# DUE GLOBVAPOUR

## Data Acquisition Plan


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|---|---|
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# Table of Contents

# 1 Introduction

## 1.1 Purpose

This document details the satellite and auxiliary data required for the generation of the GlobVapour data products. It also specifies the space- and ground-based data as well as aircraft data for validation. The data sources, procurement and potentially associated costs are stated. It is analysed whether data are already available within the Consortium or need to be acquired from external sources.

## 1.2 Definitions, acronyms and abbreviations

| | |
|---|---|
| AATSR | Advanced Along Track Scanning Radiometer |
| ATSR | Along-Track Scanning Radiometer |
| DOAS | Differential Optical Absorption Spectroscopy |
| EGVAP | European Global Water Vapour |
| GCOS | Global Climate Observing System |
| GES DISC | Goddard Earth Sciences Data and Information Services Center |
| GRUAN | GCOS Reference Upper Air Network |
| GPS | Global Positioning System |
| GTS | Global Telecommunication System |
| GUAN | GCOS Upper Air Network |
| MOL | Meteorological Observatory Lindenberg |
| MOZAIC | Measurement of Ozone on Airbus In-service Aircraft |
| MWR | MicroWave Radiometer |
| NEODC | NERC Earth Observation Data Centre |
| NWP | Numerical Weather Prediction |
| TCWV | Total Column Water Vapour |
| SSM/I | Special Sensor Microwave/Imager |
| UKMO | United Kingdom Meteorological Office |

## 1.3 Applicable Documents

[AD-1] ESRIN Statement of Work. EOEP-DUEP-EOPS-SW-09-0003, issue 1 revision 1, dated 13 May 2009

[AD-2] ECSS-E-ST-40C Part 1B; Space Engineering – Software; 6 March 2009
http://www.ecss.nl/

[AD-3] DUE GLOBVAPOUR Proposal, issue 1 revision 3, dated 9 July 2009

[AD-4] DUE GLOBVAPOUR Clarification Note, issue 1, revision 1, dated 29 October 2009

[AD-5] DUE GLOBVAPOUR Project Management Plan, issue 1, revision 2, dated 11 February 2010

## 1.4 Reference Documents


[RD-1] Luo, Z., D. Kley, R. H. Johnson, H. Smit, 2008: Ten Years of Measurements of Tropical Upper-Tropospheric Water Vapor by MOZAIC. Part II: Assessing the ECMWF Humidity Analysis. J. Climate, 21, 1449-1466.

[RD-2] Marenco, A., Thouret, V., Nedelec, P., Smit, H., Helten, M., Kley, D., Karcher, F., Simon, P., Law, K., Pyle, J., Poschmann, G., Von Wrede, R., Hume, C., and Cook, T., 1998: Measurement of ozone and water vapour by Airbus in-service aircraft: The MOZAIC airborne program, An overview, J. Geophys. Res., 103, 25 631– 25 642.


## 1.5 Structure of the document

Section 2 gives a high level overview of the data to be acquired for production and validation, as well as the relevant procurement schedule.

This is followed by a description of the satellite and auxiliary data in sections 3 and 4 that will be used for generation of the GlobVapour products.

Sections 5, 6, and 7 describe the satellite, ground based and aircraft data used for the validation of the GlobVapour products.

Finally, conclusions are stated in the last section.

# 2 Overview

## 2.1 Production and validation

Two main sources of input data are discerned:

- Data for production,
- Data for validation.

Production and validation will take place in the following project phases:

- Production and validation of prototype products (WP 380),
- Production and validation of test dataset (WP 460),
- Production and validation of final dataset (WP 510).

Satellite based data and auxiliary data will be used for generation of the GlobVapour products, total water vapour column and water vapour profiles.

For validation, a Diagnostic Dataset (DDS) will be put together, which consists of ground-based, in situ and satellite data sets.

The table below describes the different versions of the Processing system along with the generated products and DDS, with the indicated time period, for each project phase. The temporal coverage of the extended version of the DDS will not be applicable for all parts of the DDS.

**Table 2-1: High-level dataset breakdown for each project phase.**

| Phase | Processing system | Output products | Diagnostic dataset |
|---|---|---|---|
| Prototype | Prototype version | Prototype dataset<br>(4 months in 2006-2008) | Initial version<br>(4 months in 2006-2008) |
| Test | Stand-alone test version | Test dataset<br>(2006-2008, IASI+SEVIRI 2007-2008) | Nominal version<br>(2006-2008) |
| Final | Stand-alone final version | Final dataset<br>(1996-2008, IASI+SEVIRI 2007-2008) | Extended version<br>(1996-2008) |

## 2.2 Generic Procurement Schedule

Acquisition of input data for validation (WP 210) and production (WP220) is taking place during the Preparation Phase (WP 200) with planned time frame 01.12.2009 - 31.05.2010.

