**WORLD METEOROLOGICAL ORGANIZATION**

**COMMISSION FOR BASIC SYSTEMS**

**SECOND MEETING OF**

**THE INTER-PROGRAMME EXPERT TEAM ON CODES MAINTENANCE**

**FINAL REPORT**

**OFFENBACH, GERMANY, 28 MAY − 1 JUNE 2018**

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**Executive Summary**

The first meeting of the Inter-Programme Expert Team on Codes Maintenance (IPET-CM) took place at the Headquarters of Deutscher Wetterdienst (DWD) in Offenbach, Germany from 28 May to 1 June 2018.

The meeting reviewed the proposals submitted at the meeting or already approved for validation on GRIB Edition 2, BUFR and CREX in Volume I.2 of Manual on Codes (WMO-No. 306). It agreed 22 proposals duly validated or non-controversial as summarized below.

– Editorial adjustments to the time specifications in B/C Regulations

– New entries in GRIB Code tables for optimal cloud analysis, lightning and swell (4.2), for echo top (4.5), for probability of events (4.9) and for freezing drizzle (4.201)

– New BUFR sequences and pertaining amendments for satellite observations from principal component analysis, snow water equivalent (SWE), radiosonde descent data, higher precision radiosonde data, revised satellite winds, n-minute surface observations, Sentinel-3 SRAL product

– New BUFR Table B entries and code tables for IASI level 2 product

– New entries in Common Code tables for satellites and instruments (CGMS, Germany), for radiosondes and sub-centres (France), for sub-category (CCl) and for profiling floats (JCOMM)

The meeting also approved three new GTS headings for space weather advisories in text and IWXXM GML form and daily climate data in BUFR.

The meeting noted that ECMWF has prepared many sample messages for validation of experimental GRIB Edition 3. The GRIB Edition 3 will be reviewed and refined further with additional templates and tables.

The meeting agreed that BUFR Edition 4 is sufficient for the current needs of the migration to TDCF, and that work on BUFR Edition 5 should focus on modernizing the code form's design and feature set. It also agreed the development of BUFR Edition 5 should aim to fit as seamlessly as possible with the work carried out on GRIB Edition 3.

The meeting was notified that Amendment 79 to ICAO Annex 3 is being drafted within ICAO community and consequential amendments to aviation codes, such as METAR and TAF, will be forwarded from ICAO to IPET-CM in due course.

The meeting reviewed the status of migration to TDCF derived from WWW Monitoring Exercise in January 2018. It identified several areas where the migration still less progress. The meeting felt involvement of RAs will be required.

Manual on Codes, Volume I.2 has been identified as technical specifications (Res. 12 (EC-69)), which could be amended by fast-track procedure. Nonetheless, the meeting agreed to take an appropriate procedure in consideration of impact of an amendment to the Members' systems and operations.

The fast-track procedure for amending Manual on Codes is implemented every six months always in very tight schedule. In order to facilitate smooth and effective process of the adoption, it was proposed to categorize amendments. The meeting agreed to assign a category of amendment to each proposal at this meeting as the first attempt. If it fits, the expansion to amendments to other manuals will be considered.

The meeting was informed that the progress on production and exchange of national monthly climate monitoring products (NCMP), which was initially introduced to the previous IPET-DRMM in 2014. In view of the limited resources to develop BUFR template for NCMP within CCl, the meeting noted that the initial development will be made within the Secretariat in association with CCl and forwarded to IPET-CM in due course.

The meeting was informed that the Inter-programme Expert Team on Operational Weather Radar (IPET-OWR) was developing a standard data format for operational radar data exchange. The meeting agreed to give IPET-OWR an advice in collaboration with IPET-DD.

**TABLE OF CONTENTS**

**1. ORGANIZATION OF THE MEETING**

[1.1 Opening of the meeting](#S2018_1_1)

[1.2 Approval of the agenda](#S2018_1_2)

[1.3 Working arrangement](#S2018_1_3)

**2. MANUAL ON CODES: TABLE-DRIVEN CODE FORMS**

2.1 Amendments to GRIB regulations

2.2 Additions to GRIB templates and tables

[2.2.1 Additional elements for optimal cloud analysis and instantaneous rain rate products](#S2018_2_2_1)

[2.2.2 New fixed surface type in Code table 4.5](#S2018_2_2_2)

[2.2.3 New entry in GRIB2 Code table 4.9](#S2018_2_2_3)

[2.2.4 New lightning GRIB parameters](#S2018_2_2_4)

[2.2.5 New GRIB2 Code table 4.2 entries](#S2018_2_2_5)

[2.2.6 New “freezing drizzle” precipitation type](#S2018_2_2_6)

[2.2.7 Representing gnomonic grids](#S2018_2_2_7)

[2.2.8 New GRIB2 Code table 4.9 entries](#S2018_2_2_8)

2.3 Amendments to BUFR/CREX regulations

2.4 Additions to BUFR/CREX tables

[2.4.1 BUFR descriptors for flagged ancillary data](#S2018_2_4_1)

[2.4.2 New BUFR sequence for describing satellite observations compressed using principal component analysis](#S2018_2_4_2)

[2.4.3 BUFR descriptors for IASI Level 2 Products](#S2018_2_4_3)

[2.4.4 New BUFR sequence for snow water equivalent (SWE)](#S2018_2_4_4)

[2.4.5 Revision of BUFR sequence 3 09 056 – Sequence for representation of radiosonde descent data](#S2018_2_4_5)

[2.4.6 New sequence for representation of radiosonde observation data with higher precision of pressure and geopotential height](#S2018_2_4_6)

[2.4.7 New BUFR sequence for describing the "First five" Fourier components of the directional wave spectrum](#S2018_2_4_7)

[2.4.8 New BUFR sequence for the reporting as basic ship AWS data](#S2018_2_4_8)

[2.4.9 Review sequence 3-10-067](#S2018_2_4_9)

[2.4.10 Revised BUFR template for surface observations from n-minute period](#S2018_2_4_10)

[2.4.11 New BUFR sequence and code and flag tables for Sentinel-3 SRAL product](#S2018_2_4_11)

2.5 Additions to Common Code tables

[2.5.1 Proposal for new entries in Common Code table C-5 and C-8](#S2018_2_5_1)

[2.5.2 New entry in Common Code table C-2 for new radiosondes](#S2018_2_5_2)

[2.5.3 New entries in Common Code Table C-12](#S2018_2_5_3)

[2.5.4 New entries in Common Code tables C-5 and C-8](#S2018_2_5_4)

[2.5.5 New entries in Common Code Table C-3](#S2018_2_5_5)

[2.6 GRIB edition 3](#S2018_2_6)

[2.6.1 GRIB edition 3 samples](#S2018_2_6_1)

[2.6.2 Horizontal domain URL](#S2018_2_6_2)

[2.6.3 Overlay Template URL](#S2018_2_6_3)

[2.6.4 New template components and templates for model level in GRIB Edition 3](#S2018_2_6_4)

[2.6.5 New template component and templates for time interval in GRIB Edition 3](#S2018_2_6_5)

[2.6.6 Comments on functionality and structure of referencing externally defined resources (URL) – in general and in case of unstructured mesh for GRIB Edition 3](#S2018_2_6_6)

[2.7 BUFR new edition, including work plan of TT-BUFR](#S2018_2_7)

**3. MANUAL ON CODES: REGULATIONS FOR REPORTING TRADITIONAL OBSERVATION DATA IN TABLE-DRIVEN CODE FORMS**

[3.1 Amendments to B/C Regulations for standard time](#S2018_3_1)

[3.2 SYNOP data from Israel using 203YYY operator](#S2018_3_2)

**4. MANUAL ON CODES: TRADITIONAL ALPHANUMERIC CODES**

[4.1 Possible Amendment 79 to ICAO Annex 3](#S2018_4_1)

**[5. MANUAL ON GTS: DATA DESIGNATOR](#S2017_5)**

[5.1 New data designator for space weather](#S2018_5_1)

[5.2 Global exchange of daily climate data](#S2018_5_2)

**6. SUMMARY AND CONCLUSION OF PROPOSALS**

[6.1 Summary of amendments since IPET-CM-I and update of status of validation](#S2018_6_1)

6.2 Conclusion on intersessional discussion (in lieu of PFC)

[6.2.1 BUFR sequences 3 09 056 and 3 09 057](#S2018_6_2_1)

[6.2.2 BUFR template for surface observations from n-minute period](#S2018_6_2_2)

[6.2.3 New BUFR sequence for snow water equivalent (SWE)](#S2018_6_2_3)

**7. MIGRATION TO TABLE-DRIVEN CODE FORMS**

[7.1 Comparison of number of reports received in TDCF and TAC during January 2018](#S2018_7_1)

7.2 Reports by members on status of migration

[7.2.1 Status of migration to TDCF in RA I](#S2018_7_2_1)

[7.2.2 Status of migration to TDCF in RA II](#S2018_7_2_2)

[7.2.3 Status of migration to TDCF in RA III](#S2018_7_2_3)

[7.2.7 Status of migration to TDCF in JCOMM](#S2018_7_2_7)

7.3 Tools for supporting the migration to TDCF

[7.3.1 BUFR Validation Dashboard](#S2018_7_3_1)

[7.3.2 DWD’s online BUFR Viewer](#S2018_7_3_2)

[7.3.3 TAC2BUFR Check at DWD – follow-up](#S2018_7_3_3)

[7.3.4 BUFR migration tool](#S2018_7_3_4)

**8. ADMINISTRATIVE ISSUES**

[8.1 Changes to the publication of Manual on Codes](#S2018_8_1)

[8.2 Procedures for amending Manuals on Codes and the GTS](#S2018_8_2)

[8.3 Category of amendments](#S2018_8_3)

**9. IPET-CM AND TASK TEAMS**

**10. COLLABORATION WITH OTHER ORGANIZATIONS AND TECHNICAL BODIES**

[10.1 The WIGOS Data Quality Monitoring System (WDQMS)](#S2018_10_1)

[10.2 Exchange on GTS of monthly climate monitoring products](#S2018_10_2)

[10.3 Collaboration with the Inter-programme Expert Team on Operational Weather Radar (IPET-OWR)](#S2018_10_3)

**11. CLOSURE OF THE MEETING**

**SECOND MEETING OF
THE INTER-PROGRAMME EXPERT TEAM ON CODES MAINTENANCE**

**(OFFENBACH, GERMANY, 28 MAY − 1 JUNE 2018)**

# 1. ORGANIZATION OF THE MEETING

# 1.1 Opening of the meeting[⮉](#Cont_1)

The second meeting of the Inter-Programme Expert Team on Codes Maintenance (IPET-CM) took place at the Headquarters of Deutscher Wetterdienst (DWD) in Offenbach, Germany from 28 May to 1 June 2018.

