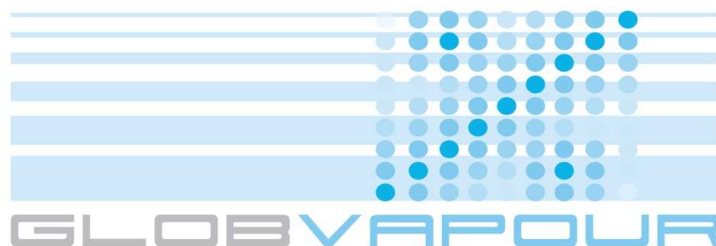




DUE GLOBVAPOUR

Metadata Definition




Issue 1 Revision 3

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1 Introduction

1.1 Purpose

This document provides the metadata definition of the GlobVapour products, ensuring compliance with the NetCDF-CF convention and the INSPIRE standard. Examples are given to ease the implementation process.

1.2 Definitions, acronyms and abbreviations


CDO	Climate Data Operator
CEOS	Committee on Earth Observation Satellites
GEOSS	Global Earth Observation System of Systems
INSPIRE	Infrastructure for Spatial Information in Europe
NetCDF-CF	Network Common Data Form for Climate and Forecast

1.3 Applicable Documents

AD-1	DUE GLOBVAPOUR Software Development Plan (SDP), issue 1, revision 0, dated 16 April 2010.
AD-2	DUE GLOBVAPOUR Technical Specification Document (TSD), issue 1, revision 0, dated 16 April 2010.

1.4 Reference Documents

RD-1	NetCDF-CF website (http://cf-pcmdi.llnl.gov/).
RD-2	“INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119”; V 1.1; 18 Feb 2009.
RD-3	Unidata NetCDF website (http://www.unidata.ucar.edu/software/).
RD-4	“GDT netCDF conventions for climate data”, version 1.3 (http://www-pcmdi.llnl.gov/drach/GDT_convention.html).
RD-5	GlobVapour Filename Convention, issue 1, revision 1, dated 21 December 2011.

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1.5 Structure of the document

Section 2 gives some background information on the subject. The metadata definition is provided in section 3. Practical examples are given in the Annex.

2 Background

As described in the Software Development Plan (SDP) [AD-1], the GlobVapour end products shall be compliant with the following international standards:

- (1) data structure with NetCDF Climate and Forecast (CF) convention
- (2) metadata compliance with INSPIRE standard
- (3) data model compliance with GEOSS Architecture standard
- (4) product quality indicator compliance with CEOS QA4EO guidelines

A metadata description of the GlobVapour output products is provided, ensuring compliance with the above mentioned points (1) and (2). Regarding the first, NetCDF-CF version 1.4 will be followed, which is generally adopted by the Climate and Atmospheric User Community. The INSPIRE standard builds on the existing international ISO and OGC standards. Implications from points (3) and (4) are outside the scope of this document.

It is important to state that the NetCDF-CF convention is implemented at data level. Since the objective of INSPIRE is to enable interoperable access to the data, compliance with the INSPIRE standard can be fulfilled also at provider level. This means that informative metadata on the dataset (in contrast to descriptive metadata) must not necessarily be included in the file, but may also be provided through e.g. the web portal that offers the datasets for download. It is herewith suggested that the INSPIRE standard is implemented in the data management layer of the GlobVapour data access system. Allowing this to work, a minimum set of metadata attributes must be included in the products.

3 Metadata definition


Metadata attributes defined in this document follow the NetCDF-CF naming convention. Qualitative compliance with INSPIRE is ensured through mapping of a minimum set of required metadata attributes. Additional (static) information will be supplied in the Product User Guide and through the GlobVapour web site.

Metadata divide into two categories:

- Service metadata
- Dataset metadata

The Service metadata provide general information about the dataset as a whole, separately from the data contents. These metadata may be defined freely, as no strict naming conventions apply. However in order to be INSPIRE compliant, a minimum set of information on the dataset must be provided.

The Dataset metadata however, which describes the datasets (data arrays) in the file, is bound to the NetCDF-CF 'template' that provides standard names for data fields and their metadata.

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3.1 Service metadata

Global attributes relate to the dataset at the more general level. They might include such information as instrument name and description, institution name, processing history, references. One aspect of the CF conventions is that extra attributes are not outlawed, so further information may be included in the global attributes, if this would be useful for the end users.

