IVS-EOP file format
Version 3.1 (Jul 18, 2023)

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INTRODUCTION

The IVS is using a dedicated IVS-EOP file format for distributing its EOP time series. The changes from version 3.0 to 3.1 are given in the next section of this document.

CHANGES FROM VERSION 3.0 TO 3.1

As the nutation components in the data block represent corrections to an a priori model, this model needs to be specified. The two additional mandatory keywords "PRECESSION_MODEL" and "NUTATION_MODEL" have been added to the header block to specify the corresponding precession and nutation model.

REFERENCES

- IVS-EOP format version (3.0):
  https://ivscc.gsfc.nasa.gov/IVS_AC/files_IVS-AC/
  IVS-EOP_Format_v30_20220627.txt

- IVS-EOP format version (2.2):
  https://ivscc.gsfc.nasa.gov/IVS_AC/files_IVS-AC/eop_transfer_format.txt

- Proposal for extending the IVS-EOP 2.2 format:
  Proposal_EOPfileformat_v30.pdf

- SINEX format description:
  https://www.iers.org/IERS/EN/Organization/AnalysisCoordinator/SinexFormat/
  sinex.html

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A P P E N D I X

I V S - E O P

V E R S I O N 3. 1

D E T A I L F O R M A T D E S C R I P T I O N

1. Introduction

This document describes the IVS-EOP format. The IVS is using a dedicated EOP format, to provide it's EOP estimates to the IERS Rapid Service/Prediction Centre, the IERS Earth Orientation Centre and to the scientific community.

The IVS-EOP format was suggested by Leonid Petrov in 1999. In 2021, the IVS analysis working group accepted a proposal made by BKG for a format update from version 2.2 to version 3.0. This latest update of the format introduced a bigger change, by adding a dedicated header block with keywords, which give information in the underlying solution used to generate the reported EOP time series. We are thankful for feedback from the IVS community, and particularly want to acknowledge the comments of James Anderson and Leonid Petrov.

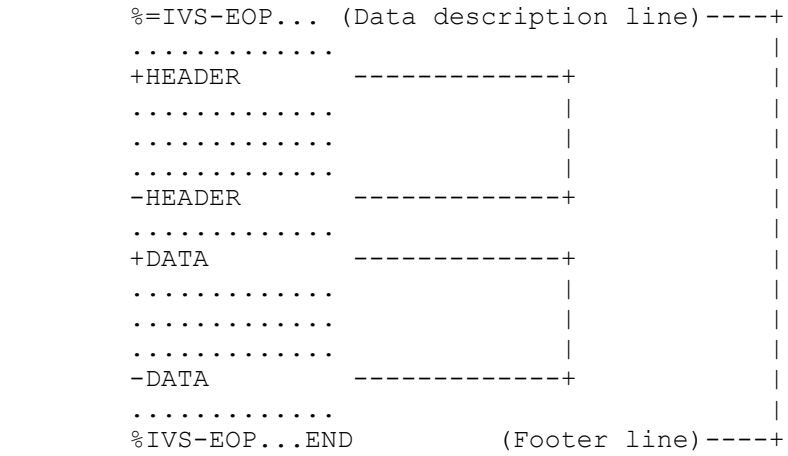
2. Data Structure

An IVS-EOP file must start with a data description line and ends with a footer line. The file is subdivided into two blocks. Each block is enclosed by a header and trailer line.

The following blocks are defined:

HEADER
DATA

These block titles are immediately preceded by a '+' or a '-' marking the beginning and the end of a block. The block titles must be in capital letters. After a block has started(+) it must be ended(-) before another block can begin. The general structure is as follow:



The DATA block comes after the HEADER block.

Lines starting with '#', '*', '!' in column 1 are considered as comment lines. Comment lines are allowed everywhere, i.e. also within the header and data block.

The IVS-EOP file is an ASCII file using the ASCII character set.

3. Data Description Line (Mandatory)

Description:

The data description line is mandatory and must be the first line in an IVS-EOP file.