The project distinguishes three major work packages where acquired datasets are needed:

(i) WP 300 for the creation of the prototype products and the Diagnostic Dataset,

(ii) WP 400 with the generation of test products for the period 2006-2008,

(iii) WP 500 for the generation of final products for the period 1996 to present date.

A further breakdown of the work packages can be found in [AD-3] and [AD-5].

The table below reflects the input data required for each phase, along with the output products, as well as the diagnostic dataset (DDS) version used for the validation.

**Table 2-2: Detailed dataset breakdown for each project phase.**

| Phase | WP | Time period | Processing system | Input dataset | Output products | Diagnostic dataset |
|---|---|---|---|---|---|---|
| Preparation | 200 | 01.12.2009 – 30.11.2010 | N/A | Acquisition of all data | N/A | Creation of all versions |
| Prototype | 300 | 01.02.2010 – 30.11.2010 | Prototype version | Prototype dataset (4 months in 2006-2008) | Prototype products (4 months in 2006-2008) | Initial version (4 months in 2006-2008) |
| Test | 400 | 01.12.2010 – 31.08.2011 | Stand-alone test version | Test dataset (2006-2008) | Test products (globally for 2006-2008, profiles for 2007-2008) | Nominal version (2006-2008) |
| Final | 500 | 01.09.2011 – 30.11.2011 | Stand-alone final version | Final dataset (1996-2008) | Final products (TCWV for 1996-on, profiles for 2007-2008) | Extended version (1996-2008) |

# 3 Satellite Data for Production

## 3.1 Data Needs

For the production of the total column water vapour (TCWV) GlobVapour dataset ([AD-1], TR-7), global satellite data over the period 2006-2008 for the test phase are needed. Initially only 4 complete months in this period are required for the prototype version. For the envisaged final version, satellite data from 1996-2008 will be required.

It is envisaged to use fully geolocated and calibrated L1 data. The following table (reworked Table 3.3a from [AD-1]) gives an overview of the required data. Per type of generated dataset, the Agency of the original satellite data, the Satellite and Sensor, the Product type of the dataset to be generated, and the available time Period are listed.

**Table 3-1: L1 satellite data required for production.**

| Agency | Satellite | Sensor | Product | Period available |
|---|---|---|---|---|
| *GOME–SCIAMACHY–GOME-2 dataset* | | | | |
| ESA | ERS-2 | GOME | TCWV | 1995–on |
| EUMETSAT | MetOp | GOME-2 | TCWV | 2007–on |
| ESA | Envisat | SCIAMACHY | TCWV | 2002–on |
| *SSM/I- MERIS-(MWR) dataset* | | | | |
| NOAA/RSS | DMSP series | SSM/I | TCWV | 1987–on |
| ESA | Envisat | MERIS | TCWV | 2003–on |
| ESA | ERS-2 | MWR | TCWV | 1996–on |
| ESA | Envisat | MWR | TCWV | 2002–on |
| *(A)ATSR dataset* | | | | |
| ESA | ERS-2 | ATSR-2 | TCWV | 1995–on |
| ESA | Envisat | AATSR | TCWV | 2002–on |
| *SEVIRI–IASI dataset* | | | | |
| EUMETSAT | MSG-2 & 3 | SEVIRI | Profiles, TCWV | 2005–on |
| EUMETSAT | MetOp | IASI | Profiles, TCWV | 2007–on |

Notes:

- The MWR TCWV product is considered as not suitable to build up a global climate series because of its limited spatial sampling.
- Only channels 10.85 and 12 µm from the (A)ATSR data are used. Band subsetting for reducing the data volume will be applied if possible and practicable.
- An analysis of the validation results for (A)ATSR will be necessary in order to assess the quality and the usefulness of (A)ATSR(-2) measurements for the GlobVapour production.

## 3.2 Data Sources

The following table provides source details to the required satellite data for production. Per data type, the Satellite, the Processing level and version (if applicable), the Agency of the original satellite data and the availability details of the providing data Centre (user interface, i.e. web portal, web address (URL), database or archive, and ftp address, if applicable) are listed, together with the targeted Centre for data processing and the envisaged acquisition method. Entries are highlighted (yellow) for which acquisition activities of external data must be performed.

It is envisaged to use the latest version where possible. No specific cases have been identified where older versions are required.

