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Organisation météorologique mondiale

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Weather • Climate • Water
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Our ref.: OBS/WIS/DRMM/MIGRATION GENEVA, 25 September 2015

Annex: 1

Subject: Status Report on Migration to Table-Driven Code Forms (MTDCF)

Action required: To note the Status Report of IPET-DRMM with a view to completing the migration to TDCF, ensuring quality of BUFR messages

Dear Sir/Madam,

I wish to refer to the consensus at the extraordinary session of the Commission for Basic Systems (CBS) in Asuncion, Paraguay in September 2014 with respect to the migration to Table-Driven Code Forms (TDCF), the relevant part of which is extracted below:

> "2.3.16 At its Extraordinary Session in 2010, the Commission had confirmed the time table for migration to TDCF. That plan included an end to parallel exchange of information in both TAC and TDCF in November 2014, permitting only TDCF to be distributed from then on. The Commission considered that no changes were necessary to the migration matrix in Annex IV to the present report. It felt, however, that the following measures were needed to facilitate and complete the migration:
>
> (…)
>
> (f) Noting the imminent November 2014 deadline, IPET-DRMM should prepare a report to be sent to Permanent Representatives of Members with WMO to communicate migration successes and remaining issues;"

The CBS/OPAG-ISS/Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) has prepared the Status Report on Migration to Table-Driven Code Forms (MTDCF) (see Annex).

I would also like to take this opportunity to refer to the WMO web page, where information for migration on technical and administrative aspects has been made available at:

http://www.wmo.int/pages/prog/www/WMOCodes/MigrationTDCF.html

To: Permanent Representatives (or Directors of Meteorological or Hydrometeorological Services) of Members of WMO (PR-6868)

cc: Hydrological Advisers to Permanent Representatives

With respect to the migration issue of upper-air observation data, a circular letter has been dispatched, which is available from:

https://www.wmo.int/edistrib_exped/grp_prs/index.php?dir=_en/2015_07/&file=2015-07-07-PR-6855-OBS-WIS-DRMM_en.pdf

to remind Members of the difficulty in processing upper-air BUFR messages converted from traditional TEMP messages to BUFR in four parts. It requests traditional TEMP messages should continue to be distributed unless the station could report upper-air BUFR messages twice, without partitioning, first up to 100 hPa and then of complete ascent.

Last, the CBS Management Group has agreed to establish a task team to deal with the issue of upper-air BUFR messages.

I am confident that the Status Report will be of great help for Members to facilitate and complete the MTDCF in your country/territory, ensuring quality of BUFR messages.

Yours faithfully,

(J. Lengoasa)
for the Secretary-General

Status Report on Migration to Table-Driven Code Forms

Inter-Programme Expert Team
on Data Representation Maintenance and Monitoring
(IPET-DRMM)

25 September 2015

DISCLAIMER

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

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Executive Summary

Table-Driven Code Forms (TDCF) were introduced to provide flexible data representation solutions and have demonstrated its benefit in the form of the wide range of templates developed for various observation data.

A migration from Traditional Alphanumeric Codes (TAC) to TDCF has been in progress for the last several years. November 2014 was set as the deadline of migration, but there are some issues to be solved to reach completion of the migration, where all centres can operate based on the TDCF information flow. The main issues are the availability of observation reports in TDCF, the quality of reported values as well as station and instrument metadata included in TDCF. According to reports from numerical weather prediction centres, the main issue for surface observations is their availability, while the main issue for upper-air observation is reporting structure and quality of data content, especially for reports separated into parts and errors associated with reformat from TAC to TDCF.

WMO Members are encouraged to review the availability and metadata quality of TDCF reports, and to review national migration and training strategy to make sure TAC dissemination is ceased after TDCF reports are assured that they have equivalent or better quality with TAC reports.

A standard approach to notifying and managing issues associated with problems with reports in TDCF will help improve the quality of reports in TDCF.

WMO Members' commitment is still required to complete the migration to meet various new requirements from WMO's projects and initiatives, including the WMO Integrated Global Observing System (WIGOS), the Global Framework for Climate Services (GFCS) and the Global Cryosphere Watch (GCW), to which Traditional Alphanumeric Codes cannot provide fundamental solutions.

1. Introduction

The Migration to Table-Driven Code Forms (MTDCF) was officially launched by CBS in 2002. Successive CBS meetings introduced and refined a multi-year migration schedule, referred to as the Migration Matrix.

