

ROM SAF CDOP 4

Product Requirements Document

Version 1.1

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ROM SAF Consortium

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ROM SAF

The Radio Occultation Meteorology Satellite Application Facility (ROM SAF) is a decentralised processing centre under EUMETSAT which is responsible for operational processing of radio occultation (RO) data from the Metop, Metop-SG and Sentinel-6 satellites and radio occultation data from other missions. The ROM SAF delivers bending angle, refractivity, temperature, pressure, humidity, and other geophysical variables in near real-time for NWP users, as well as reprocessed Climate Data Records (CDRs) and Interim Climate Data Records (ICDRs) for users requiring a higher degree of homogeneity of the RO data sets. The CDRs and ICDRs are further processed into globally gridded monthlymean data for use in climate monitoring and climate science applications.

The ROM SAF also maintains the Radio Occultation Processing Package (ROPP) which contains software modules that aid users wishing to process, quality-control and assimilate radio occultation data from any radio occultation mission into NWP and other models.

The ROM SAF Leading Entity is the Danish Meteorological Institute (DMI), with Cooperating Entities: i) European Centre for Medium-Range Weather Forecasts (ECMWF) in Reading, United Kingdom, ii) Institut D'Estudis Espacials de Catalunya (IEEC) in Barcelona, Spain, iii) Met Office in Exeter, United Kingdom, and iv) and Wegener Center, University of Graz, in Graz, Austria. To get access to our products or to read more about the ROM SAF please go to: <u>http://www.romsaf.org</u>

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Executive Summary

This document presents the product requirements of the EUMETSAT Satellite Application Facility (SAF) on Radio Occultation Meteorology (ROM), hereinafter referred to as the ROM SAF.

The requirements expressed in this document represent the commitment of the ROM SAF Team for the development under the overall EPS, EPS-SG and Sentinel-6 end-user requirements within the Fourth Continuous Development and Operations Phase (CDOP 4) based on the cooperation agreement between the Leading Entity (DMI) and EUMETSAT. This document is under the authority of the Steering Group, which approves changes and modifications. Any changes substantially changing the product list or other major commitments would need the approval by EUMETSAT Delegate Bodies.

The Product Requirements Document (PRD) is the main reference document for all development related reviews (Requirements Reviews, Product Consolidation Reviews, Operational Readiness Reviews, and Delivery Readiness Reviews) and provides the end users of the ROM SAF with a vision of what can be expected at the end of the current ROM SAF phase.



1. Introduction

1.1 Purpose of the Document

This document presents the product requirements of the EUMETSAT Radio Occultation Meteorology (ROM) Satellite Application Facility (SAF), hereinafter referred to as the ROM SAF. The products requirements have been determined taking into consideration user-based requirements as specified in the GRAS SAF User Requirements Document [RD.1].

The requirements expressed in this document represent the commitment of the ROM SAF Team for the development under the overall EPS, EPS-SG and Sentinel-6 (previously known as Jason-CS) end-user requirements [AD.1, AD.2, AD.3] and within the Fourth Continuous Development and Operations Phase (CDOP 4) [AD.4] based on the Cooperation Agreement between the Leading Entity (DMI) and EUMETSAT [AD.5]. This document is under the authority of the Steering Group, which approves changes and modifications. Any changes substantially changing the product list or other major commitments would need the approval by EUMETSAT Delegate Bodies.

The Product Requirements Document (PRD) is the main reference document for all development related reviews (Requirements Reviews, Product Consolidation Reviews, Operational Readiness Reviews, and Delivery Readiness Reviews) and provides the end users of the ROM SAF with a vision of what can be expected at the end of the current ROM SAF phase.

The requirements stated in this document apply to the nominal mode of operations of the ROM SAF and/or central EUMETSAT ground segment. The nominal mode is characterised by the following:

- The EPS/Metop, EPS-SG, Sentinel-6 satellites and the ground segment are successfully commissioned and are in an operational status;
- The satellites are outside the outage periods related to manoeuvre and decontamination within its operational tolerances;
- The RO instruments are correctly functioning to requirements and is in its nominal operational mode;
- No satellite and ground segment anomaly impacts on the on-ground processing;
- The intra- and inter-SAF data flow and data production operate at the planned capacity and efficiency;

1.2 Applicable and Reference Documents

1.2.1 Applicable Documents

The following list contains documents with a direct bearing on the contents of this document.

[AD.1] EPS End-User Requirements Document; Ref: EPS/MIS/REQ/93001 Issue 4, Rev. 2, 13 October 1997 (also Annex I to EUM/C/36/97/DOC/54)



- [AD.2] EPS-SG End User Requirements Document, Ref: EUM/PEPS/REQ/09/0151
- [AD.3] Jason-CS/Sentinel-6 End-User Requirements Document, Ref: EUM/LEO-JASCS/REQ/12/0013
- [AD.4] CDOP 4 Proposal: Proposal for the Fourth Continuous Development and Operations Phase (CDOP 4), Ref: SAF/ROM/DMI/MGT/CDOP4/001, Version 1.1, 5 April 2021, as approved by the EUMETSAT Council in document reference EUM/C/97/21/DOC/15
- [AD.5] CDOP 4 Cooperation Agreement between EUMETSAT and DMI on the CDOP 4 of the ROM SAF (EUM/C/97/21/DOC/21), signed on 31 August and 15 September 2021

1.2.2 Reference Documents

The following documents provide supplementary or background information, and could be helpful in conjunction with this document.

[RD.1] GRAS SAF User Requirements Document Ref: SAF/GRAS/METOFFICE/RQ/URD/001, version 2.1, 5 November 2001

1.3 Acronyms and Abbreviations

BUFR	Binary Universal Format for the Representation of data (also FM94)
CDR	Climate Data Record
CGS	Core Ground Segment
DMI	Danish Meteorological Institute
ECMWF	The European Centre for Medium-range Weather Forecasts
EPS	EUMETSAT Polar satellite System)
EPS-SG	EUMETSAT Polar satellite System - Second Generation
EUMETSAT	European organisation for the exploitation of Meteorological Satellites
EURD	End Users Requirements Document
FM94	Form Number 94 (see BUFR)
GBGP	Ground Based GNSS Package
GLONASS	Globalnaya Navigatsionnaya Sputnikovaya Sistema
GM	Global Mission (for EPS-SG)
GNSS	Global Navigation Satellite Systems
GPAC	GNSS Processing and Archiving Center
GPS	Global Positioning System
GPS/MET	Global Positioning System/Meteorology Experiment on Microlab-1



GRAS	GNSS Receiver for Atmospheric Sounding
GRIB	Gridded Binary format
GTS	Global Telecommunication System
IEEC	Institut d'Estudis Espacials de Catalunya
LEO	Low Earth Orbit
Met Office	United Kingdom Meteorological Office
METOP	METeorological Operational Polar satellite
NetCDF	Network Common Data Form
NRT	Near-Real Time
NTC	Non Time Critical
NWP	Numerical Weather Prediction
POD	Precise Orbit Determination
RO	Radio Occultation
ROM SAF	Radio Occultation Meteorology SAF
ROPP	Radio Occultation Processing Package
RM	Regional Mission (for EPS-SG)
RMDCN	Regional Meteorological Data Communications Network
SAF	Satellite Application Facility
TBC	To Be Confirmed
TBD	To Be Determined or To Be Decided
VAR	Variational analysis (1D, 2D, 3D or 4D variants)
UG-WEGC	University of Graz, Wegener Center
WIS	World Information System
WMO	World Meteorological Organisation



1.4 Definitions

RO data products from the Metop, Metop-SG and Sentinel-6 satellites and RO data from other missions are grouped in data levels (level 0, 1, 2, or 3) and product types (NRT, Offline, NTC, CDR, or ICDR). The data levels and product types are defined below. The lists of variables should not be considered as the complete contents of a given data level, and not all data may be contained in a given data level.

Data levels:

<u>Level 0</u>: Raw sounding, tracking and ancillary data, and other GNSS data before clock correction and reconstruction;

<u>Level 1A</u>: Reconstructed full resolution excess phases, total phases, pseudo ranges, SNRs, orbit information, I, Q values, NCO (carrier) phases, navigation bits, scintillation parameters, and quality information;

<u>Level 1B</u>: Bending angles and impact parameters, tangent point location, total electron content, and quality information;

<u>Level 2</u>: Refractivity, geopotential height, "dry" temperature profiles (Level 2A), pressure, temperature, specific humidity profiles (Level 2B), surface pressure, tropopause height, planetary boundary layer height (Level 2C), ECMWF model level coefficients (Level 2D), electron densities, and quality information;

<u>Level 3</u>: Gridded or resampled data, that are processed from Level 1 or 2 data, and that are provided as, e.g., daily, monthly, or seasonal means on a spatiotemporal grid, including metadata, uncertainties and quality information.

Product types:

<u>NRT</u>: Data product delivered less than: (i) 3 hours after measurement (ROM SAF Level 2 for EPS); (ii) 150 min after measurement (ROM SAF Level 2 for EPS-SG Global Mission); (iii) 125 min after measurement (ROM SAF Level 2 for EPS-SG Regional Mission);

<u>Offline, NTC</u>: Data product delivered from about 5 days to up to 6 months after measurement, depending on the applicable requirements. The evolution of this type of product is driven by new scientific developments and subsequent product upgrades;

<u>CDR</u>: A (Fundamental or Thematic) Climate Data Record is generated from a dedicated reprocessing activity using a fixed set of processing software.¹ The data record covers an extended time period of several years (with a fixed end point) and constitutes a homogeneous data record appropriate for climate usage;

<u>ICDR</u>: An Interim Climate Data Record (ICDR) regularly extends in time a (Fundamental or Thematic) CDR using a system having optimum consistency with and lower latency than the system used to generate the CDR.²

 ¹ (i) GCOS 2016 Implementation Plan; (ii) <u>http://climatemonitoring.info/home/terminology/</u>
 ² <u>http://climatemonitoring.info/home/terminology/</u> (the ICDR definition was endorsed at the <u>9th session of</u> the joint CEOS/CGMS Working Group Climate Meeting on 29 March 2018)



1.5 Identification of Requirements

The requirements in this document are uniquely identified as follows:

PRD-mm-nn

where *mm* represents the requirements group identifier (deliverables) and *nn* is the group requirement number. The following group identifiers are used:

- 01 General, covering all products and services.
- 02 Near-real time sounding product
- 03 Offline, NTC and ICDR sounding product
- 04 Gridded products
- 05 Near-real time validation
- 06 Offline, NTC and ICDR validation
- 07 Gridded validation
- 08 Software deliverables
- 09 User and supporting services
- 10 Re-analysis dataset
- 11 Reprocessed data records

1.6 Overview of this document

The structure of the chapters of this document is as follows:

Chapter 1 contains the introduction and definitions.

Chapter 2 contains the list of all product requirements.

Chapter 3 contains the list of TBCs and TBDs.

Annex A contains tables with product requirements for all products.