**Table 3-2: Satellite data sources for production.**

| Data | | Source | | | Target for data processing | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| *GOME data* | | | | | | |
| ERS-2 | 1 | ESA | DLR | GOME Web Page http://atmos.caf.dlr.de/gome<br>EOWEB<br>http://eoweb.dlr.de:8080/index.html | DLR | N/A<br>(data already available) |
| *GOME-2 data* | | | | | | |
| METOP | 1C | EUMETSAT | DLR | GOME Web Page http://atmos.caf.dlr.de/gome<br>EOWEB<br>http://eoweb.dlr.de:8080/index.html | DLR | N/A<br>(data already available) |
| *SCIAMACHY data* | | | | | | |
| Envisat | 1 | ESA | DLR | EOWEB<br>http://eoweb.dlr.de:8080/index.html | DLR | N/A<br>(data already available) |
| *SSM/I data* | | | | | | |
| DMSP series | 1 | NOAA CLASS | DWD | CIRRUS database<br>Note:<br>- Current series complete for (1997-on) as F8, F10 missing; will be padded/completed by CM-SAF for (1987-on), with projected availability by mid 2010;<br>- Unrestricted usage. | DWD | SQL |
| DMSP series | 1 | RSS | DWD | CIRRUS database<br>Note:<br>- Complete series (1987-on); | DWD | SQL |

| Data | | Source | | | Target for data processing | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| | | | | - Procured by EUMETSAT from RSS;<br>- Restricted usage (distribution of L2/3 end-products only). | | |
| *MERIS data* | | | | | | |
| Envisat | 1B, 3rd reproc. | ESA | ACRI-ST | EOLI Web Portal (ESA)<br>http://catalogues.eoportal.org/eoli.html<br>(latest (3rd) reprocessing campaign at ACRI available to ESA by mid 2010) | FUB | Data already obtained from ACRI-ST |
| *MWR data* | | | | | | |
| ERS-2 | 1 | ESA | ESA | EO Principal Investigator Portal (ESA)<br>http://eopi.esa.int/esa/esa?cmd=aodetail&aoname=Cat1 | DWD | FTP transfer, web ordering or disc exchange of native data |
| Envisat | 1 | ESA | ESA | EO Principal Investigator Portal (ESA)<br>http://eopi.esa.int/esa/esa?cmd=aodetail&aoname=Cat1 | DWD | FTP transfer, web ordering or disc exchange of native data |
| *ATSR-2 data* | | | | | | |
| ERS-2 | 1, V2.0 | ESA | NEODC | NEODC<br>http://www.neodc.rl.ac.uk/?option=displaypage&Itemid=91&op=page&SubMenu=91 | FUB | FTP transfer or disc exchange of native data |
| *AATSR data* | | | | | | |
| Envisat | 1, V2.0 | ESA | NEODC | NEODC<br>http://www.neodc.rl.ac.uk/?option=displaypage&Itemid=91&op=page&SubMenu=91 | FUB | FTP transfer or disc exchange of native data |
| *SEVIRI data* | | | | | | |

| **Data** | | **Source** | | | **Target for data processing** | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| MSG-2 & 3 | 1.5 | EUMETSAT | DWD | CIRRUS database | DWD | SQL |
| *IASI data* | | | | | | |
| METOP | 1C | EUMETSAT | DWD | CIRRUS database | DWD | SQL |

## 3.3 Procurement Schedule

Acquisition of input data for production (WP 220) is scheduled to be performed during 01.12.2009-31.05.2010.

The table below defines the satellite based datasets to be acquired for production and the schedule of data acquisition, as required for each project phase. The datasets must be completely available prior to the commencement of each project phase.

**Table 3-3: Acquisition schedule for satellite data for production.**

| Phase | WP | Phase schedule | Acquired dataset | Acquisition schedule |
|---|---|---|---|---|
| Prototype | 380 | 01.09.2010 – 30.11.2010 | Prototype dataset<br>(4 complete months in 2006-2008) | Starting 01.12.2009 |
| Test | 460 | 01.06.2011 – 31.08.2011 | Test dataset<br>(2006-2008) | Starting 01.12.2009 |
| Final | 510 | 01.09.2011 – 30.11.2011 | Final dataset<br>(1996-2008) | Starting 01.12.2009 |

ESA Category 1 data user with ESA for the procurement of ESA data has been requested.

A EUMETSAT User Account has been opened.

The ATSR-2 and AATSR data will be procured via UKMO from NERC Earth Observation Data Centre (NEODC), which is based at the Space Science & Technology Department of the Rutherford Appleton Laboratory (RAL) in Oxfordshire, UK.

