


**EUMETSAT
POLAR
SYSTEM**

**EPS Programme:
NOAA2EPSL1B User's
Guide**




Ref.: EUM.EPS.SYS.TEN.02.018
Issue: 2 Rev: 0
WBS Number: 240000
Date: 22/07/2004

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DOCUMENT SIGNATURE TABLE

	NAME	FUNCTION	SIGNATURE	DATE
Prepared By	Ahmad Qadir	Software Engineer		
Issued By	Maria Angeles Capellades	Imagery Engineer		
	Dorothee Diebel	System EIV&V Team Leader		

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DOCUMENT CHANGE RECORD

Issue / Revision	Date	DCN No.	Changed Pages / Paragraphs
Issue 1 Revision 0	30/11/2002		First Issue
Issue 1 Revision 1	28/02/2003		Updated to be consistent with the latest release (CN26 Baseline) of EPS product format specifications and to handle AVHRR-GAC products.
Issue 2 Revision 0	22/07/2004		Updated to be consistent with the April 2004 release of EPS product format specifications.



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1 INTRODUCTION

1.1 Purpose and Scope

The NOAA2EPSL1B set of tools is a collection of programs that can be used to generate and verify simulated EPS ATOVS level 1b products using NOAA K, L and M level 1b products as input. This document describes the programs from a users point of view. For a more in depth discussion of the NOAA2EPSL1B specification and design see RD1.

1.2 Document Structure


Section 2 – Overview of the NOAA2EPSL1B set of tools.

Section 3 – Installation instructions.

Section 4 – Software usage.


1.3 Referenced documents

- RD1 NOAA2EPSL1B Specifications and Design Document, EUM.EPS.SYS.TEN.02.019, Issue 2 Rev 0, July 2004.
- RD2 MetOpizer Specifications and Design Document, EUM.EPS.SYS.TEN.02.003, Issue 2 Rev 0, December 2003.
- RD3 MetOpizer Simulated MHS Characteristics, EUM.EPS.SYS.TEN.02.005, Issue 1 Rev 1, November 2002.
- RD4 EPS Generic Product Format Specification, EPS.GGS.SPE.96167, Issue 6 Rev 4 February 2003.
- RD5 EPS AMSU-A Level 1 Product Format Specification, EPS.MIS.SPE.97228, Issue 6 Rev 4, March 2004.
- RD6 EPS MHS Level 1 Product Format Specification, EPS.MIS.SPE.97229, Issue 6 Rev 5, March 2004.
- RD7 EPS HIRS Level 1 Product Format Specification, EPS.MIS.SPE.97230, Issue 6 Rev 4, March 2004.
- RD8 EPS AVHRR Level 1 Product Format Specification, EPS.MIS.SPE.97231, Issue 6 Rev 5, March 2004.
- RD9 NOAA K, L, M User's Guide – <http://www2.ncdc.noaa.gov/docs/klm/>
- RD10 NOAA Satellite Active Archive – <http://www.saa.noaa.gov/>

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1.4 Acronyms

AMSU-A	Advanced Microwave Sounding Unit-A
AMSU-B	Advanced Microwave Sounding Unit-B
ATOVS	Advanced TIROS Operational Vertical Sounder (It is used as a simplified name for the AVHRR, MHS/AMSU-B, AMSU-A and HIRS group of instruments)
AVHRR	Advanced Very High Resolution Radiometer
CCSDS	Consultative Committee for Space Data Systems
EPS	Eumetsat Polar System
GAC	Global Area Coverage
GEADR	Global External Auxiliary Data Record
GIADR	Global Internal Auxiliary Data Record
GPFS	Generic Product Format Specification
GRH	Generic Record Header
HIRS	High-Resolution Infrared Radiation Sounder
I/O	Input/Output
IPR	Internal Pointer Record
LAC	Local Area Coverage
MDR	Measurement Data Record
MHS	Microwave Humidity Sounder
MPHR	Main Product Header Record
NOAA	National Oceanic and Atmospheric Administration
PFS	Product Format Specification
SAA	Satellite Active Archive
SPHR	Specific Product Header Record
TIROS	Television Infrared Observation Satellite
VEADR	Variable External Auxiliary Data Record
VIADR	Variable Internal Auxiliary Data Record


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2 OVERVIEW

The NOAA2EPLS1B set of tools include three executables:

- noaa2eps1b*** Converts NOAA K, L, M level 1b products (see RD9) into their equivalent EPS ATOVS level 1b products as defined in documents RD4 to RD8.
- eps_11b_displayer*** Displays the contents of EPS ATOVS level 1b products (Note that this is not a full EPS level 1b displayer as it does not accept EPS ATOVS products as input, see section 4.2 for further details).
- noaa_11b_displayer*** Used to display the contents of NOAA K, L, M level 1b products. This displayer has been adopted from the MetOpizer (see RD2) set of tools and has been modified to read and display more fields from the NOAA products.

