International DORIS Service

STCD (STation Coordinates Difference) format
(version 1.0)

L. Soudarin, M. Feissel-Vernier, J.J. Valette

Introduction.
The STCD format has been developed by the IDS Central Bureau and the Analysis Coordinator with the objective to provide a user-friendly presentation of DORIS coordinate time-series results for a potentially broader community of users.
The STCD files are ASCII files giving for one geodetic point the times series of both Cartesian and geographic coordinates. Coordinate time series consist of residuals relative to a reference position. Each coordinate of the series is assumed to be expressed in a same reference system at the observation epoch. Users can then easily plot the time evolution of the point position and observe its horizontal and vertical displacement.
The STCD file consists of 5 mandatory blocks. 4 blocks derived of the SINEX format (FILE/REFERENCE; FILE/COMMENT; SITE/ID; SOLUTION/APRIORI) form the header. They provide information needed to the creation of the series of which main elements are the reference position of the geodetic point, and the characteristics of the ellipsoid used to express the Cartesian coordinates in geographic system. The 5th block gives the coordinate differences as a function of time. Time unit is the Modified Julian Day (MJD). Residual unit is the millimetre.
We propose hereafter a description of the STCD format, and an example of a STCD file.
Note that STCD files of DORIS stations can easily be generated from a series of SINEX files, under the condition that the SINEX solutions are all expressed in a common reference frame.

Tools to extract STCD from a series of SINEX files are currently being developed by the Central Bureau.

Description.
The 4 SINEX-like blocks follow the general description rules of the SINEX format (Blewitt 2003). They are formed of line of 80 characters or less. The 5th block (coordinate differences) is a 13-column block of which fields and format are described in the FILE/COMMENT block.
The blocks are separated by lines of 79 "-" starting with "*". There is no such a line after the 5th block. The total of the lines of the 4 blocks including the separating lines is exactly 29. The first line of the coordinate differences block is the 30th.

Block #1
FILE/REFERENCE Block (Mandatory)
Description:
This block provides description of the input and output, information on the organization, point of contact, the software and hardware involved in the creation of the file.
Contents:
DESCRIPTION *Name of Analysis Center*
OUTPUT   *Description of the file contents*
CONTACT   *Name and email of the relevant contact*
SOFTWARE   *Software use to generate the results*
HARDWARE   *Computer hardware on which above software was run*
INPUT   *Brief description of the input used to generate this time series*

The block starts with the line
+FILE/REFERENCE
The block ends with the line
-FILE/REFERENCE

Block #2
FILE/COMMENT Block (Mandatory)
Description:
This block provides information on the content of the block Coordinate Differences (fields, format, units), reference system in which the coordinates are expressed, and description of the Earth ellipsoid (flattening factor and equatorial radius) used to convert the Cartesian coordinates into geographical coordinates.
Contents:
FIELDS - modified julian date, dX, dY, dZ, sX, sY, sZ, dEast, dNorth, dUp, sEast, sNorth, sUp
FORMAT - 2x,f7.1,2(2x,3(1x,f6.1),3(1x,f5.1))
UNITS - all position residuals in millimeters
REFERENCE SYSTEM – *Name of the reference system*
EARTH ELLIPSOID - flattening factor: *value* equatorial radius: *value unit*

The block starts with the line
+FILE/COMMENT
The block ends with the line
-FILE/COMMENT

Block #3
SITE/ID Block (Mandatory)
Description:
This block provides general information for the site containing estimated parameters: site code, point code, DOMES number, station description, approximate longitude, approximate latitude, approximate height
Contents:
Comment line (mandatory)
```
*Code Pt __Domes__ T _Station Description__ _Longitude_ _Latitude__ _Height
```

immediatly followed on one line by the parameters described in the table below:
```
[Site Code] [Point Code] [DOMES number] [Observation Code] Station description
Approximate Longitude Approximate Latitude Approximate Height
```

The block starts with the line
```
+SITE/ID
```
The block ends with the line
```
-SITE/ID
```

S_I_T_E___I_D___D_A_T_A___L_I_N_E		
__Field_____	_____Description_____	___Format_____
[Site Code]	4 character mnemonic of the station	1X,A4
[Point Code]	Physical monument used at the site	1X,A2
[DOMES number]	Unique alpha-nummeric monument identification. For ITRF purposes, it is a 9 character DOMES number (5 digits, followed by the single letter 'S', followed by 3 digits)	1X,A9
[Observation Code]	Observation technique(s) used. Code for DORIS is D	1X,A1
Station description	Free-format description of the site, typically the town and/or country.	1X,A22
Approximate Longitude	Approximate longitude of the site in degrees(E/+), minutes and seconds.	1X,I3, 1X,I2, 1X,F4.1
Approximate Latitude	Approximate latitude of the site in degrees(NS/+-), minutes and seconds.	1X,I3, 1X,I2, 1X,F4.1
Approximate Height	Approximate height of the site in metres.	1X,F7.1
		75

