - \text{Sp}(\text{Cov}(A) * B(T) * z * B))$

where $\text{Cov}(A)$ -- covariance matrix of the entire solution

(NB: Sinex listing may have only a portion of the solution)

B -- matrix of equations of constraints;

z -- weight matrix of constraints;
N -- total number of equations of conditions (observables);
M -- total number of unknowns.

- 3) The blocks which keep element of matrices do not have fields
"Second Matrix Element" and "Third Matrix Element".

The purpose of this change is to facilitate the process of creation of
the listing and to reduce significantly the probability of errors.

- 4) SOLUTION/MATRIX_APRIORI is not provided. The reason is that Solve does not
operate the notion of apriori covariance matrix. And it also uses singular
constraints which cannot be reduced to the form of apriori covariance matrix.
Since full information about constraints is provided in other blocks,
SOLUTION/MATRIX_APRIORI is considered as an obsolete block.

2.1 New block SOLUTION/CONSTRAINT_EQUATION_INFO

SOLUTION/CONSTRAINT_EQUATION_INFO_BLOCK			
Field	Description	Format	
Constraint	Row index for the constraint	1X,I5	
Equation Row	equation matrix. It must match		
Index	the index of the constraint		
	equation.		
Constraint	Identifier of the constraint	1X,A8	
Equation			
Identifier			
Constraint	Index of vector constraint.	1X,I5	
Equation	1 for scalar constraint.		
Sub-index			

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Constraint	Description of the constraint	1X,A40	
Equation			
Description			

This block provides description of constraint equations. Matrix of constraint equations has dimension $N_{cns} * N_{par}$, where N_{cns} -- the number of constraint equations, N_{par} -- number of estimated parameters. The first field of the CONSTRAINT_EQUATION_INFO keeps the index of the constraint, the second field keeps constraint identifier. Currently, the following constraint identifiers are supported:

NNT_POS -- net rotation on station position. This vector constraint defines three equations:

$$1: \sum \{ \Delta_X \} = \text{const}$$

$$2: \sum \{ \Delta_Y \} = \text{const}$$

$$3: \sum \{ \Delta_Z \} = \text{const}$$

where Δ_X , Δ_Y , Δ_Z are X, Y and Z component of the adjustment to station position.

NNR_POS -- net rotation on station position. This vector constraint defines three equations:

$$1: \sum \{ \Phi_X \} = \text{const}$$

$$2: \sum \{ \Phi_Y \} = \text{const}$$

$$3: \sum \{ \Phi_Z \} = \text{const}$$

where Φ_X , Φ_Y and Φ_Z are the components of the vector of a small rotation defined as

$$\Phi = (r \times \Delta r) / |r|^2 * R_e$$

here

r -- vector of station coordinate;

Δr -- vector of adjustments to station position

R_e -- Earth's equatorial radius.

Units: dimensionless

NNT_VEL -- net rotation on station velocity. This vector constraint defines three equations:

$$1: \sum \{ \Delta_X \} = \text{const}$$

$$2: \sum \{ \Delta_Y \} = \text{const}$$

$$3: \sum \{ \Delta_Z \} = \text{const}$$

where Δ_X , Δ_Y , Δ_Z are X, Y and Z component of the adjustment to station position.

NNR_VEL -- net rotation on station velocity This vector constraint defines three equations:

$$1: \sum \{ \Phi_X \} = \text{const}$$

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2: sum { Phi_Y } = const

3: sum { Phi_Y } = const

where Phi_X, Phi_Y and Phi_Z are the components of the vector
of a small rotation defined as

$$\Phi = (r \times \Delta v) / |r|^2 * R_e$$

here

r -- vector of station coordinates;

Delta r -- vector of adjustments to station velocity;

R_e -- Earth's equatorial radius.