The executable, *noaa2eps1b*, is the main formatting tool developed to simulate realistic EPS products. The two displayers, *noaa_11b_displayer* and *eps_11b_displayer*, have both been developed to allow the contents of the input NOAA K, L, M level 1b products and the output EPS ATOVS level 1b products to be inspected. The main aim of both displayers is to aid the testing and verification of the *noaa2eps1b* formatter. Hence, the displayers only display fields that are either used or simulated by the *noaa2eps1b* formatter.

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3 INSTALLATION

3.1 Supplied files

The NOAA2EPSL1B release is a single archive called noaa2eps1b.<version>.tar.gz containing source code, a make file and some supporting files (see the Appendix for a full file listing). Documentation is supplied separately and consists of a:

User's Guide – This document.

Specifications and Design Document – Contains a more detailed description of the configuration files and the internal objects that make up the NOAA2EPSL1B tool (RD1).

Simulated MHS Characteristics Document – Contains a description of the virtual MHS device used to generate telemetry for the MHS, which combined with AMSU-B science data is utilised to produce EPS format MHS level 1b products.

3.2 Supported platforms and requirements

The NOAA2EPSL1B set of tools were developed and tested under Solaris 2.8 using the Sun C++ compiler v6.2 and also under Red Hat Linux v9 using the GCC v3.2.2 C++ compiler. There are no other dependencies.

3.3 Compilation


The make file in the top level directory will compile all three executables that make up the NOAA2EPSL1B set of tools.

The top level targets “clean” and “veryclean” will remove temporary compilation files and temporary compilation files plus executables respectively.

3.4 Configuration files

The NOAA2EPSL1B programs require configuration parameters that are read from a text file. The program will try the following four methods in the order listed below to find its settings:

- If the command line arguments include “—config <filename>” then <filename> will be read.
- If the environment variable \$NOAA2EPSL1B_CONFIG_DIR is defined the program will look inside that directory for its configuration file. The default filenames are listed below.
- If the environment variable is not set, the program will look in the directory “\$HOME/.noaa2eps1b” for its file.

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- If no file is found a set of default values will be used.

The default configuration filenames are:


Config file	Used by
amsua.config	noaa2eps1b and eps_l1b_displayer
avhrr.config	noaa2eps1b and eps_l1b_displayer
hirs.config	noaa2eps1b and eps_l1b_displayer
mhs.config	noaa2eps1b and eps_l1b_displayer

3.5 Set up

The top directory contains two script files noaa2eps1b.bash and noaa2eps1b.csh. These set up the PATH and NOAA2EPSL1B_CONFIG_DIR variables for bash-style shells and c-style shells respectively.

3.6 Testing

To test the main functionality, a set of NOAA K, L, M level 1b product files or a set of EPS ATOVS level 1b product files are required. However, for a basic test, each program can be executed with the “—version” flag just to ensure that it runs.

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4 PROGRAMS

This section describes the purpose and usage of each of the NOAA2EPSL1B programs. Further descriptions of the design of each program can be found in RD1.

4.1 noaa2eps1b

4.1.1 Purpose

To convert NOAA K, L, M level 1b products into EPS ATOVS level 1b products.

4.1.2 Inputs

NOAA K, L, M level 1b products (as defined in RD9):

- AMSU-A
- AMSU-B
- AVHRR – 10 bits per word format.
- HIRS

4.1.3 Outputs

EPS ATOVS level 1b products (as defined in RD4 to RD8):

- AMSU-A
- MHS
- AVHRR
- HIRS


The type of output produced is automatically selected from the input supplied. For example, if a NOAA AMSU-B product is used as input, the formatter will recognise it and produce an EPS MHS product as output.