The MERIS L1B data will be copied directly on disc by FUB at ACRI-ST, in order to avoid long download times.

## 3.4 Data Cost

No costs expected.

# 4 Auxiliary Data for Production

## 4.1 Data Needs

In general, 1DVAR retrievals require background information on the atmospheric state, in particular temperature and water vapour profiles. Specifically, the reanalysis ERA-Interim dataset is considered most suitable for this. Alternatively, ERA-40, JRA-25 and/or output from forecast models such as GME and GFE could be envisaged. In general the specific auxiliary data required for the generation of GlobVapour products depends on the utilised algorithms.

ERA-Interim data are envisaged for MERIS-SSM/I, ATSR-AATSR and IASI-SEVIRI retrieval. The file size is about 94 MB; a total of 6 files (one analysis and two forecast per time slot) yields 563 MB/day, i.e. 206 GB/year.

The DOAS retrievals for the GOME-type sensors do not require any external auxiliary data.

In addition to ERA-Interim background information, the algorithms for the retrieval of water vapour from MERIS, (A)ATSR(-2) and SEVIRI measurements need some auxiliary information. Cloud masks applicable to the observations of both instruments will be adopted from previous projects (SYNERGY, GLINT) and further developed in the GlobVapour framework. A proper cloudy case handling is part of the GOME(2), SCIAMACHY and IASI algorithms. The SSM/I scheme will include rain identification. The surface albedo at 900 nm will be linearly extrapolated from channels 13 (865 nm) and 14 (885 nm). The aerosol loading needed for the MERIS WV retrieval will be taken from MERIS L2 data, which will be procured from ACRI-ST as soon as the reprocessing has been finished.

It is expected that IASI Level 2 products as input to the IASI assessment include a cloud mask.

## 4.2 Data Sources

ERA-Interim data available at ECMWF covers the period 1989-on. The data can be downloaded from the ECMWF Data Server or retrieved from the MARS archive.

Note that, due to an error in the ECMWF forecast model, incident solar radiation at the top of the atmosphere is approximately 3 W $m^{-2}$ higher than intended. However this only affects the upper stratosphere, with slightly higher temperatures (approximately 1 K) for the entire ERA-Interim period (error report posted on 4 May 2009).

The SEVIRI cloud mask is available at DWD from CM-SAF.

The following table provides source details to the required auxiliary data for production. Per data type, the Version and Sensor (if applicable), the Agency of the original satellite data and the availability details of the providing data Centre (user interface, i.e. web portal, web address (URL), database or archive, and ftp address, if applicable) are listed, together with the targeted Centre for data processing and the envisaged acquisition method. Entries are highlighted (yellow) for which acquisition activities of external data must be performed.

**Table 4-1: Auxiliary data sources for production.**

| Data | Source | | | Target for data processing | |
|---|---|---|---|---|---|
| **Version/Sensor** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| *NWP data* | | | | | |
| ERA-Interim | ECMWF | ECMWF | Info:<br>http://www.ecmwf.int/research/era/do/get/era-interim<br>http://www.ecmwf.int/publications/library/do/references/show?id=89203<br>Data:<br>http://data.ecmwf.int/data/ | DLR | Internet download |
| | | | | DWD | Direct login |
| *Aerosol data* | | | | | |
| MERIS (L2B) | ESA | ACRI-ST | EOLI Web Portal (ESA)<br>http://catalogues.eoportal.org/eoli.html<br>(latest reprocessing campaign at ACRI available mid 2010) | FUB | Disc exchange of data processed by ACRI-ST |
| *Cloud mask* | | | | | |
| SEVIRI | EUMETSAT | DWD | CIRRUS database | DWD | SQL |
| IASI | EUMETSAT | DWD | N/A | DWD | N/A<br>(CM generated from L1C IASI input dataset during production) |
| MERIS | ESA | ACRI-ST | EOLI Web Portal (ESA)<br>http://catalogues.eoportal.org/eoli.html<br>(latest reprocessing campaign at ACRI available mid 2010) | FUB | N/A<br>(CM generated from L1B MERIS input dataset for production) |
| (A)ATSR(-2) | ESA | UKMO | NEODC<br>http://www.neodc.rl.ac.uk/?option=displaypage&Itemid=91&op=page&SubMenu=91 | FUB | N/A<br>(CM generated from L1 (A)ATSR-(2) input dataset for production) |

## 4.3 Procurement Schedule

Acquisition of auxiliary data is synchronised with the acquisition of satellite production data (WP 220), which is scheduled to be performed during 01.12.2009-31.05.2010. Further details on schedule can be found in section 3.3.

