

# OMNO2d File Specification

OMI NO<sub>2</sub> Algorithm Team

Document version: 1.1, January 10, 2013

Data product version: 2.1

## 1. Introduction

### 1.1 Purpose of the document

This document specifies Version 2.1 of the OMI Level 3 NO<sub>2</sub> data product, OMNO2d. This product is produced by the OMI NO<sub>2</sub> Level 3 software, from the OMI NO<sub>2</sub> Level 2 data product. The files may be found on the Goddard Earth Sciences Data and Information Services Center (GES-DISC): [http://disc.sci.gsfc.nasa.gov/Aura/data-holdings/OMI/omno2d\\_v003.shtml](http://disc.sci.gsfc.nasa.gov/Aura/data-holdings/OMI/omno2d_v003.shtml) .

### 1.2 Definitions, acronyms, and abbreviations

AMF	Air Mass Factor
APP	Application
DOAS	Differential Optical Absorption Spectroscopy
ECS	EOS Core System
HDF	Hierarchical Data Format
HDF-EOS	Hierarchical Data Format - Earth Observing System
IVCD	Initial Vertical Column Density
NISE	Near-real-time Ice and Snow Extent
NRT	Near Real Time
ODL	Object Description Language
OMI	Ozone Monitoring Instrument
OPF	Operational Parameter File
PGE	Product Generation Executive
SAA	South Atlantic Anomaly
SCD	Slant Column Density
SDP	Science Data Production
TAI	International Atomic Time
TBA	To Be Added
TBC	To Be Confirmed
TBD	To Be Determined
TBU	To Be Updated
VCD	Vertical Column Density

## 1.3 References

### 1.3.1 Applicable documents

- AD1 HDF-EOS Aura File Format Guidelines, NCAR SW-NCA-079, Version 1.3, 27 August 2003.

### 1.3.2 Reference documents

- RD1 HDF-EOS Interface Based on HDF5, 175-TP-511-001, March 2001.
- RD2 SDP Toolkit Software Version 2, and the SDP Users Guide for the ECS Project GSFC 333-CD-100-002, Version 2.0, January 1999.
- RD3 OMI Level 1B Product Format Specification, SE-OMIE-0562-FS/00, Issue 1 (draft 7), 14 August 2002.
- RD4 Near Real-Time SSM/I EASE-Grid Daily Global Ice Concentration and Snow Extent, March 2002, URL: <http://nsidc.org/data/docs/daac/nise1nise.gd.html>
- RD5 OMIS Activity Definitions, RP-OMIE-KNMI-335, Issue 1, June 17, 2002.
- RD6 Release 6A.07 Toolkit Users Guide for the ECS Project, 333-CD-605-001, p. 6-310, May 2002.

## 2. Overview of the product

The OMI Level-3 data product contains averaged NO<sub>2</sub> vertical columns, reported on a 0.25° x 0.25° geographical grid. Total vertical column amounts and tropospheric vertical column amounts are given, both with and without cloud screening. In addition, a weight is given for each grid cell, which can be used to calculate spatial or temporal averages.

### 2.1 Product identifier

The identifier for the OMI NO<sub>2</sub> product as provided by the OMI Science Support Team is “OMNO2d”. The “d” identifies this product as being a Level-3 (gridded) data product, composed of averages of Level-2 pixel data.

## 2.2 File names

The file name convention is specified in AD1. OMI file names have 4 sections within the base name of the file. Sections are delimited by an underscore character ( \_ ). The suffix follows the base name from which it is separated by a period. The four sections of the base name are InstrumentID, DataType, DataID, and Version. Thus, the filename is constructed in the following way:

*<Instrument ID>\_<DataType>\_<Data ID>\_<Version>.<Suffix>*

Table 1 details the contents of the four sections and the suffix are given.

