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EUMETSAT O3M SAF

The EUMETSAT Network of Satellite Application Facilities

O3M SAF
Ozone and Atmospheric Chemistry Monitoring

SERVICE SPECIFICATION

Issue 1.3

Document signatures			
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Document change log		
ISSUE	DATE	Description of change
0.1	5.3.2007	1st draft
0.2	17.4.2007	2nd draft
0.3	3.5.2007	3rd draft
0.4	4.10.2007	4th draft
0.5	18.10.2007	5th draft, document re-organized, ORR-A Part 2 RIDs implemented
0.6	11.3.2008	6th draft, document updated, product tables and delivery schematic added as Appendices 1 and 2
0.7	30.9.2008	7th draft, document updated according to ORR-A Part 3 RIDs and product status upgrades
0.8	28.4.2009	8th draft, updates to Appendix 1: - Tropospheric NO2 product divided to NRT (O3M-36) and offline (O3M-37) products. Product tables for OTO/SO2 and ARS/AAI added. Appendices 2 and 3 updated.
0.9	11.3.2010	9th draft, the Global Telecommunication System (GTS) of WMO added as means of delivery for NTO products. Updates in Appendix 1: - Accuracy requirement values for ARS/AAI added, product tables for OUV, OTO/HCHO and OTO/H2O added. Appendices 2 and 3 updated accordingly.
1.0	28.10.2011	Updates in Appendix 1: - the Global Telecommunication System (GTS) of WMO added as means of delivery for NOP (O3M-03) - accuracy values for NTO/NO2 (O3M-02), OTO/NO2 (O3M-07), NTO/NO2Tropo (O3M-36) and OTO/NO2Tropo (O3M-37) updated - product table for reprocessed offline total ozone (O3M-40) added Update in Appendix 2: - status of OTO/H2O (O3M-12) changed to “operational”

1.1	25.11.2013	Updates in O3M SAF product tables (Appendix 1): - Tables re-organised based on product categories, operational CDOP-2 products added - Metop-A NUV products (O3M-4, O3M-5) removed - NRT and Offline Total Ozone: NWP, MACC, ozone depletion added to Applications and users - NRT and Offline Tropospheric NO2: MACC added to Applications and users, accuracy values updated - Offline Total HCHO: Removed climate change monitoring and ozone depletion from Applications and users, added MACC Updated requirements: - PR-5: Removed reference to storage additional information - PR-8: Added NetCDF as product format - PR-9: For offline products "HDF5" → "HDF5 or NetCDF", for NRT products "HDF5 and BUFR" → "HDF5 and/or BUFR" - PR-10: Removed HIRS/4 - PR-14: Removed by addition to PR-16 - PR-15: Added dissemination methods WMO GTS and FTP - PR-17: Replaced list of various validation services with one sentence - PR-19: Removed by addition to PR-18 - PR-20: Removed - PR-21: Modified - PR-23: Modified, restriction to only offline product removed - PR-24: Modified, restriction to only offline product removed - PR-28: Reference to EOWEB removed - PR-38: Contact methods "admin message and similar media" removed - PR-39: Contact methods "admin message and similar media" removed - O3M SAF data sets (Appendix 2) added, PR-1 modified accordingly Updates in O3M SAF product delivery diagram (Appendix 3): - NHP, NAR, NAP, OHP, ARP and NUV/CLOUD added to deliverable products Updates in O3M SAF Subsystems (Appendix 4): - Subsystem charts updated

1.2	3.12.2014	Definition of availability updated according to Operations Review 6 Action 5 List of the members of the O3M SAF Steering Group updated Updates in Appendix 1: - Spatial resolution of the trace gas products (O3M-01, O3M-02, O3M-06, O3M-07, O3M-08, O3M-09, O3M-10, O3M-36, O3M-37, O3M-41, O3M-42, O3M-50, O3M-51, O3M-52, O3M-53, O3M-54, O3M-55, O3M-56, O3M-58, O3M-82) updated - Metop-A offline surface UV products (O3M-17, O3M-18, O3M-19, O3M-21, O3M-22, O3M-23, O3M-24, O3M-25, O3M-27, O3M-28, O3M-29, O3M-30, O3M-93, O3M-94) replaced by Metop-B products (O3M-95, O3M-96, O3M-97, O3M-98, O3M-99, O3M-100, O3M-101, O3M-102, O3M-103, O3M-104, O3M-105, O3M-106, O3M-107, O3M-109) Appendix 2 renamed to "O3M SAF Data Records" Update in Appendix 2: - LER surface albedo (O3M-89) added Approved by the Steering Group (O3M_DEC_CDOPSG17-02)
1.3	20.5.2015	List of the members of the O3M SAF Steering Group updated Update in Appendix 2: - Offline daily maximum nitrogen dioxide photolysis rate (O3M-109) added Update in Appendix 3: - Product acronyms updated Approved by the Steering Group (O3M_DEC_CDOPSG18-07)

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1. Introduction

1.1. Scope

This document presents the requirements for operational products and services of the Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF) of the EUMETSAT.

This document is made available to the users and constantly revised and updated as new products and services are brought into operation.

1.2. Reference documents

Reference	Title	Id.
RD1	EPS End User Requirements Document	EPS/MIS/REQ/93001

1.3. Definition of terms

Availability is the minimum probability that the system is operational over a specified period in order to assure the specified timeliness. See PR-22.

For NRT products, the availability is defined by the ratio of the number of in time processed and disseminated products to the number of received input products (L1B PDUs) per month. For offline products, the availability is defined by the ratio of the number of in time processed, archived and quality-approved L2 products to the number of orbits for which input products (L1B PDUs) have been received per month.