Dr Dieter Schröder, head of the department Systems and Operations, DWD, on behalf of the president of DWD, welcomed the participants and wished the fruitful and successful meeting. Dr Schröder emphasized that special meteorological codes are indispensable to strengthen the role in meteorological pre-processing with increasing data volume. Success will only be achieved by continuing development of BUFR and GRIB.

Ms Jitsuko Hasegawa, chairperson of IPET-CM, expressed her appreciation to DWD for kindly hosting the meeting and all participants for their valuable contribution and proposals.

Prof Dr Gerhard Adrian, President of DWD, welcomed the participants at the beginning of the second day. Dr Adrian introduced an example of a GAW station, where instruments, instruction for the observers and communication system were standardized, in order to emphasize the importance of common languages, i.e. code forms, which is an important task of IPET-CM.

# 1.2 Approval of the agenda[⮉](#Cont_1)

The meeting agreed on the [agenda](#A2018_1_2a), which is in the Annex to this paragraph, along with the [list of participants](#A2018_1_2b).

# 1.3 Working arrangement[⮉](#Cont_1)

Ms Jitsuko Hasegawa presented the working plan to the participants. It was informed a representative from a technical commission have to leave on Wednesday afternoon and some remote conference are scheduled on Monday afternoon and Wednesday morning. The meeting agreed with the working plan with some modifications, recognizing it will be reviewed and flexibly modified.

# 2. MANUAL ON CODES: TABLE-DRIVEN CODE FORMS

# 2.1 Amendments to GRIB regulations

 (none)

#

# 2.2 Additions to GRIB templates and tables

### 2.2.1 Additional elements for optimal cloud analysis and instantaneous rain rate products[⮉](#Cont_2_2)

European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) has produced the Optimal Cloud Analysis and Instantaneous Rain Rate GRIB product for several years. Historically, reserved entries in Code tables 4.2 and 4.218 have been used to encode the necessary variables. In order to make these known via WMO, and in order to prevent name conflicts in the future, EUMETSAT wishes to register them by adding the appropriate entries to the Manual on Codes.

Dr Daniel Lee, EUMETSAT, proposed several entries in Code table 4.2, discipline 3 and Code table 4.218, which are already in use.

The meeting, keeping the historical background in mind, agreed with the proposal, however, the propose entry names are not consistent with other existing entries. The meeting discussed how to cope with the issue properly in the proposal and decided with some corrections for adoption by **FT2018-2 (Cat. 1b\_EUMETSAT)** (for details of category, [see 8.3](#S2018_8_3)) as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_1) to this paragraph.

### 2.2.2 New fixed surface type in Code table 4.5[⮉](#Cont_2_2)

Within the framework of the SESAR (Single European Sky Air Traffic Management Research) project “Meteorological Information Services”, several meteorological products related to a subtask dealing with “Adverse Weather” are to be provided operationally.

A frequently used product is the forecast of Echotop for a specified threshold of radar reflectivity.

The proposal aims at a flexible way to encode echo top by encoding the variable which is actually stored in the GRIB edition 2 (GRIB2) file (here: pressure) and using level information to refer to the definition of echo top and to specify a threshold of radar reflectivity.

Dr Christoph Gebhardt, DWD, presented the new fixed surface type with reference to existing specifications, such as entry 13 in Code table 4.5: “Lowest level where vertically integrated cloud cover exceeds the specified percentage.

It was emphasized the proposal would enable the flexible use of echo top together with the information on the associated dBZ threshold in several aspects of GRIB2 encoding (e.g. as deterministic or ensemble forecasts, probabilistic forecasts like percentiles, exceedance probabilities, statistical processes).

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b+\_DWD,Meteo-France,UKMO)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_2) to this paragraph with pre-operational use as requested.

### 2.2.3 New entry in GRIB2 Code table 4.9 ([see 2.2.8](#S2018_2_2_8))[⮉](#Cont_2_2)

This document proposes a new entry in GRIB2 code table 4.9 to be used in reporting the probability of discrete events.

Mr Jeffrey Ator, National Weather Service (NWS)/NOAA, illustrated how to report probability by an example of dewpoint temperature, which is >= 283.5 K and < 290.2 K at each successive grid point, by using PDT 4.5 (or 4.9) with octet #10 set to 0, octet #11 set to 6, octet #37 (i.e. the CT 4.9 value) set to 2, and octets #38-42 and #43-47 set, respectively, to indicate the values 283.5 and 290.2.

However, since the current Code table 4.9 does not have entries that are exactly equal to either the lower or upper limits in octets 38-47, PDT4.5 and 4.9 could not be used for discrete code table entries, such as dry thunderstorm.

Mr Ator proposed a new entry in Code table 4.9 as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_3) to this paragraph. It was suggested that in such cases, the lower limit should be set to the relevant code value and upper limit should be set to missing.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b\_NOAA NWS)**.

### 2.2.4 New lightning GRIB parameters[⮉](#Cont_2_2)

European Centre for Medium-Range Weather Forecasts (ECMWF) has recently developed the capability to diagnose lightning activity from a set of predictors already produced by the convective parameterization of its Integrated Forecasting System (IFS). Those predictors are the convective available potential energy (CAPE), the contents in convective hydrometeors (cloud condensate and frozen precipitation) and the convective cloud base height.

Dr Enrico Fucile, ECMWF, presented the proposal on the new parameter. Dr Fucile emphasized the new lightning products will be relevant to both weather forecasters and decision makers, especially aviation (both at airports and in-flight), power supply companies and forestry (wildfires).

Physically, a lightning flash is usually defined as one or several electrical discharges (or strokes) that occur within less than a second and within a horizontal radius of 15 km. It can be useful to distinguish between intra-cloud flashes which transfer electrical charges within cloud regions and cloud-to-ground flashes which transfer charges between the cloud and the ground.

Dr Fucile mentioned despite of the fact that only “total” lightning flash densities are calculated, work is ongoing to also predict flash densities for cloud-to-ground and cloud-to-cloud lightning separately.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b\_ECMWF)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_4) to this paragraph.

### 2.2.5 New GRIB2 Code table 4.2 entries[⮉](#Cont_2_2)

Mr Yves Pelletier, Meteorological Service of Canada (MSC)/ECCC, presented the proposal to add entries to GRIB2 Table 4.2 for peak wave direction and swell fields.

Mr Pelletier explained primary and secondary swells parameters are commonly produced by ocean wave models and made available for use by public and private marine interests. The third swell is added to the proposal for future use. He added plans exist for making this parameter available for exchange from the Canadian wave modelling system and as an example use-case, secondary swell is a parameter often used in forecasts intended for offshore platform operations.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b\_MSC)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_5) to this paragraph.

### 2.2.6 New “freezing drizzle” precipitation type[⮉](#Cont_2_2)

An upcoming new development in ECMWF’s Integrated Forecasting System (IFS) is to allow supercooled rain from the warm-rain process (collision-coalescence), often referred to as "freezing drizzle" as the precipitation tends to be light. The formation process is very different to supercooled rain formed from melted snow particles in an upper level warm layer, commonly referred to as "freezing rain".

In association with above, Dr Sebastien Villaume, ECMWF, presented a proposal on different precipitation types.

The proposal is to add "Freezing drizzle" as an additional precipitation type in GRIB2 Code table 4.201 representing supercooled rain from the warm-rain (collision-coalescence) process.

The meeting agreed the proposal with additional entries (freezing drizzle and drizzle as requested) for adoption by **FT2018-2 (Cat. 1b\_ECMWF)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_6) to this paragraph.

### 2.2.7 Representing gnomonic grids[⮉](#Cont_2_2)

In the coming months, National Centres for Environmental Prediction (NCEP) will begin implementing a new FV3 (finite-volume cubed sphere) dynamic core within most of its numerical models, as part of a move towards a unified modelling framework. The cubed sphere consists of 6 planes, each tangential to the sphere, with the sphere projected from its centre point onto each plane resulting in a gnomonic projection.