The aerosol data based on MERIS will be copied directly on disc by FUB at ACRI-ST, in order to avoid long download times. The cloud masks based on MERIS and (A)ATSR(-2) input data will be generated at FUB.

## 4.4 Data Cost

No costs expected.

# 5 Satellite Data for Validation

## 5.1 Data Needs

To overcome limitations in geographical coverage also other satellite data will be used for validation keeping in mind that other satellite datasets have similar inherent problems as the satellites used for GlobVapour products.

The following table (reworked Table 3.3b from [AD-1]) gives an overview of the potential candidate L2/3 satellite data for validation. Per type of generated dataset, the Agency of the original satellite data, the Satellite and Sensor, the Product type of the dataset to be generated, and the available time Period are listed. The IASI retrieval assessment will start with products from July and August 2007.

**Table 5-1: L2/3 satellite data required for validation and IASI retrieval assessment.**

| Agency | Satellite | Sensor | Product | Period available |
|---|---|---|---|---|
| NASA | EOS-Aqua | AIRS | Profiles, TCWV | 2002–on |
| NOAA | NOAA 15–19 | AMSU-A | TCWV | 1999–on |
| NOAA | NOAA 15, 16, 18, 19 | ATOVS (HIRS, AMSU-A, AMSU-B/MHS) | Profiles, TCWV | 1999–on |
| DLR | CHAMP | Black Jack | Profiles | 2002–on |
| NSPO/NOAA/UCAR | FM-3/COSMIC | IGOR | Profiles | Mid 2006–on |
| EUMETSAT | MetOp | IASI | Profiles, TCWV | 2007 |
| EUMETSAT | MetOp | GRAS | Profiles | 2007–on[1] |
| NOAA | NOAA series | HIRS | Profiles, TCWV | 1991–on |
| EUMETSAT | MetOp | HIRS | Profiles, TCWV | June 2008 |
| NASA | EOS-Terra/Aqua | MODIS | TCWV | 2000–on (Terra)<br>2002–on (Aqua) |

[1] Pending reprocessing at EUMETSAT.

All missions in this table cover at least the period for which prototype and test products will be generated. Longer series are needed for validation of the final products and analyse seasonal to inter-annual variability in the datasets.

In addition, a long-term GOME dataset (1995–2008) produced at DLR, with SCIAMACHY and GOME-2 data adjusted to GOME at overlapping time periods, will be used as reference standard for the generated GOME–SCIAMACHY–GOME-2 dataset.

## 5.2 Data Sources

The following table provides source details to the required satellite data for validation. Per data type, the Satellite, the Processing level and version (if applicable), the Agency of the original satellite data and the availability details of the providing data Centre (user interface, i.e. web portal, web address (URL), database or archive, and ftp address, if applicable) are listed, together with the targeted Centre for validation and the envisaged acquisition method. Entries are highlighted (yellow) for which acquisition activities of external data must be performed.

**Table 5-2: Satellite data sources for validation and IASI retrieval assessment.**

| Data | | Source | | | Target for validation | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| *AIRS data* | | | | | | |
| EOS-Aqua | L2 V5 [1)] | NASA | GES DISC | AIRS Data Holdings web portal http://disc.sci.gsfc.nasa.gov/AIRS/data-holdings/by-data-product/data_products.shtml | DWD | FTP transfer, web ordering or disc exchange |
| *AMSU-A data* | | | | | | |
| NOAA 15-19 | Level 3 | NOAA | NOAA-STAR | Info MIRS: http://www.star.nesdis.noaa.gov/star/products.php Operational MIRS OSDPD: http://www.osdpd.noaa.gov/ml/mirs/ POES product browse facility | DWD | FTP transfer, web ordering or disc exchange |
| *ATOVS (HIRS, AMSU-A, AMSU-B/MHS) data* | | | | | | |
| NOAA 15, 16, 18, 19 | Version 320 | NOAA | DWD | CIRRUS database | DWD | SQL |
| *CHAMP data* | | | | | | |
| CHAMP | TBD | NASA/DLR | DMI | Local archive ftp://ftp.dmi.dk/pub/GlobVapour | DWD | FTP transfer of data processed by DMI |
| *COSMIC-1 data* | | | | | | |
| FORMOSAT-3-FM1 | TBD | NSPO/NOAA /UCAR | DMI | Local archive ftp://ftp.dmi.dk/pub/GlobVapour | DWD | FTP transfer of data processed by DMI |
| *GRAS data* | | | | | | |
| METOP | TBD | EUMETSAT | DMI | Local archive | DWD | FTP transfer of data processed by |