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Block #4
SOLUTION/APRIORI Block (Mandatory)
<u>Description</u>:
Reference position with respect to which residuals are given
<u>Contents</u>:
Comment line (mandatory)
```
*Index _Type_ Code Pt Soln _Ref_Epoch__ Unit S __Estimated Value____ _Std_Dev___
```

immediatly followed on three lines by the station coordinates X,Y,Z as described in the table below:
Parameter index, parameter type, site code, point code, solution ID, time, parameter units, constraint
code, parameter value, parameter standard deviation.

The block starts with the line
```
+ SOLUTION/APRIORI
```
The block ends with the line
```
- SOLUTION/APRIORI
```

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```
 _____
|_____S O L U T I O N___A P R I O R I___D A T A___L I N E_____|
|                  |                                 |                |
|__Field_____|_____Description_____|___Format_____|
|                  |                                 |                |
| Parameter Index| Index of a priori parameters.    |  1X,I5         |
|_____|_____|_____|
|                  |                                 |                |
|[Parameter Type]| Identification of the type of    |  1X,A6         |
|                  | parameter.                      |                |
|                  | STAX - Coordinate in X-direction m|              |
|                  | STAY - Coordinate in Y-direction m|              |
|                  | STAZ - Coordinate in Z-direction m|              |
|_____|_____|_____|
|                  |                                 |                |
| [Site Code]     |4 character mnemonic of the station|  1X,A4       |
|_____|_____|_____|
|                  |                                 |                |
| [Point Code]    | Physical monument used at the site|  1X,A2       |
|_____|_____|_____|
|                  |                                 |                |
| [Solution ID]   | Solution ID at the Site code     |  1X,A4         |
|_____|_____|_____|
|                  |                                 |                |
| [Time]          | Epoch at which the apriori       |  1X,I2.2,      |
|                  | parameter or the inner constraint|  1H:,I3.3,     |
|                  | is valid.                       |  1H:,I5.5      |
|_____|_____|_____|
|                  |                                 |                |
| Parameter Units| Units used for the coordinates   |  1X,A4         |
|                  | and sigmas. They should be m    |                |
|_____|_____|_____|
|                  |                                 |                |
| [Constraint     | Constraint applied to the parame-|  1X,A1        |
| Code]           | ter.                            |                |
|_____|_____|_____|
|                  |                                 |                |
| Parameter value| Value of the coordinate          |  1X,E21.15     |
|_____|_____|_____|
|                  |                                 |                |
| Parameter       | Standard deviation for the       |  1X,E11.6      |
| Standard        | coordinate                      |                |
| Deviation       |                                 |                |
|_____|_____|_____|
                                                    |                |
                                                    |  80            |
                                                    |_____|
```

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Block #5

The coordinate time series. No name block (Mandatory)

Description: coordinate differences in cartesian (XYZ) and geographic (East (E), North (N), Up (U) and associated uncertainties all expressed in mm as a function of time expressed in Modified Julian Day.

Contents:

One result per line, 13 fields separated by blanks:

MJD (Modified Julian Date), dX (X residual), dY (Y residual), dZ (Z residual), sigdX (uncertainty of dX), sigdY (uncertainty of dY), sigdZ (uncertainty of dZ), dE (East residual), dN (North residual), dU (Up residual), sigdE (uncertainty of dE), sigdN (uncertainty of dN), sigdU (uncertainty of dU)

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Example of STCD file.