CF conventions make one global attribute mandatory: **Conventions**, which should be filled with the actual version (currently 'CF-1.4'). The recommended standard set of global attributes is shown in the table below.

Table 3-1: Standard set of NetCDF-CF global attributes.

title	A succinct description of what is in the dataset.
institution	Specifies where the original data were produced.
source	The method of production of the original data. If the data are model generated, source should name the model and the version number. If the data are observational, source should characterize them, e.g. surface observation, radiosonde, satellite.
history	Provides an audit trail for modifications to the original data. Well-behaved generic software will automatically append their name, input parameters, and a timestamp.
references	Published or web-based references which describe the data, or the methods used to produce them.
comment	Miscellaneous information about the data or the methods used to produce them.

A number of additional attributes is needed in order to clearly describe the GlobVapour products. Incorporating also the afore mentioned CF attributes, the envisaged set of all global attributes looks as shown in Table 3-2. Here the size is the maximum number of characters needed in order to allow for the possible values and format. This is meant as a guideline, not as an implementation constraint; although most of the attributes are of alphanumeric type (characters), attributes with numeric values (such as 'spatial') may well be implemented as floating point type. The allowed values and formats are specified in the last column. Only one of the values given can be used per file. Note that the order is alphabetical, which is not mandatory at implementation level.

Examples of a GlobVapour NetCDF file, with the set of global attributes from above mentioned table applied, are shown in the Annex.



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Table 3-2: Complete set of GlobVapour NetCDF-CF global attributes.

Attribute	Description	Size	Value / Format
bias	Bias of one component of a merged or combined GlobVapour L3 product ¹⁾	7	Real number truncated to format 'nn.mmmm'
comment	Miscellaneous information about the GlobVapour product	256	Free form
Conventions	NetCDF-CF convention version	8	'CF-1.4'
filename	Name of the GlobVapour file	53	<i>Convention following [RD-5]</i>
filetype	Type of the GlobVapour file	9	'product', 'auxiliary'
format	NetCDF format of the GlobVapour file ²⁾	4	Format M.NN where M=major, N=minor
history	Processing history of the file	256 ³⁾	Free form ⁴⁾
institution	Centre where the file was generated	30	Free form
instrument	Set of instruments involved in the processing	25	'AATSR', 'ATSR-1', 'ATSR-2', 'GOME', 'GOME-2', 'IASI', 'MERIS', 'MWR', 'SCIAMACHY', 'SEVIRI', 'SSM/I' ⁵⁾
level	Processing level of the product	2	'L3'
parameter	Parameter of the GlobVapour product	9	'TCWV', 'WVprofile'
processor	Processor name and version of the GlobVapour product	256	Free form starting with 'GlobVapour' and including the processor acronym ⁶⁾
projection	Projection type of the product	16	'rectangular grid'
references	Referencing media (document, web site) describing the GlobVapour product	256	Free form starting with 'ESA DUE GlobVapour' and including the GlobVapour web site
sat_series	Set of satellite series involved in the processing	15	'DMSP', 'ENVISAT', 'ERS', 'METOP', 'MSG', 'NOAA', etc. ⁷⁾
sat_id	Set of satellite IDs involved in the processing	30	'ENV', 'ERS1', 'F13', 'M01', 'MSG08', 'N15', etc. ⁷⁾
selection	Selection limiting the full range of input data	50	Free form containing e.g. 'descending orbits', 'full disk 5 deg scan angle'
source	Methodic source of the GlobVapour product	50	'satellite observations'
spatial	Spatial resolution (in degrees square) of the GlobVapour product grid	4	'0.05', '0.25', '0.5'
temporal	Temporal resolution of the GlobVapour product	8	'3-hourly', 'daily', 'weekly', 'monthly'
timestamp	Date and time (UTC) of file generation	14	Format YYYYMMDDHHMMSS
title	Concise description of the file reflecting the contents	100	Free form using the string 'GlobVapour'
type	Type of product composition (averaged or not)	9	'mean', 'composite'
validity	Validity start date and time (UTC) of the GlobVapour file ⁸⁾	14	Format YYYYMMDDHHMMSS
version	Version of the GlobVapour product	4	Format M.NN where M=major, N=minor