Mr Jeffrey Ator, NWS/NOAA, presented a proposal for representing a gnomonic projection. Such a capability was apparently available within GRIB edition 1 (GRIB1) (Code table 6 “Data representation type”, code figure 2) and gnomonic projections are also referenced within the code table for BUFR descriptor 0-29-001 “Projection type”, as code figure 0. Mr Ator emphasized yet there appeared to be no reference to gnomonic grids anywhere within the existing GRIB2 regulations.

The meeting agreed the proposal for **validation** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_7) to this paragraph. Mr Ator mentioned the structure will be modified during the validation. EUMETSAT will help the validation.

### 2.2.8 New GRIB2 Code table 4.9 entries ([see 2.2.3](#S2018_2_2_3))[⮉](#Cont_2_2)

Mr Yves Pelletier, MSC, presented a proposal to add to GRIB2 Table 4.9 for new probabilistic forecasts types.

Mr Pelletier explained a categorical probabilistic forecast is often used for long term forecasts. The forecast is expressed as the probability of the forecasted event to be in one of the defined categories. Three equiprobable categories being defined: above normal, near normal and below normal.

The categories can be defined either by the model climatology or by the observed climatology. Existing probabilistic Product Definition Templates (PDT) that use Code table 4.9 do not provide space to qualify the type or methodology of the climatology that was used.

Regardless of the above, Mr Pelletier proposed entries due to the fact that in this case, the characterization of the reference climatology is best done in user documentation to be provided by the data producer.

The meeting agreed the proposal for **FT2018-2 (Cat. 1b\_MSC/MSC,Climate centres)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_2_8) to this paragraph.

# 2.3 Amendments to BUFR/CREX regulations

(none)

# 2.4 Additions to BUFR/CREX tables

# 2.4.1 BUFR descriptors for flagged ancillary data[⮉](#Cont_2_4)

EUMETSAT uses ancillary data from a number of sources in order to generate level 2 products. Examples of this are inputs from other satellites, instruments, or data from NWP models. In the past, these data have been encoded using local descriptors which essentially encode the same flag content but for different data sources.

Dr Daniel Lee, EUMETSAT, proposed to add a new code table to BUFR Table B with the intent of adopting a cleaner approach and also of enabling data producers to encode such associated flag values in a general fashion.

This proposal was **withdrawn** in favour of addressing the need within the proposal discussed under agenda item 2.4.3.

# 2.4.2 New BUFR sequence for describing satellite observations compressed using principal component analysis[⮉](#Cont_2_4)

Principal component scores (PCS) have been in use for many years in order to reduce the volume of data required to transmit satellite observations. This data reduction technique will become more important with the launch of next-generation satellites, including e.g. EUMETSAT’s planned hyperspectral sounders, the Infrared Sounder (IRS) and the Ultraviolet, Visible and Near-Infrared Sounding instrument (UVN) on board the geostationary Meteosat Third Generation Sounder (MTG-S), as well as various other instruments planned or already in orbit from other agencies.

Dr Daniel Lee, EUMETSAT, proposed a new sequence for encoding PCS from hyperspectral sounders which can be used for other hyperspectral sounding instruments.

Dr Lee explained the multiple sequences which summarize various sections of the product in order to make it more straightforward to create similar products, such as PCS products using data from next-generation polar orbiting satellites. This template is intended for use in conjunction with additional, mission-specific data, such as mission-specific quality flags to be included for EUMETSAT’s IRS.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b+\_EUMETSAT)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_2) to this paragraph with urgent validation. EUMETSAT, DWD, UKMO, INPE will help the validation.

# 2.4.3 BUFR descriptors for IASI Level 2 Products[⮉](#Cont_2_4)

EUMETSAT has produced Level 2 satellite products encoded in BUFR from observations made with the IASI instrument for more than a decade. These observations contribute greatly to the quality of numerical weather prediction and climate monitoring.

Dr Daniel Lee, EUMETSAT, explained the background briefly that historically several local descriptors have been used in order to encode portions of these data, most of which are mission-specific quality flags and proposed entries in BUFR/CREX Table B and relevant Code tables, which can be important for product interpretation. It would be advantageous to use global descriptors in order to make it easier for users to interpret the data.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1b\_EUMETSAT)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_3) to this paragraph through validation. It was suggested CREX part in BUFR/CREX Table B should be made.

### 2.4.4 New BUFR sequence for snow water equivalent (SWE)[⮉](#Cont_2_4)

Global Cryosphere Watch (GCW) community has requested the development of a BUFR sequence for the exchange of snow observations including the snow water equivalent alongside the snow density and snow depth. The need is originated by the increasing number of stations in, such as North America and Germany, providing snow water equivalent, many of them together with snow density and/or snow depth.

Snow water equivalent and snow density correspond to the model snow mass prognostic variables, so they are very relevant for assimilation in NWP systems. ECMWF has supported the GCW Snow Watch Team in the development of the new sequence.

Ms Marijana Crepulja, ECMWF, proposed a new sequence (3-07-103) based on the existing 3-07-101 by adding the WIGOS Station Identifier and the required elements to report the Snow Water Equivalent, while national identifier is included instead of WMO Station Index due to new stations.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1c\_ECMWF)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_4) to this paragraph. The validation has been done between ECMWF and DWD.

### 2.4.5 Revision of BUFR sequence 3 09 056 – Sequence for representation of radiosonde descent data[⮉](#Cont_2_4)

DWD and Finish Meteorological Institute (FMI) exchange radiosonde descent data from Vaisala RS41 radiosondes via GTS in the past several months. NWP users from European NMHSs (EUMETNET) compared the radiosonde descent data with radiosonde ascent data. First results are very promising with almost similar quality of descent data compared to corresponding ascent data (especially for wind measurements).

EUMETNET as well as NMHSs from other regions were involved in the discussion regarding the drafting of a new sequence for radiosonde descent data reporting and approved that the proposed sequence contains all relevant information.

In addition, to meet the GRUAN requirements of an increase of the precision of pressure and geopotential height in high-resolution radiosonde data, the new proposed sequence 3 03 056 is also used for the descent data (see 2.4.6).

Ms Sibylle Krebber, DWD, presented the proposal, which has been discussed in the past meetings of IPET-CM (or DRMM) and revised.

The questions raised during IPET-CM-I in July 2017 were discussed in the various groups as well as at the meeting and a consensus was made as follows.

i) How to distinguish descent data from ascent data, making sure a firm link between ascent and descent data from a radiosonde; data subcategory in section 1 is enough or not.

C: Data subcategory in section 1 is sufficient.

ii) The definition of 3 01 113 (date/time of launch) and 3 01 021 0 07 007 (lat/lon, height) should be clarified to make it clear that they are time and location of balloon burst.

C: The time and location should specify the beginning of the descent measurement. A clarification note will be added to sequence 3 01 113, as in the [annex](https://mail.google.com/mail/u/0/Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_5) to this paragraph.

iii) The template can be a general format for simple drift data both for ascent and descent data.

C: Separate templates for ascent and descent data would be better to avoid confusion and to help users understand the difference in quality in descent and ascent data.

iv) NWP users might prefer one single pack of all the drift data both for ascent and descent from a radiosonde.

C: NWP users prefer separated packing of ascent and descent data, because of the difference of quality and the availability of ascent data without delay.

v) There is a view that quality information at each level is necessary for descent data because data quality is inconsistent.

C: General quality information might be useful, but there is no concrete proposal at this moment. Therefore a proposal, such as introduction of a quality flag in a template, would be considered at a later stage.

vi) Should traditional location identifier be included in the template in addition to WIGOS identifier sequence (data users might have difficulties in using quality information associated with the observation site)?

C: Traditional 5-digit location ID facilitates the continuity of data use by ensuring traceability of data quality monitoring statistics linked to the launch site, e.g. for blacklisting, and therefore it is recommended to include it the template in addition to WIGOS ID.

In addition, the meeting agreed to include notes, as in the [annex](https://mail.google.com/mail/u/0/Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_5) to this paragraph, to the sequence 3 03 056 (temperature, dewpoint and wind data at a pressure level with radiosonde position and higher precision of pressure and geopotential height) to clarify that indication of standard levels using the extended vertical sounding significance (0 08 042) is not mandatory in descent data, and that data represented by this sequence should be sorted in descending order with respect to pressure.

Regarding the precision of pressure and geopotential, the meeting agreed not to change the proposal. With regard to a possible amendment to B/C Regulations, since observation practice over the radiosonde descent data has not been established, the meeting concurred not to amend B/C Regulations.

Since the validation has been done by DWD, INPE/CPTEC and JMA as reported in 6.2.1, the meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1c)**.

### 2.4.6 New sequence for representation of radiosonde observation data with higher precision of pressure and geopotential height[⮉](#Cont_2_4)

GCOS Reference Upper-Air Network (GRUAN) was established to perform high-quality reference upper-air observations of essential climate variables for the purpose of climate monitoring. Other applications of GRUAN data include numerical weather prediction and validation of satellite observations. GRUAN currently consists of 26 sites, distributed over various climate zones around the globe, where radiosonde observations form the backbone of GRUAN. GRUAN radiosonde data provide vertical profiles of in-situ measurements at the highest sampling rate that the sounding system supports.

As part of the service to the NWP community, several GRUAN staions are distributing high-resolution BUFR data to the GTS. With Vaisala's latest radiosounding system, MW41, it is possible to report measurement values at 1-second intervals. Among others, the radiosounding system at the DWD GRUAN station in Lindenberg is configured to produce BUFR data at this 1-second resolution.