MIGRATION MATRIX

Category of traditional Alphanumeric Codes (TAC)	Nov. 2005	Nov. 2006	Nov. 2007	Nov. 2008	Nov. 2009	Nov. 2010	Nov. 2011	Nov. 2012	Nov. 2013	Nov. 2014	Nov. 2015	Nov. 2016
Cat.1: Common												
SYNOP, SYNOP MOBIL										*Parallel distribution*		
PILOT, PILOT MOBIL	**Start operational exchange**					**Migration complete**				*of TAC and TDCF stopped*		
TEMP, TEMP MOBIL												
TEMP DROP, CLIMAT												
Cat.2: Satellite observations												
SARAD, SAREP,		**Migration complete**								*Parallel distribution*		
SATEM, SATOB										*of TAC and TDCF stopped*		
Cat.3: Aviation			*Start experimental exchange*						**Start operational exchange**			
METAR, SPECI, TAF												
AMDAR		**Migration complete**									**Migration complete**	
Cat.4: Maritime												
BUOY, TRACKOB,												
BATHY, TESAC,										*Parallel distribution*		
WAVEOB, SHIP,			**Start operational exchange**				**Migration complete**			*of TAC and TDCF stopped*		
CLIMAT SHIP,												
PILOT SHIP,	*Start experimental exchange*											
TEMP SHIP,												
Argos data				**Migration complete**								
Cat.5: Miscellaneous												
RADOB, IAC,		**Start operational exchange**										
IAC FLEET,												
GRID, RADOF				**Migration complete**								
Cat.6: Obsolete												
ICEAN, GRAF, NACLI etc., SFAZI, SFLOC, SFAZU, ROCOB, ROCOB SHIP, CODAR, WINTEM, ARFOR, RADREP, MAFOR, HYDRA, HYFOR, CLIMAT TEMP CLIMAT TEMP SHIP *NOT APPLICABLE*												

The Migration Matrix called for all WMO Members to have completed the migration in November 2010. November 2014 represented the ultimate deadline for ceasing parallel dissemination of alphanumeric and BUFR messages in Category 1 (TEMP/PILOT, SYNOP and CLIMAT). Therefore, from this point in time, it was intended for the dissemination of these alphanumeric formats to cease. Now that we have reached a point in time beyond the specified date for the end of the migration, we believe it is useful to review the achievements of the mMigration and take stock of the work that remains.

The MTDCF offers great potential to improve the quality of meteorological data being exchanged among WMO Members. This is most obvious in the case of radiosonde bulletins. BUFR TEMP and PILOT bulletins can convey data at high resolution and include radiosondes drift data for accurate positioning of every data point.

As of the beginning of 2015, there is still significant variance in the state of completion of the migration among WMO Members. While some operators have completed the migration, others are still sending traditional SYNOP, TEMP and CLIMAT reports on the GTS. As a result, a mixture of TAC and BUFR now circulates on the GTS and will continue to do so for an indeterminate period of time in the future. There are significant risks associated with this state of affairs. Yet, in the interest of an orderly completion of the

migration, good quality TAC bulletins should only be replaced by BUFR data of equivalent or better quality. Plans to address this issue are being developed (see “Scheme for managing issues with representation of data”).

Causes for the variance in completion rate will be discussed below, but we can point to the lack of a common understanding of the goals of the migration, as well as to issues of capacity and training as prime factors. There were some substantial successes in capacity-building, but there remains a strong need for national and international coordination to tackle the issues standing in the way of completion.

The Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) proposed the following criteria[1] for the MTDCF to be considered complete:

a. WMO no longer maintains the World Weather Watch Traditional Alphanumeric Codes (but OPMET codes will be maintained as long as ICAO requires them);
b. All centres using information that is exchanged on the GTS Main Telecommunications Network (MTN) can operate based on the TDCF information flow;
c. No National Centre is required to produce information in TAC for the purpose of GTS exchange.

This report gives a summary of the availability of data in TDCF as of February 2015, as well as identified benefits and issues of migration, based on the World Weather Watch (WWW) monitoring results and the migration report produced by the European Centre for Medium-Range Weather Forecasts (ECMWF), with inputs and contributions of many global numerical weather prediction (NWP) centres (Ingleby and Vasiljevic, 2015). This report is expected to facilitate improvements in both data quantity and quality. It also provides recommendations of actions by each Member to complete the migration and some options of how to report upper-air sounding in BUFR format, which is one of the main issues, especially in data use in NWP models. The report covers only initial investigation results and does not cover many of oceanographic and climate data.