4.1.4 Usage

```
noaa2eps1b [--in <filename>] [--out <filename>] [--config <filename>] [--show-config] [--show-stats] [--help] [--version]
```

where:

- in <filename> Specify name of input file (Specifying the input file name is essential because without it the tool does not know what file to read. Note that this is the only input field that must be specified. All the other fields are optional and can be left undefined).
- out <filename> Specify name of output file. Once an input file is specified, the code will automatically generate an output file name consistent with the EPS product naming conventions as defined in RD4. Hence, setting


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this field is optional, as it only needs to be set if the automatically generated name is not wanted. (Optional)

- config <filename> Specify name of configuration file. If the config field is left undefined, the code automatically searches for the relevant configuration file, first in the directory \$NOAA2EPSL1B_CONFIG_DIR and then in the directory \$HOME/.noaa2eps1b/. If the configuration file is not found a set of hard coded default values are used. Hence, setting the config field is optional, as it only needs to be defined if the user wants to use a configuration file that is different from those stored in the directories mentioned above (Optional).
- show-config Display the contents of the configuration file used once the processing is finished (Optional).
- show-stats Display the scene radiance mean, variance and ranges per channel (Optional).
- help Show usage information (Optional).
- version Show program version (Optional).

4.1.5 Description

Given a NOAA K, L, M level 1b product as input, the noaa2eps1b tool opens and reads in the product, determines its instrument type, reads the appropriate configuration file contents and executes the appropriate instrument reader filter (see RD1). The instrument reader filter converts the information gathered from the NOAA product and the configuration file into an EPS level 1b product as defined in the Generic Product Format Specification (RD4) and corresponding Product Format Specification (RD5 to RD8). The code automatically generates an appropriate output file name as defined in RD4 unless one is specified using the "--out" option. If the "--show-config" option is selected, the contents of the configuration file used is displayed once all the formatting is complete.

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4.2 eps_l1b_displayer

4.2.1 Purpose

To read NOAA K, L, M level 1b products, convert them into EPS ATOVS level 1b products and display the resulting EPS product as a text output.

4.2.2 Inputs

NOAA K, L, M level 1b products (as defined in RD9):

- AMSU-A
- AMSU-B
- AVHRR – 10 bits per word format.
- HIRS

4.2.3 Output


Text display of the corresponding EPS ATOVS level 1b product (as defined in RD4 to RD8).

4.2.4 Usage

```
eps_l1b_displayer [--in <filename>] [--record <record number>] [--config <filename>] [--show-config] [--show-stats] [--help] [--version]
```

where:


- | | |
|----------------------------------|--|
| <filename> | Specify name of input file (Specifying the input file name is essential because with out it the code does not know what file to read). |
| <record number> | The program only displays a single block from the input product at any one time. Block 0 (or record number 0) always shows the header information (MPHR, SPHR, IPRs, GADRs and VADRs). Blocks 1 and above display the contents of the measurement data records (MDRs). Note that the header display shows the total number of MDRs present. |
| --config <filename> | Specify name of configuration file. If the config field is left undefined, the code automatically searches for the relevant configuration file, first in the directory \$NOAA2EPSL1B_CONFIG_DIR and then in the directory \$HOME/.noaa2eps11b/. If the configuration file is not found a set of hard coded default values are used. Hence, setting the config field is optional, as it only needs to be defined if the user wants to use a configuration file that is different from those stored in the directories mentioned above (Optional). |
| --show-config | Display the contents of the configuration file used once the processing is finished (Optional). |

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- show-stats Display the scene radiance mean, variance and ranges per channel (Optional).
- help Show usage information (Optional).
- version Show program version (Optional).

4.2.5 Description

This program was written to verify the correctness of the output of the noaa2eps1b formatting tool. This tool is not intended to be a generic EPS level 1b reader. Consequently, this code cannot directly read in EPS ATOVS level 1b products. Instead, it reads NOAA K, L, M level 1b products, converts it into EPS ATOVS level 1b format and outputs the data as text.

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4.3 noaa_l1b_displayer

4.3.1 Purpose

To read NOAA K, L, M level 1b products and display their contents in a decoded text format.

4.3.2 Inputs

NOAA K, L, M level 1b products (as defined in RD9):

- AMSU-A
- AMSU-B
- AVHRR – 10 bits per word format.
- HIRS

4.3.3 Outputs

Text display of the corresponding NOAA level 1b products contents.