In this conextion, Dr Ruud Dirksen, DWD GRUAN Lead Centre in cooperation with Ms Sibylle Krebber, DWD, proposed new sequences with higher precision in 0.1 m (geopotential height) and in Pascal (pressure) to represent GPH as a floating point number. In addition, the WIGOS identifier and “additional information on radiosonde data” are included in the new sequence.

The meeting agreed this template be referred to as a note in B/C25, as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx%22%20%5Cl%20%22A2018_2_4_6) to this paragraph for adoption by **ABC2019**, instead of including the template in B/C25.

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1c)**.

### 2.4.7 New BUFR sequence for describing the "First five" Fourier components of the directional wave spectrum[⮉](#Cont_2_4)

In order for a wave observing system to satisfy the widest range of activities, the "First five" Fourier components of the directional spectral wave field are required. These are defined as the wave energy and the first four coefficients (a1, b1, a2, and b2) of the Fourier series defining the directional distribution of that energy for each frequency band.

Dr David Berry, Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), proposed the Table B elements and Table D sequence, which provide the capability to report the "First five" in BUFR.

The meeting agreed the proposal for **validation (Cat. 1c\_JCOMM//)** in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_7) to this paragraph with a little modification. ECMWF, NCEP, DWD and Centro de Previsao de Tempo e Estudos Climaticos (CPTEC)/INPE will help the validation.

### 2.4.8 New BUFR sequence for the reporting as basic ship AWS data[⮉](#Cont_2_4)

During the period between IPET-DRMM-IV and IPET-CM-II there has been a discussion over the need for a trimmed version of the VOS template for those ships using basic AWS systems. This has been led by the UK Met Office and ECMWF. One potential solution discussed, making use of the flexibilities of BUFR, was the use of sub-sequences from Table D sequence 3-08-014 (Synoptic reports from sea stations suitable for VOS observation data) on an ad-hoc basis.

Dr David Berry, representative of JCOMM, proposed a new sequence instead of the sub-sequence.

The meeting agreed the proposal, with adding WIGOS Identifier, for **validation (Cat. 1c+\_JCOMM//)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_8) to this paragraph.

### 2.4.9 Review sequence 3-10-067[⮉](#Cont_2_4)

Sequence 3 10 067 for satellite winds cannot be fully interpreted without the use of a spreadsheet that is circulating between users. The source of the issue is in the necessary metadata are not appropriately defined.

Ms Marijana Crepulja, ECMWF, expressed a concern that the sequence 3 10 067 for satellite-derived winds, which was adopted by FT2017-2 and is already operational, cannot be fully interpreted without using a spreadsheet circulated among users, because the necessary metadata are not appropriately defined.

The meeting considered the possibility to deprecate this descriptor, but considered the fact that the sequence was introduced through a legitimate validation and approved process and was already used, and decided to add a note to sequence 3 10 067, as in the [annex](https://mail.google.com/mail/u/0/Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_9) to this paragraph, to help the interpretation over pressure.

The meeting also asked a small group to develop a new sequence which can be interpreted without additional information. The meeting agreed with the approval of the new sequence, 3 10 077 for adoption by **FT2018-2 (Cat. 1c)** as in the [annex](https://mail.google.com/mail/u/0/Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_9) to this paragraph.

### 2.4.10 Revised BUFR template for surface observations from n-minute period[⮉](#Cont_2_4)

EUMETNET Members had agreed to work towards an international exchange of surface sub-hourly AWS data in the future and a Task Team was set up in 2016 to draft a new BUFR template for sub-hourly AWS data reporting on the basis of the draft template 3 07 092. The Task Team met in online conference meetings on 17th October 2016 as well as on 9th November 2017 and agreed on a new draft BUFR template for reporting sub-hourly AWS data, which was circulated among EUMETNET Members and several IPET-CM Members via email on 26th January 2018.

Ms Tanja Kleinert, EUMETNET in cooperation with Ms Sibylle Krebber, DWD, proposed a template for sub-hourly AWS data, which has been presented to EUMETNET governing body, Scientific and Technical Advisory Committee (STAC).

The meeting agreed the proposal for adoption by **FT2018-2 (Cat. 1c)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_10) to this paragraph.

### 2.4.11 New BUFR sequence and code and flag tables for Sentinel-3 SRAL product

EUMETSAT intends to disseminate Level 2 Water Near-Real Time Water Products produced from observations encoded in BUFR, derived from the Sentinel-3 Ku/C Radar Altimeter (SRAL) instrument on board the Sentinel-3 satellite.

Dr Daniel Lee, EUMETSAT, presented the proposal to add a BUFR Table D sequence, which is the products’ contents, as well as two Code tables and Flag tables to encode new metadata which are necessary in order to interpret the product.

The meeting agreed with the proposal for **FT2018-2 (1b\_EUMETSAT)** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_4_11) to this paragraph through urgent validation with ECMWF.

# 2.5 Additions to Common Code tables

# 2.5.1 Proposal for new entries in Common Code table C-5 and C-8[⮉](#Cont_2_5)

A number of key meteorological satellite launches are foreseen in 2018. In order to allow the unambiguous representation of data from these missions, additional entries are required in Common Code Tables C5 and C8.

Dr Simon Elliott, EUMETSAT, proposed new entries in the Common Code tables C-5 and C-8 in cooperation with the CGMS Task Force on Satellite Data and Codes.

The meeting agreed the proposal for adoption by **FT2018-2** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_5_1) to this paragraph.

It was a common understanding that category of amendments is not necessary for additions of entries to Common Code tables.

# 2.5.2 New entry in Common Code table C-2 for new radiosondes[⮉](#Cont_2_5)

Mr Yann Genin, Meteo-France, presented two entries in Common Code table C-2. Mr Genin emphasized that it is considered as non-controversial, but if necessary, one or more sample messages will be provided for validation in the coming months.

The meeting agreed the proposal for adoption by **FT2018-2** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_5_2) to this paragraph.

# 2.5.3 New entries in Common Code Table C-12[⮉](#Cont_2_5)

Mr Yann Genin, Meteo-France, proposed two sub-centres under RSMC Toulouse in Common Code table C-12. This is to represent new MACC partners contributing to the CAMS regional ensemble forecast system.

Mr Genin emphasized that this is considered as non-controversial, but if necessary one or more sample messages will be provided for validation in the coming months.

The meeting agreed the proposal for adoption by **FT2018-2** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_5_3) to this paragraph.

### 2.5.4 New entries in Common Code tables C-5 and C-8[⮉](#Cont_2_5)

On 22nd May 2018, NASA launched the Gravity Recovery and Climate Experiment - Follow-on (GRACE-FO) mission, consisting of two satellites in low Earth drifting orbit. The GRACE-FO mission is a partnership between NASA and GeoForschungsZentrum (GFZ) Potsdam, Germany, and a successor to the original GRACE mission.

Near real time data will be processed and provided by GFZ soon after carrying out the initial calibration and validation phase. The dissemination on GTS will be handled by DWD.

Dr Harald Anlauf, DWD, proposed two identifiers for GRACE-FO (2 satellites) and GNSS Radio Occultation instrument.

The meeting agreed the proposal for adoption by **FT2018-2** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_5_4) to this paragraph.

### 2.5.5 New entries in Common Code Table C-3

Dr David Berry, JCOMM, proposed three new entries to Common Code table C-3 to allow the correct reporting of new profiling float types.

The meeting agreed with no objection the proposal for **FT2018-2** as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_5_5) to this paragraph.

# 2.6 GRIB Edition 3[⮉](#Cont_2_6)

The meeting noted the progress on GRIB Edition 3 development since the last meeting:

- The section related templates and template components have been consolidated.

- The GRIB3 structure has been documented with relevant sections, templates, templates components and code/flag tables on ECMWF confluence pages.

- The sample set of data have been produced using  ECMWF ecCodes library, with emphasis on combination of variety Templates for Time, Horizontal and Vertical domain.

The meeting expressed its appreciation to Sean Arms and Ryan May, the volunteers of UCAR who have been developing new GRIB3 decoders, and welcomed potential contributors in this area.

The meeting agreed to continue development based on the proposals submitted to both IPET-CM-I and -II, and requested the lead of TT-GRIB to report back the results, especially about

- the functionality to refer externally defined resources, focusing on the functionality to identify and locate externally defined resources, possibly by integrating the concepts of fingerprints and URL.

- the approach to be taken for representing statistical processes in relation to the parameter definitions.

- how to deal with Grid Definition Templates (GDTs) of GRIB2 that were introduced at the experimental bases without validation.

The meeting agreed to the schedule for next steps:

- by September 2018, TT-GRIB will have the capability to validate samples, with at least another decoding software application besides that of ECMWF,

- by December 2018, TT-GRIB will finalize the mechanisms to reference external resources, including URL, key and checksum.

- by the team meeting in 2019, TT-GRIB will validate geography template components.

In addition, the meeting reconfirmed the schedule set by IPET-CM-I: the final proposal will be made to the responsible technical commission session planned to be held in 2020, which would be approved by the EC to be held the year after.

The meeting emphasized that communication of GRIB3 concept to potential users is an important part of its development and should be done in parallel with functionality development. In this regard, the meeting agreed to look for and use opportunities to communicate the concept at meetings in relevant areas, such as FOSS4G and the Meteorology and Oceanography Domain Working Group (Met Ocean DWG) of OGC.

