

## L2B BUFR Converter Software User Manual

### Authors

JOS DE KLOE  
KNMI

MICHAEL RENNIE  
ECMWF

**CHANGE LOG**

Version	Date	Comment
0.1	21 September 2017	First draft
0.2	13 October 2017	Adapted to comments by Michael Rennie
1.0	13 April 2018	Adapted to comments by Anne Grete Straume

## Contents

Contents .....	3
1 Introduction .....	4
1.1 Documents .....	5
1.1.1 Reference documents .....	5
1.2 Acronyms .....	6
2 Tool installation .....	7
3 Operation of the L2B BUFR converter tool.....	8
4 Usage guide of the data contained in the BUFR files .....	10
5 Conclusion .....	11

## 1 Introduction

This document is a short guide to using the BUFR conversion tool delivered as part of the L2B processor package. The tool is provided mainly for users in the NWP community who wish to run their own copy of the L2B wind processing. Since the BUFR file format is so commonly used for input files in NWP data assimilation, a tool is provided that allows to read the binary file format generated by the L2B processor and convert it to a BUFR file holding the key wind and quality information.

Section 2 briefly discusses the installation instructions. Section 3 discusses the way the tool should be operated. Finally, Section 4 explains how the data stored in the generated BUFR files is organised and how it can be used. Some final remarks in Section 5 close this document.

## 1.1 Documents

### 1.1.1 Reference documents

	Title	Ref	Ver.	Date
[RD1]	Aeolus Level-2B Processor Software User's manual	AE-MA-ECMWF-L2BP-001-SUM	1.8	6-Sep-2017
[RD2]	ADM-Aeolus Level-2B BUFR description	AE-TN-ECMWF-L2BP-0073	1.0	23-Nov-2015

## ***1.2 Acronyms***

KNMI	Royal Netherlands Meteorological Institute
L2B	Level-2B
L2Bp	L2B processor
NWP	Numerical weather prediction

## 2 Tool installation

The L2B BUFR conversion tool is part of the L2B processor package, and as such only compatible to linux and unix systems. Other computer systems are not supported.

The tool is built from source code provided by the L2B processor source code, and the build is part of the normal build procedure for the L2B processor. Further details can be found in .

It is highly recommended to also run the tests provided with the L2B processor. The BUFR converter tool shares a significant amount of source code with the L2B processor, and by running the tests you verify that all this code works as intended.

After executing the build, test, and install stages as detailed in , you will find the executable named “L2B\_ee2bufr” in the folder:

`$INSTALL/bin/`

This tool is statically linked and can without problems be copied to another location if needed.

### 3 Operation of the L2B BUFR converter tool

The L2B BUFR conversion tool takes the following inputs:

1. The BUFR tables that define the details of the BUFR file to be produced.
2. A JobOrder file that is used to communicate the name of the input L2B product file to the conversion tool

The required BUFR tables are the official WMO approved BUFR tables [version 26](#)<sup>1</sup> (as published in May 2016) or [newer](#)<sup>2</sup>. A copy of the needed tables<sup>3</sup> is provided after installation of the tool as detailed in section **Fout! Verwijzingsbron niet gevonden.** in folder:

```
$INSTALL/BUFR_tables/
```

Before the converter tool can be used an environment variable must be set to point the software to the location where these tables can be found. On a bash shell this typically is a command like:

```
export BUFR_TABLES=/full/path/to/BUFR_tables/
```

If needed the BUFR table files themselves can be moved to another location, as long as the mentioned environment value is updated as well to point to the right location.

The tool is operated by calling its name, followed by a single command line argument. This argument must be the so called JobOrder file (which is an ESA interface requirement). Therefore the tool invocation typically must look like:

```
/path/to/L2B_ee2bufr /path/to/JobOrderFile.xml
```

The JobOrder file is a fairly simple xml file, which defines the required inputs and output locations for one or more processing steps.

This file must be edited by the user (manually or using a script) to define:

1. The single input to the converter, which is the L2B product file to be converted
2. The output directory where the result must be stored.

