

DAILY CLIMAT DATA IN BUFR FORMAT

Encoding / Decoding Utility

I. OVERVIEW

All software programs and associated files are included in the file `bufrDemoV1.tar.gz`. Once the data are unzipped using the unix `gunzip` utility the files can be untarred using the command `'tar -xvf bufrDemoV1.tar'`. The files are untarred into the directory `/bufr/`. This directory contains the subdirectories listed below and a file that can be used to list the WMO numbers of stations to be processed (`wmo_list.txt`).

There are 6 subdirectories.

1. `data`: Contains the file `'dailyData.dly'`, which consists of summary of the day data in an ASCII format that can be converted to the proper BUFR format.
2. `libsrc`: Contains the `*.f` and `*.c` programs that are needed to read and write BUFR formatted data files. These programs need to be compiled and linked to make the `bufr.lib` file. A description of how to do this is included in Section II.
3. `lib`: Contains the compiled and linked `bufr.lib` file.
4. `exe`: Contains the executable files for the Main programs; `decodeDly2.exe` and `encodeDly2.exe`. A description of how to create these files for your system is included in Section III.
5. `out`: Contains the output file in the proper BUFR format.
6. `src`: Contains the FORTRAN code (`decodeDly2.f` and `encodeDly2.f`) and the `bufrtab.dly` file that contains the daily descriptors. This directory also contains the script `'c3'` that can be used to compile the two Main FORTRAN programs.

The BUFR encoding / decoding utility consists of two main FORTRAN programs.

`encodeDly2.f` reads daily data from a text file and writes the data to a file in BUFR format.

`decodeDly2.f` reads the BUFR file and writes the data to standard output in ASCII format.

Both programs use NOAA/NCEP BUFRLIB software functions (written in Fortran and C) to build and read the BUFR file.

The information provided below describes how to set up and run the demonstration in a UNIX or LINUX environment. Information also is provided that will enable the user to modify the software so that the Daily data for their CLIMAT stations can be converted to BUFR format.

II. CREATING THE `bufr.lib` LIBRARY

Commands are run from the directory `/bufr/libsrc/`.

For additional information on the NOAA/NCEP BUFRLIB functions see `/bufr/libsrc/README_BUFRLIB` or <http://www.nco.ncep.noaa.gov/sib/decoders/BUFRLIB/>)

FORTRAN programs:

If using a gfortran compiler, create object files for the FORTRAN library utilities in /bufr/libsrc/ using the following command.

```
gfortran -c -fno-second-underscore *.f
```

C programs:

Compile the c programs in /bufr/libsrc/ using the following command.

```
cc -c -DUNDERScore *.c
```

To create the Library file, use the following command.

```
ar crv ../lib/bufr.lib *.o
```

The library file is written to the /bufr/lib/ directory.

III. COMPILING THE MAIN FORTRAN PROGRAMS

A script (C3) is provided that can be used to compile the two main FORTRAN programs. This assumes the use of a gfortran compiler.

To make the script executable, run the command “chmod +x c3” from the command prompt.

Executables are create in /bufr/exe/.

```
gfortran -g -o ../exe/encodeDly2.exe encodeDly2.f ../lib/bufr.lib
```

```
gfortran -g -o ../exe/decodeDly2.exe decodeDly2.f ../lib/bufr.lib
```

IV. ENCODING AND DECODING

ENCODING BUFR DATA

Source directory: /bufr/src/

encodeDly2.f Source file for encoding BUFR data.

The program requires two parameters:

1. date.(yyyymm)
2. basepath - the path where bufrDemoV1.tar was untarred.

The BUFR description is loaded from /bufr/src/bufrtab.def.

WMO ID's are read from /bufr/wmo_list.txt.

Daily data are read from the dailyData.dly file in /bufr/data/.

The BUFR data are written to /bufr/out/dbufyymm.dly.

Note: For this demonstration, the dailyData.dly file contains data for a single station. *The user of this software can modify the program 'encodeDly2.f' to build a dailyData.dly file for their CLIMAT stations.* Please see the Section V for additional information on steps needed to modify

this software for country-specific stations.

DECODING BUFR DATA

decodeDly2.f Source file for decoding bufr files created by encodeDly2.f

The program requires two parameters:

1. date.(yyyymm)
2. basepath - is the path where bufrDemoV1.tar was untarred.

The BUFR description is loaded from /bufr/src/bufrtab.def.

The BUFR data are read from /bufr/out/dbufyyyyymm.dly.

Output goes to standard out or can be redirected to a file.

RUNNING THE PROGRAMS

Once the programs are compiled, go to the directory /bufr/exe/ to run the following commands.

encodeDly2.exe yyyymm basepath (Command to create a BUFR file for the given date).

decodeDly2.exe yyyymm basepath (Command to decode the BUFR data file created using encodeDly.exe).