The following is an example of a file name:

OMI-Aura\_L3-OMNO2d\_2004m1024\_v003-2013m0109t111834.he5

Table 1

Section	Format	Description
Instrument ID	OMI-Aura	ID for instrument and spacecraft.
Data Type	L3-OMNO2d	Level and product indicators
DATA ID	<i>&lt;date&gt;</i>	Date indicators. Date format: <i>&lt;yyyy&gt;m&lt;mmdd&gt;</i>
Version	<i>v&lt;version&gt;-&lt;production date and time&gt;</i>	Version indicators: version format: <i>&lt;nnn&gt;</i> date-time format: <i>&lt;yyyy&gt;m&lt;mmdd&gt;t&lt;hhmmss&gt;</i>
Suffix	he5	Suffix for product file

## 3. The data file

### 3.1 Description

The OM Level 3 NO<sub>2</sub> product data file contains the data and metadata produced by the OMNO2d software. The input for this product is the OMI Level-2 data product, OMNO2.

### 3.2 Format

The format of the data file is HDF-EOS 5, as described in RD1. To ease the use of Aura data sets, the Aura teams have agreed to make their files match as closely as reasonably possible. To this end, the Aura teams have agreed on a set of guidelines for their file formats, which are described in AD1.

### 3.3 Structure

The data file uses the HDF-EOS Grid format. There is a single grid group, called **ColumnAmountNO2**.

### 3.4 Grid structure

Each HDF-EOS 5 Grid structure consists of data fields, geolocation fields, and profile fields. In this product no profile fields or geolocation fields are used. All data fields are defined by their type, dimension and attributes. Attributes of the Grid group are shown in Table 2.

Table 2. Attributes of the Grid group **ColumnAmountNO2**

Attribute	Value
GCTPProjectionCode	0
GridOrigin	Center
GridSpacing	(0.25, 0.25)
GridSpacingUnit	deg
GridSpan	( -180 , 180 , -90 , 90 )
GridSpanUnit	deg
NumberOfLatitudesInGrid	720
NumberOfLongitudesInGrid	1440
Projection	Geographic

All data fields within the Grid group ColumnAmountNO2 have field-level attributes. These are listed in Table 3.

Table 3. Field-level attributes

Attribute name	Attribute type	Attribute Description
_FillValue	Same type as data field	Contains the value for missing data (See Table 4.)
MissingValue	Same type as data field	Contains the value for missing data (See Table 4.)
Title	HE5T_NATIVE_CHAR	Title of the field
Units	HE5T_NATIVE_CHAR	Units after applying the scale factor and offset
ScaleFactor	1.0	Factor for scaling data
Offset	0.0	Value to add to the data
Description	HE5T_NATIVE_CHAR	Contains a text description of the field, including filtering information. (See Section 3.4.1.)

Table 4. Fill Values

Data Type	Fill Value
HE5T_NATIVE_INT8	-127
HE5T_NATIVE_UINT8	255
HE5T_NATIVE_INT16	-32767
HE5T_NATIVE_UINT16	65535
HE5T_NATIVE_INT32	-2147483647
HE5T_NATIVE_UINT32	4294967295
HE5T_NATIVE_FLOAT	$-2^{100}$ (-0X1p+100)
HE5T_NATIVE-DOUBLE	$-2^{100}$ (-0X1p+100)

### 3.4.1 Description attribute (field-level)

The field-level Description attribute contains a text description of the field. To the extent possible, the HE5 file is self-documenting, and this attribute is designed to record the inputs and filtering that has gone into the calculation of the field.

The Description attribute is a comma-separated list of expressions of the form *<parameter> = <specification>* . Two required parameters are **Field** and **StdField**. For these two parameters, the *<specification>* is the name of a Level-2 data field. An optional parameter **UseScanPosition** may be specified. In this case, the specification would be a list of 60 values 1 or 0. The positions containing 1s are used, while those containing 0 are not.