2. Requirements

2.1 General

- PRD-01-01 The ROM SAF shall have an operational capability to process EUMETSAT Secretariat CGS Level 1B data in near-real time from the RO instruments on Metop and Metop-SG to Level 2 products according to specifications in Annex A, Tables GRM-24, 24.1, 24.2, 26, 26.1, 26.2, 40 to 44, 60 to 64, 130 to 135, 150 to 155, 200.
- PRD-01-02 The ROM SAF shall have an offline and NTC capability to process EUMETSAT Secretariat CGS Level 1A data from the RO instruments on Metop, Metop-SG and Sentinel-6 to Level 1B and Level 2 products according to specifications in Annex A, Tables GRM-24, 24.1, 24.2, 26, 26.1, 26.2, 46 to 51, 66 to 71, 103, 105, 117 to 122, 136 to 142, 156 to 162. This capability shall be used to regularly generate offline and NTC products and at certain key points, to re-process the complete Level 1B, 2, and 3 dataset up to that point to a common best-practice standard.
- PRD-01-03 The ROM SAF shall have a capability to generate offline and NTC gridded products from data from the RO instruments on Metop, Metop-SG and Sentinel-6 for climate applications, according to the product specifications in Annex A, Tables GRM-53 to 59, 73 to 79, 83 to 89, 123 to 129, 143 to 149, 163 to 169, 183 to 189, 191 to 198.
- PRD-01-04 The ROM SAF shall develop and maintain a software package ("ROPP") to support user-assimilation of RO data in NWP models, according to specifications in Annex A, Table GRM-16, 16_v12, 16_v13.
- PRD-01-05 ROM SAF near-real time, offline and climate data record products shall conform to netCDF standards for file formatting.
- PRD-01-06 ROM SAF Level 2 products shall be made available to users within the timeliness requirements specified in the EPS and EPS-SG EURDs and via GTS and EUMETCast dissemination for NRT and via HTTP for offline.
- PRD-01-07 All ROM SAF deliverables (products, datasets and software) shall be available to users according to EUMETSAT data policy.
- PRD-01-08 An on-line catalogue of ROM SAF products shall be maintained as part of the EUMETSAT Data Centre to enable offline bulk data ordering.
- PRD-01-09 ROM SAF shall archive its products for a period of no less than 10 years after the end of the EPS/Metop mission.
- PRD-01-10 Archived products shall be capable of extraction, with no degradation to the original product quality, on user request, ordered via the EUMETSAT Data Centre.
- PRD-01-11 Archived products shall be capable of extraction, with no degradation to the original product quality, on user request, ordered via the ROM SAF Product Archive.
- PRD-01-12 Archived products shall be available to users in the same file formats as used for the original data.
- PRD-01-13 The ROM SAF shall develop and maintain a software package ("GBGP") containing tools for formatting of GNSS ground-based data, according to



specifications in Annex A, Table GRM-92.

2.2 Near-Real Time Sounding Products

- PRD-02-01 NRT Sounding products shall contain all required Level 2 parameters (including date, time and geodetic location, error estimates and quality control flagging). Level 2 NRT product parameter specifications are as presented in Annex A, Tables GRM-24, 24.1, 24.2, 26, 26.1, 26.2, 40 to 44, 60 to 64, 130 to 135, 150 to 155, 200.
- PRD-02-02 NRT Sounding products shall contain a sub-set of required Level 1 parameters selected from EUMETSAT Secretariat CGS NRT products (from which the Level 2 product are derived), including: thinned profiles of bending angle, impact parameters, geographical location, position and velocity data.
- PRD-02-03 Of those Level 1B NRT products with correct instrument operation and available to the ROM SAF within: (i) 2h 15min (EPS), (ii) 70 min (EPS-SG GM), (iii) 30 min (EPS-SG RM), more than 95% shall be processed to Level 2 products and disseminated to users within the following SAF Level 2 breakthrough values calculated from end of sensing time: (i) 3 hours, (ii) 150 min, (iii) 125 min. This availability rate shall be calculated over a 1 month period.
- PRD-02-04 NRT sounding products shall be disseminated via GTS, RMDCN and EUMETCast.
- PRD-02-05 NRT sounding products disseminated via GTS or RMDCN shall use WMO FM94 (BUFR) encoded format. Dissemination over EUMETCast shall use BUFR or netCDF.
- PRD-02-07 The near real-time sounding products shall be archived within the ROM SAF leading entity.

2.3 Offline and NTC Sounding Products

- PRD-03-01 Offline and NTC products shall be generated to take advantage of RO NRT data not meeting the timeliness requirements for NRT products and with the offline and NTC products fulfilling Level 1B and 2 product parameter specifications as presented in Annex A, Tables GRM-24, 24.1, 24.2, 26, 26.1, 26.2, 46 to 51, 66 to 71, 103, 105, 117 to 122, 136 to 142, 156 to 162.
- PRD-03-02 The ROM SAF shall have the capability to process data from RO instruments other than onboard EUMETSAT missions in order to generate offline and NTC Level 1B and Level 2 products to the same specification (within the limits of the available data) as the EUMETSAT missions RO products.
- PRD-03-03 Offline and NTC products shall at least contain identical parameters to the nearreal time products.
- PRD-03-04 All available offline and NTC occultation events with correct instrument operation shall be processed to Level 1B and Level 2 sounding products and shall be available to users within 30 days to 6 months of observation time. This availability rate shall be calculated over a 1 month period.
- PRD-03-05 Offline and NTC products shall be made available to users via HTTP using the file



formats netCDF and BUFR.

- PRD-03-06 The offline and NTC sounding products shall be archived within the ROM SAF leading entity.
- PRD-03-07 More than 95% of all generated Sentinel-6 Level 2 NTC products shall be available to users within 60 days of observation time. This availability rate shall be calculated over a 1-year period.

2.4 Gridded Products

- PRD-04-01 Gridded products shall be generated from best-quality offline and NTC products from Metop/GRAS, Metop-SG, Sentinel-6 and other RO receivers that are readily available and have high enough quality. Gridded product parameter specifications are as presented in Annex A, Tables GRM-53 to 59, 73 to 79, 83 to 89, 123 to 129, 143 to 149, 163 to 169, 183 to 189, 191 to 198.
- PRD-04-02 Gridded products shall contain gridded monthly means together with estimates of corresponding errors and contain meta-data providing traceability to the individual occultations and software versions.
- PRD-04-03 Gridded products shall be made available to users via HTTP using the file format netCDF.
- PRD-04-04 The gridded products shall be archived within the ROM SAF leading entity.

2.5 Near-Real Time Validation

- PRD-05-01 The ROM SAF shall generate, and make publicly available, validation information supporting available RO NRT sounding products using information obtained from Met Office and ECMWF NWP fields and RO measurements from Metop, Metop-SG, Sentinel-6, COSMIC, COSMIC-2, CHAMP, GRACE, TanDEM-X, TerraSAR-X, FY-3 (GNOS).
- PRD-05-02 The ROM SAF shall generate (for use only by team members and EUMETSAT) validation and monitoring information on the GPAC NRT product processing.
- PRD-05-03 Validation shall include statistics on the quantity of products.
- PRD-05-04 The validation domain shall be global and over the full vertical domain of the NRT products.
- PRD-05-05 Validation statistics shall be generated with a time resolution of 1 day and 1 month, including Metop commissioning periods.
- PRD-05-06 Metop/GRAS and Metop-SG NRT product validation information shall be made publicly available via the project's website.
- PRD-05-07 The ROM SAF shall also validate data available in NRT from other available RO instruments and present the same information, and in the same way, as for Metop and Metop-SG.
- PRD-05-08 The NRT product validation information shall be archived within the ROM SAF leading entity.



2.6 Offline and NTC Validation

- PRD-06-01 The ROM SAF shall generate, and make publicly available, validation information supporting available RO offline and NTC sounding products using information obtained from NWP fields.
- PRD-06-02 The ROM SAF shall generate (for use only by team members and EUMETSAT) validation and monitoring information on the GPAC offline and NTC product processing.
- PRD-06-03 Validation shall include statistics on the quantity of products.
- PRD-06-04 The validation domain shall be global and over the full vertical domain of the offline and NTC products.
- PRD-06-05 Validation statistics shall be generated with a time resolution of 1 calendar month, excluding Metop commissioning periods.
- PRD-06-06 Offline and NTC product validation information shall be made available via the project's website.
- PRD-06-07 The offline and NTC product validation information shall be archived within the ROM SAF leading entity.

2.7 Gridded Validation

- PRD-07-01 The ROM SAF shall generate, and make publicly available, validation information supporting gridded products.
- PRD-07-02 The ROM SAF shall generate (for use only by team members and EUMETSAT) validation and monitoring information on the GPAC gridded product processing.
- PRD-07-03 Validation shall include statistics on the quantity of products.
- PRD-07-04 The validation domain shall be global and over the full vertical domain of the gridded products.
- PRD-07-05 Validation statistics shall be generated with a time resolution of 1 calendar month and based on full length of data sets.
- PRD-07-06 Gridded product validation information shall be made available via the project's website.
- PRD-07-07 The gridded product validation information shall be archived within the ROM SAF leading entity.
- PRD-07-08 The ROM SAF shall generate metrics to monitor the stability of gridded data in time.
- PRD-07-09 The ROM SAF shall generate time series for the whole length of the data set and make it available at the web site.



2.8 Software Deliverables

ROM SAF deliverables include software to support user applications, such as 1D-Var code and RO observation operators for NWP assimilation, pre-processing algorithms and supporting code for interfacing with various standard file formats. Collectively, this deliverable is known as the 'Radio Occultation processing Package' (ROPP). The software deliverables also include tools for formatting Ground-based GNSS data; this deliverable is known as the "Ground Based GNSS Package" (GBGP).

- PRD-08-01 The ROM SAF shall make available the ROPP software deliverable according to the specifications in Annex A, Table GRM-16, 16_v12, 16_v13. This package shall include key user documentation describing the software deliverable, and shall include: Release notes, User Guide and Reference Manual(s).
- PRD-08-02 The ROM SAF shall support user assimilation in NWP models by the provision of associated observation error covariance matrices appropriate to the ROM SAF Level 2 products.
- PRD-08-03 Software deliverables shall be coded in ISO-standard high-level languages (principally Fortran-95) and shall follow programming standards guidelines. The code shall be designed to be portable so as to be capable of being built, installed and run on a variety of different POSIX-compliant platforms and compilers.
- PRD-08-04 The ROM SAF shall make the software deliverable and associated supporting documentation and datasets available (to registered users) for download from the project website.
- PRD-08-05 The ROPP software deliverable shall continue to be developed and maintained by the ROM SAF. Maintenance activity shall include fixes to programming errors, improvements to code efficiency, and developments supporting improved scientific processing in response to evolving Product Requirements. Updates resulting from development & maintenance shall be released to users according to plans.
- PRD-08-06 The ROM SAF shall make available the GBGP software deliverable according to the specifications in Annex A, Table GRM-92. This package shall include key user documentation describing the software deliverable, and shall include: Release notes, User Guide and Reference Manual(s).
- PRD-08-07 The GBGP software deliverable shall continue to be maintained by the ROM SAF. Maintenance activity shall include fixes to programming errors.
- PRD-08-08 The ROPP software shall contain low-level utility routines (geodesy calculations, date/time conversion, coordinate transformations, error messages).
- PRD-08-09 The ROPP software shall contain I/O routines (support for intrinsic ROPP netCDF data structure, and its conversion to and from BUFR, tools to read UCAR, GFZ and EUMETSAT Leve1b data in their proprietary formats, ability to process data from the missions listed below, tool to extract background profiles from GRIB files, range-checking, profile thinning).
- PRD-08-10 The ROPP software shall contain pre-processing routines (tools to generate L1 and L2 channel bending angles from excess phase and amplitude, and to compute ionospheric corrected bending angle and refractivity profiles from L1 and L2 bending angles, 1D and 2D wave optics propagation codes).
- PRD-08-11 The ROPP software shall contain forward modelling routines (tools to generate



refractivities and bending angles from background profiles produced by ECMWF and Met Office models, 1D refractivity operator, 1D and 2D bending angle operators, routines to calculate electron density and L2-L1 bending angle profiles for idealised ionospheres, tangent linear and adjoint counterparts for use in 1D-Var).

