Update to Tropical Cyclone tracks

This page describes two changes to be made to the Tropical Cyclone tracks (TC tracks):

1. TC tracks from the 06/18 UTC forecast cycles will be made available as WMO essential products, including graphical product.
2. All TC tracks BUFR files, including those from the 00/12 UTC forecast cycles, will use WMO BUFR tables version 35.

The Tropical Cyclone tracks from the 06/18 UTC forecast cycles : Test Products previously announced on 3 September 2020 will continue to be produced from the current operational IFS cycle 47r1 until the implementation of IFS cycle 47r2. However, users of these test products are strongly advised to start using the TC tracks test files from the pre-operational e-suite once these are available. See Access to test data for further details.

Guidelines for testing are available below. We encourage users of the TC tracks (BUFR data) to test their decoding software .

- **The number of tracks identified in the 06/18 cycles is lower due to the shorter forecast range available in these cycles (up to step 90 for HRES and 144 for ENS)**

- Updates to the TC tracks BUFR header
- Sample TC tracks BUFR data for technical testing
- Testing your TC tracks BUFR decoding software
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NOTE: If you are facing problems with the decoding the updated TC tracks please contact the ECMWF ServiceDesk. Please include information on the software used (ecCodes, BUFRDC, ...), the version number, the error message and, if possible, the source code.

Software requirements

Users will need ECMWF ecCodes version 2.20.0 or above to decode the updated TC tracks in BUFR. Those users using BUFRDC will need to download and install the BUFR tables version 35. ECMWF is unable to advise on the usage of third party software, other then that WMO BUFR tables version 35 are needed.

Updates to the TC tracks BUFR header

New sequence of data descriptors

WMO BUFR Tables version 35 contain new sequence of data descriptors **316082** that combines all previously used descriptors. The single 316082 sequence is used that expands into the previous sequence.

	New	Old
ecCodes key = unexpandedDataDescriptors	316082	1033, 1034, 1032, 1025, 1027, 1090, 1091, 1092, 301011, 301012, 8005, 301023, 8005, 301023, 10051, 8005, 301023, 11012, 107003, 19003, 105004, 5021, 5021, 201131,19004, 201000, 116000, 31001, 8021, 4024, 8005, 301023,10051, 8005, 301023,11012, 107003, 19003, 105004, 5021, 5021,201131,19004,201000

Correction to inconsistent encoding of the BUFR headers

With the introduction of the TC tracks from the 06/18 UTC forecast cycles, an inconsistency in the encoding of the BUFR headers has been corrected. The ensembleForecastType key (BUFR descriptor 001092) now contains the correct information for the different member forecasts (key ensembleMemberNumber, BUFR descriptor 001091), including situations where only one member is present.

WMO BUFR Tables 35 also introduce the new type of ensemble forecast type for BUFR Descriptor 001092 which can be set to 4 to indicate a Perturbed forecast.   The ENS perturbed members were previously set to 'MISSING'. The changes made are summarised in the table:

	BUFR Descriptor 001091 ecCodes key = ensembleMemberNumber	BUFR Descriptor 001092 ecCodes key = ensembleForecastType
HRES	52	0
ENS control	51	1
ENS perturbed member	1 - 50	4

See WMO=35 code-flag table#CF_001092 (TYPE OF ENSEMBLE FORECAST).

In addition, the ecCodes key internationalDataSubCategory (BUFRDC section 1 element named DATA SUB-CATEGORY) for TC tracks from HRES is set to 2 (instead of 255 as a missing value). For TC tracks from ENS it remains set to 0.

Sample TC tracks BUFR data for technical testing

Sample Tropical Cyclone tracks data in BUFR format are available for Tropical Cyclone GENEVIEVE for 22 August 2020 at 00 UTC, for HRES and ENS. These can be used for technical testing.

	Old (using WMO BUFR tables version 33)	New (using WMO BUFR tables version 35)
HRES	old_tracks_12E_GENEVIEVE_2020082200.hres.bufr4	tracks_12E_GENEVIEVE_2020082200.hres.bufr4
ENS	old_tracks_12E_GENEVIEVE_2020082200.ens.bufr4	tracks_12E_GENEVIEVE_2020082200.ens.bufr4

Both new and old TC track files use the same IFS input data. Users should be able to run their existing Tropical Cyclones decoder programs 'as they are' on the old tracks data encoded using WMO BUFR Tables version 33. These files should be used as a reference. Users should make sure that their programs run with the new tracks data encoded using WMO BUFR Tables version 35. You may need to make changes to your programs.

Testing your TC tracks BUFR decoding software

We recommend users to test their decoding software with the above mentioned sample data. ecCodes versions 2.20.0 and above and BUFRDC with WMO tables version 35 have been tested at ECMWF and do work correctly. As the sequence of data descriptors (ecCodes key unexpandedDescriptors) is different in the new TC tracks, the decoder programs previously used may need to be adapted.

ecCodes users:

If you do not use a recent version (2.20.0 or newer), you will see an error message like:

```
ECCODES ERROR : unable to find definition file sequence.def in bufr/tables/0/wmo/35/sequence.def::bufr/tables/0
/local/0/98/0/sequence.def
Definition files path="/usr/local/apps/eccodes/2.19.1/GNU/7.3.0/share/eccodes/definitions"
ECCODES ERROR : unable to get hash value for sequences
ERROR: unable to unpack data section: Hash array no match (message=1)
```

You will then need to download, install and use a newer version of ecCodes.

BUFRDC users:

If you use BUFRDC and do not have the WMO BUFR tables version 35 installed, you will see an error message like:

```
BUFR TABLES TO BE LOADED B0000000000000035000.TXT,D0000000000000035000.TXT
open error on /usr/local/apps/bufrdc/tables/000417/B0000000000000035000.TXT
```

You will then need to download, install and use the WMO BUFR tables version 35. You can point BUFRDC to a different version of the BUFR tables by setting the environmental variable `BUFR_TABLES` e.g.::

```
export BUFR_TABLES=<dir>/bufrdc_tables_wmo_v35/
```

where `<dir>/bufrdc_tables_wmo_v35` is the directory containing the BUFR tables.

> ✓ **On ECMWF systems** the WMO BUFR tables version 35 are installed in /usr/local/apps/bufrdc/tables/000418/
>
> ```
> export BUFR_TABLES=/usr/local/apps/bufrdc/tables/000418/
> ```

Access to test data

TC tracks test files from the pre-operational e-suite are available in real-time for download in BUFR4 format from:

ftp://wmo:essential@xpds.ecmwf.int

For users with TC tracks configured via ECMWF real time dissemination system see Availability of IFS cycle 47r2 test datav

Further documentation

The ecCodes HOME page includes (Fortran, C and python) examples to decode BUFR messages as well as a command line tool to generate sample source code/scripts to decode any BUFR message.

The BUFRDC HOME page includes the necessary WMO BUFR tables and the BUFRDC user and reference manuals. Note that we do not release new versions of the BUFRDC software any longer. We advise users to migrate their BUFRDC codes to ecCodes.