Units: 1/yr

NNR_SRC -- net rotation on source coordinates

1: sum { Phi_X } = const

2: sum { Phi_Y } = const

3: sum { Phi_Y } = const

where Phi_X, Phi_Y and Phi_Z are the components of the vector
of a small rotation

EOP_XPL -- constraint on X pole coordinate

EOP_YPL -- constraint on Y pole coordinate

EOP_UT1 -- constraint on UT1 angle

EOR_XPL -- constraint on X pole rate

EOR_YPL -- constraint on Y pole rate

EOR_UT1 -- constraint on UT1 rate

VEL_U -- constraint on Up topocentric coordinate of station velocity

VEL_E -- constraint on East topocentric coordinate of station velocity

VEL_N -- constraint on North topocentric coordinate of station velocity

VEL_X -- constraint on X coordinate of station velocity

VEL_Y -- constraint on Y coordinate of station velocity

VEL_Z -- constraint on Z coordinate of station velocity

STA_U -- constraint on Up topocentric coordinate of station position

STA_E -- constraint on East topocentric coordinate of station position

STA_N -- constraint on North topocentric coordinate of station position

STA_X -- constraint on X coordinate of station position

STA_Y -- constraint on Y coordinate of station position

STA_Z -- constraint on Z coordinate of station position

BLC_VAL -- constraint on baseline clocks

DCL_ORG -- constraint on declination of the set of certain sources

GRD_OFF -- constraint on atmosphere path delay gradient offset

NUT_OFF -- constraint on offset of nutation in longitude and nutation in

obliquity

OAT_RAT -- constraint on rate of changes of atmosphere path delay
 OCL_RAT -- constraint on clock drift
 RAS_ORG -- constraint on right ascension of the set of certain sources
 SRC_COO -- constraint on source right ascension and declination
 STA_ORG -- constraint on position of certain stations
 STA_TIE -- constraint on differences in position of several sites
 VEL_DIR -- constraint on horizontal projection of the differences
 in velocities of two stations
 VEL_ORG -- constraint on velocities of certain stations
 VEL_SET -- constraint on linear combination of velocity components
 VEL_TIE -- constraint on differences in velocities of several sites
 VEL_VER -- constraint on vertical component of station velocity

Constraints on segmented parameters

STA_PWC -- constraint on site velocity in the the case when site position
 is modeled by linear spline
 GRD_RAT -- constraint on atmosphere path delay gradient rate
 ATM_RAT -- constraint on atmosphere path delay rate between segments
 CLO_RAT -- constraint on clock rate between segments
 UT1_RAT -- constraint on UT1 rate in the case of linear spline
 EOP parametrization
 XPL_RAT -- constraint on X pole coordinate in the case of linear spline
 EOP parametrization
 YPL_RAT -- constraint on Y pole coordinate in the case of linear spline
 EOP parametrization

Constraint equation sub-index is 1 for scalar constraint, like EOP_XPL and
 runs over components of vector constraints, like NNT_POS (1,2,3 in this
 example).

2.2 New block SOLUTION/CONSTRAINT_EQUATION_MATRIX

This block keep matrix of constraint equations. Equations are organized by
 rows. Zero elements are omitted.

|_S_O_L_U_T_I_O_N_C_O_N_S_T_R_A_I_T_E_Q_U_A_T_I_O_N_B_L_O_C_K_|

Field	Description	Format
Constraint	Row index for the constraint	1X,I5
equation row	equation matrix. It must match	
Index	the index of the constraint	
	equation.	
Constraint	Column index for the Constraint	1X,I5
equation	Equation. It must match the	
column index	parameter index in the	
	SOLUTION/ESTIMATE block for the	
	same parameter.	
Constraint	Matrix element at the location	1X,E21.14
matrix element	(row index, column index).	

2.3 New block SOLUTION/CONSTRAINT_EQUATION_VECTOR

This block keeps the right-hand side of constraint equations.