| Data | | Source | | | Target for validation | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| | | | | ftp://ftp.dmi.dk/pub/GlobVapour | | DMI |
| *HIRS data* | | | | | | |
| NOAA series | L2/L3 | NOAA | NOAA-NCDC | Direct contact with NOAA NCDC,<br>Some information on publically available products under:<br>http://www.ncdc.noaa.gov/oa/rsad/hirs-cs.html | DWD | FTP transfer |
| METOP | L2 | EUMETSAT | EUMETSAT | EO Portal<br>https://eoportal.eumetsat.int/userMgmt/login.faces<br>Part of ATOVS L2 dataset | DWD | FTP transfer or disc exchange |
| *MODIS data* | | | | | | |
| EOS-Terra/ Aqua | L2/L3 | NASA | NASA-LAADS | http://ladsweb.nascom.nasa.gov/data/search.html | DWD | FTP transfer, web ordering or disc exchange |
| *IASI data* | | | | | | |
| METOP | L2 | EUMETSAT | UKMO | Local archive | DWD | FTP transfer of data processed by UKMO |
| | | | NOAA-STAR | MIRS (Info)<br>http://www.star.nesdis.noaa.gov/star/products.php<br>Operational MIRS OSDPD<br>http://www.osdpd.noaa.gov/ml/mirs/<br>POES product browse facility | DWD | FTP transfer or disc exchange |
| | | | DWD | N/A | DWD | N/A<br>(L1 IASI data available, processing at DWD with CM-SAF algorithm) |

| Data | | Source | | | Target for validation | |
|---|---|---|---|---|---|---|
| **Satellite** | **Proc. level & version** | **Agency** | **Centre** | **User interface** | **Centre** | **Acquisition method** |
| | | | EUMETSAT | EO Portal<br>https://eoportal.eumetsat.int/userMgmt/login.faces<br>Operational data available from 22.11.2007 on. | DWD | FTP transfer or disc exchange |
| *GOME-2 data* | | | | | | |
| METOP | L2 | EUMETSAT | DLR/O3M-SAF | GOME-2 Web Page<br>http://atmos.caf.dlr.de/gome2<br>EOWEB<br>http://eoweb.dlr.de:8080/index.html | DLR | N/A<br>(data already available) |

[1)] Two versions of 5.x AIRS Level-2 and Level-3 data products are now available:

1. Beginning of the mission (2002) - September 30, 2007: version 5.0 only.
2. October 1, 2007 onwards: version 5.2 only.

The version switch-over date is October 1, 2007. The version 5.2 algorithm smoothly continues the version 5.0 data record forward. The newer version number (5.2.2) is evident in the product filenames. There is no change in the file specification.

The AIRX2RET datasets can be ordered with two processing versions, ‘V003’ or ‘V005’ (the filename is extended with resp. ‘.003’ and ‘.005’). V005 is the latest version and will be favoured.

Files (Data Type) to be ordered:

Level 2:

1. AIRX2RET: AIRS/Aqua Level 2 Standard physical retrieval (AIRS+AMSU), available from 30.08.2002 on; Spatial Resolution: 50 km x 50 km, Temporal Resolution: 6 Minute(s); File Size 5.138 MB, 240 files per day.
2. AIRS2RET: AIRS/Aqua Level 2 Standard physical retrieval (AIRS-only), available from 31.05.2007 on; Spatial Resolution: 50 km x 50 km, Temporal Resolution: 6 Minute(s); File Size 2.078 MB, 240 files per day.

Level 3:

3. AIRX3STD: AIRS/Aqua Level 3 Daily standard physical retrieval (AIRS+AMSU), available from 31.08.2002 on; Spatial Resolution: 1 x 1 deg x 1 x 1 deg, Temporal Resolution: 1 Day(s); File Size 39.905 MB.
4. AIRX3STM: AIRS/Aqua Level 3 Monthly standard physical retrieval (AIRS+AMSU), available from 01.09.2002 on; Spatial Resolution: 1 x 1 deg x 1 x 1 deg, Temporal Resolution: 30 Day(s); File Size 58.76 MB.
5. AIRS3STD: AIRS/Aqua Level 3 Daily standard physical retrieval (AIRS-only), available from 31.05.2007 on; Spatial Resolution: 1 x 1 deg x 1 x 1 deg, Temporal Resolution: 1 Day(s); File Size 55.206 MB.
6. AIRS3STM: AIRS/Aqua Level 3 Monthly standard physical retrieval (AIRS-only), available from 31.05.2007 on; Spatial Resolution: 1 x 1 deg x 1 x 1 deg, Temporal Resolution: 30 Day(s); File Size 86.416 MB.