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- ¹⁾ This is currently only foreseen for the SSMI component in SSMI+MERIS L3 products. The field should be left empty if non-applicable.
- ²⁾ This concerns the minimum required version. It would for instance be possible to generate the well established version 3.63 with software supporting the modern NetCDF 4 format; the value '3.63' should be written.
- ³⁾ Certain tools such as Climate Data Operator (CDO) automatically generate this. Such tools usually do not put constraints on the size of the field. It would be recommended however to limit the field size by the GlobVapour processing software.
- ⁴⁾ For the first version, the string 'created on %date %jdate %time UTC' is to be written.
- ⁵⁾ A hyphen (-) or N-dash (--) is to be used for combinations of instruments.
- ⁶⁾ The processor acronym shall be conform to the TSD tables [AD-2].
- ⁷⁾ A hyphen (-) or N-dash (--) is to be used for combinations of satellites. The given set of values is expandable.
- ⁸⁾ This involves the starting date/time of the validity period. E.g. for a daily mean, the time '00:00:00' of the particular day is referenced, whereas for a monthly mean the first day of the particular month is specified.

3.2 Dataset metadata

The NetCDF-CF convention offers several attributes for the description of the dataset elements or variable arrays, and for specific variables the use of standard names is prescribed. The following standard names applying to the main GlobVapour variables 'TCWV' and 'WVprofiles' (in line with the values defined for the global attribute 'parameter') have been chosen from the NetCDF-CF standard names table, Version 14 [RD-1]:

Table 3-3: GlobVapour NetCDF-CF main variables (TCWV and WVprofiles).

GlobVapour variable	NetCDF-CF standard name	
TCWV	Name	atmosphere_water_vapor_content
	Descr.	"Content" indicates a quantity per unit area. The "atmosphere content" of a quantity refers to the vertical integral from the surface to the top of the atmosphere. For the content between specified levels in the atmosphere, standard names including <code>content_of_atmosphere_layer</code> are used. Atmosphere water vapor content is sometimes referred to as "precipitable water", although this term does not imply the water could all be precipitated.
	Unit	kg m ⁻²
WVprofile	Name	water_vapor_content_of_atmosphere_layer
	Descr.	"Content" indicates a quantity per unit area. "Layer" means any layer with upper and lower boundaries that have constant values in some vertical coordinate. There must be a vertical coordinate variable indicating the extent of the layer(s). If the layers are model layers, the vertical coordinate can be <code>model_level_number</code> , but it is recommended to specify a physical coordinate (in a scalar or auxiliary coordinate variable) as well.
	Unit	kg m ⁻²

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Note that for TCWV also the table [atmosphere_mass_content_of_water_vapor](#) would have fitted, whose description appears to be identical to the standard name chosen.

The standard deviation arrays of the GlobVapour dataset variables are referenced to the same standard names, using the ‘inheritance’ principle of NetCDF. This is illustrated in the examples of the Annex.

The units have to be specified as attribute in the NetCDF file as well, in agreement with the tables above. The ‘_FillValue’ attribute for this field is to be set as ‘-999.f’. Other attributes such as ‘scale_factor’, ‘valid_range’ and ‘add_offset’ are to be defined with the final product structure in the Product User Guide (PUG). Attributes such as ‘C_format’ and ‘FORTRAN_format’ may be useful as well. See the examples in the Annex for how the NetCDF-CF attributes are implemented.

The following variable types are available in NetCDF: byte (1 B), char (1 B), short (2 B), int (4 B), float (4 B), double (8 B) [RD-3]. The byte size is independent of the platform. It has to be analysed which type is needed for each variable in order to obtain the required accuracy.

An additional field of the GlobVapour products is the number of observations used for the main (TCWV and WV profile) fields. The values of this field vary per grid point. This field can be implemented as an integer variable, as the maximum value equals the number of orbital overpasses per time period (which is 13 or 14 per day at the poles). Since no applicable standard name is available, this field is only to be defined with a long_name attribute. The same applies to the quality flags (no standard name), which can be implemented as a byte type variable using the ‘flag_meanings’ attribute in combination with either the ‘flag_values’ or the ‘flag_masks’ attribute.

The cloud and land masks can be assigned to standard names as in the following table. It is envisaged to generate the land mask as auxiliary file, whereas the cloud mask will be included in the product files.

Table 3-4: GlobVapour NetCDF-CF additional variables (Cloud and Land Mask).