SOLUTION_CONSTRAINT_VALUE_BLOCK		
Field	Description	Format
Constraint	Row index for the constraint	1X,I5
Equation Row	equation vector. It must match	
	the index of the constraint	
	equation.	
Right hand	Value of right hand part of the	
side value	constraint equation.	1X,E21.15
Sigma	Reciprocal weight which is	
	ascribed to this constraint	1X,E21.15

	equation.		
	48		

2.4 New block SOLUTION/CONSTRAINT_WEIGHT_MATRIX

This block contains the elements of the weight matrix of constraint equations. Zero elements are omitted.

C_O_N_S_T_R_A_I_N_T_W_E_I_G_H_T_M_A_T_R_I_X			
Field	Description	Format	
Row index of the weight matrix of constraint equations	Row index for the weight constraint matrix. It matches the index of the constraint equation.	1X,I5	
Column index of the weight matrix of constraint equations	Column index for the weight constraint matrix. It matches the index of the constraint equation	1X,I5	
Weight matrix of constraint equations element	Matrix element at the location (row index, column index).	1X,E21.14	

2.5 New block SOLUTION/DECOMPOSED_NORMAL_MATRIX_BLOCK

This block contains decomposed normal equations for the subset of parameters described in the SOLUTION/ESTIMATE block. In the case if the SOLUTION/ESTIMATE block described all parameters adjusted in the solution, decomposed normal matrix is equivalent to the full normal matrix. In the

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case if the SOLUTION/ESTIMATE block describes only a subset of parameters,
then the decomposed normal matrix D_{ii} is defined as

$$D_{ii} = N_{ii} - N_{ei}(T) * (C_{ee} + N_{ee})^{-1} * N_{ei} \quad \text{where}$$

N_{ii} -- the block of normal matrix which corresponds to the
equations included in the SOLUTION/ESTIMATE list;

N_{ee} -- the block of normal matrix which corresponds to omitted
parameters;

N_{ei} -- the block of normal matrix which corresponds to the product
of equations of conditions of the omitted parameters and
parameters included in the SOLUTION/ESTIMATE list.

C_{ee} -- the block of normal matrix of constraints which corresponds
to omitted parameters;

Solve computes D_{ii} as $D_{ii} = (V_{ii})^{-1} - C_{ii}$ where

V_{ii} -- covariance matrix of the parameters mentioned in
SOLUTION/ESTIMATE list;

C_{ii} -- the block of normal matrix of constraints which corresponds
to the parameters in SOLUTION/ESTIMATE list.

It is assumed that $C_{ei} = 0$

C_{ei} -- the block of normal matrix of constraints which corresponds
to the product of equations of constraints of the omitted
parameters and parameters from the SOLUTION/ESTIMATE list.

SOLUTION DECOMPOSED NORMAL MATRIX			
Field	Description	Format	
Decomposed normal matrix	Row index for the normal matrix. It must match the parameter index in the SOLUTION/ESTIMATE block for the same parameter.	1X,I5	
Decomposed normal matrix	Column index for the normal matrix. It must match the parameter index in the SOLUTION/ESTIMATE block for the same parameter.	1X,I5	

Decomposed	Matrix element at the location	1X,E21.14	
normal matrix	(row index, column index).		
element			

2.6 New block SOLUTION/DECOMPOSED_NORMAL_VECTOR BLOCK

This block contains decomposed right hand parts of normal equations for the subset of parameters described in the SOLUTION/ESTIMATE block. In the case if the SOLUTION/ESTIMATE block describes all parameters adjusted in the solution, the decomposed normal vector is equivalent to the full normal vector. In the case if the SOLUTION/ESTIMATE block describes only a subset of parameters, then the decomposed normal vector d_i is defined as

$$d_i = n_i - N_{ei}(T) * (C_{ee} + N_{ee})^{-1} * n_e \text{ where}$$

n_i -- the block of normal vector which corresponds to the equations listed in the SOLUTION/ESTIMATE;

n_e -- the block of the normal vector which corresponds to the omitted parameters;

N_{ee} -- the block of normal matrix which corresponds to omitted parameters;

N_{ei} -- the block of normal matrix which corresponds to the product of equations of conditions of the omitted parameters and parameters from the SOLUTION/ESTIMATE list.