[1] Condition a. is fulfilled with respect to Category 1 code forms (TEMP, SYNOP, CLIMAT). Conditions b. and c. remain to be completed.

Condition c. implicitly permits conversion of TAC to BUFR. If done sufficiently well, this meets the technical requirements for the migration. However, TAC lack the precision and metadata elements that are present in the BUFR bulletins, and the quality of BUFR bulletins derived from TAC is often inferior to data produced in BUFR from native data.

2. Migration status

2.1 TAC maintenance discontinued

With the end of the Migration Matrix, any future amendment to WMO observation reporting practices requiring changes to WMO Codes will only apply to the Tables of TDCF and to the B/C regulations (which are the regulations on reporting various data types in BUFR). Operators using traditional TEMP, SYNOP or CLIMAT will run the risk of being unable to implement the amendments. Furthermore, operators performing conversion of TAC to BUFR are, in effect, using TAC as national code forms, no longer supported by an external authority.

2.2 Availability of surface and upper-air BUFR reports

The list of registered BUFR bulletins in WMO Publication No. 9, Volume C1 is provided here[2] and updated every two weeks. Coverage maps of received TAC and surface and upper-air bulletins in BUFR during the latest Special MTN Monitoring (SMM) period: 1-15 April 2015 are available here[3]. Numbers of TAC and BUFR reports for SYNOP, TEMP and PILOT are available here[4] by each country/territory.

About 70% of surface and upper-air stations now provide BUFR reports and about 90% of SHIP data is available in BUFR format, although the ship template used is a temporary measure and is being replaced by new templates.

2.3 Identified benefits

2.3.1 Flexibility and scalability of TDCF

BUFR provides a simple and scalable solution for representing various physical parameters as well as observation platforms and instruments, by simply adding new descriptors and code table figures. Satellite data, among others, enjoy the benefits of BUFR most. Other examples include the WMO Integrated Global Observing System (WIGOS) identifier, which is designed for providing a systematic observation station identification system to replace the traditional five-digit WMO station identifier, daily CLIMAT report that provides daily statistics of parameters in addition to the traditional

[2] http://www.wmo.int/pages/prog/www/ois/Operational_Information/TDCFMigration_en.html

[3] http://www.wmo.int/pages/prog/www/ois/monitor/smm/smm_apr15_analysis.html

[4] ftp://ftp.wmo.int/GTS_monitoring/SMM/From_WMO/sm15401.015/ANALYSIS/RBSCN_TACvsTDCF201504.docx

CLIMAT report, and snow depth data to include zero-snow information, for which TAC can provide limited solutions.

2.3.2 Higher precision of values

BUFR has capacity to report values in higher precision, which solves TAC's intrinsic issues in precision of values reported with rounded values. For example, in TEMP, temperatures of both +13.5°C and +13.4°C are coded as 134. Decoding them as face value gives an average offset of -0.05°C. In some cases, measurements are done to two decimal places and all values between +13.40°C and +13.59°C are coded as 134, where decoding the value as 13.4°C gives an average offset of -0.095°C. The difference is at the noise level for NWP, but it can matter to applications for climate research.

2.3.3 Native BUFR upper-air reports

Native BUFR[5] upper-air reports often provide high-vertical-resolution radiosonde data, sometimes with position (drift) information at each point of ascent. Statistics have shown that high-resolution radiosonde data improves analysis and forecast performance on the premise of good quality control, while reformatted BUFR data do not bring significant difference in performance. Given the increasing resolution of the current global, regional and local forecast models, drift information is becoming a significant factor for improved forecast performance.

2.4 Identified issues in encoding and decoding BUFR reports

2.4.1 Use of BUFR editions and templates

Some BUFR reports are still using edition 3, rather than edition 4 as they should do. TDCF have templates, i.e. sequences of descriptors designed for reporting specific observations. The use of templates is not consistent among BUFR producers, which puts additional work on data users. New BUFR templates for ships and buoys have not been used widely.

2.4.2 Drift information in upper-air data

Though drift information (position at each point of ascent) is one of the benefits of native BUFR, as of January 2015 only about 20% of upper-air stations provide drift information. Many stations using radiosonde types with the capability to provide drift information do not report it.

