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Document Change Log

Issue.	Datum	New pages	Modified pages (after introducing new pages)	Observations	Name
Draft	11.01.2006	--	--	Draft	M.Rohn
	01.02.2006			Include BUFR library and compilation of tables	M.Rohn
	23.03.2006				M. Rohn
1.0	11.12.2006			Compatible with L2BP v1.2 and L1BP v1.04.	D. Tan
1.1	23.02.2007			Compatible with L2BP v1.3, L1BP v1.05, and Bufr Edition 310. Change bars wrt V1.0.	D. Tan





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1 Introduction and Purpose of Document

This document is the User's Manual for supporting functionalities provided within WP2310 of the Project "Development and Production of Aeolus Wind Data Products".

Currently, the document describes the BUFR conversion of L1B data which links the output of the Aeolus PDS to a NWP system.

Later, the generation of L2B, L2C, and AMD products after the routinely assimilation of Aeolus data at the L2B MetPF at ECMWF can be included here.

The document serves to explain the software implementation together with instructions on how to install and apply the tools.

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2 BUFR template definition L1B/L2B data

The template definitions are contained in a separate document “WMO FM94 (BUFR) description ADM-Aeolus L1B/L2B products” [R3] to facilitate the planned WMO approval [R1] of the L1B data definition.

3 Level 1B to BUFR conversion

3.1 General

As part of the L2B processor software package a tool is provided to convert a L1B product in Earth-Explorer (EE) format to BUFR format used within a NWP environment. This section explains the dependency on the EE file handling and BUFR encoding software.

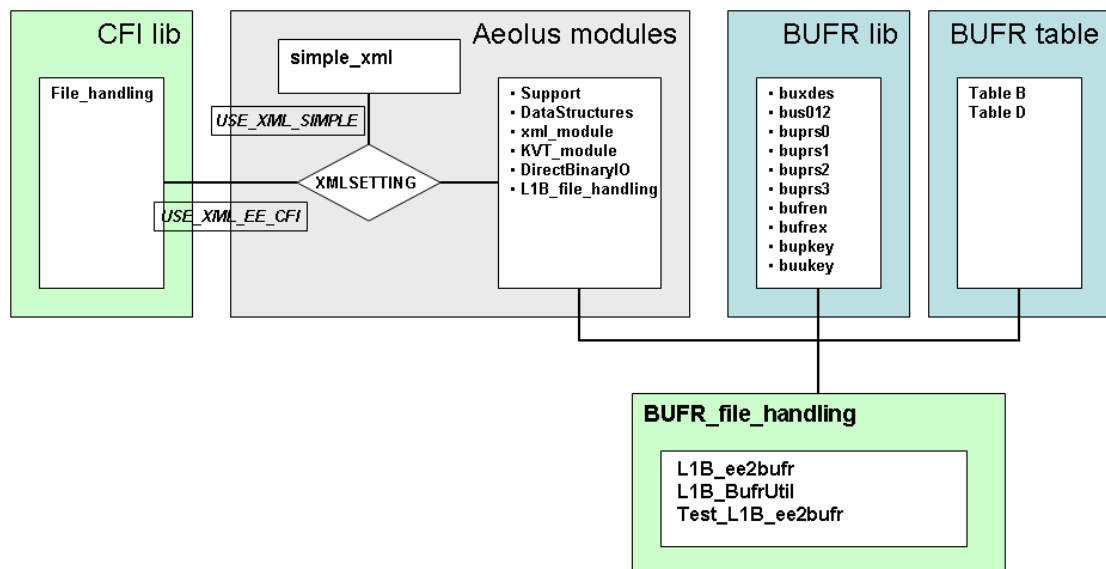




Figure 1: Package dependencies of the BUFR converter.

This conversion software (L1B_ee2bufr) makes use of the EE file handling functionality and is therefore included in the L2B processor software. However, the conversion can be used as standalone application independent from the actual L2B processing mode. In order to minimize external dependencies the software can be compiled without usage of the binary CFI library (see [R4] section on Software Requirements). Instead the native XML handling of the L2B processor software (simple_xml) is used.

For BUFR encoding and writing the converter uses the freely available BUFR software of ECMWF. Additionally, BUFR tables are provided including new descriptors defined to accommodate the new L1B elements.

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3.2 Software Requirements

Aeolus-modules of the following subdirectories are used:

\$BUILD / support

\$BUILD / DataStructures

\$BUILD / simple_xml (optional depending on compilation option “XML_SETTINGS”)

\$BUILD / KVT_module

\$BUILD / DirectBinaryIO

\$BUILD / L1B_file_handling

\$BUILD / BUFR_file_handling

\$BUILD / BUFR_tables

CFI library (optional depending on compilation option “XML_SETTINGS”)

ESA Earth Explorer CFI v3.4

BUFR software:

Encoding/Decoding WMO FM-94 BUFR: Version [310](#)

This version is the latest available update. It will be available for free download from [\[http://www.ecmwf.int/products/data/software/download/bufr.html\]](http://www.ecmwf.int/products/data/software/download/bufr.html).