All other expressions in the comma-separated list have *<parameter>* values that are names of Level-2 fields. For these, the *<specification>* may be a single value, a

logically-negated value (discussed below), or a range of values. Ranges are given in the form “[<val1>:<val2>]”, where <val1> and <val2> are numeric values indicating the endpoints of the range of values for which the Level-2 field data are accepted.

Logically negated values are specified as “~<value>”. This syntax is generally intended to filter flag words, and means this: take the bitwise logical conjunction (AND) of <value> with the indicated <parameter>; accept only if all bits of the result are zero.

Here is an example:

```
Field=ColumnAmountNO2, StdField=ColumnAmountNO2Std, SolarZenithAngle=[0:85], CloudFraction=[0:300], VcdQualityFlags=~19, XTrackQualityFlags=0, RootMeanSquareErrorOfFit=[0:0.0003], TerrainReflectivity=[0:300]
```

The interpretation is explained in Table 5.

Table 5. Explanation of the example Description text.

Description text	Interpretation
Field=ColumnAmountNO2	The data input field is “ColumnAmountNO2”
StdField=ColumnAmountNO2Std	The uncertainty field is “ColumnAmountNO2Std”
SolarZenithAngle=[0:85]	Accept solar zenith angles less than 85 deg.
CloudFraction=[0:300]	Accept cloud fractions less than 0.3 (taking account of the scaling of 1000 that applies to this field in the Level-2 data product).
VcdQualityFlags=~19	Reject data that are on descending leg of the orbit, or where the summary flag is set.
XTrackQualityFlags=0	Accept only data whose cross-track quality flags are all zero.
RootMeanSquareErrorOfFit=[0:0.0003]	Accept data that have an RMS fit error less than 0.0003
TerrainReflectivity=[0:300]	Accept data whose terrain reflectivity is less than 0.3 (=30%) (taking account of the scaling of 1000 that applies to this field in the Level-2 data product).

### 3.5 Data fields

The OMNO2d data product contains five fields. All are of type HE5T\_NATIVE\_FLOAT. These fields are listed in Table 6.

Table 6. Data fields

Field name	Description
ColumnAmountNO2	Total column amount of NO <sub>2</sub>
ColumnAmountNO2CloudScreened	Total column amount of NO <sub>2</sub> , considering only Level-2 fields of view for which the cloud fraction is less than 30%.
ColumnAmountNO2Trop	Tropospheric column amount of NO <sub>2</sub>
ColumnAmountNO2TropCloudScreened	Tropospheric column amount of NO <sub>2</sub> , considering only Level-2 fields of view for which the cloud fraction is less than 30%.
Weight	Statistical weight factor. See the OMNO2 Readme file for an explanation.

### 3.6 Metadata

The OMNO2d product files have metadata stored in the global file attributes. Table 7 list the attributes and their values.

Table 7. Global file attributes.

Attribute name	Value (typical)	Description
StartUTC	2004-10-03T00:00:00.000000Z	Coordinated Universal Time (UTC) at the beginning of the day
EndUTC	2004-10-04T00:00:00.000000Z	Coordinated Universal Time (UTC) at the end of the day
StartOrbit	1146	First orbit number used.
EndOrbit	1161	Last orbit number used
OrbitCount	16	Number of orbits used
OrbitNumber	1146, 1147, ...1161	Integer list of orbit numbers used
InputPointer	(Text string)	Comma-separated list of file names that were used as input.
GranuleYear	2004	Year number
GranuleMonth	10	Month number
GranuleDay	2	Day of month
GranuleDayOfYear	276	Day of year
InstrumentName	"OMI"	Name of instrument
PGE	"OMNO2d"	Name of PGE that generated the data set
PGEVersion	"1.0.3.8"	Version number of PGE
ProcessLevel	"3d"	Processing level (3d is level-3 data using averages.)
Period	"Daily"	Period of coverage of each data file.
Resolution	0.250 degrees	Geospatial resolution of the grid.
TAI93At0zOfGranule	3.70742405E8	International atomic time (TAI-93) at 0z of the granule.