Exceptions:

The NUV product is required to be produced every day, either on the basis of new GOME ATO input or in the case of ATO delivery failure based on back-up total ozone data (ECMWF or climatology). Availability is defined as the fraction of days in a month when NUV product is delivered to all users on time.

OUV is a Level 3 product, and availability is defined as the fraction of days in a month with product fulfilling the timeliness requirement.

Timeliness defines whether the product is near real time (NRT) product which is disseminated or ready for download in three hours from sensing at the latest or offline product which is available for download in two weeks after sensing at the latest, during system availability. System unavailability will in most cases not lead to loss of data but to delays with respect to the specified timeliness.

Accuracy is defined as in the EPS End User Requirements Document [RD1]: the values of accuracy “represent RMS values” taking as reference the 'true value' measured by ground based instruments.

2. Requirements related to products

2.1. General requirements

PR-1: The O3M SAF shall generate and distribute the products as specified in Appendices 1 and 2. Delivery of operational products is presented in Appendix 2.

2.2. Requirements related to product archiving and distribution

PR-2: The products and services shall be available to all EUMETSAT member counties.

PR-3: All offline products derived within O3M SAF shall be available from the (decentralized) O3M SAF archive.

PR-4: National Meteorological Services of the EUMETSAT member states, and users authorized by these shall have access to the O3M SAF archive.

PR-5: All O3M SAF products shall be archived at least until the end of the Metop program.

PR-6: The SAF products shall be recoverable for at a minimum the EPS mission duration.

PR-7: A catalogue containing the list of O3M SAF products and associated metadata shall be made available to UMARF.

PR-8: HDF5 or NetCDF (for Thematic Climate Data Records) shall be the archive and disk storage format for the geophysical products.

PR-9: O3M SAF shall deliver the offline products in HDF5 or NetCDF formats. NRT products, excluding NUV, shall be delivered in HDF5 and/or BUFR format. NUV shall be delivered in PNG format.

PR-10: It shall be possible to reprocess all the GOME-2 data sets using new or improved algorithms.

PR-11: Temporary access failures to archive items shall not exceed 0.5 % over any one month period.

PR-12: There shall be provisions to ensure that no more than 0.1 % of vital data, and none of the algorithms and coefficients, of the total archive can be permanently lost.

PR-13: There shall be provisions to ensure that no more than 0.5 % of non-vital data of the total archive can be permanently lost.

PR-14: **Removed.**

PR-15: NRT products shall be made available in three hours from sensing. Products are made available to users via EUMETCast, WMO GTS, FTP, web pages and/or web-services.

PR-16: Offline products shall be delivered to O3M SAF archives at DLR or FMI and made available directly from the archives or through UMARF via FTP and other web services in 15 days from sensing.

2.3. Requirements related to product validation and quality control

PR-17: The O3MSAF shall provide validation services for all the products in operations, against their product requirements.

PR-18: Quality of the products shall be controlled with continuous online quality monitoring services.

PR-19: **Removed.**

PR-20: **Removed.**

PR-21: Validation reports shall be available via Internet.

PR-22: The Ozone SAF project team shall cooperate with the community of the EPS system development in order to ensure that the following availability requirements are to be fulfilled:

- EPS-SYS-8.3-220: The EPS Ground Segment NRT product delivery function to any single user shall be successful within timeliness for more than 97.5% of the overall data downlinked by the spacecraft, for any 30 days period.
- EPS-SYS-8.3-225: Service for a SAF chain shall be better than 95% over calendar month with a target availability of 98%.
- EPS-SYS-8.3-230: The EPS Ground Segment archive function shall be successful within the specified timeliness for more than 95.5% of the overall data downlinked by the spacecraft, for any 30 days period.
- EPS-SYS-8.3-240: The EPS Ground Segment archive function at the end of the full mission lifetime shall have been successful for more than 98.9% of the overall data downlinked by the successive operational spacecrafts during the whole mission.
- EPS-SYS-8.3-245: The access to the archive function provided by the EPS Ground Segment to any single user shall be successful within the specified timeliness for more than 98 % of the overall user access requests, for any 30 days period.
- EPS-SYS-8.3-250: The access to the archive function provided by the EPS Ground Segment to any single user shall be successful for more than 99.5% of the overall user access requests, for any 30 days period.

PR-23: Online quality control shall be undertaken during the generation of the SAF products.

PR-24: Online quality control shall be performed within the timeliness requirements.

PR-25: Offline quality control of the data and products generated by the product generation facilities shall be implemented.

PR-26: Offline quality control shall be performed for each type of data and product in order to identify improvements required in the data and product processing chains.

3. Requirements related to user services

3.1. Product ordering, O3M SAF website and helpdesk

PR-27: Users shall be able to submit orders for receiving O3M SAF products by using UMARF.

PR-28: Users shall be able to submit orders for receiving offline O3M SAF products directly from the DLR archive.

PR-29: Users shall be able to submit orders for receiving offline O3M SAF products directly from the FMI archive.

PR-30: O3M SAF shall provide a centralized website (http://o3msaf.fmi.fi) for user services.

PR-31: The website and associated user services shall be maintained by the operative SAF personnel at the FMI.

PR-32: The website shall reflect that the O3M SAF is a consortium effort.

PR-33: The O3M SAF website shall provide the following public functions:

- Overview of the SAF project
- Access to the product descriptions
- Link to UMARF
- Links to the websites of the consortium members
- Latest SAF news
- Links to product user manuals and validation reports
- Section for frequently asked questions
- Contact information

PR-34: The SAF team pages shall have restricted access. These pages shall include the whole SAF documentation and additional information about the project.