4.3.4 Usage


noaa_l1b_displayer <filename> <record number> [--help] [--version]

where:

- | | |
|------------------------------|---|
| <filename> | Specify name of input file (Specifying the input file name is essential because with out it the code does not know what file to read). |
| <record number> | The program only displays a single block from the input product at any one time. Block 0 (or record number 0) always shows the header record. Blocks 1 and above display the contents of the data records. Note that the header display shows the total number of data records present. |
| --help | Show usage information (Optional). |
| --version | Show program version (Optional). |

4.3.5 Description

This program was developed for testing purposes. It is not intended to be a generic NOAA K, L, M level 1b product reader. It only supports the NOAA K, L, M level 1b file formats (AVHRR, AMSU-A, AMSU-B, HIRS). This code only supports the 10 bits per sample AVHRR format. In addition, the text output produced does not show the full contents of the NOAA level 1b products and only concentrates on fields used by the noaa2eps1b tool.

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5 APPENDIX

Inside the NOAA2EPSL1B software package, the code is separated into the following subdirectories:

- /src – C++ source files (*.cpp).
- /bin – Binary executables.
- /inc – C++ header files (*.hpp).
- /conf – Instrument specific configuration files (*.config).

The remainder of this appendix lists the full contents of the base directory and the subdirectories mentioned above.

File listing of base directory:

File Name	Usage
FILES	Test file containing file listing.
Makefile	Project makefile, builds all executables.
makefile.linux	Linux specific makefile called by the main project Makefile.
makefike.sun	Sun Solaris specific makefile called by the main project Makefile.
README	Readme text file.
VERSIONS	Text file containing version information.


File listing of 'src' directory containing all the C++ cpp files:

eps_l1b_displayer.cpp
noaa2eps1b.cpp
noaa_l1b_displayer.cpp

File listing of 'bin' directory containing all the binary executables:


eps_l1b_displayer
noaa2eps1b
noaa_l1b_displayer

*Note that each cpp file builds one executable with the same base name.

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File listing of 'inc' directory containing all the C++ header files:

File name	Contains
amsua.hpp	Miscellaneous code associated with AMSU-A
amsuareader.hpp	AMSU-A Reader filter
avhrr.hpp	Miscellaneous code associated with AVHRR-LAC products
avhrrreader.hpp	AVHRR-LAC Reader filter
avhrr_gac.hpp	Miscellaneous code associated with AVHRR-GAC products
avhrrreader_gac.hpp	AVHRR-GAC Reader filter
common.hpp	Miscellaneous functions
config.hpp	Code to parse configuration files, and definitions of all configuration files used.
eps1b.hpp	Miscellaneous code associated with the EPS generic format
eps1b_gen_header.hpp	Filter to create the EPS generic header (MPH)
epsproductextractor.hpp	EPSProductExtractor filter
epsproductproducer.hpp	EPSProductProducer interface
epstextheaderdisplayer.hpp	EPSTextHeaderDisplayer filter
epstextheaderproducer.hpp	EPSTextHeaderProducer interface
epstextrecorddisplayer.hpp	EPSTextRecordDisplayer filter
epstextrecordproducer.hpp	EPSTextRecordProducer interface
fileconsumer.hpp	FileConsumer interface
fileproducer.hpp	FileProducer interface
filereader.hpp	FileReader filter
hirs.hpp	Miscellaneous code associated with HIRS
hirsreader.hpp	HIRS Reader filter
mhs.hpp	Miscellaneous code associated with MHS
mhsreader.hpp	MHS Reader filter
mhstempconv.hpp	Functions and look up tables for converting MHS temperature values to and from AMSU-B instrument counts.
noaa.hpp	Various structs for representing NOAA level 1b format data.
noaaproductreader.hpp	NOAAPProductReader filter

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productproducer.hpp	ProductProducer interface
singlefilewriter.hpp	SingleFileWriter filter
spinner.hpp	A collection of ascii art spinners displayed to the user on the screen during long calculations.
textconfigdisplayer.hpp	TextConfigDisplayer filter
textconfigproducer.hpp	TextConfigProducer interface
textheaderdisplayer.hpp	TextHeaderDisplayer filter
textheaderproducer.hpp	TextHeaderProducer interface
textrecorddisplayer.hpp	TextRecordDisplayer filter
textrecordproducer.hpp	TextRecordProducer interface

File listing of 'conf' directory containing all the instrument specific configuration files:

amsua.config
avhrr.config
hirs.config
mhs.config