[5] Definition of native BUFR messages is still being discussed, but here, those being produced directly from observation results in whatever form (manual input, files, data streams via TCP/IP protocols) rather than by conversion/reformat from traditional codes, which has significant omission of information.

2.4.3 Metadata

Although having metadata of observation stations and instruments in each message is one of the strong points of TDCF, there are still issues to be solved.

2.4.3.1 Observation station position, latitude/longitude, height

Position metadata errors are reported, including missing latitude/longitude, changing positions in time and different coordinates between registered stations in WMO Publication No. 9, Volume A and BUFR location coordinates. The position information is missing or wrong for up to 30% of BUFR radiosonde reports. The biggest single cause of error seems to be conversion error from degrees and minutes to decimals (e.g., 3 30 is converted to 3.30 instead of 3.50). Station height is also important, especially for surface stations but hasn't been examined yet. In addition, BUFR is capable of reporting the height of pressure sensor, but in many cases this is filled by the same value of the height of the station.

2.4.3.2 Identifier of upper-air data from ships

Identifiers are occasionally missing or blank. Some radiosonde reports from ships have a numeric WMO identifier and a ship call sign, which is confusing because there is no clean way to distinguish ship from land reports. Some radiosonde reports from fixed land station have characters in ship or mobile land station identifier, which is supposed to be missing for fixed land stations, and cause decoding errors.

2.4.3.3 Instruments types and software versions

Errors of reported radiosonde types are problematic to NWP systems, where the information can be used for radiation bias correction, observation error estimates and for decision on use of upper-tropospheric humidity. Wrong reports of radiosonde type in BUFR are mainly caused by using the same radiosonde type code figures used in TEMP, because in Common Code table C-2 in the *Manual on Codes* (WMO-No. 306, Volume I.2 - Part C) for radiosonde types, code figures up to 99 are used for TEMP and code figures up to 255 are used for BUFR; for example reports labelled type 30 in TEMP can be 130 in BUFR. There are also cases of missing values and values that appear to be wrong in TEMP and/or BUFR.

The BUFR template for reporting upper-air sounding may have additional descriptors to identify radiosonde serial number and software version, which can be used to identify instrument and processing changes to a particular radiosonde type and are potentially useful for radiosonde bias correction in NWP and climate studies. This information has not been fully used in NWP systems.

2.4.3.4 BUFR content errors due to conversion from TAC, etc.

A number of errors are detected in many BUFR reports converted/reformatted from TAC. Many of them are caused by errors in converting units and parameters, as well as in decoding source TAC messages, which consist of a variety of complicated rules (such as omission of leading digits to reduce message length). The issue is that TAC decoders used in TAC-TDCF conversion often do not have skills to treat these specific rules correctly, unlike decoders used in NWP systems, which have accumulated experience in treating special cases. Below are the lists of reported errors in reformatted BUFR reports. Generally speaking, surface BUFR reports (reformatted from SYNOP and SHIP) have fewer and less serious errors than upper-air BUFR reports (reformatted from TEMP and PILOT).

One of the motivations to introduce TDCF was to graduate from handling TAC's complex rules. Due to slow communications speeds at the time the TAC were first put in practice, much effort was expended on devising coding rules that aimed to minimize the length of messages. Unfortunately, initial investigation results show that many BUFR reports are still affected by these rules through the TAC-TDCF reformatting process.

For example, geopotential heights are coded with omitted leading digits in TAC. This practice is sometimes erroneously perpetuated in converted BUFR TEMP. In TEMP reports, geopotential heights are reported in whole geopotential meters; the thousands digit is omitted for surfaces up to, but not including, 500-hPa. For example, 3,249 meters at 700-hPa is coded as 249 in TEMP and the thousand digit needs to be inferred when decoding the TEMP report to generate a BUFR message, based on the approximate heights of the standard isobaric surfaces. Wrong guesses are often made for the height at 700-hPa, because the actual height varies from around 2,100 meters (e.g., in the Polar Region) to 3,400 meters (i.e. the leading digit can be both 2 and 3). Similarly, geopotential heights are reported in tens of geopotential meters for surfaces at 500-hPa and higher (i.e., only the thousands, hundreds, and tens digits of the height are reported; 11,784 meters at 200-hPa level is coded as 178). The tens of thousands digit need to be inferred, which sometimes brings wrong values in converted/reformatted BUFR messages. There is also an exceptional rule for coding negative geopotential heights (below sea level), which is reported by adding 500 to the absolute value of the geopotential in TAC (i.e., –90 meters is coded as 590). This is often wrongly coded as 590, instead of –90 in converted/reformatted BUFR messages. These errors are rooted in the intrinsic complexity of TAC and illustrate the difficulty of conversion/reformat.