C_{ee} -- the block of normal matrix of constraints which corresponds to omitted parameters;

Solve computes d_i as $d_i = D_i * e_i$ where

e_i -- vector of the estimates of the parameters from the SOLUTION/ESTIMATE list.

SOLUTION/DECOMPOSED_NORMAL_VECTOR			
Field	Description	Format	
Estimated	Index of the estimated parameter.	1X,I5	
Parameter			

[illegible]

2.7 New block NUTATION/DATA

This block describes which apriori nutation model is used and what is the reference model to which the nutation angles are referred.

N U T A T I O N D A T A L I N E			
Field	Description	Format	
[Nutat. Code]	Code for nutation reference	1X,A8	
	NONE		
	REN2000		
	IAU1980		
	IERS1996		
	IAU2000a		
	IAU2000b		
[Nut. Usage]	Usage flag: APR or REF	1X,A3	
	APR means that the previous		
	field kept the nutation model		
	used for apriori.		
	REF means that the previous		
	field kept the nutation model		
	used as a reference.		
	NONE means that the total		
	nutation angles are presented		

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Comments		1X,A66	
		80	

2.8 New block PRECESSION/DATA

This block describes the apriori precession constant which was used.

N_U_T_A_T_I_O_N_D_A_T_A_L_I_N_E			
Field	Description	Format	
[Prec. Code]	Code for nutation reference	1X,A8	
	NONE		
	IAU1980		
	IAU2000		
Comments		1X,A70	
		80	

Nutation angles can be presented either as nutation in obliquity and nutation in longitude in accordance to Newcomb-Andoyer formalism or as nutation X, nutation Y in accordance to Ginot-Capitaine formalism. Contrary to claims of Dr. Capitaine, both approaches are equivalent.

2.9 New block SOURCE/ID

R_A_D_I_O_S_O_U_R_C_E_D_A_T_A_L_I_N_E			
Field	Description	Format	
Source Code	Call sign for a source	1X,A4	

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IERS name		IERS name of the radio source		1X,A8
ICRF name		ICRF name of the radio source		1X,A16
IAU name		IAU J2000.0 name of the radio source		1X,A10
IVS name		IVS name of the radio source		1X,A8
Comments		Comments or other names of the radio source		1X,A29
80				

3 Deviations from the SINEX 2.10 standard

Sinex listing in 2.20 format has different names for parameters in accordance to an anonymous document circulated in 2008 known as "Proposal 2".

4 Implementation in Solve

Solve normally produces the listing in its own so-called "spool-format". In addition to the spool listing, Solve has a limited ability to generate listings in Sinex format. It can write the listing in Sinex format when it runs in batch mode. Description of the keyword Sinex in the control language can be found in http://gemini.gsfc.nasa.gov/solve_root/help/solve_guide_03.html#section3.13

When a user requests to apply specific constraints, Solve does not modify normal matrix immediately. Procedures of imposing constraints collect all constraint equation coefficients, weights, right hand part equations as well as constraint description in an intermediate data structure. After collecting all information about constraints Solve "applies" constraints by modifying normal matrix and normal matrix. If a Sinex output option is specified, then Solve passes this intermediate data structure to the routine which writes listing down and, thus, this subroutine has access to full information about the constraints.

Solve allows a user to specify which items among ESTIMATES, COVARIANCES, CONSTRAINTS, DECOMPOSED_NORMAL_EQUATIONS or all of them are to be included in the listing together with mandatory blocks. Solve allows a user to specify which parameters are to be included in the output. Currently, Solve does not allow to include any parameter in the listing, but only one from the pre-defined list of supported parameter.

4.1 Syntax of INCLUDE_PARAM and EXCLUDE_PARAM lists

INCLUDE_PARAM and EXCLUDE_PARAM files contain the parameter lists. List consists of one or more lines with Solve intrinsic 20-characters long parameter names. The lines which starts from # are considered as comments. Wild-card symbols * and ? can be included.