The meeting was reminded of items, mainly pointed out by IPET-CM-I, to be discussed and agreed in the process of finalizing the proposal, including:

- criteria for making the new edition operational, especially the requirements for software applications to encode and decode GRIB3 files.

- how to communicate the status of GRIB2 after the introduction of edition 3; at the moment, the meeting looks at a similar approach that was taken for the migration from edition 1 to 2, i.e. the phased approach of stopping regulation changes and addition of new features as the first step and stopping addition of templates and parameters as the second step.

- how to communicate selling points of GRIB3 to motivate WMO Members and other WMO communities, including ICAO and aviation community, to start using the new edition and eventually fully migrate from edition 2.

- amendments in regulations that are necessary according to the introduction of edition 3.

- how to improve understanding of strengths and benefits of GRIB3, especially from the user's point of view, in order to speed up its uptake.

# [2.6.1 GRIB Edition 3 samples](#S2017_2_6_1)[⮉](#Cont_2_6)

Following up presented proposals on GRIB Edition 3 at IPET-CM-I meeting the following development have been done:

- The section related templates and template components have been consolidated.

- The GRIB Edition 3 structure has been documented with relevant sections, templates, templates components and code/flag tables on ECMWF confluence pages.
Here is the link to the pages for convenience: [https://software.ecmwf.int/wiki/display/DGOV/GRIB3+Structure](https://software.ecmwf.int/wiki/display/DGOV/GRIB3%2BStructure)

- The sample set of data have been produced with emphasis on combination of variety Templates for Time, Horizontal and Vertical domain. For this purpose, ECMWF ecCodes library for encoding/decoding GRIB Edition 3 data is used.

Ms Marijana Crepulja, ECMWF, presented what ECMWF has done for the edition 3 and invited the meeting to examine and comment the samples, links to which are as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_1) to this paragraph. It was informed ECMWF will facilitate the development next year due to the current commitments to other issues.

It was noted that USA would be ready for decoding samples by September 2018, then a deadline will be set up for reviewing a part of GRIB Edition 3 and some teleconference will be organized.

# 2.6.2 Horizontal domain URL[⮉](#Cont_2_6)

# 2.6.3 Overlay Template URL[⮉](#Cont_2_6)

(2.6.2) Some of the horizontal domain templates defined can have a size comparable to the data section. ECMWF proposed a mechanism to refer to externally defined templates to omit the grid description in the GRIB message by providing a Uniform Resource Locator (URL). This is a special URI (Uniform Resource Identifier) which in addition to being a unique identifier is also providing location and retrieval mechanism for the sample GRIB providing the missing template.

(2.6.3) In GRIB3, the concept of overlay was introduced to extend the bitmap used in GRIB2 to provide information that a value was missing in the field. The aim is to superimpose a field as a land/sea mask, a vegetation or type of soil map. These are all overlays that can be applied to many fields and encoding them with all the relevant GRIB messages is very inefficient from the volume point of view. ECMWF proposed a way to uniquely locate the overlay GRIB with a URL.

Dr Sebastien Villaume, ECMWF, presented remotely the proposals on templates, which have been updated since the previous IPET-CM meeting, to refer to an externally defined horizontal domain and overlay by URL as in the annexes to [2.6.2](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_2) and [2.6.3](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_3).

Dr Villaume expressed the URL section will replace any of the horizontal domain sections and the decoding software should be able to locate a GRIB pointed by the URL and to get the horizontal domain section from it to replace the URL template which is a place holder and a pointer.

Dr Villaume emphasized data producers must guarantee that the URL is valid and points to a valid GRIB with the expected information. To improve the security during the transfer and to guarantee that the GRIB message is not corrupted nor counterfeit, a file verification checksum can be optionally included in the template. It was informed that this function could be established on some caching mechanism. Character sets to be used for URL also seemed a subject to be solved.

Dr Enrico Fucile, ECMWF, expressed that further discussion will be welcome on some new mechanisms of GRIB3 to solve their problems.

# 2.6.4 New template components and templates for model level in GRIB Edition 3[⮉](#Cont_2_6)

# 2.6.5 New template component and templates for time interval in GRIB Edition 3[⮉](#Cont_2_6)

(2.6.4) To define model levels, some vertical domain templates (VDTs) and template components (VDTCs) were introduced at the last meeting, which refer to Code table 5.2 for model levels. However, sole information of model level is useless without any other information like total number of levels and the computing algorithm. As for horizontal domain, the usage of URL has to go along with additional identifier for the vertical grid.

Another issue is to define the general vertical coordinate, already implemented in GRIB2 and used by all DWD models. The concept of general vertical coordinates becomes more and more important, as the algorithm to compute the model levels becomes more complicated. In future the constructing of adaptive vertical grids, varying in time, will be an issue to be solved.

Ms Dörte Liermann, DWD, highlighted the necessity of a general template component providing vertical model level grid identifier, also needed in case of URL usage for model level definitions. Ms Liermann added there was another problem that code figures from Code table 5.2 was unknown, if the model level parameter list was provided via URL (VDT 5.3).

Ms Liermann presented the proposal as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_4) to this paragraph to extend the title of Code table 5.2 and to introduce some vertical domain templates, in which a new template component for "metadata for vertical coordinate" is included.

(2.6.5) Ms Liermann continued to present another proposal as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_5) to this paragraph on a new template component and two new templates to include the number of missing data and the number of data in statistical process.

Comparing metadata in GRIB2, which defines time intervals, with the new GRIB3 template component TC 3.1, it would be recognized that metadata are not defined in GRIB 3, such as definition of time increment and total number of data values missing in statistical process, which is important, in particular, when an accumulation is followed by an averaging process.

It was mentioned that first of all where the finger print is needed and how to use it should be discussed. DWD emphasized that it was required to link GRIB messages not as a locator, which is missing in GRIB2.

It was felt possible to have a single template component, which would meet the both requirements for finger print (identification) and URL (location). The meeting concurred to sort out how to realize it.

# 2.6.6 Comments on functionality and structure of referencing externally defined resources (URL) – in general and in case of unstructured mesh for GRIB Edition 3[⮉](#Cont_2_6)

At the IPET-CM-I, new template components and templates were proposed for horizontal domain (section 4), vertical domain (section 5) and overlay section (9) introducing the concept of “URL” to store big (meta) data externally.

Ms Dörte Liermann, DWD, expressed that they agree on the URL usage in principle to remove big data in GRIB messages, provided that the GRIB message behind the URL is NOT needed to identify the coded field.

Regardless of above, Ms Liermann saw some problems in the way it is implemented, which are a) structure of URL string, b) uniqueness, c) redundant definition of URL in the sections 4, 5, 9, d) unusefulness of templates only consisting of an URL and e) NetCDF usage.

Ms Liermann presented some templates and Code tables as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_2_6_6) to this paragraph, including finger print, from the idea that URL will be the same but the contents may not be the same. Dr Enrico Fucile, ECMWF, emphasized the importance of URL not URI but welcomed further discussion (see [2.6.4](#S2018_2_6_4) and [2.6.5](#S2018_2_6_5)).

# 2.7 BUFR new edition, including work plan of TT-BUFR[⮉](#Cont_2_7)

The meeting recalled the documents submitted at the IPET-CM-I on the topic of BUFR Edition 5, and in particular, the reconstructed list of requirements that guided the design of BUFR up to Edition 4. The meeting noted that interoperability was a distinctive and critical new requirement for BUFR Edition 5.

With the above in mind, the meeting noted the scoping and requirement gathering work that was carried out in recent years.

The meeting agreed that BUFR Edition 4 is sufficient for the current needs of the Migration to TDCF, and that therefore work on BUFR Edition 5 should focus on modernizing the code form's design and feature set. It was observed that BUFR Edition 5 and GRIB Edition 3 should be similar in design and philosophy. Therefore the development of BUFR Edition 5 should aim to fit as seamlessly as possible with the work carried out on GRIB Edition 3.

The meeting agreed that since BUFR's Data Description Syntax (DDS) determines the manner in which data is structured and understood in BUFR, interoperability and ease of adoption of BUFR Edition 5 depend on the DDS's suitability for use alongside other broadly used data syntaxes, such as XML Schema. This is consistent with the work that was presented at a previous meeting in Exeter. It was also noted that additional specialized expertise could be required.

MSC and DWD offered to perform a preliminary scoping on the specific matter of the DDS and interoperability, which would be followed by more concrete work where they will be joined by ECMWF, Meteo-France, and EUMETSAT.

# 3. MANUAL ON CODES: REGULATIONS FOR REPORTING TRADITIONAL OBSERVATION DATA IN TABLE-DRIVEN CODE FORMS

# 3.1 Amendments to B/C Regulations for standard time[⮉](#Cont_3)

*Standard time* is specified in B/C Regulations other than B/C30 and 32, for example, in B/C1.1.1

– Year (year of the century up to BUFR edition 3);

– Month (standard time);

– Day (standard time = YY in the abbreviated telecommunication header for SYNOP data);

– Hour (standard time = GG in the abbreviated telecommunication header for SYNOP data);

– Minute (standard time = 00 for SYNOP data);

B/C1.2.2.1, B/C5.2.2.1 and B/C10.2.4.1 refer to the *standard time*. However, the *standard time* is the "most typical time for the BUFR message contents" according to the definition of FM94 BUFR.

When *standard time* is used for surface observations, it is likely to evoke the *standard times of observations* in Manual on the GOS (WMO-No. 544). However, what above *standard times* mean is ambiguous and inconsistent. In addition, it is not clearly specified in B/C Regulations that the date and time are reported in universal coordinated time (UTC).

