GRUAN and BUFR – what is the actual goal?

A: If GRUAN related metadata are to be reported along with operational NRT upper-air results dissemination over GTS the latter value for majority of users (NWP etc.) shall not be compromised. Then top priority is preserving conformance to **B/C 25 Regulations**.

B: For a separate data stream there is lot of freedom – up to defining own GRUAN Master Table, i.e. defining own Table A, B and D

Best practice:

"Focus on the data product specification. The template is essentially a re-statement of that specification using the BUFR data description language. It bears repeating that an unclear or incomplete data product specification cannot lead to a good template."

Yves Pelletier, The Meteorological Service of Canada

Implemenation issues:

Who will take the responsibility for proposed amendments implementation – manufacturers? When not – it will be a big challenge either to GRUAN community to implement encoding operational data to BUFR from scratch or supplement original BUFR messages with GRUAN add-on metadata

Generality:

Proposed amendments should be generic as much as possible to benefit other radiosonde data providers and another applications

Case A: Upper-air BUFR message augmented with GRUAN metadata – possible layout

Possible placeholders – each position has own specific limitations that one need to bear in mind

Table D sequence	Element name	Comments
3 01 xxx	GRUAN add-on metadata I	Hardy applicable
3 01 128	Additional information on radiosonde ascent	Operational data
3 01 xxx	GRUAN add-on metadata II	Ground check results, flight train configuration
3 09 052	Sequence for representation TEMP, TEMP SHIP and TEMP MOBIL observation type data	Operational data
3 01 xxx	GRUAN add-on metadata III	Uncertainties

BUFR syntax imposes constrains – meaning of data elements are dependent from preceding “coordinate” descriptors. E.g. once Radiosonde serial number is defined with 0 01 081 within 3 01 128 it applies to all radiosondes if they would be referenced below as a part of multi-payload rig

Transmitting uncertainties – clarifications required

- Which quantities shall be addressed: reported or 'observed': issues with reporting dew point instead of relative humidity and wind direction and speed instead of u- and v- components
- Wind (vector quantity) uncertainty expression – components' uncertainty (including correlation) or just root-mean square vector wind deviation?
- What is the product reported uncertainty should refer to – original manufacturer's or GRUAN one?
- What should be reported –total uncertainty only or its constituents (random and vertically correlated systematic components)?
- How uncertainty shall be expressed – standard uncertainty, expanded uncertainty (with wich k-factor)? With same precision as a quantity (0.1 hPa for pressure is enough)?
- Vertically resolved uncertainties, i.e. for each flight level?
- Technical details of encoding – last and least issue

Using data present bit map followed by 3 09 052 – preferable way of reporting uncertainties

Descriptor (Section 3)	Data value (Section 4)	Comments
ED1	DV1	
ED2	DV2	
ED3	DV3	
ED4	DV4	
ED5	DV5	
ED6	DV6	
ED7	DV7	
ED8	DV8	
ED9	DV9	
2 22 000	(no corresponding DV)	Quality information follows
2 36 000	(no corresponding DV)	Define a data present bit map for future re-use
1 01 009	(no corresponding DV)	
0 31 031	100000111	The data present bit map – zeroes in respective positions indicate backward reference to DV2,DV3,DV4,DV5,DV6
0 08 0xx	X	Specify uncertainty expression (standard, expanded, etc.)
0 33 xxx	Uncertainty estimate	This uncertainty estimate value applies to DV2
0 33 xxx	Uncertainty estimate	This uncertainty estimate value applies to DV3
0 33 xxx	Uncertainty estimate	This uncertainty estimate value applies to DV4
0 33 xxx	Uncertainty estimate	This uncertainty estimate value applies to DV5
0 33 xxx	Uncertainty estimate	This uncertainty estimate value applies to DV6

Shortage – reported uncertainty should refer to a quantity reported by respective data value.
An alternative way – repeat after 3 09 052 all levels with uncertainties followed by coordinate descriptors

Ground-check information

Parameters to be reported
Ground Check (Sonde temperature)
Ground Check (Reference temperature)
Ground Check (Sonde humidity)
Ground Check (Reference humidity)
SHC Check (sonde temperature under 0% environment)
SHC Check (Reference temperature under 0% environment)
SHC Check (Sonde Humidity under 0% environment)
SHC Check (Reference Humidity under 0% environment)
SHC Check (sonde temperature under 100% environment)
SHC Check (Reference temperature under 100% environment)
SHC Check (Sonde Humidity under 100% environment)
SHC Check (Reference Humidity under 100% environment)

- Is more generality possible to allow reporting ground check against surface observations?
- Are duration and time of performing ground check under interest?
- Is information about application of ground check correction under interest?
- Other related information: e.g. ventilation available?

Additional metadata

Parameters to be reported	Comment
Volume of gas used in balloon	Isn't possible to derive nozzle lift with sufficient accuracy to allow using 0 02 085?
Information if add-on sensors are attached to a radiosonde	1. Radiosonde is a primary instrument within BUFR report context as well as downlink provider 2. Booleans is better accumulate to Flag tables
Information if a radiosonde is a part of multi-payload rig	Could be in the same Flag table as above
Information about add-on sensors	Type (ozonezonde) or model (ECC Z, ECC 1Z, ECC 2Z etc.) or both? E.g. two descriptors: one referencing generic type of add-on sensor (frost-point hygrometer, backscatter, ozonesonde) and another referencing model. More than one add-on sensor are possible
Information about multi-payload rig configuration	Alone, bar, cross, T, etc
Information about launching by Autosonde	Code figure 4 'Automated (unmanned) sounding system' in 0 02 083 'Type of balloon shelter' proposed to IPET-DRMM III. GRUAN is encouraged to support the proposal

- All entries to Code and Flag tables should be described/explained in GRUAN document

Two Issues of Full BUFR for GRUAN required

1 Uncertainty is required by GRUAN and which one?

-> If the consent of this meeting, Ruud, Sasha and Kizu will do the work by email.

2 New additional metadata（X XX XXX）is required by GRUAN?

If the consent of this meeting, it will be three patterns of reporting to GTS as follows.

-1. Only < 3 09 052 >

-2. < 3 01 128 > + < 3 09 052 >

-3. < 3 01 128 > + <3 09 052> + additional GRUAN metadata (place to be determined)

-> If the consent of this meeting, Ruud, Sasha, Kizu and members of interested in this BUFR will do the work of confirm to content of element by email.