The Level 2 datasets contain 28 pressure levels, 1100 to 0.1 mbar. The water vapour retrievals of both versions are based on AIRS + AMSU-A. A.o., temperature profiles are included. For a full product Description of (1, 2) and (3–6) see resp. README.AIR_2RET.pdf [RD-xx] and README.AIR_3ST_.pdf [RD-yy].

For the initial 4 months of data, a total of 240 * (31 * 4) = 29,760 AIRS L2 files will be downloaded, which will require a total disc space of 149.3 GB.

## 5.3 Procurement Schedule

Acquisition of input data for validation (WP 210), is scheduled to be performed during 01.12.2009-31.05.2009.

The table below defines the satellite based datasets to be acquired for validation and the schedule of data acquisition, as required for the validation phase. It is important to state that the dataset acquired must be completely available prior to the commencement of each project phase.

**Table 5-3: Acquisition schedule for satellite data for validation.**

| Phase | WP | Phase schedule | Acquired dataset | Acquisition schedule |
|---|---|---|---|---|
| Prototype | 380 | 01.12.2009 – 30.11.2010 | Diagnostic dataset – initial version (4 months in 2006-2008) | Starting 01.12.2009 |
| Test | 460 | 01.06.2011 – 31.08.2011 | Diagnostic dataset – nominal version (2006-2008) | Starting 01.12.2009 |
| Final | 510 | 01.09.2011 – 30.11.2011 | Diagnostic dataset – extended version (1996-2008) | Starting 01.12.2009 |

A EUMETSAT User Account has been opened.

## 5.4 Workload estimate for quality control

The availability of error indicators and quality flags will be checked. Data without error indicators or quality flags will not be considered for validation and for the DDS. The data contents will be sanity checked on range (minimum/maximum) and undefined values.

## 5.5 Data Cost

No costs expected. The contact to NOAA-NCDC is established, and restrictions regarding HIRS dataset provision is not expected.

# 6 Ground-based Validation Data

## 6.1 Data Needs

The use of radiosonde data is envisaged as main source of ground based data for validation. Radiosonde data are generally distributed globally via GTS on a daily basis. In addition, total column water vapour (TCWV) derived from ground based GPS data will be used, as well as ground based microwave radiometer data and data from lidar systems. The following datasets are potential candidates for the DDS:

- Radiosonde data:
  - GCOS Upper Air Network (GUAN) radiosonde data archived at DWD,
  - Other radiosonde data holdings at DWD, UKMO and ECMWF,
  - Meteorological Observatory Lindenberg (MOL) radiosonde data as part of GRUAN,
  - Radiosonde data from specific campaigns (e.g. EUMETSAT IASI validation campaign).

- GPS data for total column water vapour (TCWV)
  - EUMETNET European Global Water Vapour (EGVAP) Project:
    - original data available on hourly basis (2001-on),
    - data available from many but not all European stations.
  - NOAA Forecasts System Laboratory (FSL) Net:
    - about 40 stations in USA,
    - data processed daily (2005-on).
  - SuomiNet:
    - about 60 stations in USA,
    - data processed daily (2005-on).

- Microwave radiometer data from
  - Microwave Water Radiometer ARM facilities (1993–on)
  - Meteorological Observatory Lindenberg (MOL) microwave data

- Lidar data
  - Meteorological Observatory Lindenberg (MOL) Lidar data

The radiosonde data and the GPS data from the EGVAP project are distributed via the Global Telecommunication System (GTS).

## 6.2 Data Sources

The following table provides source details to the required ground based data for validation. Per data type, the Availability details of the providing data Centre (user interface, i.e. web portal, web address (URL), database or archive, and ftp address, if applicable) are listed.