The BUFR software is provided as part of the binary datapack of the L2B processor package (see [R4]) for the purpose of encoding the EE products into BUFR. Note the “Software Download Terms and Conditions” of ECMWF in Appendix A.

3.3 Installation

The compilation is done automatically when installing the L2B processor package ([R4]) based on default location of the external components CFI and BUFR library. Since the installation paths for these components might differ locally the compilation of the L1B_ee2bufr converter is explicitly described here.



3.3.1 Setting up the environment variables

The environment variable ARCH must be defined for the shell, and for compilers different from pgf90 the environment variable CNAME must also be defined. Edit the templates for these settings in the file \${BUILD}/Scripts/Set_SystemSettings:

```
# set ARCH = linux
# set CNAME = # default for CNAME can be blank
```

Notes:

1) ARCH - must be a defined shell variable. If not already set up in your environment, then uncomment in Scripts/Set_SystemSettings and modify to your platform architecture as appropriate.

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2) CNAME - should only be defined for systems using Fortran compilers different from pgf90. If not already set up in your environment, then uncomment in Scripts/Set_SystemSettings and modify to the name of your Fortran compiler (e.g. g95). This is because compilation of the BUFR library looks for a file `${BUILD}/BUFR_file_handling/${BUFR_INSTALL_DIR}/config/config.${ARCH}[_${CNAME}].` When CNAME is undefined, the standard config/config.linux file invokes the pgf90 Fortran compiler.

3.3.2 Making the Level-1B EE2BUFR convertor

The entire L2B processor package is assumed to be installed in a directory \$BUILD. The installation of the converter is done by a single make command:

```
%> cd ${BUILD}/BUFR_file_handling
%> make -f Makefile.aeolus all
```

The following steps are performed automatically and are based on the default definitions in `${BUILD}/Scripts/Set_Systemsettings`:

```
set BUFR_VERSION=000310
set BUFR_INSTALL_DIR=../BUFR_install
set BUFR_TABLE_DIR=../BUFR_tables
```

I. Compilation of the BUFR library:

The default path for the packed BUFR sources is `${BUILD}/BUFR_file_handling/${BUFR_INSTALL_DIR}`. After unpacking of the binary datapack file it contains a zipped file with the BUFR resources.

```
%> gunzip bufr_${BUFRVERSION}.tar.gz
%> tar xvf bufr_${BUFRVERSION}.tar
%> cd bufr_${BUFRVERSION}
%> make -f Makefile.aeolus all
```



The “Makefile.aeolus” simply links to the BUFR Makefile to interface with the iterative make strategy of the L2B processor package.

In case of a separate installation of the BUFR library at a different location please refer to the RE-ADME file provided with the BUFR software package.

II. Compilation of BUFR tables:

The default path for the BUFR tables is `${BUILD}/BUFR_file_handling/${BUFR_TABLES_DIR}`. These tables are ASCII tables which need to be compiled once.

```
%> cd ${BUILD}/BUFR_file_handling/${BUFR_TABLES_DIR}
%> ${BUFR_INSTALL_DIR}/bufr_${BUFRVERSION}/bufrtables/create_bufr_tables /
-o <tablename_without_extension>
```

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Here <tablename> refers to each of the two files (Table B: descriptors and Table D: sequences).

The BUFR software contains the WMO approved BUFR tables. During the development phase of the L2B Processor and prior to a possible WMO approval of the L1B BUFR template for ADM-Aeolus data BUFR tables are distributed together with the L2B processor software package.

III. Compile the Aeolus file handling modules:

As default the CFI library is used to access EE products. If required the usage of the native XML handling can be enabled by executing

```
%> ./use_simple_xml
```

prior to compilation as described in [R4] ("Context and installation Guide").

The compilation of the actual converter uses a simple make command:

```
%> make -f Makefile.aeolus all
```

IV. The test procedure follows the general validation strategy of the L2B processor:

```
%> make -f Makefile.aeolus test
```

It assumes the tables to be located in the default directory and defines the corresponding BUFR variable BUFR_TABLES accordingly:

```
%> export BUFR_TABLES=./${BUFR_TABLE_DIR}/
```

The test consists of a suite of tests corresponding to the following aspects:

- Compare result of table compilation with expected binary BUFR tables

```
${BUILD}/Test/BUFR_tables/testoutput.<tablename>.expected
```

- Compare log information for the conversion of two test data sets (N=20 and N=67 measurements):

```
${BUILD}/Test/BUFR_file_handling/testoutput*.L1B_ee2bufr.expected
```

- Decode the BUFR result file and compare the first and observation together with first and last measurement to the expected result:

```
${BUILD}/Test/BUFR_file_handling/testoutput*.TestL1B_ee2bufr.expected
```

3.4 How to run the software - standalone mode

- Set environment variable BUFR_TABLES to the directory where the compiled BUFR-tables can be found.



```
%> export BUFR_TABLES = <your BUFR table location>/
```

Note that the definition has to end with "/"!