Contents:

DATA DESCRIPTION LINE		
Field	Description	Format
First Character	Single character '%' in column #1. No other character than '%' is allowed.	A1
Second Character	Single character '=' in column #2. Indicates resultant solution. No other character than '=' is allowed.	A1
Document Type	Seven characters 'IVS-EOP' indicating that this is an IVS-EOP file.	A7
Format Version	Three digits indicating the format version used. '3.0' for this version	1X,F3.1
File Agency Code	Agency creating the file, e.g, IVS for IVS combination center	1X,A3
File Time	Creation time of this IVS-EOP file (YYYY-MM-DDTHH:MM:SS)	1X,I4,"-",I2,"-",I2,"T",I2,":",I2,":",I2
Agency Code	Agency providing the data in the file, e.g., BKG, which runs the IVS combination center	1X,A3
Start Time	Start time of the data used in the file (YYYY-MM-DDTHH:MM:SS)	1X,I4,"-",I2,"-",I2,"T",I2,":",I2,":",I2
End Time	End time of the data used in the file (YYYY-MM-DDTHH:MM:SS)	1X,I4,"-",I2,"-",I2,"T",I2,":",I2,":",I2

Time scale	Three letters indicating the time scale used	1X,A3
Observation Code	Single character indicating the technique(s) used to generate the EOP solution. It should be consistent with the IERS convention. This character code may be: C - combined techniques used D - DORIS L - SLR M - LLR P - GNSS R - VLBI	1X,A1

4. HEADER block (Mandatory)

Description:

The header block is built of single lines for each keyword, starting with a keyword, followed by a value. Keywords can be mandatory or optional. The keyword values can be specific values from a given list (for machine readability) or free values (for information only).

Contents:

HEADER KEYWORD LINE		
Field	Description	Format
Keyword	Keyword in free format, in capital letters, no blanks are allowed in between words forming one keyword (use '_' instead). The keyword starts at the beginning of each line and is separated from the following value by a single ASCII character space. The list of allowed keyword is provided below.	A, 1X
Value	Values may be preceded by extra ASCII spaces or ASCII tabs to aid forming readable columns. Values that contain lists must have the values separated by one or more ACSII spaces or ASCII tabs between each element of the list. Values use either a fixed format, tokens from a defined list or free format. The list of allowed values for each keyword is provided below.	see below

List of allowed keywords and values:

Most keywords are mandatory. Optional keywords are given in brackets in the table below.

Keyword	Description	Value
GENERATION_TIME	Time of file generation	YYYY-MM-DDTHH:MM:SS I4,"-",I2,"-",I2,"T" I2,":",I2,":",I2
DATA_START	Start of data	as above
DATA_END	End of data	as above
DESCRIPTION	Description of solution	free format
ANALYSIS_CENTER	IVS analysis center code	free format
CONTACT	IVS analysis center point of contact	free format
SOFTWARE	Software and version number used to generate the EOP solution	free format
TECHNIQUE	Observation technique(s) used to generate the EOP solution	Choose one value from list for single technique solution: V24 (VLBI R1/R4) VINT (VLBI Intensives) VGOS (VLBI VGOS sess.) VLBI (VLBI, if none of the above) GNSS SLR DORIS Combine individual codes with '+' to generate one value for combined sol- ution, e.g.:

		VINT+V24 VINT+V24+GNSS VINT+GNSS V24+GNSS+SLR
PRECESSION_MODEL	Precession a priori model (The nutation components in the data block represent corrections to the a priori precession/nutation model)	Choose one value from list: IAU1976 IERS1996 IAU2006
NUTATION_MODEL	Nutation a priori model (The nutation components in the data block represent corrections to the a priori precession/nutation model)	Choose one value from list: IAU1980 IERS1996 IAU2000A IAU2000B
NUTATION_TYPE	Representation of nutation	Choose one value from list: EQUINOX-BASED CIO-BASED
ROTATION_TYPE	Representation of rotation	Choose one value from list: UT1-UTC_LOD UT1-TAI_LOD
CRF_APRIORI	A priori celestial reference frame	free format
TRF_APRIORI	A priori terrestrial reference frame	free format
EOP_SUBDAILY	Sub-daily pole model	Choose one value from list: IERS2010 DESAI-SIBOIS GIPSON NONE
EOP_APRIORI	A priori EOP	free format
EOP_ESTIMATED	One line for each estimated EOP, with values separated by one or more ASCII spaces or	Examples for offsets:

	ASCII tabs, following the notation: NAME[_TIMEDEP_DEGREE] CONSTRAINT UNIT [RHS] with [] indicating optional arguments NAME specifies the parameter name. Valid names are: XPOL, YPOL, DUT1, LOD, DPSI or DX, DEPS or DY TIMEDEP could be either DER (time derivative) or BSP (B-spline) DEGREE is the degree of the time derivative/B-spline. CONSTRAINT is the value for the constraint (i.e. the reciprocal weight) applied for the specific parameter. Use 'NONE' if no constraint was used. UNIT specifies the unit of the EOP estimates and of the corresponding constraint (both units have to be the same). Valid units are: s - second ms - millisecond us - microsecond as - arcsecond mas - milliarcsecond uas - microarcsecond /day - each unit above/day RHS specified the right hand side value. EOP, which are not estimated, should not be specified here. EOP can appear in random order. Note: LOD is treated here as individual parameter and not as dUT1 derivative. It is maintained with the group of rates for consistency with the other techniques.	XPOL 0.045 as YPOL 0.045 as DUT1 0.003 s DPSI NONE mas DEPS NONE mas rates: XPOL_DER_1 0.045 as/day YPOL_DER_1 0.045 as/day LOD 0.003 s DPSI_DER_1 NONE mas/day DEPS_DER_1 NONE mas/day piece-wise linear offsets: XPOL_BSP_1 0.045 as YPOL_BSP 1 0.045 as DUT1_BSP_1 0.003 s DPSI_BSP_1 NONE mas DEPS_BSP_1 NONE mas

[NUMBER_OF_ ENTRIES]	Total number of entries (data lines) in the data block	Integer number

5. DATA block (Mandatory)

Description:

The data block is built of single lines per epoch. Two additional comment lines, with the first line describing the data field and the second line describing the units, are placed immediately before the first data line. The units have to be consistent with the units described in the header block (keyword UNIT). They can differ from the example given in the DATA LINE table below (3rd column). Consult the keyword table above (Sec. 4) for valid units.

For readability the values in these two comment lines should be placed centered over the columns. All data records have to be ordered in time.

The lines of the data block are free format, allowing for a variable field length. The fields are separated by at least one ASCII space. The lines should be parsed by splitting on whitespaces rather than using hard-coded field widths. There are 31 data fields (columns) per line. Data which is unavailable is replaced by NA. This is the case for example with Intensives, which don't estimate polar motion, nutation, or EOP rates. Several data entries (i.e. lines) per parameter and session are possible, depending on the EOP parameterization, e.g., high resolution of offsets (every hour) or piece-wise linear offsets.

Contents:

DATA LINE				
Field No.	1st line Identifier	2nd line Unit	Description	Number of min. decimal_digits
1	epoch	[MJD]	Decimal MJD of measurements	5
2	xPol	[as]	x component of the pole	7 for [as]
3	yPol	[as]	y component of the pole	7 for [as]
4	dUT1	[s]	UT1-UTC or UT1R-UTC or UT1-TAI or UT1R-TAI	8 for [s]
5	dPsi or dX	[mas]	Nutation component dPsi or dX	4 for [mas]
6	dEps or dY	[mas]	Nutation component dEps or dY	4 for [mas]
7	sig_xP	[as]	Uncertainty in x pole	7 for [as]