- PRD-08-12 The ROPP software shall contain 1D-Var routines (tools to retrieve solution profiles from ECMWF and Met Office models and refractivity and bending angle profiles, tools to retrieve electron density profiles from L2-L1 bending angle differences, quality control, minimisers, solution diagnostics).
- PRD-08-13 The ROPP software shall contain applications routines (tools to diagnose tropopause height and boundary layer height from profiles of a variety of observational and model variables).
- PRD-08-14 The ROPP software shall be tested on the following platforms and compilers:
 - (i) All 'compile', 'run' and 'regression' tests shall be carried out on one compiler (probably either gfortran or ifort).
 - (ii) All 'compile' and all 'run' tests must be performed with at least two compilers (probably ifort and gfortran).
 - (iii) All 'compile' tests must be performed on at least two platforms (probably linux and Cygwin).
 - (iv) All 'compile' tests must be performed with at least five compilers.
- PRD-08-15 The ROPP software shall be tested through verification and validation methods ("Test Folder") as follows:
 - Coding and compilation testing (compliance to coding standards; tests of basic functionality ('core tests') on at least 6 commonly available compilers and at least two platforms);
 - (ii) Module testing for the I/O module (test reading and writing of data is within tolerances, test unit conversion);
 - (iii) Integration testing for the pre-processing module (test Abel transform, ionospheric correction, excess phase processing, wave optics propagators);
 - (iv) Integration testing for the forward modelling module (test computed refractivities and bending angles from ECMWF and Met Office background temperature, water vapour and pressure, against independently generated profiles, including at least one test of a full day of data);
 - Integration testing for the 1D-Var module (test the propriety of the input data, sensitivity to assumed errors, retrievals using real observational data from a variety of sources, including at least one test of a full day of data);
 - (vi) Integration testing for the applications module (calculated TPH and PBLHs compared against independently calculated reference values);
 - (vii) Regression testing (for each module, the results of one test are closely compared against those of the immediately preceding ROPP release);
 - (viii) Portability testing (check that at least one compiler passes as many tests as the default compiler);
 - (ix) Timing testing (check that code runs in reasonable times on differen compilers and platforms);
 - (x) Documentation testing (check that user guides and reference manuals are clear and correct).



2.9 User and Supporting Services

ROM SAF deliverables include information services such as user documentation, education and Helpdesk and other web-based resources for SAF products, plus supporting users through holding workshops and providing opportunities under the SAF Visiting Scientist programme.

- PRD-09-01 The ROM SAF shall establish and maintain a project website as a service to users. This user service shall include (but not be limited to) news and announcements about, and information and documentation on, ROM SAF products, validation, software and data sets; technical and scientific reports; announcements of seminars, workshops, and visiting scientist opportunities; information on how to contact the SAF; and shall allow a user to search the product catalogue for quick-view and to order products and data sets.
- PRD-09-02 The ROM SAF website shall be hosted by the leading entity and shall be an operational element of the ROM SAF, with a maximum of one interruption per week and with an interruption time of one working day as a maximum.
- PRD-09-03 The website shall implement a user interface function (Helpdesk) for users to report problems, request help or give other feedback. The Helpdesk facility shall track user interactions, and shall acknowledge receipt of a new contact by automated response. Helpdesk shall answer at least 90% of requests within 3 working days. Resolution of an issue depends on its complexity, and is thus not guaranteed.
- PRD-09-04 Access to ROM SAF products (data, software) shall require the user to first register their details.
- PRD-09-05 User Services shall include a User Notification service as an option for registered users to be notified by email of changes to operational or offline products, software or data sets or on their availability via the website, GTS/RMDCN or EUMETCast as appropriate to the user.
- PRD-09-06 Access to ROM SAF software deliverables shall require the user to agree to a User Licence.
- PRD-09-07 Information on the availability, quality and web access statistics, of ROM SAF deliverables shall be reported in a ROM SAF half-yearly Operations Report.
- PRD-09-08 The ROM SAF shall organise and hold ROM SAF User and Training Workshop(s).
- PRD-09-09 The ROM SAF shall encourage and conduct Visiting Scientist activities aimed at improving the information exchange between the ROM SAF team and the scientific community, and at improving the science in, and promoting the use of, ROM SAF deliverables.

2.10 Re-Analysis Dataset

- PRD-10-01 With the ERA5 system, ECMWF generates a GNSS-RO global reanalysis dataset for the 2007-2015 period by assimilating reprocessed GNSS-RO measurements and conventional measurements that do not require bias correction. The reprocessed measurements is provided by ECMWF as part of the ERA CLIM project.
- PRD-10-02 The processing uses the ECMWF reanalysis system run at T159 resolution, to



produce daily, gridded reanalyses at 00Z and 12Z. The daily reanalyses and the corresponding departure statistics of both active and passive observations are archived.

- PRD-10-03 The quality of the dataset is monitored using the departure statistics with respect to both active and passive observations, and by comparison with other global reanalyses.
- PRD-10-04 Three dimensional and zonally averaged Monthly Mean Climatologies (MMCs) of various variables, including temperature, humidity and geopotential height, is derived from the daily reanalyses. Time-series of climate indicators are computed, stored and made available to users.
- PRD-10-05 The dataset and derived data are archived at ECMWF.
- PRD-10-06 The dataset and derived data is made available to users in standard formats, such as GRIB fields, via appropriate links such as at the ROM SAF web site.

2.11 Climate Data Records

- PRD-11-01 Reprocessed climate data records shall be generated to take advantage of improved algorithms not available at the original time of processing. Original products are the ROM SAF Offline and NTC Level 1B, 2 and 3 products. Product parameter specifications for reprocessed data records are as presented in Annex A, Tables GRM-28-R1, 29-R1, 30-R1, 32-R1, 33-R1; GRM-28-R2, 29-R2, 30-R2, 31-R2, 32-R2, 33-R2; GRM-28-R3, 29-R3, 30-R3, 31-R3, 32-R3, 33-R3, 34-R3, 35-R3.
- PRD-11-02 The ROM SAF shall have the capability to reprocess data from RO instruments from COSMIC, COSMIC-2, GRACE, CHAMP to generate reprocessed Level 1B, 2, and 3 climate data records to the same specification (within the limits of the available data) as the Metop/GRAS products.
- PRD-11-03 Reprocessed climate data records shall contain identical parameters to the original products.
- PRD-11-04 Reprocessed climate data records shall be made available to users via appropriate links, channels or media using standard file formats such as netCDF and BUFR.
- PRD-11-05 Reprocessed climate data records shall be archived within the ROM SAF leading entity.
- PRD-11-06 Reprocessed climate data records shall be made available to users via HTTP using the file formats netCDF and BUFR.
- PRD-11-07 The ROM SAF shall generate (for use only by team members and EUMETSAT) validation and monitoring information on the GPAC reprocessing.
- PRD-11-08 Validation shall include statistics on the quantity of products and on their improvement with respect to the original products.
- PRD-11-09 The validation domain shall be global and over the full vertical domain of the reprocessed climate data records.
- PRD-11-10 Reprocessed climate data records validation information shall be made available



via the project's website.

- PRD-11-11 Reprocessed climate data records validation information shall be archived within the ROM SAF leading entity.
- PRD-11-12 Validation statistics for reprocessed climate data records shall be generated with a time resolution of 1 calendar month and based on full length of data sets.
- PRD-11-13 The ROM SAF shall generate reprocessed time series for the whole length of the climate data records and make it available at the web site.
- PRD-11-14 Reprocessed climate data records shall be extended in time using the same software as used in the generation of the CDRs and allow for the generation of Interim CDRs. Product parameter specifications for reprocessed data records are as presented in Annex A, Tables GRM-29-I1, 29-I2, 29-I3.
- PRD-11-15 Interim CDRs shall be monitored similarly to the monitoring of Offline and NTC profile and gridded products as described in requirements PRD-06-01 to PRD-06-07 and PRD-07-01 to PRD-07-09.



3. List of TBDs and TBCs

Annex A, table GRM-26: PBLH requirements (TBD)

Annex A, table GRM-170 to 173: Ionosphere products for EPS-SG (TBD)



ANNEX A. Product Specifications

The following tables summarize the specifications for each ROM SAF deliverable product.

A1. Definitions:

Threshold Accuracy The minimum accuracy limit which is needed, so that the procession of the considered being useful for some user groups		
Target Accuracy	The product accuracy that is targeted in the development and the reference in product quality before the (pre-) operational product generation and dissemination.	
Optimal Accuracy	The accuracy that can be reached under optimal conditions.	

The interpretation, definition and validation approach of accuracy for a given product is described under the verification and validation method in the following tables.

A2. Product Levels and Groups:

ROM SAF products are divided into the following groups:

- Level 1B Bending Angle (GRM-46, 66, 136, 156)
- Level 2A Refractivity (GRM-40, 47, 60, 67, 117, 130, 137, 150, 157)
- Level 2A Dry temperature (GRM-103, 105)
- Level 2B, 2C Temperature, Pressure, and Humidity (GRM-41 to 44, 48 to 51, 61 to 64, 68 to 71, 118 to 121, 131 to 134, 138 to 141, 151 to 154, 158 to 161)
- Level 2C Tropopause Height (GRM-24, 24.1, 24.2)
- Level 2C Planetary Boundary Layer Height (GRM-26, 26.1, 26.2)
- Level 3 Gridded Data (GRM-53 to 59, 73 to 79, 83 to 89, 123 to 129, 143 to 149, 163 to 169, 191 to 198)
- Climate Data Records (GRM-28-R1, 29-R1, 30-R1, 32-R1, 33-R1; GRM-28-R2, 29-R2, 30-R2, 32-R2, 33-R2; GRM-28-R2, 29-R3, 30-R3, 31-R3, 32-R3, 33-R3, 34-R3, 35-R3)
- ICDR products (GRM-29-I1, 29-I2, 29-I3)
- ROPP software (GRM-16, 16_v12, 16_v13)
- GBGP software (GRM-92)
- Ionosphere products (GRM-170 to 173)
- Verification product (GRM-200)



A3. Overview list of sub GRM-ids for climate data records:

Product ID	Product Name	Product Acronym	
GRM-28-R1 GRM-28-R2 GRM-28-R3	Reprocessed Multi-Mission climate data record (Metop, COSMIC, CHAMP, GRACE L3)		
GRM-28-L3-B-R1/R2/R3	Reprocessed Bending Angle Grid	RBGMUL	
GRM-28-L3-R-R1/R2/R3	Reprocessed Refractivity Grid	RRGMUL	
GRM-28-L3-D-R1/R2/R3	Reprocessed Dry Temperature Grid	RDGMUL	
GRM-28-L3-Y-R1/R2/R3	Reprocessed Dry Pressure Grid	RYGMUL	
GRM-28-L3-Z-R1/R2/R3	Reprocessed Dry Geopotential Height Grid	RZGMUL	
GRM-28-L3-T-R1/R2/R3	Reprocessed Temperature Grid	RTGMUL	
GRM-28-L3-H-R1/R2/R3	Reprocessed Specific Humidity Grid	RHGMUL	
GRM-28-L3-C-R1/R2/R3	Reprocessed Tropopause Height Grid	RCGMUL	
GRM-28-L3-L-R2/R3	Reprocessed Planetary Boundary Layer Height Grid	RLGMUL	
GRM-29-R1 GRM-29-R2 GRM-29-R3	Reprocessed Metop dataset climate data record (Metop-A/B L1, L2, L3)	REPMET	
GRM-29-L1-B-R1/R2/R3	Reprocessed Bending Angle	RBAMET	
GRM-29-L2-R-R1/R2/R3	Reprocessed Refractivity Profile	RRPMET	
GRM-29-L2-D-R1/R2/R3	Reprocessed Dry Temperature Profile	RDPMET	
GRM-29-L2-T-R1/R2/R3	Reprocessed Temperature Profile	RTPMET	
GRM-29-L2-H-R1/R2/R3	Reprocessed Specific Humidity Profile	RHPMET	
GRM-29-L2-P-R1/R2/R3	Reprocessed Pressure Profile	RPPMET	
GRM-29-L2-S-R1/R2/R3	Reprocessed Surface Pressure	RSPMET	
GRM-29-L2-C-R1/R2/R3	Reprocessed Tropopause Height	RCHMET	
GRM-29-L2-L-R1/R2/R3	Reprocessed Planetary Boundary Layer Height	RLHMET	
GRM-29-L3-B-R1/R2/R3	Reprocessed Bending Angle Grid	RBGMET	
GRM-29-L3-R-R1/R2/R3	Reprocessed Refractivity Grid	RRGMET	
GRM-29-L3-D-R1/R2/R3	Reprocessed Dry Temperature Grid	RDGMET	
GRM-29-L3-Y-R1/R2/R3	Reprocessed Dry Pressure Grid	RYGMET	
GRM-29-L3-Z-R1/R2/R3	Reprocessed Dry Geopotential Height Grid	RZGMET	
GRM-29-L3-T-R1/R2/R3	Reprocessed Temperature Grid	RTGMET	
GRM-29-L3-H-R1/R2/R3	Reprocessed Specific Humidity Grid	RHGMET	
GRM-29-L3-C-R1/R2/R3	Reprocessed Tropopause Height Grid	RCGMET	
GRM-29-L3-L-R2/R3	Reprocessed Planetary Boundary Layer Height Grid	RLGMET	
GRM-30-R1 GRM-30-R2 GRM-30-R3	Reprocessed COSMIC-1 climate data record (COSMIC-1 L1, L2, L3)	REPCO1	
GRM-30-L1-B-R1/R2/R3	Reprocessed Bending Angle	RBACO1	
GRM-30-L2-R-R1/R2/R3	Reprocessed Refractivity Profile	RRPC01	
GRM-30-L2-D-R1/R2/R3	Reprocessed Dry Temperature Profile	RDPCO1	
GRM-30-L2-T-R1/R2/R3	Reprocessed Temperature Profile	RTPCO1	