GlobVapour variable	NetCDF-CF standard name	
Cloud Mask	Name	cloud_area_fraction
	Descr.	"X_area_fraction" means the fraction of horizontal area occupied by X. "X_area" means the horizontal area occupied by X within the grid cell. Cloud area fraction is also called "cloud amount" and "cloud cover". The cloud area fraction is for the whole atmosphere column, as seen from the surface or the top of the atmosphere. The cloud area fraction in a layer of the atmosphere has the standard name cloud_area_fraction_in_atmosphere_layer.
	Unit	1
Land Mask	Name	land_area_fraction
	Descr.	"X_area_fraction" means the fraction of horizontal area occupied by X. "X_area" means the horizontal area occupied by X within the grid cell.
	Unit	1

The spatio-temporal co-ordinates used for the geolocation and temporal location of the product variables are defined in NetCDF by standard coordinate variables as in the following table [RD-1].


Table 3-5: GlobVapour NetCDF-CF spatio-temporal variables.

GlobVapour variable	NetCDF-CF standard name	
latitude	Name	latitude
	Descr.	Latitude is positive northward; its units of degree_north (or equivalent) indicate this explicitly. In a latitude-longitude system defined with respect to a rotated North Pole, the standard name of grid_latitude should be used instead of latitude. Grid latitude is positive in the grid-northward direction, but its units should be plain degree.
	Unit	degree
longitude	Name	longitude
	Descr.	Longitude is positive eastward; its units of degree_east (or equivalent) indicate this explicitly. In a latitude-longitude system defined with respect to a rotated North Pole, the standard name of grid_longitude should be used instead of longitude. Grid longitude is positive in the grid-eastward direction, but its units should be plain degree.
	Unit	degree
time	Name	time
	Descr.	No help available
	Unit	s
layer	Name	air_pressure
	Descr.	No help available
	Unit	hPa

Regarding the spatial co-ordinates latitude/longitude, it is proposed by convention to define these as co-ordinates of the grid point centre, not of the edges. Considering the accuracy of the finest grid (0.05 degree square), the lat/lon vector variables implemented as float type variable should be sufficient. The possible values are:

latitude:valid_range = -90.f, 90.f ; longitude:valid_range = -180.f, 180.f ;

Time, although it isn't a dimension for the nominal GlobVapour products, is suggested to be included in the GlobVapour products. Its function is to provide a standard metadata attribute for validity date/time, which is the same as the global attribute 'validity'. The latter may thus be obsolete, however for clarity and flexibility reasons both will be useful. The unit of the standard_name 'time' is seconds. This is however not favourable for the GlobVapour products. By defining time as a long_name attribute, one can represent the time variable in absolute or relative units, in various ways. In order to ensure NetCDF-CF compatibility, relative units must be specified, e.g. "days since 1996-01-01 00:00:00" or "seconds since 1999-04-14 16:10:00". The 'relative time' data values would be in Julian time units (e.g. days, seconds, see [RD-3] for all

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valid units) with respect to the reference base time as defined by the ‘units’ attribute. This implies a reference base time to be defined, and kept fixed for a certain time period, which could cover the entire GlobVapour dataset or a shorter time period. One could think of generating monthly means with reference to the envisaged first day of the GlobVapour dataset (e.g. 01.01.1996), whereas it would make sense to generate e.g. 3-hourly IASI-SEVIRI products, containing 8 x 3-hourly slots, referencing hours since the start of the validity day (see second Annex example). It is suggested to use 01.01.1996 as reference base time for all products with daily, weekly and monthly timeliness.

An alternative would be ‘absolute units’ specified as e.g. "day as %Y%m%d.%f", which would be conform to the so called GDT standard [RD-4], but however would not be NetCDF-CF compliant. Note that this is the standard option of the well known Climate Data Operator (CDO) tool, which also supports relative time units. Absolute time units have certain advantages, but may cause problems for visualisation tools such as ‘grads’.

The IASI-SEVIRI Water Vapour Profile product, which is the only GlobVapour product with a vertical dimension, is defined in the Technical Specification Document (TSD) [AD-2] for three vertical layers: Surface-850 hPa, 850-500 hPa and 500-200 hPa. These layers should be defined in the NetCDF file through pressure level boundaries by appropriate assignment, as in the second Annex example.

Further details on the NetCDF-CF convention [RD-1] are supplied in e.g. <http://cf-cmdl.lnl.gov/conformance/requirements-and-recommendations/1.4/> .