Moreover, references to the BUFR edition 3 and CREX edition 1 should be removed in consistent with the removal of these code forms from Manual on Codes as agreed by the 15th session of Commission for Basic Systems (CBS-XV) (Jakarta, Indonesia, 10-15 September 2012).

In this context, it was proposed to rewrite the relevant regulations.

The meeting agreed the proposal for adoption by **ABC2019** (adoption between CBS sessions in 2019) (Cat. CLR) as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_3_1) to this paragraph regardless of the regulations designated as technical specification, which could be amended by the fast-track procedure.

The meeting noted that the change would not have an impact to Members' system and operations, because it is to generalize the times in the relevant regulations of BUFR and CREX.

# 3.2 SYNOP data from Israel using 203YYY operator[⮉](#Cont_3)

Israel Meteorological Service (IMS) is sending surface hourly data prepending WIGOS Station Identifier to sequence 3 07 080. IMS is also using operator 2 03 YYY (change reference values) in order to encode a value of -415 metres in the elements 0 07 030 (Height of station ground above mean sea level) and 0 07 031 (Height of barometer above mean sea level). The value of -415 m is required to encode observations from En Gedi (WSI 0-376-0-564). However, the reference value for both elements is -4 000 which allows only a minimum value of -400 m. Accordingly 2 03 YYY is applied in BUFR message as follows.

Ms Marijana Crepulja, ECMWF, proposed a adding a note to B/C1 allow the use of operator 2 03 YYY before the standard sequence to allow station height of - 415 m in Israel.

The meeting confirmed the validity of usage of 2 03 YYY (see [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_3_2) to this paragraph) but did not think the note was necessary in B/C1. The meeting noted that further details of usage of 2 03 YYY is in the Guide to WMO Table-Driven Code Forms, as a good reference when users have questions about this operator descriptor.

# 4. MANUAL ON CODES: TRADITIONAL ALPHANUMERIC CODES

### 4.1 Possible Amendment 79 to ICAO Annex 3[⮉](#Cont_4)

ICAO has discussed the Amendment 79 to ICAO Annex 3 (Meteorological Service for International Air Navigation) to deal with missing/incorrect mandatory meteorological parameters within METAR messages, ensuring the other parameters are still available. ICAO Annex 3 does not have clear rules to specify missing parameters within METAR messages, when an element is temporarily missing or its value considered temporarily as incorrect.

Mr Kentaro Tsuboi, Japan Meteorological Agency (JMA), who participated in the recent meeting of ICAO/Working Group on Meteorological Information Exchange (WG-MIE), informed the meeting that WG-MIE decided to indicate missing values reporting in the METAR template (Table A3-2) in ICAO Annex 3.

Mr Tsuboi further added that WG-MIE discussed whether the METAR should be sent whatever the missing parameter is or that some parameters should never be missing/NIL, i.e. if such a parameter is missing, then the METAR message will be sent as NIL (for example: pressure). ICAO/WG-MIE will propose to change the METAR template (Table A3-2) in Annex 3, which possible amendments are shown in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_4_1) to this paragraph.

Mr Tsuboi asked the meeting to consider possible options to reflect ICAO Annex 3 amendments to the aviation codes in Manual on Codes, depending on a conclusion to be made by ICAO in the coming year.

The meeting thanked Mr Tsuboi for bringing the issue still significant for operational aviation. The Secretariat will contact ICAO Secretariat to confirm how to deal with the amendments by the two organizations.

# 5. MANUAL ON CODES: DATA DESIGNATOR[⮉](#Cont_5)

### 5.1 New data designator for space weather[⮉](#Cont_5)

Amendment 78 to ICAO Annex 3 was adopted by ICAO Council at the fifth meeting of its 213rd Session on 7 March 2018, which will become effective on 16 July 2018 and applicable on 8 November 2018.

As part of Amendment 78, a new space weather advisory information service for international air navigation will be introduced.

The advisory information on space weather should (i.e. recommended practice) be issued in abbreviated plain language as of 8 November 2018 and should (i.e. recommended practice) be made available in IWXXM GML form as of 7 November 2019. As of 5 November 2020, the IWXXM GML form for the space weather advisory information will become a standard practice.

To support the service, WMO is requested to introduce data designators for messages in plain text and IWXXM GML form.

The Secretariat in cooperation with ICAO proposed two data designators T1T2 as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_5_1) to this paragraph.

The meeting agreed with no objection the proposal for adoption by **FT2018-2** (to be implemented on 7 November 2018).

The Secretariat will take a necessary action to communicate with ET-WISC for their awareness to this proposal.

### 5.2 Global exchange of daily climate data[⮉](#Cont_5)

The 17th session of the Commission for Climatology (CCl-17) (Geneva, 10 and 13 April 2018) recommended to carry out a one-year-trial phase of the international exchange of daily climate data, on a voluntary basis, by using the BUFR template 3 07 074 - Supplemental daily temperature and precipitation values for monthly climate report, which was introduced in May 2015 by the collaborative initiative of CCl and United States.

To facilitate the exchange of the daily climate data on the WIS/GTS, the Commission for Basic Systems is requested to introduce a data designator and a sub-category of the daily climate data as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_5_2) to this paragraph.

The meeting agreed the proposal without change for adoption by **FT2018-2**.

The Secretariat will take a necessary action to communicate with ET-WISC for their awareness to this proposal.

# 6. SUMMARY AND CONCLUSION OF PROPOSALS

### 6.1 Summary of amendments since IPET-CM-I and update of status of validation[⮉](#Cont_6)

In accordance with the *Procedures for amending WMO Manuals and Guides that are the responsibility of the Commission for Basic Systems* ([Res. 12 (EC-LXVIII)](http://www.wmo.int/pages/prog/www/ISS/Meetings/IPET-CM_Offenbach2018/References/4-EC_LXVIII_2016_RES12_WMOPres-TechSpec_20160624.pdf)), the amendments by the fast-track procedure and the procedure for adoption between CBS sessions were approved by WMO Members (focal points or PRs).

The meeting noted that the amendments have been implemented or adopted (waiting for implementation) after the 1st meeting of IPET-CM as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_6_1a) to this paragraph.

Furthermore, the meeting confirmed status of the proposals, which have already been approved for validation, on amendments to the Manual on Codes one by one as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_6_1b) to this paragraph.

### 6.2 Conclusion on intersessional discussion (in lieu of PFC)

### 6.2.1 BUFR sequences 3 09 056 and 3 09 057[⮉](#Cont_6)

(see 2.4.5 and 2.4.6)

### 6.2.2 BUFR template for surface observations from n-minute period[⮉](#Cont_6)

(see 2.4.10)

### 6.2.3 New BUFR sequence for snow water equivalent (SWE)[⮉](#Cont_6)

(see 2.4.4)

# 7. MIGRATION TO TABLE-DRIVEN CODE FORMS

### 7.1 Comparison of number of reports received in TDCF and TAC during January 2018[⮉](#Cont_7_1)

The Secretariat presented the report on migration to Table-Driven Code Forms (TDCF) based on the results from the Special Main Telecommunication Network Monitoring (SMM) carried in 1-15 January 2018.

The SMM records all messages containing observations from the RBSN and RBCN stations. The summaries produced by the RTHs participating in SMM are sent to processing centres that produce lists of the times for which observations were available during the monitoring period. In January 2018, however, the processing of CLIMAT reports by the RTHs was incomplete and statistics are not available for those reports.

The tables 1 and 2 (broken down by WMO Regions) and figures 1 and 2 are to compare the percentage of required reports received from stations in TDCF and TAC.

Keeping in mind that the low availability itself is not an issue of migration to TDCF, the Secretariat highlighted some impressive areas in the figures (circled) as shown in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_1) to this paragraph.

Some information was given by the participants as follows.

a) Canada has ongoing project to upgrade the systems but at the moment conversion to BUFR is made.

b) In Africa telecommunication is the critical problem.

c) Brasilia and Buenos Aires have converted to BUFR the messages within their responsible area.

In this connection, it was suggested that the migration status should be given from the regional bodies. It was noticed that Region II has a working structure to deal with migration to TDCF, which could be referred by other regions. The Secretariat mentioned it would be considered within the Secretariat.

# 7.2 Reports by members on status of migration

### 7.2.1 Status of migration to TDCF in RA I[⮉](#Cont_7_2)

Mr Abderrazak Lemkhenter, Direction de la Météorologie Nationale du Maroc, presented the status of migration in Region I.

Mr Lemkhenter explained that since there were not technical meetings after IPET-CM-I, he and Moroccan WIS Focal Point collaboratively developed a questionnaire to monitor the progress of the implementation of the Casablanca GISC together with the questions on TDCF migration in Region I.

Mr Lemkhenter mentioned that he relied on ECMWF monitoring as a migration monitoring to establish a diagnosis and to see the possibility of making corrections, in particular, on the case of Morocco. The diagnosis is shown in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_2_1) to this paragraph.

The meeting thanked Mr Lemkhenter and his colleague for their initiative and involvement in the migration to TDCF in Region I.