Product ID	Product Name	Product Acronym	
GRM-30-L2-H-R1/R2/R3	H-R1/R2/R3 Reprocessed Specific Humidity Profile		
GRM-30-L2-P-R1/R2/R3	Reprocessed Pressure Profile	RPPCO1	
GRM-30-L2-S-R1/R2/R3	Reprocessed Surface Pressure	RSPC01	
GRM-30-L2-C-R1/R2/R3	Reprocessed Tropopause Height	RCHCO1	
GRM-30-L2-L-R1/R2/R3	Reprocessed Planetary Boundary Layer Height	RLHCO1	
GRM-30-L3-B-R1/R2/R3	Reprocessed Bending Angle Grid	RBGCO1	
GRM-30-L3-R-R1/R2/R3	Reprocessed Refractivity Grid	RRGC01	
GRM-30-L3-D-R1/R2/R3	Reprocessed Dry Temperature Grid	RDGC01	
GRM-30-L3-Y-R1/R2/R3	Reprocessed Dry Pressure Grid	RYGC01	
GRM-30-L3-Z-R1/R2/R3	Reprocessed Dry Geopotential Height Grid	RZGCO1	
GRM-30-L3-T-R1/R2/R3	Reprocessed Temperature Grid	RTGC01	
GRM-30-L3-H-R1/R2/R3	Reprocessed Specific Humidity Grid	RHGCO1	
GRM-30-L3-C-R1/R2/R3	Reprocessed Tropopause Height Grid	RCGCO1	
GRM-30-L3-L-R2/R3	Reprocessed Planetary Boundary Layer Height Grid	RLGC01	
GRM-31-R3	Reprocessed COSMIC-2 climate data record (COSMIC-2 L1, L2, L3)	REPCO2	
GRM-31-L1-B-R3	Reprocessed Bending Angle	RBACO2	
GRM-31-L2-R-R3	Reprocessed Refractivity Profile	RRPC02	
GRM-31-L2-D-R3	Reprocessed Dry Temperature Profile	RDPCO2	
GRM-31-L2-T-R3	Reprocessed Temperature Profile	RTPCO2	
GRM-31-L2-H-R3	Reprocessed Specific Humidity Profile	RHPCO2	
GRM-31-L2-P-R3	Reprocessed Pressure Profile	RPPCO2	
GRM-31-L2-S-R3	Reprocessed Surface Pressure	RSPCO2	
GRM-31-L2-C-R3	Reprocessed Tropopause Height	RCHCO2	
GRM-31-L2-L-R3	Reprocessed Planetary Boundary Layer Height	RLHCO2	
GRM-31-L3-B-R3	Reprocessed Bending Angle Grid	RBGCO2	
GRM-31-L3-R-R3	Reprocessed Refractivity Grid	RRGCO2	
GRM-31-L3-D-R3	Reprocessed Dry Temperature Grid	RDGCO2	
GRM-31-L3-Y-R3	Reprocessed Dry Pressure Grid	RYGCO2	
GRM-31-L3-Z-R3	Reprocessed Dry Geopotential Height Grid	RZGCO2	
GRM-31-L3-T-R3	Reprocessed Temperature Grid	RTGCO2	
GRM-31-L3-H-R3	Reprocessed Specific Humidity Grid	RHGCO2	
GRM-31-L3-C-R3	Reprocessed Tropopause Height Grid	RCGCO2	
GRM-31-L3-L-R3	Reprocessed Planetary Boundary Layer Height Grid	RLGCO2	
GRM-32-R1 GRM-32-R2 GRM-32-R3	GRM-32-R2 (CHAMP L1, L2, L3)		
GRM-32-L1-B-R1/R2/R3	Reprocessed Bending Angle	RBACHA	
GRM-32-L2-R-R1/R2/R3	Reprocessed Refractivity Profile	RRPCHA	
GRM-32-L2-D-R1/R2/R3	Reprocessed Dry Temperature Profile	RDPCHA	
GRM-32-L2-T-R1/R2/R3	Reprocessed Temperature Profile	RTPCHA	



Product ID	Product Name	Product Acronym	
GRM-32-L2-H-R1/R2/R3	32-L2-H-R1/R2/R3 Reprocessed Specific Humidity Profile		
GRM-32-L2-P-R1/R2/R3	Reprocessed Pressure Profile	RPPCHA	
GRM-32-L2-S-R1/R2/R3	Reprocessed Surface Pressure	RSPCHA	
GRM-32-L2-C-R1/R2/R3	Reprocessed Tropopause Height	RCHCHA	
GRM-32-L2-L-R1/R2/R3	Reprocessed Planetary Boundary Layer Height	RLGCHA	
GRM-32-L3-B-R1/R2/R3	Reprocessed Bending Angle Grid	RBGCHA	
GRM-32-L3-R-R1/R2/R3	Reprocessed Refractivity Grid	RRGCHA	
GRM-32-L3-D-R1/R2/R3	Reprocessed Dry Temperature Grid	RDGCHA	
GRM-32-L3-Y-R1/R2/R3	Reprocessed Dry Pressure Grid	RYGCHA	
GRM-32-L3-Z-R1/R2/R3	Reprocessed Dry Geopotential Height Grid	RZGCHA	
GRM-32-L3-T-R1/R2/R3	Reprocessed Temperature Grid	RTGCHA	
GRM-32-L3-H-R1/R2/R3	Reprocessed Specific Humidity Grid	RHGCHA	
GRM-32-L3-C-R1/R2/R3	Reprocessed Tropopause Height Grid	RCGCHA	
GRM-32-L3-L-R2/R3	Reprocessed Planetary Boundary Layer Height Grid	RLGCHA	
GRM-33-R1 GRM-33-R2 GRM-33-R3	Reprocessed GRACE climate data record (GRACE L1, L2, L3)	REPGRA	
GRM-33-L1-B-R1/R2/R3	Reprocessed Bending Angle	RBAGRA	
GRM-33-L2-R-R1/R2/R3	Reprocessed Refractivity Profile	RRPGRA	
GRM-33-L2-D-R1/R2/R3	Reprocessed Dry Temperature Profile	RDPGRA	
GRM-33-L2-T-R1/R2/R3	Reprocessed Temperature Profile	RTPGRA	
GRM-33-L2-H-R1/R2/R3	Reprocessed Specific Humidity Profile	RHPGRA	
GRM-33-L2-P-R1/R2/R3	Reprocessed Pressure Profile	RPPGRA	
GRM-33-L2-S-R1/R2/R3	Reprocessed Surface Pressure	RSPGRA	
GRM-33-L2-C-R1/R2/R3	Reprocessed Tropopause Height	RCHGRA	
GRM-33-L2-L-R1/R2/R3	Reprocessed Planetary Boundary Layer Height	RLGGRA	
GRM-33-L3-B-R1/R2/R3	Reprocessed Bending Angle Grid	RBGGRA	
GRM-33-L3-R-R1/R2/R3	Reprocessed Refractivity Grid	RRGGRA	
GRM-33-L3-D-R1/R2/R3	Reprocessed Dry Temperature Grid	RDGGRA	
GRM-33-L3-Y-R1/R2/R3	Reprocessed Dry Pressure Grid	RYGGRA	
GRM-33-L3-Z-R1/R2/R3	Reprocessed Dry Geopotential Height Grid	RZGGRA	
GRM-33-L3-T-R1/R2/R3	Reprocessed Temperature Grid	RTGGRA	
GRM-33-L3-H-R1/R2/R3	Reprocessed Specific Humidity Grid	RHGGRA	
GRM-33-L3-C-R1/R2/R3	Reprocessed Tropopause Height Grid	RCGGRA	
GRM-33-L3-L-R2/R3	Reprocessed Planetary Boundary Layer Height Grid	RLGGRA	
GRM-34-R3	Reprocessed Sentinel-6 climate data record (Sentinel-6 L1, L2, L3)	REPSEN	
GRM-34-L1-B-R3	Reprocessed Bending Angle	RBASEN	
GRM-34-L2-R-R3	Reprocessed Refractivity Profile	RRPSEN	
GRM-34-L2-D-R3	Reprocessed Dry Temperature Profile	RDPSEN	
GRM-34-L2-T-R3	Reprocessed Temperature Profile	RTPSEN	



Product ID	Product Name	Product Acronym
GRM-34-L2-H-R3	Reprocessed Specific Humidity Profile	RHPSEN
GRM-34-L2-P-R3	Reprocessed Pressure Profile	RPPSEN
GRM-34-L2-S-R3	Reprocessed Surface Pressure	RSPSEN
GRM-34-L2-C-R3	Reprocessed Tropopause Height	RCHSEN
GRM-34-L2-L-R3	Reprocessed Planetary Boundary Layer Height	RLGSEN
GRM-34-L3-B-R3	Reprocessed Bending Angle Grid	RBGSEN
GRM-34-L3-R-R3	Reprocessed Refractivity Grid	RRGSEN
GRM-34-L3-D-R3	Reprocessed Dry Temperature Grid	RDGSEN
GRM-34-L3-Y-R3	Reprocessed Dry Pressure Grid	RYGSEN
GRM-34-L3-Z-R3	Reprocessed Dry Geopotential Height Grid	RZGSEN
GRM-34-L3-T-R3	Reprocessed Temperature Grid	RTGSEN
GRM-34-L3-H-R3	Reprocessed Specific Humidity Grid	RHGSEN
GRM-34-L3-C-R3	Reprocessed Tropopause Height Grid	RCGSEN
GRM-34-L3-L-R3	Reprocessed Planetary Boundary Layer Height Grid	RLGSEN
GRM-35-R3	-35-R3 Reprocessed FY-3 climate data record (FY-3 L1, L2, L3)	
GRM-35-L1-B-R3	Reprocessed Bending Angle	RBAFY3
GRM-35-L2-R-R3	Reprocessed Refractivity Profile	RRPFY3
GRM-35-L2-D-R3	Reprocessed Dry Temperature Profile	RDPFY3
GRM-35-L2-T-R3	Reprocessed Temperature Profile	RTPFY3
GRM-35-L2-H-R3	Reprocessed Specific Humidity Profile	RHPFY3
GRM-35-L2-P-R3	Reprocessed Pressure Profile	RPPFY3
GRM-35-L2-S-R3	Reprocessed Surface Pressure	RSPFY3
GRM-35-L2-C-R3	Reprocessed Tropopause Height	RCHFY3
GRM-35-L2-L-R3	Reprocessed Planetary Boundary Layer Height	RLGFY3
GRM-35-L3-B-R3	Reprocessed Bending Angle Grid	RBGFY3
GRM-35-L3-R-R3	Reprocessed Refractivity Grid	RRGFY3
GRM-35-L3-D-R3	Reprocessed Dry Temperature Grid	RDGFY3
GRM-35-L3-Y-R3	Reprocessed Dry Pressure Grid	RYGFY3
GRM-35-L3-Z-R3	Reprocessed Dry Geopotential Height Grid	RZGFY3
GRM-35-L3-T-R3	Reprocessed Temperature Grid RTGFY3	
GRM-35-L3-H-R3	Reprocessed Specific Humidity Grid	RHGFY3
GRM-35-L3-C-R3	Reprocessed Tropopause Height Grid	RCGFY3
GRM-35-L3-L-R3	Reprocessed Planetary Boundary Layer Height Grid	RLGFY3