Annex - Examples of a GlobVapour NetCDF file

Example 1 - GlobVapour SSMI-MERIS TCWV daily composite

In this file, the field Total Column Water Vapour (TCWV) has been defined as NetCDF element ‘tcwv’, which in turn is declared as standard_name ‘atmosphere_water_vapor_content’. The TCWV standard error is defined with this standard_name as well. The global attributes are in agreement with the ones mentioned as service metadata in this document. A quality flag per grid point has been implemented. As in this case an original product is concerned, the history is empty. The filename is hypothetical awaiting a precise file-naming convention. The grid resolution must be consistent with the (lat, lon) grid dimensions. Note that, as reflected in the latitude/longitude vectors, the central grid point co-ordinates are used. A test product generated using ‘ncgen’ with the ASCII template as below has a size of about 2.6 MB and has successfully passed the compliance checker [RD-1].

```
netcdf GV_SSMI-MERISx_DC_20090201_I0 {
dimensions:
    time = 1 ;
    lat = 360 ;
    lon = 720 ;
variables:
    float    lat(lat) ;
             lat:long_name = "Latitude" ;
             lat:standard_name = "latitude" ;
             lat:units = "degrees_north" ;

    float    lon(lon) ;
             lon:long_name = "Longitude" ;
```



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```

lon:standard_name = "longitude" ;
lon:units = "degrees_east" ;

int    time(time) ;
time:long_name = "Time" ;
time:calendar = "standard" ;
time:units = "days since 1996-01-01 00:00:00" ;

float  tcwv(time, lat, lon) ;
tcwv:long_name = "Total Column Water Vapour" ;
tcwv:standard_name = "atmosphere_water_vapor_content" ;
tcwv:units = "kg m-2" ;
tcwv:_FillValue = -999.f ;


float  tcwv_err(time, lat, lon) ;
tcwv_err:long_name = "Total Column Water Vapour Error" ;
tcwv_err:standard_name = "atmosphere_water_vapor_content" ;
tcwv_err:units = "kg m-2" ;
tcwv_err:_FillValue = -999.f ;

byte   qf (time, lat, lon) ;
qf:long_name = "Quality Flag" ;
qf:units = "1" ;
qf:flag_values = 0b, 1b, 2b, 3b ;
qf:flag_meanings = "ok wv_outside_valid_range
retrieval_incomplete not_performed" ;
qf:_FillValue = -128b ;

int    nobs(time, lat, lon) ;
nobs:long_name = "Number of Observations" ;
nobs:units = "1" ;
nobs:_FillValue = -999 ;

// global attributes:
:Conventions = "CF-1.4" ;
:format = "3.63" ;
:filename = "GlobVapour_SSMI_MERIS_tcwv_dc_20090201" ;
:filetype = "product" ;
:timestamp = "20090202175959" ;
:history = "created on 2009-02-02 17:59:59 UTC (033)" ;
:institution = "Freie Universität Berlin" ;
:title = "GlobVapour - Global Total Column Water Vapour daily composite
from SSMI-MERIS" ;
:source = "satellite observations" ;
:sat_series = "DMSP-ENVISAT" ;
:sat_id = "F13-F14-ENV" ;
:instrument = "SSM/I-MERIS" ;
:level = "L3" ;
:selection = "descending orbits" ;
:parameter = "TCWV" ;
:validity = "20090201000000" ;
:processor = "GlobVapour WV_SSMI_MERIS processor v1.0" ;
:projection = "rectangular grid" ;
:spatial = "0.5" ;
:temporal = "daily" ;
:type = "composite" ;
:version = "1.00" ;

```

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```

: bias = "00.1234" ;
: references = "GlobVapour web site
(http://www.globvapour.info/title.html)" ;
: comment = "Validated with DDS version 1.0" ;

```

```

data:
  time = 1128 ;
  lon = -89.75, -89.25, -88.75, -88.25, -87.75, -87.25, -86.75, ..

  [etc.]
}