**Table 6-1: Ground based data sources for validation.**

| Data type | Source | |
|---|---|---|
| | Centre | User interface |
| *Radiosonde data* | | |
| GCOS Upper Air Network (GUAN) radiosonde data | DWD | Local archive (Mirakel database) |
| Other radiosonde data holdings at DWD, UKMO and ECMWF | DWD, UKMO, ECMWF | Local archive (DWD: Mirakel & CIRRUS database) |
| Meteorological Observatory Lindenberg (MOL) radiosonde data as part of GRUAN | DWD | GRUAN, http://www.gruan.org<br>Data not yet available. |
| Radiosonde data from specific campaigns (e.g. EUMETSAT IASI validation campaign) | EUMETSAT, DWD | N/A (data transfer completed) |
| *GPS data for total column water vapour (TCWV)* | | |
| EUMETNET European Global Water Vapour (EGVAP) Project | EGVAP (DMI) | EGVAP<br>http://egvap.dmi.dk |
| NOAA Forecasts System Laboratory (FSL), now called NOAA Global Systems Division (GSD) | NOAA GSD | GSD (Info)<br>http://esrl.noaa.gov/gsd/<br>GPS-MET (data)<br>http://gpsmet.noaa.gov/jsp/index.jsp |
| SuomiNet | UCAR, NOAA | SuomiNet<br>http://www.suominet.ucar.edu/indexGlobal.html |

| **Data type** | **Source** | |
|---|---|---|
| | **Centre** | **User interface** |
| *Microwave radiometer data* | | |
| Microwave Water Radiometer ARM facilities | ARM | ARM, www.arm.gov/data/pi/28 (TCWV) |
| Meteorological Observatory Lindenberg (MOL) microwave data | DWD | Local archive (‘Lindenberger Säule’ database) |
| *Lidar* | | |
| Meteorological Observatory Lindenberg (MOL) Lidar data | DWD | Local archive (‘Lindenberger Säule’ database) |

## 6.3 Procurement Schedule

Acquisition of ground-based data is synchronised with the acquisition of satellite validation data (WP 210), which is scheduled to be performed during 01.12.2009-31.05.2010. Further details on schedule can be found in section 5.3.

## 6.4 Workload estimate for quality control

The availability of error indicators and quality flags will be checked. Data without error indicators or quality flags will not be considered for validation and for the DDS. The data contents will be sanity checked on range (minimum/maximum) and undefined values.

## 6.5 Data Cost

No costs expected.

# 7 Aircraft Data for Validation

## 7.1 Data Needs

Airborne humidity sensing devices (Helten et al., 1998) are used to measure relative humidity with respect to water. The overall uncertainty is ±4% relative humidity in the middle troposphere and ±7% relative humidity between 9 and 13 km altitude. This implies a good usage for comparisons within the troposphere and a limited use in the stratosphere.

## 7.2 Data Sources

The MOZAIC database (1994–on) is a potential candidate for the DDS:

The Measurements of OZone, water vapour, carbon monoxide and nitrogen oxides by in-service AIrbus airCraft (MOZAIC) program consists of automatic and regular measurements of reactive gases by five long range passenger airliners. A large database of measurements (about 30,000 flights since 1994) allows studies of chemical and physical processes in the atmosphere, validations of global chemistry transport models and satellite retrievals.

The flights are distributed amongst eight main directions, the respective densities of MOZAIC flights over the five continents were Europe (42%), North America (25%), Asia (16.5%), South America (13%), and Africa (3.5%). In 1995, the start of the Austrian Airlines operation gave a better coverage of Asia and Africa, while South American coverage reduced, due to some airlines' redistribution of A340 flights toward North America and Asia. Currently, 3 aircraft are in operation. Most of the measurements (90%) correspond to cruise altitudes 9–12 km (Marenco et al., 1998), lying in the troposphere in the tropics and subtropics and in the UT/LS at mid latitudes. The long duration of the measurement program coupled with the extensive geographical coverage makes it suitable for comparison at inter-seasonal and seasonal time scales.

More details on the MOZAIC project can also be found in [RD-1, 2] and in Luo et al. (2008). MOZAIC data are available from the MOZAIC project homepage at http://mozaic.aero.obs-mip.fr/web/.

## 7.3 Procurement Schedule

Acquisition of aircraft data is synchronised with the acquisition of satellite validation data (WP 210), which is scheduled to be performed during 01.12.2009-31.05.2009. Further details on schedule can be found in section 5.3.

Note that the Mozaic Data Protocol needs to be filled by DWD and accepted by Mozaic principle investigators. The distribution of the Mozaic data, even within GlobVapour, needs clarification.

## 7.4 Workload estimate for quality control

The availability of error indicators and quality flags will be checked. Data without error indicators or quality flags will not be considered for validation and for the DDS. The data contents will be sanity checked on range (minimum/maximum) and undefined values.

## 7.5 Data Cost

No costs expected.

# 8 Conclusions

The satellite and auxiliary data required for the generation of the GlobVapour data products are specified, together with the space- and ground-based data as well as aircraft data needed for the validation. Details on data sources, procurement and potentially associated costs are stated.