

A STD BUFR Template

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Some requirements for the STD BUFR:

- Information for STD validation and research should be provided.
- All SINEX-TRO 2.0 data relevant for atmosphere sounding should be available.
- All information from the ZTD BUFR template should also be in the new one.
- Option to encode ZTDs as well as STDs.
- Improved meta-data, e.g., processing center, product, processing software, ...
- New BUFR table B descriptors for GNSS related quantities, like gradients, SHD, SWD, ...

STD BUFR Section 4

General Information

Station, coordinates, observation time, ...

ZTD Observations

- ZTD processing, temporal integration, ...
- ZTD replication
 - ZTD, ZTD error
 - ZHD, ZWD, gradients, ...

STD Observations

- STD processing, quality flag, ...
- STD replication
 - STD, STD error
 - SHD, SWD, gradients, residuals, ...

BUFR Section 4 - General

Element Name	Descriptor	Comments
Station or Site Name	0 01 015	Station & Processing Centre
Processing centre ID code	0 01 040	GNSS processing center
Time Significance	0 08 021	30=Time of occurrence
Date	3 01 011	Observation date: year/month/day
Time	3 01 013	Observation time: hour/min./second
Lat/Lon/Hei	3 01 022	station coordinates
Geoid Undulation	0 10 036	Geoid height above WGS-84 ellipsoid
Software identification and version number	0 25 061	GNSS processing software, software version
Meteorological Observations at GNSS Site		
Pressure	0 10 004	to 0.1 hPa
Temperature	0 12 001	to 0.1 K
Relative Humidity	0 13 003	to 1% RH

BUFR Section 4 - ZTD

Element Name	Descriptor	Comments
Software Identification	0 25 060	Modification of software or processing
Time Significance	0 08 021	2=Time Averaged
Time Period	0 04 025	5–60 mins, nominally 15 mins
ZTD Replication		
Delayed descriptor replication factor	0 31 001	Number of ZTDs
Zenith path delay	0 15 197	ZTD 0–3000 mm to 0.1 mm
Estimated ZTD error	0 15 198	ZTD error 0–400 mm to 0.1 mm
Total Number	0 08 022	No. of satellites in ZTD solution
Extended quality Flags for ground-based GNSS data	0 33 193	real-time/post-processing, Galileo, GLO-NASS, BeiDou, ...
ZHD	0 15 207	0–3000 mm to 0.1 mm
ZWD	0 15 035	0–1000 mm to 0.1 mm
Gradients		N-S and E-W gradients
Precipitable Water	0 13 016	0–100 kg m ⁻² to 0.1 kg m ⁻²
Log ₁₀ of TEC	0 15 011	14–22 to 0.001 – TEC=10 ^{value}

Element Name	Descriptor	Comments
Software Identification	0 25 060	Modification of software or processing
Extended quality Flags for ground-based GNSS data	0 33 193	e.g. residual applied?
STD Replication		
Extended delayed replication factor	0 31 001	Number of STDs, max. 256
Satellite Classification	0 02 020	GNSS series – see Table 7
Platform Transmitter ID	0 01 050	GNSS PRN (1-40)
Coordinate reference system	0 01 150	ECF coordinate system
Location of Platform	3 04 030	GNSS satellite pos., ECEF to 10 cm
Azimuth	0 05 021	to 0.01°
Elevation	0 07 021	to 0.01°
STD	0 15 195	0–100000 mm to 0.1 mm
STD error	0 15 196	0–1000 mm to 0.1 mm

Element Name	Descriptor	Comments
STD Replication, continued		
SHD	0 15 208	0–100000 mm to 0.1 mm
SWD	0 15 199	0–10500 mm to 0.1 mm
Path integrated WV	0 15 200	0–4440 Kg m ⁻² to 0.1 Kg m ⁻²
ZTD	0 15 197	0–3000 mm to 0.1 mm, single mapped STD
ZHD	0 15 207	(STD processing) 0–3000 mm to 0.1 mm
ZWD	0 15 035	(STD processing) 0–1000 mm to 0.1 mm
Gradients		(STD processing)
GNSS residual	0 15 202	post-fit residual
GNSS multi-path delay	0 15 203	phase multipath
hydrostatic mapping fct.	0 15 204	GNSS hydrostatic mapping function
wet mapping function	0 15 205	GNSS wet mapping function
gradient mapping fct.	0 15 206	GNSS gradient mapping function
Log ₁₀ of STEC	0 15 011	14–22 to 0.001 – TEC=10 ^{value}

- DWD modified local BUFR tables to encode STD data and to store STD BUFR data in its data base.
- A WMO approved STD BUFR would be highly desirable for exchanging STD BUFR data:
 - Who would like to improve/extend/validate the STD BUFR template?
 - Are there weather services willing to support the WMO review process for new BUFR templates?
- Development of a BUFR converter, SINEX TRO 2.0 encoder/decoder?