8	sig_yP	[as]	Uncertainty in y pole	7 for [as]
9	sig_UT	[s]	Uncertainty in UT1-UTC or UT1-TAI	8 for [s]
10	sig_dPsi or sig_dX	[mas]	Uncertainty in nutation component dPsi or dX	4 for [mas]
11	sig_dEps or sig_dY	[mas]	Uncertainty in nutation component dEps or dY	4 for [mas]
12	d	[ps]	WRMS residual delay of the session	1 for [ps]
13	cor_xPyP	[-]	Correlation coefficient: xPol, yPol	
14	cor_xPUT	[-]	Correlation coefficient: xPol, dUT1	
15	cor_yPUT	[-]	Correlation coefficient: yPol, dUT1	
16	cor_dPdE or cor_dXdY	[-]	Correlation coefficient: dPsi, dEps or dX, dY	
17	nObs	[-]	Number of observables used for deriving reported EOP or '0' for a global solution.	
18	sessID	[-]	6-character session code according to the 2nd column of IVS master schedules Use the key 'COMBINED' for combined sessions or techniques. Use the key 'GLOBAL' for a global solution. Note: The current 6-character session code might, in the future, change to at least 32 characters.	
19	T	[h]	Span of the observation used for deriving reported EOP or '0' for a global solution.	

20	xPolR	[as/day]	Rate of the x pole component	8 for [as/day]
21	yPolR	[as/day]	Rate of the y pole component	8 for [as/day]
22	LOD	[s]	Excess length of day Note: see comment below	9 for [s]
23	dPsiR or dXR	[mas/day]	Rate of the nutation component dPsi or dX	5 for [mas/day]
24	dEpsR or dYR	[mas/day]	Rate of the nutation component dEps or dY	5 for [mas/day]
25	sig_xPR	[as/day]	Uncertainty in x pole rate	8 for [as/day]
26	sig_yPR	[as/day]	Uncertainty in y pole rate	8 for [as/day]
27	sig_LOD	[s]	Uncertainty in LOD	9 for [s]
28	sig_dPR or sig_dXR	[mas/day]	Uncertainty in rate of the nutation component dPsi or dX	5 for [mas/day]
29	sig_dER or sig_dYR	[mas/day]	Uncertainty in rate of the nutation component dEps or dY	5 for [mas/day]
30	network	[-]	Configuration of network employed for the solution: sequence of 2-character IVS station identifiers as maintained in the IVS master control file ns-codes.txt with '-' between the station codes (no blanks) Example: Ts-Wz-Ny Use the key 'COMBINED' for combined sessions or techniques. Use the key 'GLOBAL' for a global solution.	
31	comments	[-]	Comment field, could be used for any additional information, e.g. session specific	

			constraints, details on combined sessions.		
			Entry has to start with a leading '!'		

Comment:

Although it is inconsistent to have LOD in the group of rates due to the toggling of the sign, it is maintained here for consistency with the other space-geodetic techniques.

LOD = UT1(n)-UT1(n+1) with n in days

LOD has the same magnitude but opposite sign of the UT1-UTC rate or the UT1-TAI rate, which are normally determined in VLBI analyses and given in s/day.

6. Footer Line (Mandatory)

Description:

The footer line is mandatory and must be the last line in an IVS-EOP file.

Contents:

FOOTER LINE		
Field	Description	Format
First Character	Single character '%' in column #1. No other character than '%' is allowed.	A1
Document Type	Seven characters 'IVS-EOP' indicating that this is an IVS-EOP file.	A7
Format Version	Three digits indicating the format version used. '3.0' for this version.	1X,F3.1
End	Last 3 characters 'END' marking the end of the file.	1X,A3

7. File name convention

The IVS-EOP file name follows the file name convention as given at:

https://ivscc.gsfc.nasa.gov/products-data/submit-product.html

There are three file types with different extensions:

File_type	Naming_convention	Comment
EOP-I results	aaaccccc.eopi	Intensives EOP series (without nutation offsets)
EOP-S results (IAU1980)	aaaccccc.eops	Session EOP series (with nutation offsets referring to the IAU1980 model)
EOP-S results (IAU2000)	aaaccccc.eoxy	Session EOP series (with nutation offsets referring to the IAU2000 model)

The following keys are used:

- aaa = Analysis Center 3-letter code
- ccccc = Solution 5-character code