### 7.2.2 Status of migration to TDCF in RA II[⮉](#Cont_7_2)

Following the decisions of the sixteenth session of Regional Association II (Abu Dhabi, February 12-16, 2017), the RA II Management Group defined working structures and the terms of reference of Working Groups and Leaders. The Leader in Data Representation and Metadata, appointed under the Working Group on WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) (WG-WIGOS/WIS), is responsible for:

a) Keeping under review inter-programme data representation matters, including migration to Table-Driven Code Forms and regional codes, and make recommendations.

b) Keeping under review the status of implementation of the WIS DAR metadata catalogue and migration from WMO Catalogue of Meteorological Bulletins (Volume C1) to DAR metadata.

In accordance with this mandate, the leader monitors and gives technical assistance as well as conducts survey on migration status on a regular basis as it has been done in the past years. Ms Jitsuko Hasegawa, JMA, presented the document, summarizing the monitoring results of migration status of Region II as of April 2018 and related activities by Region II Members during the period between July 2017 and May 2018, which are as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_2_2) to this paragraph.

The meeting thanked Ms Hasegawa for her continuing efforts to facilitate the migration to TDCF in Region II.

### 7.2.3 Status of migration to TDCF in RA III[⮉](#Cont_7_2)

Dr Sergio Henrique Soares Ferreira, CPTEC/INPE, presented the status of migration in Region III,

The summary in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_2_3) to this paragraph contains information provided by experts and focal points in Region III following an email request to most of them as well as monitoring and verification of BUFR bulletins on GTS.

Dr Ferreira mentioned there has been no significant progress over the past year. During April, the number of surface data per day in TDCF in the region was 5898, including automatic weather station, that is reported only in TDCF. The number of surface data in TAC was 2740 reports per day. The number of upper-air data was 74 per day in TAC and TDCF.

The meeting thanked Dr Ferreira, CPTEC/INPE, and Mr Jose Mauro de Rezende, INMET, who is the co-author, for their active involvement in the migration to BUFR in Region III.

### 7.2.7 Status of migration to TDCF in JCOMM[⮉](#Cont_7_2)

Dr David Berry, JCOMM, explained status of migration by JCOMM: a) number of observations in TAC and BUFR from marine platforms and b) BUFR templates for reporting marine meteorological and oceanographic observations in BUFR.

Dr Berry expressed the majority of marine observations for buoys, VOS and profiling Argo floats were now reported in either TAC and BUFR or BUFR only as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_2_7a) to this paragraph.

Dr Berry added: a) the representation of wave data in the template for moored buoys has been flagged as insufficient (revision undergoing), b) migration to BUFR for E-ASAP observations was completed in 2016, c) migration of BATHY reports to BUFR is underway (almost complete), and d) a BUFR template for TRACKOB is available but has been reported to include limited metadata (revision undergoing).

The meeting thanked Dr Berry and JCOMM for what Dr Berry and JCOMM achieved for the migration to TDCF and also for maintaining the mapping table, which is comprehensive, in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_7_2_7b).

# 7.3 Tools for supporting the migration to TDCF

### 7.3.1 BUFR Validation Dashboard[⮉](#Cont_7_3)

Mr Markus Heene, DWD, presented BUFR Validation Dashboard, which is a web-based service developed by volunteer experts of China, Iran, Australia and Germany, now in a proof-of-concept phase. The dashboard is to show users the summarized output of various BUFR decoders available online, i.e. those of ECMWF, DWD and PyBufrKit at the moment and others to be added. This tool is intended to help users check the BUFR messages with different decoders.

The meeting thanked Mr Heene for the presentation.

### 7.3.2 DWD’s online BUFR Viewer[⮉](#Cont_7_3)

Mr Markus Heene, DWD, presented DWD’s online BUFR Viewer, which DWD recently released as a web-based service. The Viewer is intended to provide users with an online tool to examine BUFR with the tools which DWD uses internally to decode BUFR. The tool has manual file uploading interface and a machine to machine communication function. Mr Heene requested the meeting to use the tool and give feedback, in particular about unexpected decoding results.

The meeting thanked DWD for introducing the tool and noted his request.

### 7.3.3 DWD TAC2BUFR Check tool[⮉](#Cont_7_3)

Mr Markus Heene, DWD, gave an update on DWD’s TAC2BUFR Check tool, which was presented at IPET-DRMM-IV meeting in 2016. The meeting noted the usefulness of the tool to identify BUFR encoding and data quality issues, and that every WMO Member is encouraged to use the tool to identify issues and to take actions, particularly GISCs.

Team members whose organization hosts a GISC agreed to play a role of communication between DWD and the GISC when serious issues are identified by the tool within each GISC’s area of responsibility. They are encouraged, on a voluntary basis, to use the tool by themselves to identify potential issues in the area of responsibility of their GISC and to take actions to fix them.

### 7.3.4 BUFR Migration tool[⮉](#Cont_7_3)

Dr David Berry, JCOMM, presented the BUFR migration tool developed by him, which is to check BUFR messages and available online.

Dr Berry agreed to submit later one page paper on the tool.

# 8. PUBLICATION

### [8.1 Changes to the publication of Manual on Codes](#S2017_9_1)[⮉](#Cont_8)

B/C Regulations (B/Cs, hereafter) are available in four languages, i.e. English, French, Russian and Spanish in accordance with the endorsement by the third meeting of IPET-DRMM (Beijing, 2015) and in compliance with the Annex to Resolution 58 (Cg-17) (PUBLICATIONS FOR THE SEVENTEENTH FINANCIAL PERIOD), which adopted these four languages to publish Manual on Codes. Since last year, B/Cs are available in four languages from the WMO Web at:

 https://www.wmo.int/pages/prog/www/WMOCodes/WMO306\_vI2/TemplateExamples\_en.html

Other language versions are available from the above link, modifying "en" to "fr", "ru" or "es".

However, since B/Cs become one of the most significant components of the Volume I.2 for the progress of migration to TDCF, it is being a risk to maintain them on the WMO Web separately from other major components of the Volume I.2. Possible problems are 1) WMO Members may be unaware of or even disregard B/Cs due to misunderstanding on their legal status and 2) B/Cs are not likely reviewed comprehensively from editorial viewpoint, which is usually performed for annual publication.

The Secretariat reported that the B/C Regulations are now available in the annual publication of Manual on Codes in consideration of the risks and the change from paper to electronic media in the publication of the Manual.

In addition, the Secretariat also reported that BUFR tables version 13 and CREX tables version 5 in machine readable form are now available from the WMO Web. It is to cover the BUFR tables version 13 and the previous ones and similarly CREX version 5 and the previous ones as there are disconnections between versions 13 and 14 of BUFR tables (versions 5 and 6 for CREX), which arises from the changes to the reference value and bit width of some entries in BUFR/CREX Table B. These files of the version 13 are made retroactively from the version 30. The versions are available as usual at:

 http://www.wmo.int/pages/prog/www/WMOCodes/WMO306\_vI2/PrevVERSIONS/PreviousVERSIONS.html

There was a comment about the publication of Volume I.3 Model-driven Code forms. The meeting noted that relevant people in the Secretariat would discuss the way to provide a better access to Volume I.3 publication on the website of the Manual on Codes.

### 8.2 Procedures for amending Manuals on Codes and the GTS[⮉](#Cont_8)

The Procedures for amending the Manual on Codes (WMO-No. 306) were implemented on 1 July 2009 (Res. 7 (EC-LXI)), introducing the new procedure for adoption between CBS sessions to supplement the fast-track procedure already in use.

Yet another new step, i.e. adoption by the President of WMO, was introduced to the fast-track procedure in 2016 (Res. 12 (EC\_LXVIII)). At the same time, the TDCF tables in the Volume I.2, Manual on Codes and the data designator tables in Attachment II-5, Manual on the GTS (WMO-No. 386) were designated as technical specifications, which "may" be amended by the fast-track procedure.

In May 2017, the Volume I.2 itself was designated as technical specifications. Since then, the Volume I.2, including B/C Regulations and Regulations of BUFR and GRIB, may be amended by the fast-track procedure.

The Secretariat emphasized regardless of the above the fast-track procedure and the procedure for adoption between CBS sessions have a practical constraint, which is "unanimous approval" principle.

It is therefore requested, when IPET-CM approves an amendment to the Volume I.2, in particular, on B/C Regulations and Regulations of GRIB, BUFR and CREX, to choose an appropriate procedure for that amendment so as to avoid any risks that the amendment will be rejected.

The meeting concurred to decide an appropriate procedure to be used for each amendment, which were actually done at the meeting when approving proposals as concurred.

### 8.3 Category of amendments[⮉](#Cont_8)

In terms of Manual on Codes (WMO-No. 306) and Attachment II-5, Manual on the GTS (WMO-No. 386), amendments are in principle connected closely to (emerging) data productions, such as observations, statistics, forecasting and any other data processing unless it is to clarify (clarifications) or to correct editorially (editorial corrections).

Impact to Members' systems and operations would be the most critical factor in adoption by WMO Members and WMO officers (the presidents and vice-presidents of the constituent bodies) together with the date of implementation, although some may be interested in coding aspects, which is also encouraged.

Due to diversity of amendments, each amendment is usually listed without additional information about data production and exchange in the draft amendments for fast-track, adoption between CBS sessions and CBS sessions. If such additional information is available, Members and WMO officers, such as the President of WMO, could EFFICIENTLY review and approve amendments with LOW RISK in the very tight schedule for the fast-track and adoption between CBS sessions.

The meeting considered the suggestion by the Secretariat as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_8_3) to this paragraph to specify information in amendments to Manual on Codes, which makes possible (even rough) evaluation of impacts to Members.