Solve check the name of each estimated parameter against INCLUDE_PARAM list. If the name matches with at least one line (except comment) then the name is flagged as "included". After that Solve check each parameter against EXCLUDE_PARAM list. If it matches with at least one line (except comment) then it is flagged as "excluded". All parameters which are flagged as "included" and are not flagged as "excluded" will be included in the Sinex output.

The list of intrinsic parameter names:

Parameters which can be put in the listing in Sinex format:

```
ssssssss X COMPONENT  X-coordinate of station position at reference epoch
ssssssss Y COMPONENT  Y-coordinate of station position at reference epoch
ssssssss Z COMPONENT  Z-coordinate of station position at reference epoch
ssssssss X VELOCITY   X-coordinate of station velocity
ssssssss Y VELOCITY   Y-coordinate of station velocity
ssssssss Z VELOCITY   Z-coordinate of station velocity
```

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ssssssss Xyymmdd-COO X-coordinate of station position at epoch yymmdd
ssssssss Yyymmdd-COO Y-coordinate of station position at epoch yymmdd
ssssssss Zyymmdd-COO Z-coordinate of station position at epoch yymmdd
ssssssss Xyymmdd-POS X-coordinate of station position at epoch yymmdd
ssssssss Yyymmdd-POS Y-coordinate of station position at epoch yymmdd
ssssssss Zyymmdd-POS Z-coordinate of station position at epoch yymmdd
ssssssss AXIS OFFSET axis offset of the ssssssss station
X WOBBLE 0yymmddhhmm X-coordinate of pole position at epoch yymmddhhmm
X WOBBLE 1yymmddhhmm Time derivative of X pole coordinate at yymmddhhmm
Y WOBBLE 0yymmddhhmm Y-coordinate of pole position at epoch yymmddhhmm
Y WOBBLE 1yymmddhhmm Time derivative of Y pole coordinate at yymmddhhmm
UT1-TAI 0yymmddhhmm UT1 angle at epoch yymmddhhmm
UT1-TAI 1yymmddhhmm First time derivative of UT1 angle at epoch yymmddhhmm
LONGITUDE NUTATION Nutation in longitude
OBLIQUITY NUTATION Nutation in obliquity
qqqqqqqq RIGHT ASCEN Right ascension at J2000.0 epoch
qqqqqqqq DECLINATION Declination at J2000.0 epoch
qqqqqqqq RIGHT ASC V Proper motion in right ascension
qqqqqqqq DEC VELO Proper motion in declination

Other parameters which the current version of Solve cannot put in the listing in Sinex format:

ssssssssA0yymmddhhmm Atmosphere path delay at epoch yymmddhhmm
ssssssssa0yymmddhhmm Atmosphere path delay at epoch yymmddhhmm
ssssssssC0yymmddhhmm Global clock offset at epoch yymmddhhmm
ssssssssC1yymmddhhmm Global clock rate at epoch yymmddhhmm
ssssssssC2yymmddhhmm Global clock rate drift at epoch yymmddhhmm
ssssssss--ssssssss C baseline dependent clocks
ssssssssNGyymmddhhmm Atmosphere gradient in north direction
ssssssssEGyymmddhhmm Atmosphere gradient in east direction
X WOBBLE 2yymmddhhmm Second time derivative of X pole coordinate at yymmddhhmm
Y WOBBLE 2yymmddhhmm Second time derivative of Y pole coordinate at yymmddhhmm
UT1-TAI 2yymmddhhmm Second time derivative of UT1 angle at epoch yymmddhhmm
Gamma Relativistic PPN parameter gamma

where

"ssssssss" stands for the IVS station name

"qqqqqqqq" stands for the IVS source name

"yyddmmhhss" stands for time epoch like 980729113459 -- July 29, 1998 11 hours
34 minutes 59 seconds.