- Executing the conversion :

```
%> <your converter location>/L1B_ee2bufr <filename without extension>
```

The conversion expects both the XML-header and the binary DBL-datablock file according to the EE format definition.



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Succesful execution will result in a file called “<filename without extension>.BUFR”.

3.5 Design

This section lists the software components of the converter and explains the purpose of each subroutine.

Directory	Resource	Description
./BUFR_file_handling	L1B_ee2bufr.F90	Main program
	L1B_BufrUtil.F90	Subroutines for definition of BUFR sections, descriptor list and population of message.
	Test L1B_ee2bufr.F90	Test program to print data for comparison of content
	Makefile.aeolus	
./BUFR_tables	B0000000000098015001.TXT	Table B descriptors
	D0000000000098015001.TXT	Table D sequences
	Objects.txt	Declaration of current table version
	Makefile.aeolus	
./BUFR_install	< bufr_000310.tar.gz : provided by binary datapack of the L2B processor installation >	This directory contains the BUFR library publicly available by download. (Version: 000310)
./Test/BUFR_file_handling	Testoutput1.L1B_ee2bufr.expected	Test existence of converter
	Testoutput2.L1B_ee2bufr.expected	Conversion TDS 1
	Testoutput3.L1B_ee2bufr.expected	Conversion TDS 2
	Testoutput4.L1B_ee2bufr.expected	Compare content TDS 1
	Testoutput5.L1B_ee2bufr.expected	Compare content TDS 2
	Makefile.aeolus	
./Test/BUFR_tables	testoutput.B0000000000098015001	Table B generation
	testoutput.D0000000000098015001	Table D generation

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Directory	Resource	Description
	<B0000000000098015001.expected.LINUX_pgf90 provided by binary datapack of installation >	Compare result Table B
	<D0000000000098015001.expected.LINUX_pgf90 provided by binary datapack of installation >	Compare result Table D
	Makefile.aeolus	

The following calling trees explain the usage of the different subroutines:

main

L1B_ee2bufr

```

|
+--> call InitReadL1BfileModule
+--> call pbopen                ! BUFR file
+--> call Init_L1B_DataStructure
+--> call ReadL1Bfile

+--> call L1B_bufr_encode_init  ! prepare first obs



+--> LOOP NOOBSERVATIONS
|
+--> call Init_L1B_DataStructure
+--> call ReadL1Bfile
+--> call L1B_bufr_encode

IF (LAST OBS or MESSAGE FULL)
|
+--> call L1B_bufr_encode_finish
+--> call pbwrite
+--> call L1B_bufr_encode_init
ENDIF

ENDLOOP

+--> call Delete_L1B_DataStructure

```

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```
+--> call pbclose
```

#subroutines in L1B_BufrUtil

L1B bufr encode init

```
|
+--> call set_L1B_bufr_sec0
+--> call set_LxB_bufr_header_dd      ! set template header section
+--> call set_L1B_bufr_data_obs_dd    ! set template obs scale
+--> call set_L1B_bufr_data_meas_dd  ! set template measurement scale
```

L1B bufr encode

```
|
+--> call fill_L1B_bufr_header
+--> call fill_L1B_bufr_data_obs
+--> LOOP MEASUREMENTS
|
+--> call fill_L1B_bufr_data_meas
ENDLOOP
```



L1B bufr encode finish

```
|
+--> call buprq
+--> call set_L1B_bufr_sec1
+--> call set_L1B_bufr_sec2
+--> call set_L1B_bufr_sec3
+--> call buxdes                ! QC: check template
+--> call bufren
```

4 Exit Codes

These are TBD and will be tabulated here in future versions of this document.



5 Abbreviations

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ADM	Atmospheric Dynamic Mission
BRC	Basic Repeat Cycle
BUFR	Binary Universal Format for Representation
L1B	Level 1B
L2B	Level 2B
MetPF	Meteorological Processing Facility
NRT	Near Real Time
PDS	Payload Data Segment
QRT	Quasi Real Time
TBD	To be defined

6 References

- [R1]** Enhanced Aeolus Level 2B/2C Functionalities & Pre-Launch Validation, AE-SW-ESA-GS-023.
- [R2]** Purpose and Functionality of Tools (WP2310), AE-TN-ECMWF-L2P-0071.
- [R3]** WMO FM94 (BUFR) description ADM-Aeolus L1B/L2B products, AE-TN-ECMWF-L2P-0072-TEMPLATE.
- [R4]** Aeolus Level-2B Processor User's Manual, AE-MA-ECMWF-L2BP-001.

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