It was suggested this is to be applied commonly to the fast-track for amendments to other manuals. The Secretariat expressed it would be discussed at first within the Secretariat, because it depends on decision by each expert team if the categorization is to be used.

The meeting agreed with the idea and decided as the first attempt to assign a category of amendment to each proposal when approving at this meeting. If it fits, the expansion to amendments to other manuals will be considered.

# 9. IPET-CM AND TASK TEAMS

### 9.1 IPET-CM and establishment of task teams[⮉](#Cont_10)

(Jointly discussed with relevant agenda items, i.e. TT-GRIB with 2.6, TT-BUFR with 2.7, TT-MTDCF with 7.2 and TT-AvCI with 4.1.)

# 10. COLLABORATION WITH OTHER ORGANIZATIONS AND TECHNICAL BODIES

### 10.1 The WIGOS Data Quality Monitoring System (WDQMS)[⮉](#Cont_10)

As part of the migration to WIGOS, WMO established an Inter-Commission Coordination Group on WIGOS (ICG-WIGOS). One desired feature of the WIGOS migration is to develop a worldwide system for the real-time monitoring of WIGOS observing site performance, along with a mechanism for the prompt resolution of any diagnosed issues. The concept is known as the WIGOS Data Quality Monitoring System (WDQMS), and the ICG-WIGOS established a task team (TT-WDQMS) to begin developing this new system and sketch out its new features.

Mr Jeffrey Ator, NWS/NOAA and a member of TT-WDQMS, presented the activity by the TT. Mr Ator informed the WDQMS consists of 3 components: monitoring function, evaluation function and incident management function.

Mr Ator expressed most of the TT’s efforts have been devoted to the monitoring function; specifically, to the development of a web-based tool for monitoring the timeliness and quality of observations received at worldwide NWP centers. A prototype is available at

<http://128.65.196.37/wdqms/map>. More capability is envisioned to be added in the next 1-2 years.

The idea behind the monitoring function is that any issues or anomalies diagnosed by this function would be immediately referred to the evaluation function, whose objective would be to analyze the referred issue and determine if it requires any further attention.

It is envisioned that this function will be housed at one or more Global WIGOS Centers (GWCs). If it is deemed worthy of further attention, it will then be assigned a tracking number and referred to the incident management function for resolution, which would be housed at Regional WIGOS Centers (RWCs) within each of the WMO regions. It was informed at present RA-VI (Europe) has organized an RWC which is expected to be declared operational very shortly.

Mr Stefan Klink, EUMETNET, emphasized importance of the evaluation and the incident management system.

*Editorial note: In view of the ongoing discussion, the situation ​could be detailed as (a) the monitoring function will be housed at ​several global centres, while (b) the evaluation and the incident management functions will be housed by several Regional WIGOS Centres (RWCs) for the surface-based stations of the GOS; These functions may be performed at global level rather than regional level for some observing systems of the GOS and for the other WIGOS observing components​.*

### 10.2 Exchange on GTS of monthly climate monitoring products[⮉](#Cont_10)

Since the second meeting of IPET-DRMM (College Park, USA, 28 April - 2 May 2014), the plan on the National Climate Monitoring Products (NCMP) has been brought into shape and the 17th session of CCl (Geneva, April 2018) noted with satisfaction the publication in 2017 of the WMO [*Guidelines*](https://library.wmo.int/opac/index.php?lvl=notice_display&id=20166#.Wqpsga6nGUl) *on Generating a Defined Set of National Climate Monitoring Products* (WMO-No. 1204) and invitedthe Commission for Basic Systems (CBS) to provide technical advice, as deems useful, for collecting and exchanging NCMP on operational basis (Recommendation 5.2/1 (CCl-17)).

Dr Fatima Driouech, representative of Commission for Climatology (CCl), introduced the NCMP remotely and informed of their future plan, such as organizing workshop.

IPET-CM is invited to assist the development of a BUFR template for the monthly exchange of NCMP together with an appropriate data designator and others, if any, to exchange on GTS this message. In view of the limited resources available for developing BUFR template within CCl community, the Secretariat staff, for the time being, will be playing the role of focal points for the two commissions, i.e. CBS and CCl (under the current structure), to facilitate the initial development. The initial draft will be forwarded to IPET-CM in due course for developing further and finalizing, which will be expected in a year or two. The expected components of NCMP are as in the [annex](Report_IPET-CM-II_Offenbach_annex.docx#A2018_10_2) to this paragraph.

The meeting thanked Dr Driouech for her presentation and agreed to discuss and develop the BUFR format based on the further inputs from CCl.

### 10.3 Collaboration with the Inter-programme Expert Team on Operational Weather Radar (IPET-OWR)[⮉](#Cont_10)

Ms Jitsuko Hasegawa, JMA, introduced the topic highlighting:

- The Inter-programme Expert Team on Operational Weather Radar (IPET-OWR) is developing a standard data format for operational radar data exchange consisting of an Information Model (IM, the abstract model of the radar data itself), a Data Model (DM) and a File Format Specification using CfRadial 2.0 standard, which is an extension of the NetCDF Climate and Forecast (CF) Metadata Conventions.

- IPET-OWR requested support of IPET-CM to the process of data format standardization in WMO Community.

The team agreed that the topic is important and has high priority for the whole WMO community. The team also agreed that the team has relevant expertise and experience on a broad range of data format standardization, and therefore it is the team's responsibility to give advice to IPET-OWR about their efforts to develop a standard data format with collaboration with IPET-DD.

The team discussed possible ways to support this activity and agreed to report back to IPET-OWR that:

1) a decision to use this data format specification as WMO standard should be made through an appropriate procedure, e.g. through CIMO and/or CBS Management Group.

2) the team recommends that in making the decision, governance mechanism and control of the new data format, including publication of information and data models and data format specifications, should be carefully considered, because the team believes that governance is the critical part of WMO's data format standard. Governance mechanism of the Manual on Codes is well established and has been implemented for a long time. WMO Members and international organizations including ECMWF and EUMETSAT have been using GRIB and BUFR for a long time because of among other reasons this established governance mechanism and control. The most relevant issue in this discussion is the status of CF 2.0. IPET-OWR is developing its format specification based on CfRadial2.0, which was developed in anticipation of the approval of CF 2.0, but the decision is out of control of WMO. At this status, it is not possible to include the data format specification into WMO regulation. This is a typical example of governance and control issue associated with data format standardization.

# 11. CLOSURE OF THE MEETING

The meeting was closed at 15:00 on Friday 1 June 2018.

* **ANNEX TO PARAGRAPH 1.2**[**⮉**](#S2018_1_2)

**PROVISIONAL AGENDA**

|  |  |
| --- | --- |
|  **1** | **ORGANIZATION OF THE MEETING** |
|    1.1  |    Opening of the meeting |
|    1.2  |    Approval of the agenda |
|    1.3  |    Working arrangement |
| **2** | **MANUAL ON CODES: TABLE DRIVEN-CODE FORMS** |
|    2.1 |    Amendments to GRIB regulations |
|  2.2 |  Additions to GRIB templates and tables |
|    2.3 |    Amendments to BUFR/CREX regulations |
|    2.4 |    Additions to BUFR/CREX tables |
|    2.5  |    Additions to Common Code tables |
|  2.6 |  GRIB edition 3 |
|  2.7 |  BUFR and CREX new editions |
| **3** | **MANUAL ON CODES: REGULATIONS FOR REPORTING TRADITIONAL OBSERVATION DATA IN TABLE-DRIVEN CODE FORMS** |
|  |  Amendments to B/C Regulations for standard time |
|  |  SYNOP data from Israel using 2 03 YYY operator |
|  **4** | **MANUAL ON CODES: TRADITIONAL ALPHANUMERIC CODES** |
|    4.1 |    Possible Amendment 79 to ICAO Annex 3 |
|  **5** | **MANUAL ON GTS: DATA DESIGNATOR** |
|  |  New data designator for space weather |
|  |  Global exchange of daily climate data |
|  **6** | **SUMMARY AND CONCLUSION OF PROPOSALS** |
|    6.1 |  Summary of amendments since IPET-CM-I and update of status of validation |
|  6.2 |  Conclusion on intersessional discussion (in lieu of PFC) |
|  **7** | **MIGRATION TO TABLE-DRIVEN CODE FORMS** |
|    7.1 |    Comparison of number of reports received in TDCF and TAC during April 2018 |
|  7.2 |  Reports on status of migration |
|  7.3 |  Tools for supporting the migration to TDCF |
| **8** | **ADMINISTRATIVE ISSUES**  |
|  8.1 |  Changes to the publication of Manual on Codes |
|  8.2 |  Procedures for amending Manuals on Codes and the GTS |
|  8.3 |  Category of amendments |
|  **9** | **IPET-CM AND TASK TEAMS** |
| **10** | **COLLABORATION WITH OTHER ORGANIZATIONS AND TECHNICAL BODIES** |
|  10.1 |  The WIGOS Data Quality Monitoring System (WDQMS) |
|  10.2 |  Exchange on GTS of monthly climate monitoring products |
|  10.3 |  Collaboration with the Inter-programme Expert Team on Operational Weather Radar (IPET-OWR) |
| **11** | **CLOSURE OF THE MEETING** |

**SECOND MEETING OF THE INTER-PROGRAMME EXPERT TEAM**

**ON CODES MAINTENANCE (IPET-CM)**

(OFFENBACH, GERMANY, 28 MAY - 1 JUNE 2018)[**⮉**](#S2018_1_2)

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