PR-35: Contacts by users shall be responded as soon as possible. FMI personnel can forward the inquiries to other consortium members, if necessary.

PR-36: The user community shall be kept informed of any service disruptions and possibly associated reduced quality of the service offered.

PR-37: All users shall be informed in advance of any planned reduction of service by email.

PR-38: All users shall be informed of any failure within the SAF affecting operational services by email.

Appendix 1: O3M SAF Products

The following tables provide detailed characteristics and requirements of pre-operational and operational O3M SAF products. Products are divided into product categories. The coloured bar on top of each category table lists the product IDs, names and acronyms.

NOTE: the nominal spatial resolution of the GOME-2 instrument depends on the actually implemented instrument operations mode.

NRT and Offline Total Ozone		
NRT: O3M-01, O3M-41 **Offline: O3M-06, O3M-42**	**MAG-N-O3, MBG-N-O3** **MAG-O-O3, MBG-O-O3**	
Type	Product	
Applications and users	Climate monitoring, air quality, NWP, MACC, ozone depletion	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
20%	4% (SZA < 80) 6% (SZA > 80)	1.5%
Verification method	Comparison with ground-based measurements Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

NRT and Offline Ozone Profiles, low resolution		
NRT: O3M-03, O3M-45 **Offline: O3M-13, O3M-46**	**MAG-N-O3PR, MBG-N-O3PR** **MAG-O-O3PR, MBG-O-O3PR**	
Type	Product	
Applications and users	NWP, air quality, health, scientific, ECMWF	
Characteristics and methods	RTModel: LidortA; Inversion: Optimal estimation	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
30% in stratosphere 70% in troposphere	15% in stratosphere 30% in troposphere	10% in stratosphere 25% in troposphere
Verification method	Balloon soundings, lidar and microwave radiometer measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 band 1a resolution nominal size: 640x40km	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

NRT and Offline Ozone Profiles, high resolution		
NRT: O3M-38, O3M-47 **Offline: O3M-39, O3M-48**	**MAG-N-O3HRPR, MBG-N-O3HRPR** **MAG-O-O3HRPR, MBG-O-O3HRPR**	
Type	Product	
Applications and users	NWP, air quality, health, scientific, ECMWF	
Characteristics and methods	RTModel: LidortA; Inversion: Optimal estimation	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
30% in stratosphere 70% in troposphere	15% in stratosphere 30% in troposphere	10% in stratosphere 25% in troposphere
Verification method	Balloon soundings, lidar and microwave radiometer measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 resolution nominal size 80x40 km	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

NRT and Offline Total NO2		
NRT: O3M-02, O3M-50 **Offline: O3M-07, O3M-51**	**MAG-N-NO2, MBG-N-NO2** **MAG-O-NO2, MBG-O-NO2**	
Type	Product	
Applications and users	NWP, Climate change monitoring, air quality, health, MACC	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
10^{15} molec/cm^2 (20% annual mean)	3-5·10^{14} molec/cm^2 (8-15% annual mean)	1-3·10^{14} molec/cm^2 (4-8% annual mean)
Verification method	Comparison with ground-based measurements. Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

NRT and Offline Tropospheric NO2		
NRT: O3M-36, O3M-52 **Offline: O3M-37, O3M-53**	**MAG-N-NO2TR, MBG-N-NO2TR** **MAG-O-NO2TR, MBG-O-NO2TR**	
Type	Product	
Applications and users	NWP, air quality, health, MACC	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	30%	20%
Verification method	Comparison with ground-based measurements Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

NRT and Offline Total SO2		
NRT: O3M-54, O3M-55 **Offline: O3M-09, O3M-56**	**MAG-N-SO2, MBG-N-SO2** **MAG-O-SO2, MBG-O-SO2**	
Type	Product	
Applications and users	Volcanic emissions, SACS, VAACs, TEMIS, Research institutes, Antrophogenic emission monitoring	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
100%	50% (SZA < 70˚)	30%
Verification method	Comparison with ground-based measurements. Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

Offline Total HCHO		
O3M-10 **O3M-58**	**MAG-O-HCHO** **MBG-O-HCHO**	
Type	Product	
Applications and users	Air quality, MACC	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
100%	50% (polluted)	30%
Verification method	Comparison with ground-based measurements Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	Offline ≤ 2 weeks
Comments		

Offline Total BrO		
O3M-08 **O3M-82**	**MAG-O-BrO** **MBG-O-BrO**	
Type	Product	
Applications and users	Climate monitoring research: ozone depletion, UCAM	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	30%	15%
Verification method	Comparison with ground-based measurements Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2/Metop-A: nominal pixel size 80 x 40 km^2 (before 15 July 2013) nominal pixel size 40 x 40 km^2 (after 15 July 2013) GOME-2/Metop-B: nominal pixel size 80 x 40 km^2	Offline ≤ 2 weeks
Comments		

Absorbing Aerosol Index		
NRT: O3M-61, O3M-71 **Offline: O3M-14, O3M-70**	**MAG-N-AAI, MBG-N-AAI** **MAG-O-AAI, MBG-O-AAI**	
Type	Product	
Applications and users	Climate monitoring, desert dust, biomass burning, volcanic ash, aerosol modelling	
Characteristics and methods	Rayleigh scattering	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	BUFR, HDF5	EUMETCast, WMO GTS
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
1.0 index points	0.5 index points	0.2 index points
Verification method	Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 resolution nominal size 80x40 km	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