A3. Overview list of all sub GRM-ids for ICDRs:

Product ID	Product Name	Product Acronym
GRM-29-l1 GRM-29-l2 GRM-29-l3	Metop Interim Climate Data Record (Data Levels L1B, L2, L3)	ICDRMET
GRM-29-L1-B-I1/I2/I3	ICDR Bending Angle	IBAMET
GRM-29-L2-R-I1/I2/I3	ICDR Refractivity Profile	IRPMET
GRM-29-L2-D-I1/I2/I3	ICDR Dry Temperature Profile	IDPMET
GRM-29-L2-T-I1/I2/I3	ICDR Temperature Profile	ITPMET
GRM-29-L2-H-I1/I2/I3	ICDR Specific Humidity Profile	IHPMET
GRM-29-L2-P-I1/I2/I3	ICDR Pressure Profile	IPPMET
GRM-29-L2-S-I1/I2/I3	ICDR Surface Pressure	ISPMET
GRM-29-L2-C-I1/I2/I3	ICDR Tropopause Height	ICHMET
GRM-29-L2-L-I2/I3	ICDR Planetary Boundary Layer Height	ILHMET
GRM-29-L3-B-I1/I2/I3	ICDR Bending Angle Grid	IBGMET
GRM-29-L3-R-I1/I2/I3	ICDR Refractivity Grid	IRGMET
GRM-29-L3-D-I1/I2/I3	ICDR Dry Temperature Grid	IDGMET
GRM-29-L3-Y-I1/I2/I3	ICDR Dry Pressure Grid	IYGMET
GRM-29-L3-Z-I1/I2/I3	ICDR Dry Geopotential Height Grid	IZGMET
GRM-29-L3-T-I1/I2/I3	ICDR Temperature Grid	ITGMET
GRM-29-L3-H-I1/I2/I3	ICDR Specific Humidity Grid	IHGMET
GRM-29-L3-C-I1/I2/I3	ICDR Tropopause Height Grid	ICGMET
GRM-29-L3-L-I2/I3	ICDR Planetary Boundary Layer Height Grid	ILGMET

A4. Product Requirements Tables

(On the following pages)



GRM-16 R	adio Occultat	ion Processing Pa	ackage ROPP CDOP4-PRD-1		CDOP4-PRD-1.1	
Туре		Software Proc	Software Product			
Applications and Users		NWP, RO dat	NWP, RO data suppliers, scientific users			
Characteristics and Methods		- Utiliti - Input - Pre-r - Forw - 1D-V				
Operational Satellite Input Data		Metop-SG COSMIC COSMIC-2 CHAMP GPS/MET GRACE TerraSAR-X TanDEM-X PAZ	COSMIC COSMIC-2 CHAMP GPS/MET GRACE TerraSAR-X TanDEM-X			
Other Operational	Input Data	NWP model fi	NWP model fields			
Dissemination						
Format		Means	eans Timeliness		3	
tarballs		Web	N/A			
Accuracy		-		-		
Threshold Tar		Target	arget		Optimal	
N/A N/A		N/A		N/A		
Notes						
Verification/Validation Methods Tes		Test Folder	est Folder			
Coverage, Resolu	Coverage, Resolution					
Spatial Coverage	al Coverage Horizontal Resolution		Vertical Resolution Temporal Resolution		Temporal Resolution	
N/A	N/A		N/A	N/A N/A		



GRM-16_v11 Radio O	ccultati	on Processing Pa	ckage	ROPP_v1	1	CDOP4-PRD-1.1	
Туре		Software Produ	Software Product				
Applications and Users		NWP, RO data	suppliers, scientif	ic users			
Characteristics and Metho		GRM-16; 1D-Var routines tools to retrieve electron density profiles from L2-L1 bending angle differences					
Operational Satellite Inpu	t Data	GRM-16					
Other Operational Input D	ata	GRM-16					
Dissemination							
Format		Means	leans		Timeliness		
tarballs		Web		N/A			
Accuracy				<u>.</u>			
Threshold		Target	arget		Optimal		
N/A		N/A	/Α		N/A		
Notes			!				
Verification/Validation Me	thods	Test Folder	est Folder				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
N/A	N/A		N/A		N/A		



GRM-16_v12 Radio O	ccultati	on Processing Pa	ckage	ROPP_v12	2	CDOP4-PRD-1.1	
Туре		Software Produ	Software Product				
Applications and Users		NWP, RO data	suppliers, scientif	ic users			
Characteristics and Metho	Updated 2D for	GRM-16; Improved spline interpolation in forward operators; Updated 2D forward operator; Algorithms for EPS-SG Day 2 ionosphere products;					
Operational Satellite Input	t Data	GRM-16					
Other Operational Input D	ata	GRM-16					
Dissemination							
Format		Means	leans		Timeliness		
tarballs		Web		N/A			
Accuracy				-			
Threshold		Target	arget		Optimal		
N/A		N/A		N/A			
Notes							
Verification/Validation Me	thods	Test Folder	est Folder				
Coverage, Resolution							
Spatial Coverage	Horizontal Resolution		Vertical Resolution		Temporal Resolution		
N/A	N/A		N/A		N/A		



GRM-16_v13 Radio O	ccultati	on Processing Pa	ckage	ROPP_v1	3	CDOP4-PRD-1.1	
Туре		Software Produ	Software Product				
Applications and Users		NWP, RO data	suppliers, scientif	ic users			
Characteristics and Metho		GRM-16; 2D airborne RO forward operator; 2D LEO-LEO forward operator;					
Operational Satellite Input	t Data	GRM-16					
Other Operational Input D	ata	GRM-16					
Dissemination							
Format		Means	vleans		Timeliness		
tarballs		Web		N/A			
Accuracy				<u>.</u>			
Threshold		Target	arget		Optimal		
N/A		N/A	/A		N/A		
Notes							
Verification/Validation Me	Test Folder	est Folder					
Coverage, Resolution							
Spatial Coverage	Horizontal Resolution		Vertical Resolution		Temporal Re	esolution	
N/A	N/A		N/A		N/A		



GRM-24 GRM-24.1 GRM-24.2	Тгорора	use He	ight (EPS) ight (EPS-SG Sat ight (EPS-SG Sat		ТРН		CDOP4-PRD-1.1	
Туре				NRT Product Offline Product Reprocessed Product				
Applications and	Users		NWP, Climate	e and atmosphere r	esearchers			
Characteristics a	and Metho	ods	One scalar va	alue based on the d	ry temperat	ure lapse rate		
Operational Sate	ellite Input	Data	All ROM SAF	RO products				
Other Operation	al Input D	ata	ECMWF field	S				
Dissemination								
Format			Means	leans		Timeliness		
netCDF W			Veb		NRT: 80 min - 3 h Offline: 5 - 30 d			
Accuracy								
Threshold			Target	arget		Optimal		
2 km			1 km	km		0.5 km		
Notes								
Verification/Validation Methods Sta			Standard deviation	tandard deviation of (TPH product ERA Interim analysis)				
Coverage, Res	olution							
Spatial Coverage	е	Horizor	tal Resolution	Vertical Resolution		Temporal Resolution		
Global		RO res	olution	Scalar		RO resolution		



GRM-26 GRM-26.1 GRM-26.2	Planetar	y Boun	dary Layer Heigł dary Layer Heigł dary Layer Heigł	PBLH		CDOP4-PRD-1.1			
Туре			Offline Produ	NRT Product Offline Product Reprocessed Product					
Applications and	Users		NWP, Climate	e and atmosphere rese	archers				
Characteristics a	and Metho	ods	TBD						
Operational Sate	ellite Input	Data	All ROM SAF	RO products					
Other Operation	al Input D	ata	ECMWF field	s					
Dissemination									
Format			Means	leans		Timeliness			
netCDF We			Web	Veb		NRT: 80 min - 3 h Offline: 5 - 30 d			
Accuracy					<u>.</u>				
Threshold			Target	arget			Optimal		
TBD			TBD	BD		ТВD			
Notes				· · ·					
Verification/Validation Methods TB			TBD	BD					
Coverage, Res	olution								
Spatial Coverage	е	Horizor	ntal Resolution	Vertical Resolution	Vertical Resolution		esolution		
Global		RO res	olution	Scalar		RO resolution			



		ulti-Mission clima C, CHAMP, GRACE		REPMUL		CDOP4-PRD-1.1		
Туре		Climate Data R	Climate Data Record					
Applications and Users		Climate and at	mosphere researc	hers				
Characteristics and Metho	ods	(1)						
Operational Satellite Input	EÚMETSAT Se (b) Reprocesse CHAMP: 09/20 GRACE: 03/20 COSMIC: 07/20 COSMIC-2: TB	 (a) Reprocessed level 1A Metop, CHAMP, GRACE, COSMIC from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; CHAMP: 09/2001 – 10/2008 GRACE: 03/2007 – 12/2018 COSMIC: 07/2006 – 12/2018 COSMIC-2: TBD Metop: 10/2006 – 12/2018 						
Other Operational Input D	ata	(1)	(1)					
Dissemination								
Format		Means	leans		Timeliness			
netCDF		Web	√eb		n/a			
Accuracy								
Threshold		Target	Optimal					
(1)		(1)	1)		(1)			
Notes			I) ROM SAF CDOP-2 RR-RE1 Review Board Report (Ref: UM/TSS/DOC/14/784725, 9 Dec 2014)					
Verification/Validation Me	(1)							
Coverage, Resolution								
Spatial Coverage	Horizor	ntal Resolution	lution Vertical Resoluti		Temporal Re	esolution		
(1)	(1)		(1)		(1)			