For this demo, use the date 201708.

basepath is the path where bufrDemo.tar was untarred.

V. CHANGES NEEDED TO CONVERT THE DEMONSTRATION CODE INTO AN OPERATIONAL PROGRAM

1. Edit bufr/wmo_list.txt adding the wmo id's for your stations.
2. Make modifications to encodeDly2.f necessary for creating the bufr/data/dailyData.dly file (and subsequent conversion to BUFR format) from your country's stations.

On line 154 of the /bufr/src/encodeDly2.f, the following lines are commented out.

```
c      CALL SYSTEM ('rm /home/ops/bufr/data/*')
c      cmd='java -classpath /home/ops/climat/java/climat.jar '//
c      +      'gov.noaa.ncdc.climat.getDailyForBufr '//wmon//' '//
c      +      cdate
```

When run in operations at NOAA/NCEI, the command in these lines executes a query to the NCEI Oracle database to retrieve the daily data for each station being processed (one station at a time each time through the loop). It produces the dailyData.dly file each time through the loop for each US station. The data in this file are then available for conversion to the BUFR format.

The dailyData.dly file is read by the subroutine loadDailyData, which is executed in line 164. This subroutine writes the data to the proper BUFR format.

These two routines run in a loop reading the WMO ID from the wmo list each time through the loop. A new dailyData.dly file is created for each station each time through the loop, overwriting the file from the previous loop.

The user will need to create their own process for producing the dailyData.dly file each time through the loop.

The dailyData.dly file is in a comma delimited format with the first four records containing metadata, and the remaining records containing the daily data.

Rec 1 – WMO Number, WBAN ID, UTC time zone offset

Rec 2 - Latitude

rec 3 - Longitude

Rec 4 - Elevation

Daily data record:

Column 1 - Day of the Month

Column 2 – Daily Maximum Temperature

Column 3 – Daily Minimum Temperature

Column 4 – Daily Average Temperature

Column 5 – Daily Precipitation Total

Column 6 – Daily Snowfall Amount

Column 7 – Snow Depth at Observation Time

The demonstration data in dailyData.dly are shown below.

```
72517,14737,-5
40.65083
-75.4492
390
01,277.1,263.3,270.2,0.0,0.000,0.00
02,278.8,268.3,273.5,0.0,0.000,0.00
03,276.0,266.6,271.3,16.0,0.005,0.00
04,283.2,274.9,279.0,4.3,0.000,0.00
05,280.4,265.5,272.9,0.0,0.000,0.00
06,267.2,260.0,263.6,2.3,0.036,0.00
07,267.7,260.0,263.8,0.3, T,0.03
08,265.0,256.6,260.8,0.0,0.000,0.03
09,272.7,263.9,268.3,0.3, T, T
10,266.6,261.1,263.8,0.0,0.000,0.00
11,276.5,261.6,269.0,0.3,0.000,0.00
12,276.0,273.2,274.6,10.9, T, T
13,274.9,262.7,268.8,0.0,0.000,0.00
14,271.1,262.2,266.6,0.0,0.000,0.00
```

```
15,274.3,266.6,270.4,0.0,0.000,0.00
16,277.6,265.0,271.3, T, T,0.00
17,273.2,260.5,266.8,0.0,0.000,0.00
18,276.5,267.7,272.1,10.4,0.000,0.00
19,278.8,270.5,274.6,0.0,0.000,0.00
20,278.2,270.0,274.1, T, T,0.00
21,272.7,266.6,269.6,2.3,0.025,0.00
22,277.1,270.0,273.5, T, T,0.03
23,276.0,266.1,271.0,0.5,0.003,0.00
24,276.5,272.7,274.6,16.8,0.198,0.20
25,277.6,271.6,274.6, T, T,0.15
26,271.6,266.1,268.8,3.3,0.048,0.13
27,272.2,265.0,268.6, T, T,0.15
28,272.7,264.4,268.5,0.0,0.000,0.13
29,272.7,256.6,264.6,1.3,0.010,0.13
30,275.4,263.9,269.6,0.3, T,0.13
31,270.0,261.6,265.8,0.0,0.000,0.13
```

3. On line 458, the following boolean variable is set to false to exit the loop after one station for this demonstration.

```
moreData=.false.
```

Comment this out and the loop will continue until the end of the WMO list.

```
c moreData=.false.
```

VI. QUESTIONS

Questions about this software and processing can be directed to Ron Ray (Ron.Ray@noaa.gov) and Jay Lawrimore (Jay.Lawrimore@noaa.gov).