4.2 Examples of INCLUDE_PARAM and EXCLUDE_PARAM lists

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1. daily_inc.bsc

```
#
# -- Include parameters which will be put in Sinex listing
#
# The following parameters are to be included in the Sinex listing:
#
# 1) Station coordinates
# 2) pole coordinates
# 3) UT1
# 4) rate of change of pole coordinates
# 5) rate of change of UT1
# 6) daily nutation angles
#
????????X COMPONENT
????????Y COMPONENT
????????Z COMPONENT
????????X?????-COO
????????Y?????-COO
????????Z?????-COO
????????X?????-POS
????????Y?????-POS
????????Z?????-POS
X WOBBLE 0*
X WOBBLE 1*
Y WOBBLE 0*
Y WOBBLE 1*
UT1-TAI 0*
UT1-TAI 1*
LONGITUDE NUTATION
OBLIQUITY NUTATION
```

2. daily_exc.bsc

```
#
# -- Exclude parameters which will be put in Sinex listing
#
# Nothing to exclude
#
```

3. daily_esc_notigo.bsc

```
#
# -- Exclude parameters which will be put in Sinex listing
```

```
#
# All parameters related to station TIGOCONC are excluded
#
# (NB: no common constraint equations with other stations can be
#      imposed if computation of the decomposed normal matrix is required )
#
TIGOCONC*
```

4.3 Treatment of station with discontinuous motion

It is an empirical fact that some stations has a quasi-instant motion due to seismic events, rails repair and other reasons of instability of VLBI site positions.

It is an analyst who determines the appropriate model for handling such stations. In the case if an analyst trusts to results of the measurements of such a motion by an independent technique, f.e. results of local survey before and after rails repairing, then position of the station is modeled by one parameter, and the motion of the station is described by the set of eccentricity values at the epochs before and after the motion.

If an analyst does not trust to independent measurements, or such measurements are unavailable, f.e. in the case of seismic motion, then coordinates of such station are described by a model

$$X = a_1 * B_0(t_0, t_1) + a_2 * B_0(t_1, t_2) + \dots + b * (t - t_{ref})$$

where B_0 -- a basis spline of the 0-th order on the range t_0, t_1

(it is 1 at the range $[t_0, t_1]$, and 0 otherwise)

t_{ref} -- reference epoch;

t_0 -- epoch of the first observations;

$t_1, t_2 \dots$ -- epoch of discontinuities.

Parameters $a_1, a_2 \dots$ have the same parameter name STAX, STAY, STAZ, but they are distinguished by sub-index 1,2... in the field SBIN (former name SOLN). This field is used in sections SITE/EPOCHS, SITE/APRIORI, SITE/ESTIMATES. If the station did not have discontinuity in the motion than SBIN always has the value 1.

The modern approach is to model non-linear site position with B-spline or order 0,1,2,3. Sinex format does not allow to put in the listing estimates of B-spline of order higher than 0.

4.4 Restrictions

The current implementation (2002.10.04) cannot write the listing in Sinex format in several cases:

1) Constraint NO_NET_TRANSLATION is not supported. Use NO_NET_TRANSLATION_POSITION instead of that.

2) Suppressions

VELOCITIES	NO
STATIONS	NO
SOURCES	NO
PROPER_MOTIONS	NO

3) Solve cannot put in the listing site position modeled by linear spline.

4) Currently, Solve can include in Sinex listing global parameters if it runs in global mode and local parameters if it runs in independent mode. It cannot include local parameters if it runs in global mode. This restriction may be lifted in the future.

5) Solve cannot include in the listing in Sinex format second and higher order UT1 and polar motion time derivatives.

6) Solve cannot include user parameters in the listing in Sinex format, but can include user constraints.

7) No common constraints between included and not included parameters can be imposed if computation of decomposed normal matrix is required. Solve will issue a warning if a constraint equation has non-zero elements for the parameters from both groups of included and not included parameters in the case if computation of a decomposed normal matrix is required, and will issue an error message and stop if the decomposed normal matrix is to be included in the sinex listing.

Questions and comments about this guide should be sent to:

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