GRM-28-L3-R-R1ReprocesseGRM-28-L3-D-R1ReprocesseGRM-28-L3-Y-R1ReprocesseGRM-28-L3-Z-R1ReprocesseGRM-28-L3-T-R1ReprocesseGRM-28-L3-H-R1Reprocesse	ed r ed c ed c ed c ed t ed s	pending angle grid efractivity grid dry temperature grid dry pressure grid dry geopotential height grid emperature grid specific humidity grid ropopause height grid	RBGMUL RRGMUL RDGMUL RYGMUL RZGMUL RTGMUL RHGMUL RCGMUL	CDOP4- PRD-1.1	
Туре		Reprocessed Data Set			
Applications and Users		Climate and atmosphere rese	archers		
Characteristics and Methods		Zonal monthly means on 200	m x 5 deg grids		
Operational Satellite Input Data		Reprocessed level 1a Metop, CHAMP, GRACE, COSMIC from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-002: GRAS L1 R1: 01/ 2007 – 05/2014; WG-DRG Plan CF-016: CHAMP L1 R1: 09/2001 - 09/2008; WG-DRG Plan CF-017: GRACE L1 R1: 01/2005 - 12/2014; WG-DRG Plan CF-018: COSMIC L1 R1: 07/2006 - 12/2014;			
Other Operational Input Data		ECMWF ERA Interim (validati	on, sampling error e	estimation)	
Dissemination		<u>-</u>			
Format	Me	eans	Timeliness		
netCDF	W	eb	n/a		
Accuracy					
Threshold	Та	rget	Optimal		
Bending angle					
25 – 50 km: 0.4 % or 0.8 μrad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	8	– 50 km: 0.2 % or 0.4 μrad*) – 25 km: 0.2 % – 8 km: 2.0– 0.20 %	25 – 50 km: 0.10 % or 0.2 μrad*) 8 – 25 km: 0.10 % 0 – 8 km: 1.0 – 0.10 %		
Refractivity					
25 – 50 km: 0.16 % or 0.008 N- units*) 8 – 25 km: 0.16 %		– 50 km: 0.08 % or 0.004 N- units*) – 25 km: 0.08 % – 8 km: 0.8 – 0.08 %	25 – 50 km: 0.04 % units*) 8 – 25 km: 0.04 % 0 – 8 km: 0.4 – 0	6	
Dry temperature					
8 – 25 km: 0.4 K 8		– 50 km: 0.2 – 2 K – 25 km: 0.2 K – 8 km: –	25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K 0 – 8 km: –		
Dry pressure					
8 – 25 km: 0.16 % 8		– 50 km: 0.08 – 0.40 % – 25 km: 0.08 % – 8 km: –	25 – 50 km: 0.04 – 0.20 % 8 – 25 km: 0.04 % 0 – 8 km: –		
Dry geopotential height					
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m		– 50 km: 4 – 40 m – 25 km: 4 m	25 – 50 km: 2 – 20 8 – 25 km: 2 m	m	



0-8 km: –		0 – 8 km: –		0-8 km	ı: —
Temperature					
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 8 km: 2.0 – 0.4 K	25 km: 0.4 K		25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K 0 – 8 km: 1.0 – 0.2 K		1: 0.10 – 1.0 K 1: 0.10 K 1: 0.50 – 0.10 K
Specific humidity					
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %				8 – 12 km: 1.5 % 0 – 8 km: 1.5 %	
Tropopause Height					
0.2 km		0.1 km 0.05 km			
Notes	two v	ccuracy interval m alues over the giv ichever is greater	en vertical coord		antity between the
Verification/Validation Methods		stics of differences relative to ECMWF ERA Interim. Impling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution					
Spatial Coverage	Horizontal Resolution		Vertical Resolution		Temporal Resolution
global	5 deg latit	ude	200 m		1 month



	Reproce L1, L2, L		etop climate dat	a record (Metop	REPMET		CDOP4-PRD-1.1			
Туре			Climate Data	Climate Data Record						
Applications and	Users		Climate and a	atmosphere researc	chers					
Characteristics a	nd Metho	ds	(1)							
Operational Satellite Input Data			WP230, WP2 (b) Reproces	 (a) Reprocessed level 1A Metop from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; Metop: 10/2006 – 12/2018 						
Other Operationa	I Input D	ata	(1)							
Dissemination										
Format			Means	vleans		Timeliness				
netCDF BUFR			Web		n/a					
Accuracy										
Threshold			Target	Target		Optimal				
(1)			(1)	(1)		(1)				
				1) ROM SAF CDOP-2 RR-RE1 Review Board Report (Ref: EUM/TSS/DOC/14/784725, 9 Dec 2014)						
Verification/Validation Methods (1)			(1)	1)						
Coverage, Reso	lution									
Spatial Coverage		Horizor	ntal Resolution	Vertical Resoluti	on	Temporal Resolution				
(1)		(1)		(1)	(1)		(1)			



GRM-29-L1-B-R1 Re	epro	cesse	ed bending an	gle	RBAMET		CDOP4-PRD-1.1	
Туре			Reprocessed	Reprocessed Data Set				
Applications and Users			Climate and a	atmosphere res	earchers			
Characteristics and Met	thods	5	Hi-res wave c	optics retrieval				
Operational Satellite Inp	out D	ata	CSDP WP23	Reprocessed level 1a Metop from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-002: GRAS L1 R1: 01/ 2007 – 05/2014;				
Other Operational Input	t Dat	а	ECMWF ERA	Interim fields				
Dissemination								
Format		Me	eans		Timeliness	6		
netCDF BUFR		W	/eb		n/a			
Accuracy								
Threshold		Ta	arget		Optimal			
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		8	5 – 60 km: 2 μrad 3 – 35 km: 2% 2 – _ 8 km: 10% - 2%		35 – 60 km: 1 μrad 8 – 35 km: 1% 2 – 8 km: 5% - 1%		%	
Notes		two v	alues over the	l means a linea given vertical c km is expected	oordinate			
Verification/Validation Methods				of (Product – El 1ETSAT reproc				
Coverage, Resolution								
Spatial Coverage	Spa	tial Re	esolution	Vertical Resolu	ution	Tempor	al resolution	
Global	RO	resoli	ution	Hi-res wave op sampling; interpolated to levels		RO reso	blution	



			ed refractivity ed dry tempera		RRPMET RDPMET		CDOP4-PRD- 1.1	
Туре			Reprocessed	Reprocessed Data Set				
Applications and Users			Climate and atmosphere researchers					
Characteristics and Me	thods		Hi-res wave o	ptics retrieval				
Operational Satellite Input Data			Reprocessed level 1a Metop from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-002: GRAS L1 R1: 01/ 2007 – 05/2014;					
Other Operational Inpu	t Data		ECMWF ERA	Interim fields				
Dissemination								
Format		Me	eans		Timeliness			
netCDF BUFR	_		eb		n/a			
Accuracy								
Threshold		Та	rget		Optimal			
Refractivity profile								
30 – 50 km: 0.06 N-unit 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		5	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%			
Dry temperature profi	le							
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K – 2 K		5	0 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K – 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K – 0.5 K			
Notes				l means a linea given vertical c		g quanti	ty between the	
Verification/Validation Methods	St	tand	dard deviation of (Product – E		RA Interim	forecast	s)	
Coverage, Resolution								
Spatial Coverage	Spatia	l Re	esolution	Vertical Resolution	ution	Tempor	al resolution	
global	RO resolution		tion	Hi-res wave optics sampling; interpolated to 247 fixe levels		RO reso	olution	



GRM-29-L2-H-R1 R GRM-29-L2-P-R1 R	eproce eproce	ssed temperate ssed specific h ssed pressure ssed surface p	numidity profile profile	RTPME RHPME RPPME RSPME	T T		
Туре		Reprocesse	Reprocessed Data Set				
Applications and Users		Climate and	l atmosphere resea	chers			
Characteristics and Me	thods	1D-Var algo background	prithm on model leve	els, ERA	Interim forecast as		
Operational Satellite In	put Dat	CSDP WP2	ed level 1a Metop fro 30 (EUM/STG/65/14 lan CF-002: GRAS	4/DOC/18			
Other Operational Inpu	t Data	ECMWF EF	RA Interim fields.				
Dissemination		<u> </u>					
Format		Means		Timeline	ess		
netCDF BUFR		Web		n/a			
Accuracy							
Threshold		Target	arget				
Temperature profile							
30 – 50 km: 3 K – 6 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		5 – 30 km: 1 l	80 – 50 km: 1 K – 2 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		km: 0.5 K – 1 K km: 0.5 K km: 1 K – 0.5 K		
Specific humidity pro	file						
0 – 12 km: 1.8 g/kg or	30% *)	0 – 12 km: 0.6) – 12 km: 0.6 g/kg or 10% *)		<pre>km: 0.3 g/kg or 10% *)</pre>		
Pressure profile							
0 – 50 km: a) 0.03 hPa 0 – 50 km: b) 0.75% 0 – 50 km: c) 2.4 hPa		0 – 50 km: b)) – 50 km: a) 0.01 hPa) – 50 km: b) 0.25%) – 50 km: c) 0.8 hPa **)		0 – 50 km: a) 0.005 hPa 0 – 50 km: b) 0.1% 0 – 50 km: c) 0.7 hPa **)		
Surface pressure							
2.4 hPa		0.8 hPa		0.7 hPa			
Notes	tw *)	vo values over th Whichever is gr	ne given vertical coc	ordinate	g quantity between the t greater than (c);		
Verification/Validation Methods	S	tandard deviatio	dard deviation of (1D-Var solution – ERA Interim analysis)				
Coverage, Resolution	1						
Spatial Coverage	Spatia	I Resolution	esolution Vertical Resolutio		Temporal resolution		
global	RO re	solution	model levels		RO resolution		



GRM-29-L2-C-R1 R	epro	cesse	ed tropopause	e height	RCHM	ET	CDOP4-PRD-1.1	
Туре			Reprocessed Data Set					
Applications and Users			Climate and a	Climate and atmosphere researchers				
Characteristics and Me	ethods	5	Dry temperat	ure lapse rate				
Operational Satellite Input Data			CSDP WP23	Reprocessed level 1a Metop from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-002: GRAS L1 R1: 01/ 2007 – 05/2014;				
Other Operational Inpu	it Data	а	ECMWF ERA	Interim fields				
Dissemination								
Format	Μ			leans		Timeliness		
netCDF BUFR		W	Web		n/a	n/a		
Accuracy		-			<u>.</u>			
Threshold		Ta	arget		Optimal			
2 km		11	km		0.5 km			
Notes								
Verification/Validation Methods	/Validation Stan			dard deviation of (Product - ERA Interi)	
Coverage, Resolution	า							
Spatial Coverage	Spat	tial Re	solution Vertical Resolution		ution	Tempor	al resolution	
global	RO	resolu	Ition	scalar		RO reso	olution	



GRM-29-L3-R-R1ReprocesseGRM-29-L3-D-R1ReprocesseGRM-29-L3-Y-R1ReprocesseGRM-29-L3-Z-R1ReprocesseGRM-29-L3-T-R1ReprocesseGRM-29-L3-H-R1Reprocesse	ed r ed c ed c ed c ed c ed t ed s	pending angle grid refractivity grid dry temperature grid dry pressure grid dry geopotential height grid emperature grid specific humidity grid ropopause height grid	RBGMET CDOP4- RRGMET PRD-1.1 RDGMET RYGMET RZGMET RTGMET RHGMET RCGMET		
Туре		Reprocessed Data Set			
Applications and Users		Climate and atmosphere resea	archers		
Characteristics and Methods		Zonal monthly means on 200	m x 5 deg grids		
Operational Satellite Input Data		Reprocessed level 1a Metop f CSDP WP230 (EUM/STG/65/ WG-DRG Plan CF-002: GRAS	rom EUMETSAT CF, cf. Refs.: 14/DOC/18); S L1 R1: 01/ 2007 – 05/2014;		
Other Operational Input Data		ECMWF ERA Interim (validati	on, sampling error estimation)		
Dissemination					
Format	Me	eans	Timeliness		
netCDF	W	eb	n/a		
Accuracy					
Threshold	Та	ırget	Optimal		
Bending angle					
25 – 50 km: 0.6 % or 1.2 μrad*) 8 – 25 km: 0.6 % 0 – 8 km: 6 – 0.6 %	25 – 50 km: 0.3 % or 0.6 μrad*) 8 – 25 km: 0.3 % 0 – 8 km: 3 – 0.3 %		25 – 50 km: 0.15 % or 0.3 μrad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %		
Refractivity					
25 – 50 km: 0.24 % or 0.012 N- units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N- units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %		
Dry temperature					
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –	8	– 50 km: 0.3 – 3 K – 25 km: 0.3 K – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Dry pressure					
25 – 50 km: 0.24 – 1.20 % 8 – 25 km: 0.24 % 0 – 8 km –	8	– 50 km: 0.12 – 0.60 % – 25 km: 0.12 % – 8 km: –	25 – 50 km: 0.06 – 0.30 % 8 – 25 km: 0.06 % 0 – 8 km: –		
Dry geopotential height					
25 – 50 km: 12 – 120 m 8 – 25 km: 12 m 0 - 8 km: –	8	– 50 km: 6 – 60 m – 25 km: 6 m – 8 km: –	25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –		
Temperature					
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 K	8	– 50 km: 0.3 – 3 K – 25 km: 0.3 K – 8 km: 1.0 – 0.3 K	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: 0.50 – 0.15 K		