Absorbing Aerosol Index from PMD's		
NRT: O3M-62, O3M-72 **Offline: O3M-63, O3M-73**	**MAG-N-AAIPMD, MBG-N-AAIPMD** **MAG-O-AAIPMD, MBG-O-AAIPMD**	
Type	Product	
Applications and users	Climate monitoring, desert dust, biomass burning, volcanic ash, aerosol modelling	
Characteristics and methods	Rayleigh scattering	
Generation frequency	NRT: PDU dissemination, every 3 minutes on daylight side of orbit Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
NRT	HDF5	EUMETCast
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
1.0 index points	0.5 index points	0.2 index points
Verification method	Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 resolution nominal size 80x40 km	NRT ≤ 3hours Offline ≤ 2 weeks
Comments		

Offline Total H2O		
O3M-12 **O3M-86**	**MAG-O-H2O** **MBG-O-H2O**	
Type	Product	
Applications and users	Climate monitoring: Climate change, GlobVapour	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Generation frequency	Offline: Metop orbit repeat cycle	
Input satellite data	Metop A and B: GOME-2	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
25%	10%	5%
Verification method	Comparison with ground-based measurements. Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 resolution nominal size 80x40 km	Offline ≤ 2 weeks
Comments		

NRT UV, Clear-sky		
O3M-91	**MBG-NUV_CLEAR**	
Type	Product	
Applications and users	Climate monitoring, health risk evaluation, INMH	
Characteristics and methods	Climatologies applied to Assimilated Total Ozone from KNMI	
Generation frequency	1 per day	
Input satellite data	Metop A and B: GOME-2 via internal ATO product	
Dissemination		
Type	Format	Means
NRT	PNG, HTML	FTP, WWW, GE
Accuracy		
Threshold	Target	Optimal
20%	10%	5%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.25˚ x 0.25˚ grid	NRT ≤ 3hours
Comments		

NRT UV, Cloud-corrected		
O3M-92	**MBG-NUV_CLOUD**	
Type	Product	
Applications and users	Climate monitoring, health risk evaluation, INMH	
Characteristics and methods	Climatologies applied to Assimilated Total Ozone from KNMI	
Generation frequency	1 per day	
Input satellite data	Metop A and B: GOME-2 via internal ATO product	
Dissemination		
Type	Format	Means
NRT	PNG, HTML	FTP, WWW, GE
Accuracy		
Threshold	Target	Optimal
20%	10%	5%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.25˚ x 0.25˚ grid	NRT ≤ 3hours
Comments		

Offline UV Daily dose, erythemal (CIE) weighting		
O3M-95	**MBG-OUV_DD_CIE**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV Daily dose, plant response weighting		
O3M-96	**MBG-OUV_DD_PLANT**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV Daily dose, DNA damage weighting		
O3M-97	**MBG-OUV_DD_DNA**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV Daily dose, UVA weighting		
O3M-99	**MBG-OUV_DD_UVA**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV Daily dose, UVB weighting		
O3M-100	**MBG-OUV_DD_UVB**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, erythemal (CIE) weighting		
O3M-101	**MBG-OUV_MDSR_CIE**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, plant response weighting		
O3M-102	**MBG-OUV_MDSR_PLANT**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, DNA damage weighting		
O3M-103	**MBG-OUV_MDSR_DNA**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, UVA weighting		
O3M-105	**MBG-OUV_MDSR_UVA**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, UVB weighting		
O3M-106	**MBG-OUV_MDSR_UVB**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline solar noon UV Index		
O3M-107	**MBG-OUV_NOON_UVI**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline daily maximum ozone photolysis rate		
O3M-108	**MBG-OUV_MPHR_O3**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV Daily dose, D-vitamin weighting		
O3M-98	**MBG-OUV_DD_VITD**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Offline UV daily maximum dose, D-vitamin weighting		
O3M-104	**MBG-OUV_MDSR_VITD**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