Reported errors and offsets in reformatted surface BUFR reports include:

- Offsets of temperature, caused by the Celsius (TAC) and Kelvin (BUFR) conversion and rounding of values in TAC reports;
- Wrong conversion and/or mixture of wind speed between knots and km/hour;
- Rounding difference in wind speed;
- Missing leading digits in pressure;
- Slight difference in pressure reported in TAC and BUFR.

Reported errors and offsets in reformatted upper-air BUFR reports include:

- Confusion of dew point depression and dew point temperature;
- Wrong conversion of dew point depression, which has a special treatment in TEMP code table in a specific depression range;
- Problems with the reported tropopause level;
- Surface winds repeated as upper-level significant winds;
- Surface data repeated as 1000 hPa data;
- Wrong conversion and/or mixture of wind speed between knots and km/hour;
- Wrong guesses of omitted leading digits of geopotential heights in TEMP code;
- Unrealistic values in temperature and missing vertical coordinate.

2.4.4 Reformatted BUFR upper-air reports separated into parts

The main issue of BUFR upper-air reports for NWP users is the *reformatted BUFR* which are received for separated parts A, B, C and D. The practice comes from TAC reports, where levels are split into standard and significant levels and reported separately up to 100 hPa and above. The original idea of introducing TDCF was to move towards high vertical-resolution reporting and also to simplify the reporting structure to include all the information from one ascent to one report. Unfortunately, however, the reporting structure has been transferred to many BUFR reports through the TAC-BUFR reformatting process. To make things worse, the same GTS headers are used, making it all but impossible to identify and merge the constituent parts. This practice is clearly excluded by B/C 25 Regulations[6], but many Members seem to be unaware that these reports are not only uncompliant, but almost unusable.

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[6] A BUFR (or CREX) message shall be sent when the 100 hPa level is reached. Subsequently, a BUFR (or CREX) message shall be produced when the sounding is completed containing data from the entire sounding. If the sounding is terminated below 100 hPa level, only the later message shall be produced.

If high resolution data are reported, only one BUFR message shall be sent when the 100 hPa level is reached and only one BUFR message shall be produced when the sounding is completed, provided that all standard and significant levels are properly identified in compliance with the relevant B/C 25 Regulations.

2.4.5 Use of BUFR reports in NWP systems

According to the survey conducted by ECMWF in January 2015, surface observation data provided by BUFR format are used in six global NWP centres, in the proportion of 1–70% for SYNOP and in one centre 80%, upper-air data in four global NWP centres in the proportion of 0.5–2%, which indicates that NWP centres still have a long way to go to complete the migration.

2.5 Identified issues in managing migration process

2.5.1 Lack of shared understanding of migration goals

Not all Members shared a common understanding of the requirements and justification of the migration to TDCF. In particular, the migration strategy of using TAC-TDCF conversion was adopted too easily without enough understanding of its deficiencies. The benefits of native TDCF reports (generated directly from measured data) should have been stressed more forcefully throughout the migration process, especially in the planning phase, so that Members could better appreciate and take actions towards the goal of migration, which is to improve observation report quality and availability, not to change data *formats*. In the case of BUFR upper-air reports, the importance of native high-resolution BUFR reports should have been clearly communicated in the early stage, although this is mentioned in B/C 25.

2.5.2 Lack of advanced notification of turning off TAC reporting

One of the critical issues of managing migration is some Members' stopping TAC distribution with no or very-short advanced notification, leaving no time for data users to validate contents of new BUFR messages. Notification of amendments in WMO publications is supposed to be sent to the Secretariat at least two months in advance of the effective date of the change (Manual on GTS), but this seems not enough for data users to validate the contents.

2.5.3 Lack of consolidated process for quality checking and reporting issues

There is a need for quality checking of new TDCF bulletins and a validation process taking into account the comparison with TDCF messages and their TAC equivalent, as well as the absence of a consolidated process for reporting and addressing issues arising from the migration needs to be resolved. A standard procedure for reporting issues with the content of TDCF reports will help reduce the number of reports that are unusable.