Specific humidity					
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %			% %	8 – 12 km 0 – 8 km	
Tropopause height					
0.4 km	.4 km			0.1 km	
Notes	two	ccuracy interval m values over the giv hichever is greater	en vertical coord		antity between the
Verification/Validation Methods		stics of differences ampling statistics:			
Coverage, Resolution	1				
Spatial Coverage	Horizonta	al Resolution	Vertical Resolut	tion	Temporal Resolution
global	5 deg lati	tude	200 m		1 month



		processed COSMIC-1 climate data record REPCO1 CDOP4-PF DSMIC-1 L1, L2, L3)							
Туре			Climate Data R	limate Data Record					
Applications and	Users		Climate and atr	nosphere researc	hers				
Characteristics a	nd Methods		(1)						
Operational Sate	llite Input Data		 (a) Reprocessed level 1A COSMIC-1 from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; COSMIC: 07/2006 – 12/2018 						
Other Operationa	l Input Data		(1)						
Dissemination			•						
Format	at M			Means			Timeliness		
netCDF BUFR		We	Web		n/a				
Accuracy		•			•				
Threshold		Та	rget	Optimal					
(1)		(1)			(1)				
Notes				SAF CDOP-2 RR-RE1 Review Board Report (Ref: S/DOC/14/784725, 9 Dec 2014)					
Verification/Valida	ation Methods	(1)	1)						
Coverage, Reso	lution								
Spatial Coverage	Horiz	ontal	Resolution	Vertical Resolution		Temporal Re	esolution		
(1)	(1)			(1)		(1)			



GRM-30-L1-B-R1 R	eproc	esse	ed bending an	gle	RBAC01	CDOP4-PRD-1.1		
Туре			Reprocessed	Data Set				
Applications and Users	;		Climate and a	Climate and atmosphere researchers				
Characteristics and Me	thods		Hi-res wave c	optics retrieval				
Operational Satellite Input Data			CSDP WP23	Reprocessed level 1a COSMIC from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-018: COSMIC L1 R1: 07/2006 -12/2014				
Other Operational Inpu	t Data		ECMWF ERA	Interim fields				
Dissemination			÷					
Format		Me	eans		Timeliness	5		
netCDF BUFR	W		Veb		n/a			
Accuracy								
Threshold		Та	arget (Optimal	Optimal		
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		8	5 – 60 km: 2 µrad 8 – 35 km: 2% 2 – 8 km: 10% - 2%		35 – 60 km: 1 μrad 8 – 35 km: 1% 2 – 8 km: 5% - 1%			
Notes	t۱	NO Va	alues over the	given vertical of	coordinate	ng quantity between the reen 1 and 2.5 μrad;		
Verification/Validation Methods				of (Product – E 1ETSAT reproc				
Coverage, Resolutior	۱							
Spatial Coverage	Spatia	al Re	esolution	Vertical Resolu	ution	Temporal resolution		
Global	RO r	esolı				RO resolution		



		ssed refractiv ssed dry temp	ity profile perature profile	RRPC01 RDPC01	CDOP4-PRD-1.1		
Туре		Reprocess	Reprocessed Data Set				
Applications and Users	Climate an	Climate and atmosphere researchers					
Characteristics and Met	hods	Hi-res wav	e optics retrieva				
Operational Satellite Inp	CSDP WP	Reprocessed level 1a COSMIC from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-018: COSMIC L1 R1: 07/2006 -12/2014					
Other Operational Input	Data	ECMWF E	RA Interim fields	;			
Dissemination							
Format		Means		Timeliness			
netCDF BUFR	_			n/a	n/a		
Accuracy							
Threshold		Target		Optimal			
Refractivity Profile							
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%	S	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		5 – 30 km	n: 0.02 N-units n: 0.3% n: 1% – 0.3%		
Dry temperature Profil	е						
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K – 2 K		5 – 20 km: 1	20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K – 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes			rval means a line the given vertica		ng quantity between the		
Verification/Validation Methods				ERA Interim	forecasts)		
Coverage, Resolution							
Spatial Coverage	Spatia	I Resolution	esolution Vertical Resol		Temporal resolution		
global	RO resolution		Hi-res wave sampling; interpolated levels		RO resolution		



GRM-30-L2-H-R1 F GRM-30-L2-P-R1 F	Reproce Reproce	essed temperatur essed specific hu essed pressure p essed surface pre	midity profile rofile	RTPCO1 RHPCO1 RPPCO1 RSPCO1	CDOP4-PRD-1.1		
Туре		Reprocessed	Reprocessed Data Set				
Applications and Users	S	Climate and a	atmosphere res	earchers			
Characteristics and Me	ethods	1D-Var algori background	thm on model le	evels, ERA	Interim forecast as		
Operational Satellite Ir	nput Dat	CSDP WP23	Reprocessed level 1a COSMIC from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-018: COSMIC L1 R1: 07/2006 -12/2014				
Other Operational Inpu	ut Data	ECMWF ERA	Interim fields				
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web		n/a			
Accuracy							
Threshold		Target		Optimal			
Temperature Profile							
30 – 50 km: 3 K – 6 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		5 – 30 km: 1 K	80 – 50 km: 1 K – 2 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 1 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Specific Humidity Pro	ofile						
0 – 12 km: 1.8 g/kg or	· 30% *)	0 – 12 km: 0.6 g) – 12 km: 0.6 g/kg or 10% *)		0 – 12 km: 0.3 g/kg or 10% *)		
Pressure Profile							
0 – 50 km: a) 0.03 hP 0 – 50 km: b) 0.75% 0 – 50 km: c) 2.4 hPa		0 – 50 km: a) 0. 0 – 50 km: b) 0. 0 – 50 km: c) 0.	25%	0 – 50 km: a) 0.005 hPa 0 – 50 km: b) 0.1% 0 – 50 km: c) 0.7 hPa **)			
Surface Pressure							
2.4 hPa		0.8 hPa		0.7 hPa			
Notes	tv *)	vo values over the Whichever is gre	e given vertical o ater	coordinate	g quantity between the t greater than (c);		
Verification/Validation Methods	S	tandard deviation	of (1D-Var solu	ition – ERA	Interim analysis)		
Coverage, Resolution	n						
Spatial Coverage	Spatia	al Resolution	esolution Vertical Resolu		Temporal resolution		
global	RO re	solution	model levels		RO resolution		



GRM-30-L2-C-R1 R	eproc	esse	d tropopause	e height	RCHCO1	CDOP4-PRD-1.1		
Туре				Reprocessed Data Set				
Applications and Users			Climate and a	Climate and atmosphere researchers				
Characteristics and Me	thods		Dry temperat	ure lapse rate				
Operational Satellite Input Data			CSDP WP23	Reprocessed level 1a COSMIC from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-018: COSMIC L1 R1: 07/2006 -12/2014				
Other Operational Inpu	t Data		ECMWF ERA	Interim fields				
Dissemination								
Format		Me	leans		Timeliness			
netCDF BUFR		W	Web		n/a			
Accuracy		<u>.</u>			<u>.</u>			
Threshold		Ta	arget		Optimal			
2 km		11	٢m		0.5 km			
Notes								
Verification/Validation Methods	on/Validation Standard devia			of (Product - El	RA Interim	Analysis)		
Coverage, Resolution								
Spatial Coverage	Spati	al Re	esolution	Vertical Resolution		Temporal resolution		
global	RO re	esolu	ition	scalar		RO resolution		



GRM-30-L3-B-R1 Reprocess	ed I	pending angle grid	RBGCO1	CDOP4-PRD-
GRM-30-L3-R-R1 Reprocess	ed ı	refractivity grid	RRGCO1	1.1
		dry temperature grid	RDGCO1 RYGCO1	
	Reprocessed dry pressure grid			
	eprocessed dry geopotential height grid eprocessed temperature grid			
		specific humidity grid	RTGCO1 RHGCO1	
		ropopause height grid	RCGC01	
Туре		Reprocessed Data Set		
Applications and Users		Climate and atmosphere rese	archers	
Characteristics and Methods		Zonal monthly means on 200		
Operational Satellite Input Data		Reprocessed level 1a COSMI Refs.: CSDP WP230 (EUM/STG/65/ WG-DRG Plan CF-018: COSI	14/DOC/18);	
Other Operational Input Data		ECMWF ERA Interim (validati	on, sampling erro	r estimation)
Dissemination				
Format	M	eans	Timeliness	
netCDF	W	eb	n/a	
Accuracy				
Threshold	Ta	arget	Optimal	
Bending angle				
25 – 50 km: 0.4 % or 0.8 μrad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	8	5 – 50 km: 0.2 % or 0.4 μrad*) 3 – 25 km: 0.2 % 9 – 8 km: 2.0– 0.20 %	25 – 50 km: 0.10 μrad*) 8 – 25 km: 0.10 0 – 8 km: 1.0 -	0 %
Refractivity				
25 – 50 km: 0.16 % or 0.008 N- units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	8	5 – 50 km: 0.08 % or 0.004 N- units*) 8 – 25 km: 0.08 % 9 – 8 km: 0.8 – 0.08 %	25 – 50 km: 0.04 units*) 8 – 25 km: 0.04 0 – 8 km: 0.4	%
Dry temperature				
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 8 km: –	8	6 – 50 km: 0.2 – 2 K 6 – 25 km: 0.2 K 0 – 8 km: –	25 – 50 km: 0.10 8 – 25 km: 0.10 0 – 8 km: –	-
Dry pressure				
25 – 50 km: 0.16 – 0.80 % 8 – 25 km: 0.16 % 0 – 8 km –	8	5 – 50 km: 0.08 – 0.40 % 8 – 25 km: 0.08 % 9 – 8 km: –	25 – 50 km: 0.04 8 – 25 km: 0.04 0 – 8 km: –	
Dry geopotential height				
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –	8	5 – 50 km: 4 – 40 m 5 – 25 km: 4 m 9 – 8 km: –	25 – 50 km: 2 – 2 8 – 25 km: 2 m 0 – 8 km: –	20 m
Temperature				
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K		5 – 50 km: 0.2 – 2 K 5 – 25 km: 0.2 K	25 – 50 km: 0.10 8 – 25 km: 0.10	



	0-8 km: 1.0	– 0.2 K	0 – 8 km	n: 0.50 – 0.10 K
			8 – 12 km 0 – 8 km	
	0.1 km	0.05 km		
two v	8			
Horizonta	I Resolution	Vertical Resolut	ion	Temporal Resolution
5 deg latit	ude	200 m		1 month
	two v *) wh Statis Resa Horizonta	8 – 12 km: 3.0 9 0 – 8 km: 3.0 9 0.1 km An accuracy interval m two values over the giv *) whichever is greater Statistics of differences Resampling statistics:	8 – 12 km: 3.0 % 0 – 8 km: 3.0 % 0.1 km An accuracy interval means a linearly c two values over the given vertical coord *) whichever is greater Statistics of differences relative to ECM Resampling statistics: inter-comparison Horizontal Resolution	8 – 12 km: 3.0 % 8 – 12 km 0 – 8 km: 3.0 % 0 – 8 km 0.1 km 0.05 km An accuracy interval means a linearly changing que two values over the given vertical coordinate. *) whichever is greater Statistics of differences relative to ECMWF ERA In Resampling statistics: inter-comparison of RO data Horizontal Resolution Vertical Resolution