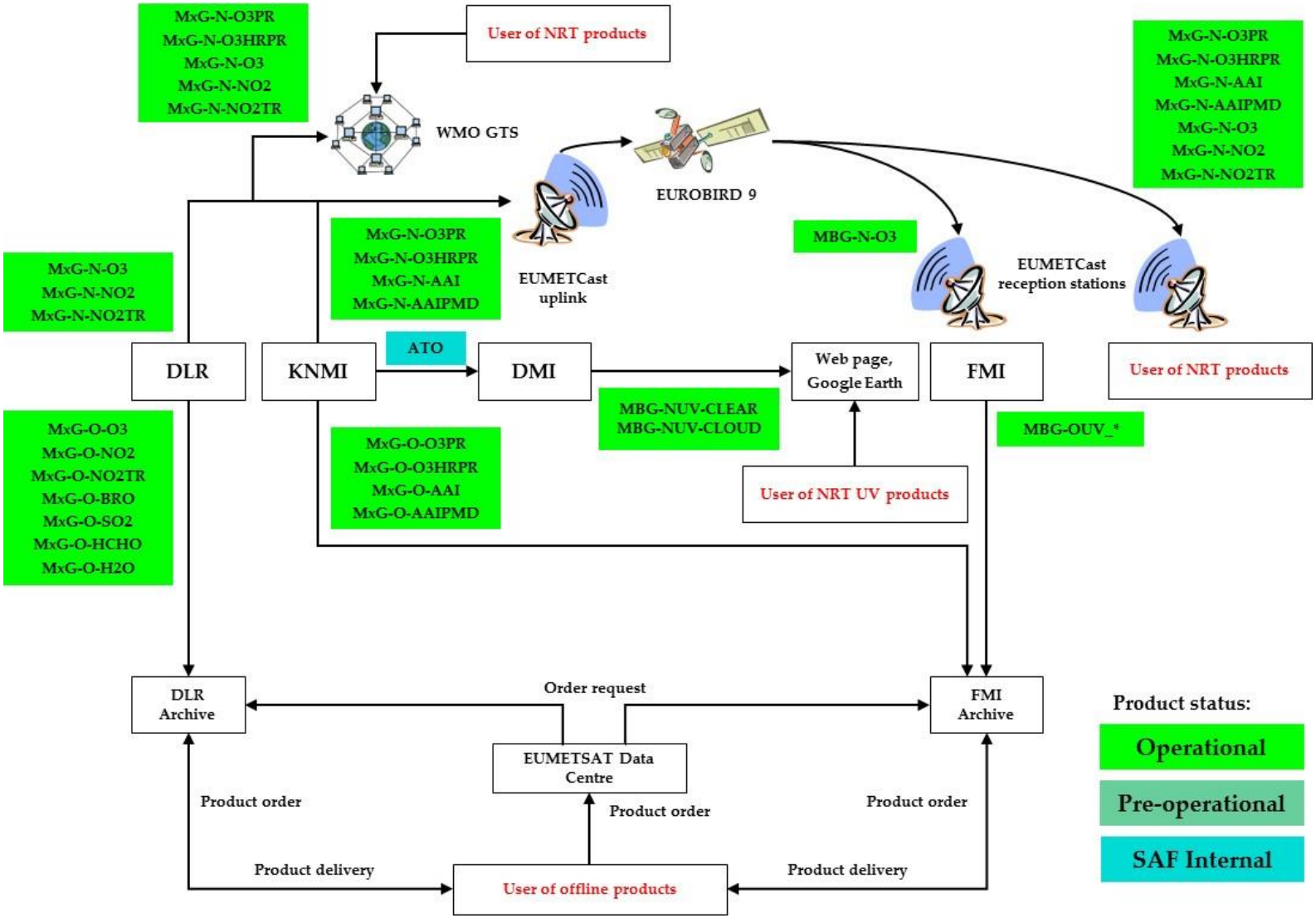
Offline daily maximum nitrogen dioxide photolysis rate		
O3M-109	**MBG-OUV_MPHR_NO2**	
Type	Product	
Applications and users	Climate monitoring, UV biological effects	
Characteristics and methods	Radiative transfer modelling	
Generation frequency	1 per day	
Input satellite data	GOME-2 via NTO, and AVHRR (Metop/NOAA)	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
50%	20%	10%
Verification method	Comparison with ground-based measurements	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	0.5˚ x 0.5˚ grid	Offline ≤ 2 weeks
Comments		

Appendix 2: O3M SAF Data Records

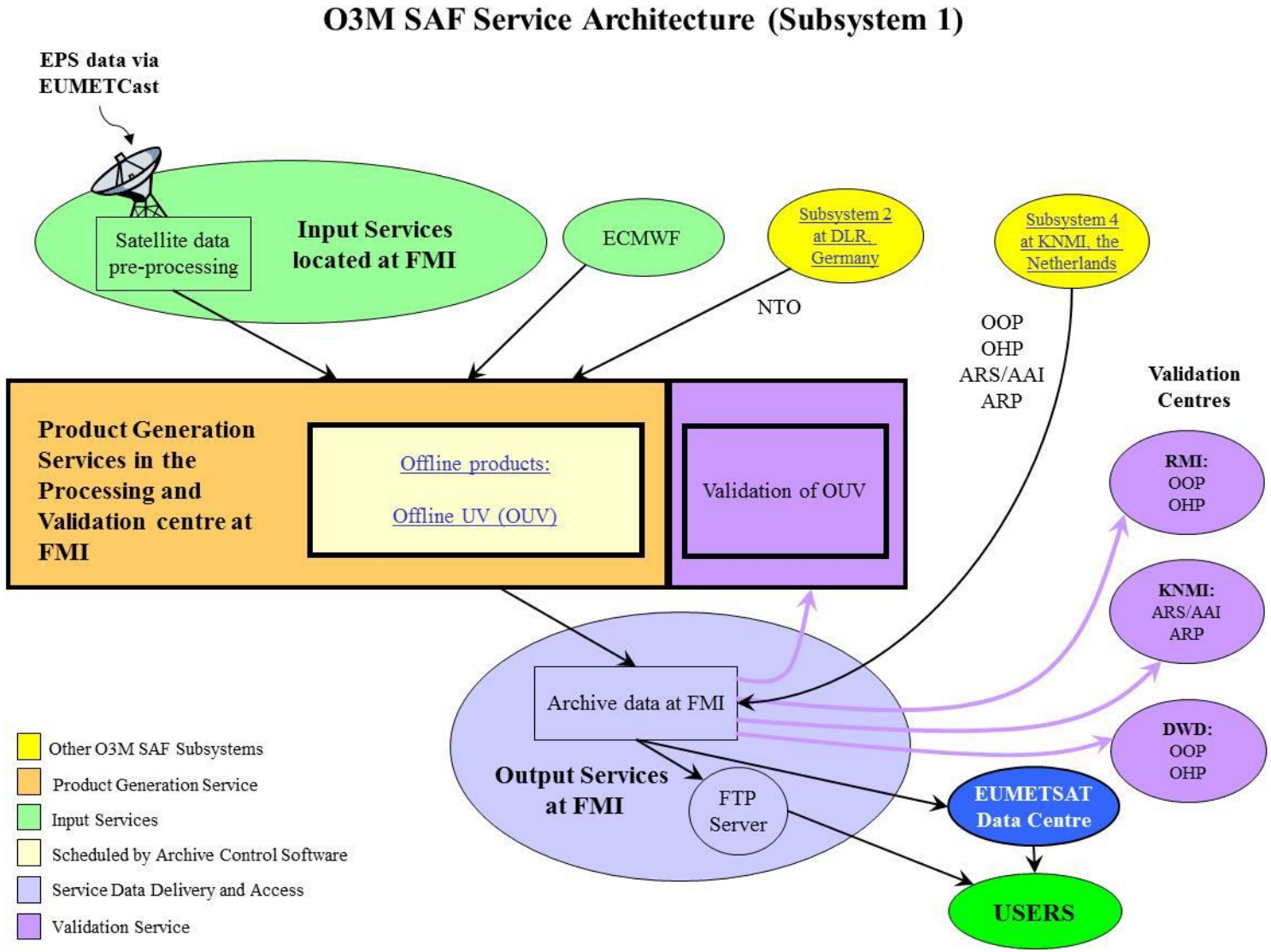
Reprocessed Total Ozone		
O3M-40	**MAG-RP1-O3**	
Type	Data Record	
Applications and users	Climate monitoring	
Characteristics and methods	DOAS slant column fitting + AMF conversion	
Input satellite data	Metop-A: GOME-2 L1 (PPF 4.x)	
Algorithm version	GDP 4.4	
Time period	January 2007 – December 2009	
Data volume	200 GB	
Dissemination		
Type	Format	Means
Offline, reprocessed	HDF5	FTP, EDC
Accuracy		
Threshold	Target	Optimal
20%	3% (SZA < 80°) 6% (SZA > 80°)	1.5%
Verification methods	Comparison with ground-based measurements Satellite-to-satellite comparison	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	GOME-2 resolution, nominal size 80x40 km	-
Comments		