```

Example 2 - GlobVapour IASI-SEVIRI WV 3-hourly mean profile

In this file, the field Water Vapour Profile (WVprofile) and standard error has been defined as NetCDF elements 'wvpr' and 'wvpr_err', which are both declared as standard_name 'water_vapor_content_of_atmosphere_layer'. The global attributes are in agreement with the ones mentioned as service metadata in this document. A quality flag per grid point and layer has been implemented. As reflected in the history, the product was modified by the cdo tool (details do not make sense). Attribute 'CDO' has been added by this operation, which illustrates the flexibility of NetCDF-CF. A test product generated using 'ncgen' with the ASCII template as below has a size of about 221 MB and has successfully passed the compliance checker [RD-1].

```

netcdf GV_IASI-SEVIRI_3M_20090803_I1 {
dimensions:
  time = 8 ;
  lat = 720 ;
  lon = 1440 ;
  layers = 3 ; // vertical layers
  levels = 2 ; // upper and lower layer boundaries
variables:
  float lat(lat) ;
  lat:long_name = "Latitude" ;
  lat:standard_name = "latitude" ;
  lat:units = "degrees_north" ;


  float lon(lon) ;
  lon:long_name = "Longitude" ;
  lon:standard_name = "longitude" ;
  lon:units = "degrees_east" ;

  int time(time) ;
  time:long_name = "Time" ;
  time:calendar = "standard" ;
  time:units = "hours since 2009-08-03 00:00:00" ;

  int layer(layers) ;
  layer:long_name = "Vertical Layer" ;
  layer:standard_name = "air_pressure" ;
  layer:units = "hPa" ;
  layer:bounds = "layer_bounds" ;

  int layer_bounds(layers, levels) ;

```


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```

layer_bounds:long_name = "Vertical Layer Pressure Level
bounds" ;
layer_bounds:standard_name = "air_pressure" ;
layer_bounds:units = "hPa" ;
float   wvpr(time, lat, lon, layers) ;
wvpr:long_name = "Water Vapour Profile" ;
wvpr:standard_name = "water_vapor_content_of_atmosphere_layer" ;
wvpr:units = "kg m-2" ;
wvpr:_FillValue = -999.f ;
float   wvpr_err(time, lat, lon, layers) ;
wvpr_err:long_name = "Water Vapour Profile Error" ;
wvpr_err:standard_name =
"water_vapor_content_of_atmosphere_layer" ;
wvpr_err:units = "kg m-2" ;
wvpr_err:_FillValue = -999.f ;
byte    qf (time, lat, lon, layers) ;
qf:long_name = "Quality Flag" ;
qf:units = "1" ;
qf:flag_values = 0b, 1b, 2b, 3b ;
qf:flag_meanings = "ok wv_outside_valid_range
retrieval_incomplete not_performed" ;
qf:_FillValue = -128b ;
int     nobs(time, lat, lon) ;
nobs:long_name = "Number of Observations" ;
nobs:units = "1" ;
nobs:_FillValue = -999 ;

// global attributes:
:Conventions = "CF-1.4" ;
:format = "4.01" ;
:filename = "GlobVapour_IASI_SEVIRI_wvpr_3m_20090803" ;
:filetype = "product" ;
:timestamp = "20090804120001" ;
:history = "created on 2009-08-04 12:00:01 UTC (216); Tue Jun 08
17:58:49 2010: cdo -a -f nc monmean ERAint_t2m_200908.nc
ERAint_t2m_mm_200908.nc\n" ;
:institution = "Deutscher Wetterdienst" ;
:title = "GlobVapour - Global Water Vapour 3-hourly Profiles from IASI-
SEVIRI" ;
:source = "satellite observations" ;
:sat_series = "METOP-MSG" ;
:sat_id = "M01-MSG08" ;
:instrument = "IASI-SEVIRI" ;
:level = "L3" ;
:selection = "full disk max 70 deg zenith angle" ;
:parameter = "WVprofile" ;
:validity = "20090803000000" ;
:processor = "GlobVapour WV_IASI_SEVIRI processor v2.1" ;
:projection = "rectangular grid" ;
:spatial = "0.25" ;
:temporal = "3-hourly" ;
:type = "mean" ;

```

	Doc:	20100707_GlobVapour_Metadata_I1R3.doc		
	Date:	02 February 2011		
	Issue:	1	Revision:	3

```

:version = "3.01" ;
:bias = "" ;
:references = "GlobVapour web site
(http://www.globvapour.info/title.html)" ;
:comment = "Not validated" ;
:CDO = "Climate Data Operators version 1.4.4
(http://code.zmaw.de/projects/cdo)" ;

```

```

data:
  time = 0, 3, 6, 9, 12, 15, 18, 21 ;
  layer = 1, 2, 3 ;
  layer_bounds = 1014, 850, 850, 500, 500, 200 ;
  lon = -89.875, -89.625, -89.375, -89.125, -88.875, -88.625, -88.375, ..

  [etc.]
}

```