2.5.4 Training and expertise

The TDCF represent a substantial paradigm shift over the TAC, whose way is profoundly ingrained throughout the worldwide meteorological enterprise. A very large amount of

training was invested in TAC over the years, and they are well understood to the point of being second nature to staff, all the way up to the most senior. Thus, not only is technical training required, but an actual culture change is needed. Significant efforts have been devoted to TDCF training, but more is needed.

2.5.5 Lack of capacity and infrastructure

Aside from training issues, existing infrastructure in low capacity States may not be capable of handling TDCF. In those cases, an upgrade, eventually leading to completion of the migration, is dependent on grants or help from higher capacity partners.

In the case of high capacity operators, the TAC may be deeply hard-wired into the existing production systems. In such a case, a complete overhaul of the physical and software infrastructure may be necessary as a precondition for the migration to take place. Carrying out such a change in a complex operational system can easily take longer than initially anticipated.

3. Recommendations

3.1 Recommended actions for all WMO Members

1. To make sure all the data are available in TDCF format, in full compliance with B/C Rregulations of the *Manual on Codes*, (WMO-No. 306, Volume I.2 – Part C, d. Regulations for reporting traditional observation data in Table-Driven Code Forms (TDCF): BUFR or CREX).
2. To make sure that all the metadata of observation stations and instruments are properly maintained and provided in TDCF.
3. To review their national migration strategy to include the goal that TDCF reports be generated directly from measured data where possible, instead of by converting/ reformatting TAC reports.
4. To cease the parallel dissemination of TAC as soon as possible, but only after providing all centres with advanced warning and ascertaining that the TDCF is of equivalent or better quality (see “Scheme for managing issues with representation of data”).
5. To review their national meteorological training strategy to harmonize current and future institutional knowledge and practices with TDCF regulations and templates, and to seek or undertake TDCF training activities as required to facilitate the completion of migration activities.

3.2 Recommendation on BUFR upper-air reports

Members are encouraged to pursue ways, depending on the levels of observation and communication infrastructure capacity and capability, to take advantage of additional reporting features provided for upper-air data in BUFR, especially native BUFR reports with high vertical resolution and drift positions. Recognizing that many centres are unable to produce anything other than reformatted BUFR reports from TEMP and PILOT, NWP centres stated they prefer to continue using TEMP and PILOT reports rather than using reformatted BUFR reports in parts, until data producers are ready to provide native BUFR reports containing all data from one ascent. IPET-DRMM recommends that Members re-evaluate BUFR upper-air reports quality to make sure that they are compliant with the regulations and consider the option to continue TAC reporting regardless the November 2014 deadline, with a clear migration plan to native BUFR, if reformatted BUFR in parts is the only possibility at the moment.

3.3 Scheme for managing issues with representation of data

A scheme for managing migration process is being developed, to ensure enough time to validate new messages and to establish a systematic quality checking and reporting process with necessary escalations so that identified issues are addressed towards correction and improvement. Members will be informed of the scheme in due course. This should be supported by a standard procedure for notifying and managing issues that are detected in the reports in TDCF.

4. Conclusion

TDCF, especially BUFR that is mainly used for representing a range of observation data, has proven some of its benefits, including flexibility, scalability and higher precision of values, and native BUFR upper-air reports have shown a positive impact on analysis and forecasting performance. NWP centres directly benefit from these effects, but the improvements bring benefits to all the WMO Members through the cascading process of the Severe Weather Forecasting Demonstration Project (SWFDP), where Members can access improved NWP products.

Numerical weather prediction (NWP) centres have conducted quantity and quality checking of incoming observation data in TDCF and reported that surface observation reports in BUFR were generally usable for NWP, although there are problems to be corrected in metadata and reformatting process, while upper-air reports generated by reformatting TEMP and PILOT reports, especially the ones separated in parts, are problematic in quality and a very limited number of reports are actually in use. The migration process has also revealed existing information and data quality management

issues. This shows that solving issues in BUFR reports requires overall improvement of quality control and maintenance of metadata of observing stations and instruments.

There are still a number of issues to be solved to make the best use of TDCF and a strong commitment of WMO Members is required to complete this project even after the November 2014 deadline.

5. Reference

Ingleby B. and D. Vasiljevic, 2015: Progress report on migration to BUFR
https://software.ecmwf.int/wiki/download/attachments/29332277/Migration_2_BUFR_Report.pdf?version=1&modificationDate=1426266818726&api=v2