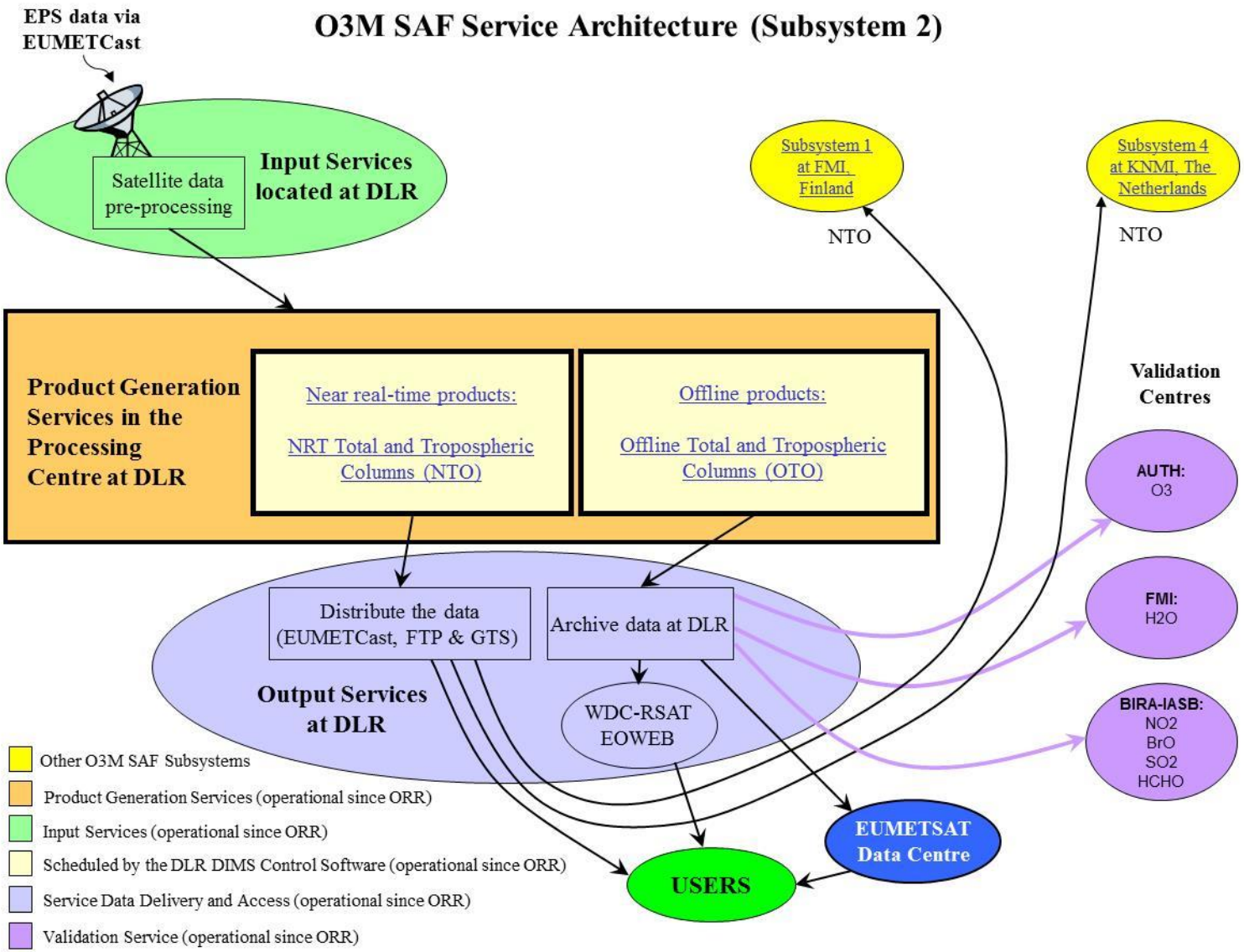
LER Surface Albedo		
O3M-89	**MAG-DS-LER**	
Type	Data Record	
Applications and users	Climate monitoring: shortwave radiation balance, models, trace gas retrievals	
Characteristics and methods	LER is provided for 15 selected GOME-2 wavelength bands located outside strong gaseous absorption bands. From the main science channels: 325, 335, 340, 354, 380, 388, 416, 440, 494, 555, 610, 670, 758, 772 nm From the PMDs: 325, 332, 369, 382, 413, 460, 519, 554, 589, 639, 756, 799 nm.	
Generation frequency	Once, covering the period 1 February 2007 - 30 June 2013	
Input satellite data	Metop-A GOME-2 L1b and assimilated total ozone columns from NTO	
Dissemination		
Type	Format	Means
Offline	HDF5	FTP
Accuracy		
Threshold	Target	Optimal
0.10	0.04	0.02
Verification method	Intercomparison with TOMS, GOME-1, and OMI surface LER databases	
Coverage, resolution and timeliness		
Spatial coverage	Spatial resolution	Timeliness
Global	Main science channels: 1° x 1° PMD bands: 0.5° x 0.5°	-
Comments		