```
+FILE/REFERENCE
 DESCRIPTION    LEGOS/CLS Analysis Center
 OUTPUT         Monthly position residuals at observation epoch
 CONTACT        Laurent Soudarin <laurent.soudarin@cls.fr> info-doris@cls.fr
 SOFTWARE       GINS / DYNAMO (GRGS/CNES)
 HARDWARE       SUN / CRAY
 INPUT          SPOT2, SPOT3, SPOT4, SPOT5, TOPEX, ENVISAT DORIS data
-FILE/REFERENCE
*_____
+FILE/COMMENT
 FIELDS - modified julian date, dX, dY, dZ, sX, sY, sZ, dEast, dNorth, dUp, sEast, sNorth,
sUp
 FORMAT - 2x,f7.1,2(2x,3(1x,f6.1),3(1x,f5.1))
 UNITS - all position residuals in millimeters
 REFERENCE SYSTEM - ITRF2000 using a global LCA solution (1993_2004) for transformation
 EARTH ELLIPSOID - flattening factor: 298.257810 equatorial radius: 6378136.0 m
-FILE/COMMENT
*_____
+SITE/ID
*Code Pt __Domes__ T _Station Description__ _Longitude_ _Latitude__ _Height
 AMSA  A 91401S001 C AMSTERDAM antenna       77 34 17.0 -37 47 54.3    62.3
-SITE/ID
*_____
+SOLUTION/APRIORI
*Index _Type_ Code Pt Soln _Ref_Epoch__ Unit S __Estimated Value____ _Std_Dev___
     1 STAX   AMSA  A    1 97:001:00000 m    2 0.108606165885490E+07 0.17099E-02
     2 STAY   AMSA  A    1 97:001:00000 m    2 0.492796300849270E+07 0.89032E-03
     3 STAZ   AMSA  A    1 97:001:00000 m    2 -.388782838175110E+07 0.89761E-03
-SOLUTION/APRIORI
*_____
  49001.9     -0.9    42.6    51.5   12.0    8.3   10.9     10.1    66.3     1.1   15.4    9.6    9.6
  49031.2     -1.4    28.1    33.3   12.7    8.7   11.7      7.4    43.1     1.0   16.1   10.5   10.0
  49064.0     -8.5     7.5    11.4   13.4    9.3   11.8      9.9    12.4    -2.6   17.1   10.5   10.5
  49093.3     13.2    20.4    36.0   12.6    9.2   12.5     -8.5    42.5    -4.0   16.1   11.1   10.7
  49126.1    -19.2    45.3    18.4   11.1    8.0   11.1     28.4    39.3    20.4   14.1   10.0    9.2
  49155.3    -27.6    40.0    38.6   10.6    7.4   10.4     35.5    51.0     2.5   13.6    9.3    8.6
  49184.6      9.3    13.7    21.4   11.3    7.9   10.7     -6.1    26.4    -1.0   14.3    9.5    9.3
  49213.8     20.9    15.6    18.9   10.6    7.3   10.3    -17.1    27.1     4.0   13.5    9.2    8.5
  49246.7    -38.5    22.1    35.1   11.3    7.5   10.4     42.3    36.0   -11.1   14.4    9.3    8.7
  49275.9    -40.9    24.4    20.1   11.2    8.3   10.6     45.1    25.2    -0.4   14.3    9.3    9.6
  49308.7    -17.6    28.9    32.2    9.2    6.3    8.9     23.3    40.5    -0.5   11.7    8.0    7.4
  49338.0      4.2    28.1     8.2   10.1    6.7    9.1      1.9    23.9    17.4   12.8    8.2    7.7
  49367.2    -25.8    42.8    14.2    9.7    6.5    9.2     34.4    33.5    20.0   12.4    8.3    7.5
  49396.4    -20.4    37.6    10.8    9.4    6.4    8.9     28.0    28.4    18.9   12.0    8.0    7.4
  49429.3    -29.4    31.3    23.3    8.6    5.8    8.4     35.4    33.4     4.9   10.9    7.5    6.9
  49458.5     -9.2    25.5    14.0    8.4    5.6    8.5     14.5    25.2     9.5   10.7    7.6    6.8
  49491.4    -17.9    28.3    -1.6   12.5    8.7    9.7     23.6    13.4    19.8   16.1    8.6    9.6
```

Annex

Relationship between MJD and decimal year.

Decimal year = $2000.0000 + (MJD-51544.03)/365.2422$

Relationship between MJD and day of year (DOY):

```
------------------------------------------------
  Year    MJD         Year    MJD
------------------------------------------------
  1991  48256 + DOY    2006  53735 + DOY
  1992  48621 + DOY    2007  54100 + DOY
  1993  48987 + DOY    2008  54465 + DOY
  1994  49352 + DOY    2009  54831 + DOY
  1995  49717 + DOY    2010  55196 + DOY

  1996  50082 + DOY    2011  55561 + DOY
  1997  50448 + DOY    2012  55926 + DOY
  1998  50813 + DOY    2013  56292 + DOY
  1999  51178 + DOY    2014  56657 + DOY
  2000  51543 + DOY    2015  57022 + DOY

  2001  51908 + DOY    2016  57387 + DOY
  2002  52274 + DOY    2017  57753 + DOY
  2003  52639 + DOY    2018  58118 + DOY
  2004  53004 + DOY    2019  58483 + DOY
  2005  53370 + DOY    2020  58848 + DOY
```