An example JobOrder file to only run the L2B BUFR converter tool can be found in:

```
$INSTALL/working/example_testcase_1/
```

and is named:

```
JobOrder.run_l2b_ee2bufr_only.xml [available in L2BP release v3.1 and above]
```

An example script running the L2B processor, the L2B BUFR converter, and the so called report generator tool, is present in this directory and is named:

```
JobOrder.run_l2b_processor_l2b_ee2bufr_and_report_generator.xml
```

If the section following `<Ipf_Proc> <!-- L2B_ee2bufr conversion Task -->` is modified as described above, and the JobOrder file is passed on to the L2B\_ee2bufr executable, the settings inserted in it will be used. The other two definitions will just be ignored, and can be left as is.

1 See: [http://www.wmo.int/pages/prog/www/WMOCodes/WMO306\\_vI2/PrevVERSIONS/PreviousVERSIONS.html](http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/PrevVERSIONS/PreviousVERSIONS.html)

2 See: [http://www.wmo.int/pages/prog/www/WMOCodes/WMO306\\_vI2/LatestVERSION/LatestVERSION.html](http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/LatestVERSION/LatestVERSION.html)

3 It should be noted that the L2BP BUFR converter tool (L2B\_ee2bufr) used local BUFR tables during development of the BUFR template. This is the case for L2BP versions 2.30 and before. In this case a user should use the local BUFR table files named B000000000098026002.TXT and D000000000098026002.TXT. For L2BP version 3.00 or above the official WMO tables as described in the main text should be used. These are named B000000000000026000.TXT and D000000000000026000.TXT (so without the 98 in their names).



At the moment no reader tool for the BUFR products is included in the L2B processor software package. However, there are several general tools that can be used to inspect the contents of these files. Examples are:

- the bufr\_dump tool from the ECMWF [ecCodes package](#)<sup>4</sup>
- the bufr\_to\_ascii.py script from the python [BUFR reader module](#)<sup>5</sup>

4 See: <https://software.ecmwf.int/wiki/display/ECC/ecCodes+Home>

5 See: <https://pypi.python.org/pypi/pybufr-ecmwf/>

## 4 Usage guide of the data contained in the BUFR files

The structure of the L2B BUFR product is defined in . It must be noted that the L2B BUFR product only contains a subset of the data contained in the binary L2B product file. It is a simplified version, but does contain the parameters which are most important to end users.

The BUFR file itself is structured as a long list of individual HLOS wind retrieval results with associated geolocation and product confidence data.

It should be specifically noted that we do not provide profile definitions as such. However, each wind does have a profile index number, and by scanning the product for wind results with the same profile index a profile can be reconstructed.

Please note that the L2B wind processing does weighted horizontal averaging of the spectrometer signals before calculating the winds on each level. This has as consequence that winds on each level may be located at different locations along the orbit and should not be expected to form a vertical (or slanted) profile.

For each wind result we provide the coordinates of the box on the “curtain” of atmosphere that was measured by Aeolus. We provide bottom and top of the range bin, and start and end latitude, longitude and date-time of the region that was accumulated.

We also provide a “center-of-gravity” along the horizontal and vertical (slanted LOS) axis that defines the weighted average location of the signal used to calculate the current wind result. Depending on the sorting on clear and cloudy measurements within the accumulation box, this can be anywhere inside the box.

The wind results themselves come with a Confidence flag. Only if the Confidence flag is set to “Valid” the winds should be used. Invalid winds are provided as well, but these are mostly interesting for problem investigation by the Aeolus L2B team.

Finally, for the Rayleigh channel it should be noted that a forecasted value of pressure and temperature was used in the wind retrieval. These were taken from the operational ECMWF model. Other users may wish to use the pressure and temperature information from another (limited area or global) NWP model. To allow this, a set of partial derivatives (of HLOS wind with respect to temperature and pressure) is provided together with the actually used pressure and temperature values. In this way the wind result can be corrected (under a tangent-linear assumption) to be consistent with deviations in these parameters between the ECMWF and the other model

The same can be done for the backscatter ratio. The L2B processing estimates a value from the Aeolus spectrometer data. In case a user wishes to test winds consistent with other backscatter auxiliary data this is possible using the provided partial derivative (of HLOS wind with respect to backscatter ratio).

## 5 Conclusion

In case you still have questions regarding this conversion tool or the use of the Aeolus L2B BUFR data after reading this document, or if you have any other related questions, feel free to contact the Level-2B processing team via [aeolus@ecmwf.int](mailto:aeolus@ecmwf.int).