Appendix 3: O3M SAF Product Delivery Diagram

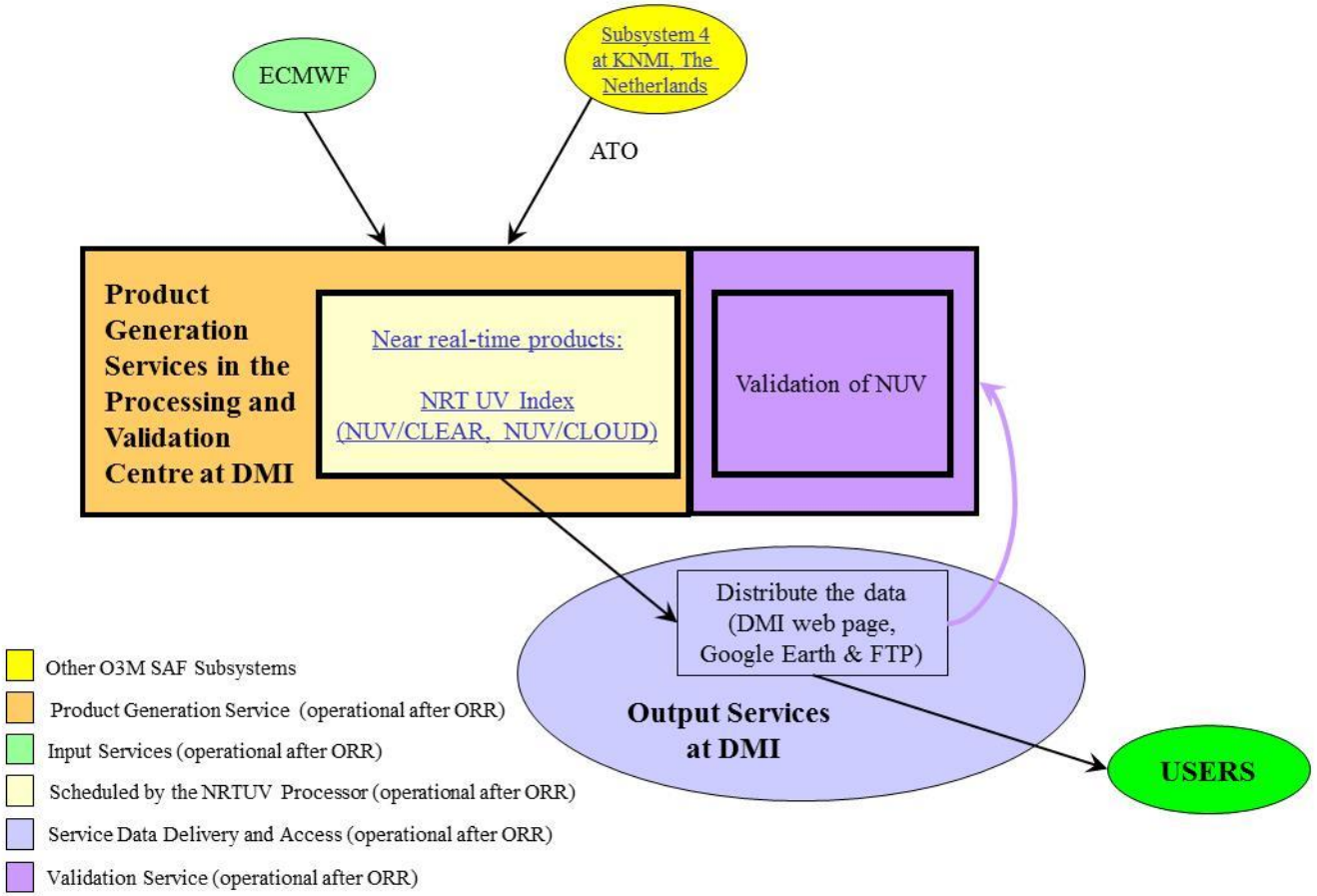


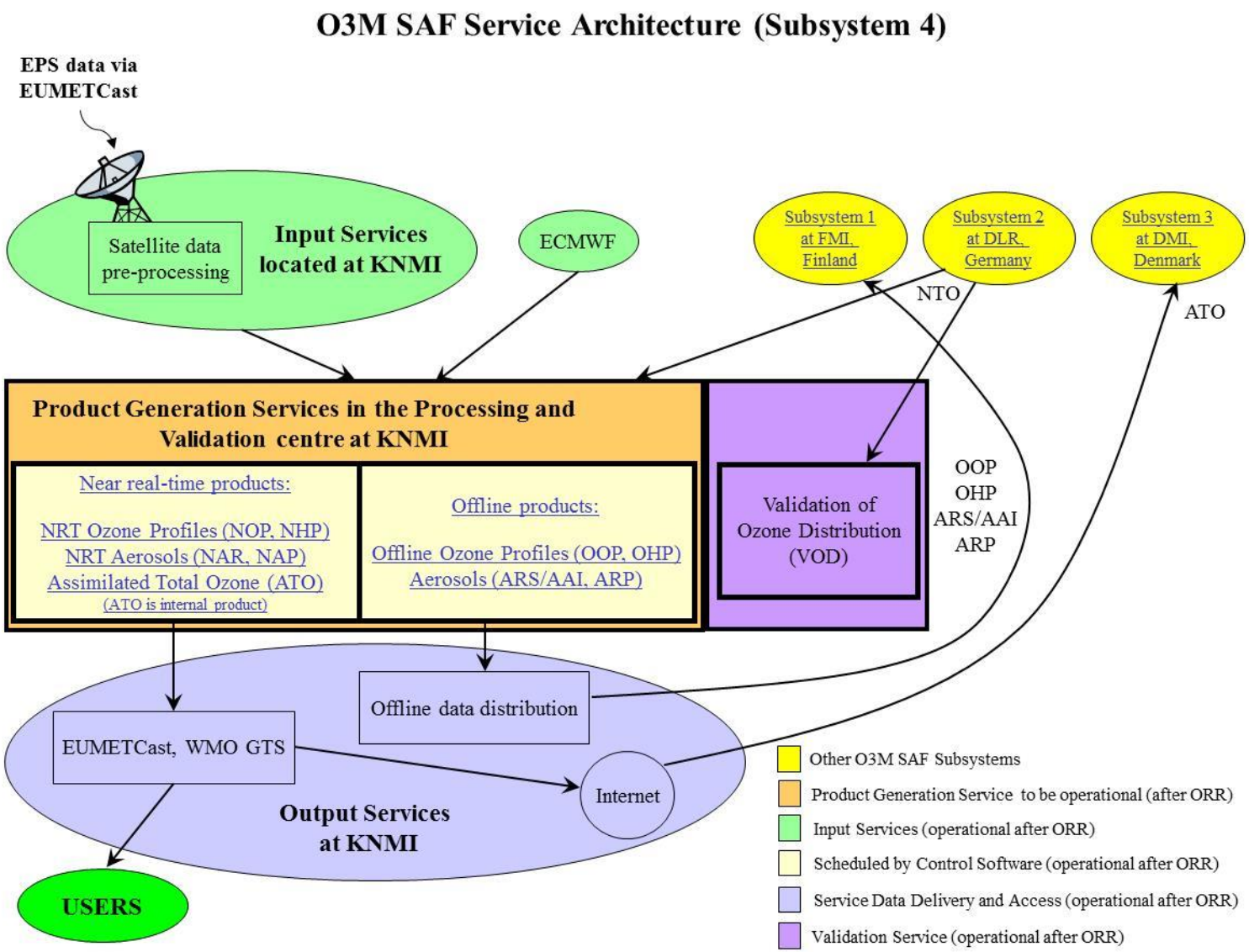
Appendix 4: O3M SAF Subsystems




O3M SAF Service Architecture (Subsystem 2)
EPS data via EUMETCast
Satellite data pre-processing
Input Services located at DLR
Subsystem 1 at FMI, Finland
NTO
Subsystem 4 at KNMI, The Netherlands
NTO
Product Generation Services in the Processing Centre at DLR
Near real-time products:
NRT Total and Tropospheric Columns (NTO)
Offline products:
Offline Total and Tropospheric Columns (OTO)
Validation Centres
AUTH: O3
FMI: H2O
BIRA-IASB: NO2 BrO SO2 HCHO
Distribute the data (EUMETCast, FTP & GTS)
Archive data at DLR
Output Services at DLR
WDC-RSAT EOWEB
EUMETSAT Data Centre
USERS
Other O3M SAF Subsystems
Product Generation Services (operational since ORR)
Input Services (operational since ORR)
Scheduled by the DLR DIMS Control Software (operational since ORR)
Service Data Delivery and Access (operational since ORR)
Validation Service (operational since ORR)

O3M SAF Service Architecture (Subsystem 3)




O3M SAF Service Architecture (Subsystem 4)
EPS data via EUMETCast
Satellite data pre-processing
Input Services located at KNMI
ECMWF
Subsystem 1 at FMI, Finland
Subsystem 2 at DLR, Germany
Subsystem 3 at DMI, Denmark
NTO
ATO
Product Generation Services in the Processing and Validation centre at KNMI
Near real-time products:
NRT Ozone Profiles (NOP, NHP)
NRT Aerosols (NAR, NAP)
Assimilated Total Ozone (ATO)
(ATO is internal product)
Offline products:
Offline Ozone Profiles (OOP, OHP)
Aerosols (ARS/AAI, ARP)
Validation of Ozone Distribution (VOD)
OOP
OHP
ARS/AAI
ARP
Offline data distribution
EUMETCast, WMO GTS
Internet
Output Services at KNMI
USERS
Other O3M SAF Subsystems
Product Generation Service to be operational (after ORR)
Input Services (operational after ORR)
Scheduled by Control Software (operational after ORR)
Service Data Delivery and Access (operational after ORR)
Validation Service (operational after ORR)