GRM-32-R1	Reproce (CHAMP		HAMP climate da , L3)	ita record	REPCHA		CDOP4-PRD-1.1	
Туре	Туре			Record				
Applications and	Users		Climate and a	atmosphere researc	hers			
Characteristics a	nd Metho	ds	(1)					
Operational Sate	ellite Input	Data	WP230, WP2 (b) Reprocess	 (a) Reprocessed level 1A CHAMP from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; CHAMP: 09/2001 – 10/2008 				
Other Operationa	al Input Da	ata	(1)					
Dissemination								
Format			Means		Timeliness			
netCDF BUFR			Web		n/a			
Accuracy								
Threshold			Target		Optimal			
(1)			(1)		(1)			
Notes			· · /	1) ROM SAF CDOP-2 RR-RE1 Review Board Report (Ref: EUM/TSS/DOC/14/784725, 9 Dec 2014)				
Verification/Validation Methods (1)			(1)					
Coverage, Reso	olution							
Spatial Coverage	9	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution	
(1)		(1)		(1)	(1)			



GRM-32-L1-B-R1 Re	eproces	ssed bending ar	ngle	RBACHA	CDOP4-PRD-1.1	
Туре		Reprocessed	Data Set			
Applications and Users		Climate and a	Climate and atmosphere researchers			
Characteristics and Met	thods	Hi-res wave o	optics retrieval			
Operational Satellite Inp	out Data	CSDP WP23	Reprocessed level 1a CHAMP from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); NG-DRG Plan CF-016: CHAMP L1 R1: 09/2001-09/2008			
Other Operational Input	t Data	ECMWF ERA	A Interim fields			
Dissemination						
Format		Means		Timeliness	6	
netCDF BUFR		Web		n/a		
Accuracy						
Threshold		Target	arget			
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		8 – 35 km: 2%	5 – 60 km: 2 μrad 3 – 35 km: 2% 2 – – 8 km: 10% - 2%		n: 1 μrad n: 1% n: 5% - 1%	
Notes	two BA Pro	o values over the A noise above 60	given vertical o km is expected reduced information	coordinate; to be abou ation conter	ng quantity between the nt 4 μrad; nt below 8–10 km due to	
Verification/Validation Methods		andard deviation mparison to EUN				
Coverage, Resolution						
Spatial Coverage	Spatial	Resolution	Vertical Resolu	ution	Temporal resolution	
Global	RO re	solution	Hi-res wave op sampling; interpolated to levels		RO resolution	



			ed refractivity ed dry tempera		RRPCHA RDPCHA	CDOP4-PRD-1.1
Туре			Reprocessed	Data Set		
Applications and Users	;		Climate and atmosphere researchers			
Characteristics and Me	thods		Hi-res wave o	ptics retrieval		
Operational Satellite In	put Dai	a	CSDP WP230	Reprocessed level 1a CHAMP from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-016: CHAMP L1 R1: 09/2001-09/2008		
Other Operational Inpu	t Data		ECMWF ERA	Interim fields		
Dissemination						
Format		Me	eans		Timeliness	
netCDF BUFR		W	eb		n/a	
Accuracy						
Threshold		Та	Target		Optimal	
Refractivity Profile						
30 – 50 km: 0.06 N-uni 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		5	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%	
Dry temperature Profi	ile					
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K – 2 K		5	20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K – 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K – 0.5 K	
Notes	two v Produ		accuracy interval means a linea values over the given vertical o oduct may have reduced informa itations in the CHAMP closed lo		coordinate; ation conten	
Verification/Validation Star Methods		tano	dard deviation of	of (Product – E	RA Interim	forecasts)
Coverage, Resolution	1					
Spatial Coverage	Spatial Re		esolution	Vertical Resolution	ution	Temporal resolution
global	Spatial Resolution RO resolution		ution	Hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolution



GRM-32-L2-H-R1 R0 GRM-32-L2-P-R1 R0	eproces eproces	ssed temperature ssed specific hu ssed pressure ssed surface pre	midity	RTPCHA RHPCHA RPPCHA RSPCHA	CDOP4-PRD-1.1		
Туре		Reprocessed	Data Set				
Applications and Users		Climate and a	Climate and atmosphere researchers				
Characteristics and Me	thods	1D-Var algorit background	hm on model le	evels, ERA l	Interim forecast as		
Operational Satellite Inp	out Data	CSDP WP230) (EUM/STG/65	5/14/DOC/18	METSAT CF, cf. Refs.: 8); 09/2001-09/2008		
Other Operational Input	t Data	ECMWF ERA	Interim fields				
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web		n/a			
Accuracy							
Threshold		Target		Optimal			
Temperature Profile							
30 – 50 km: 3 K – 6 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 2 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 1 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K			
Specific Humidity Pro	file						
0 – 12 km: 1.8 g/kg or	30% *)	0 – 12 km: 0.6 g/kg or 10% *)		0 – 12 km: 0.3 g/kg or 10% *)			
Pressure Profile							
0 – 50 km: a) 0.03 hPa 0 – 50 km: b) 0.75% 0 – 50 km: c) 2.4 hPa *		0 – 50 km: b) 0.2	0 – 50 km: a) 0.01 hPa 0 – 50 km: b) 0.25% 0 – 50 km: c) 0.8 hPa **)		0 – 50 km: a) 0.005 hPa 0 – 50 km: b) 0.1% 0 – 50 km: c) 0.7 hPa **)		
Surface Pressure							
2.4 hPa		0.8 hPa		0.7 hPa			
Notes	tw Pr lim *)	o values over the oduct may have r nitations in the CH Whichever is grea	accuracy interval means a linearly changing quantity between the values over the given vertical coordinate; duct may have reduced information content below 8–10 km due to ations in the CHAMP closed loop data; /hichever is greater Whichever is greatest of (a) and (b) but not greater than (c);				
Verification/Validation Methods	St	andard deviation	ndard deviation of (1D-Var solution – ERA Interim analysis)				
Coverage, Resolution	L.						
Spatial Coverage	Spatia	Resolution	Vertical Resol	ution	Temporal resolution		
global	RO res	olution	model levels		RO resolution		



GRM-32-L2-C-R1 R	eproc	esse	ed tropopause	e height	RCHCHA	CDOP4-PRD-1.1	
Туре			Reprocessed	Data Set			
Applications and Users	;		Climate and a	atmosphere res	earchers		
Characteristics and Me	thods		Dry temperat	ure lapse rate			
Operational Satellite In	put Da	ita	CSDP WP23	Reprocessed level 1a CHAMP from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-016: CHAMP L1 R1: 09/2001-09/2008			
Other Operational Inpu	it Data		ECMWF ERA	A Interim fields			
Dissemination							
Format		Me	leans		Timeliness		
netCDF BUFR		W	Web		n/a		
Accuracy		-			•		
Threshold		Ta	arget		Optimal		
2 km		11	km		0.5 km		
Notes							
Verification/Validation Methods	S	Stanc	lard deviation	of (Product - El	RA Interim	Analysis)	
Coverage, Resolution							
Spatial Coverage	Spati	Spatial Resolutior		Vertical Resolu	ution	Temporal resolution	
global	RO re	esolu	ition	scalar		RO resolution	



GRM-32-L3-R-R1ReprocessGRM-32-L3-D-R1ReprocessGRM-32-L3-Y-R1ReprocessGRM-32-L3-Z-R1ReprocessGRM-32-L3-T-R1ReprocessGRM-32-L3-H-R1Reprocess	ed i ed (ed (ed (ed i ed i	bending angle grid refractivity grid dry temperature grid dry pressure grid dry geopotential height grid temperature grid humidity grid tropopause height grid Reprocessed Data Set Climate and atmosphere rese Zonal monthly means on 200 Reprocessed level 1a CHAMF CSDP WP230 (EUM/STG/65/ WG-DRG Plan CF-016: CHAM	m x 5 deg grids P from EUMETSA 14/DOC/18);	
Other Operational Input Data		ECMWF ERA Interim (validati	on, sampling erro	r estimation)
Dissemination				
Format netCDF	-	eans eb	Timeliness n/a	
Accuracy				
Threshold	Та	arget	Optimal	
Bending angle				
25 – 40 km: 0.8 % or 1.6 μrad*) 8 – 25 km: 0.8 % 0 – 8 km: –	8	5 – 40 km: 0.4 % or 0.8 μrad*) 3 – 25 km: 0.4 % 0 – - 8 km: –	25 – 40 km: 0.20 μrad*) 8 – 25 km: 0.20 0 – 8 km: –	
Refractivity				
25 – 40 km: 0.4 % or 0.016 N- units*) 8 – 25 km: 0.4 % 0 – 8 km: –	25 – 40 km: 0.20 % or 0.008 N- units*) 8 – 25 km: 0.20 % 0 – 8 km: –		25 – 40 km: 0.10 % or 0.004 N- units*) 8 – 25 km: 0.10 % 0 – 8 km: –	
Dry temperature				
25 – 40 km: 0.8 – 8 K 8 – 25 km: 0.8 K 0 – 8 km: –	8	5 – 40 km: 0.4 – 4 K 3 – 25 km: 0.4 K 0 – 8 km: –	25 – 40 km: 0.20 8 – 25 km: 0.20 0 – 8 km: –	
Dry pressure				
25 – 40 km: 0.4 – 2.0 % 8 – 25 km: 0.4 % 0 – 8 km –	8	5 – 40 km: 0.2 – 1.0 % 3 – 25 km: 0.2 % 0 – 8 km: –	25 – 40 km: 0.10 8 – 25 km: 0.10 0 – 8 km: –	
Dry geopotential height				
25 – 40 km: 16 – 160 m 8 – 25 km: 16 m 0 - 8 km: –	8	5 – 40 km: 8 – 80 m 8 – 25 km: 8 m 0 – 8 km: –	25 – 40 km: 4– 4 8 – 25 km: 4 m 0 – 8 km: –	0 m
Temperature				
25 – 40 km: 0.8 – 8 K 8 – 25 km: 0.8 K 0 – 8 km: –	8	5 – 40 km: 0.4 – 4 K 3 – 25 km: 0.4 K 0 – 8 km: –	25 – 40 km: 0.20 8 – 25 km: 0.20 0 – 8 km: –	



Specific humidity					
8 – 12 km: 12 % 0 – 8 km: –		8 – 12 km: 6.0 0 – 8 km: –	%	8 – 12 km 0 – 8 km	
Tropopause Height					
0.6 km		0.3 km		0.15 km	
Notes	two v Produ limita	alues over the giv	ven vertical coord uced information /IP closed loop d	linate; content bel	antity between the ow 8–10 km due to
Verification/Validation Methods		stics of differences mpling statistics:			
Coverage, Resolution					
Spatial Coverage	Horizonta	I Resolution	Vertical Resolut	ion	Temporal Resolution
global	5 deg latit	tude	200 m		1 month



GRM-33-R1	Reproces (GRACE		RACE climate data L3)	a record	REPGRA		CDOP4-PRD-1.1	
Туре			Climate Data R	Record				
Applications and	Users		Climate and at	mosphere researc	hers			
Characteristics a	nd Methoo	ds	(1)					
Operational Satellite Input Data			WP230, WP23 (b) Reprocesse	 (a) Reprocessed level 1A GRACE from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; GRACE: 03/2007 – 12/2018 				
Other Operationa	al Input Da	ata	(1)					
Dissemination								
Format			Means		Timeliness			
netCDF BUFR			Web		n/a			
Accuracy					<u>.</u>			
Threshold			Target		Optimal			
(1)			(1)	(1)		(1)		
Notes) ROM SAF CDOP-2 RR-RE1 Review Board Report (Ref: JM/TSS/DOC/14/784725, 9 Dec 2014)				
Verification/Validation Methods (1)			(1)	1)				
Coverage, Resc	olution							
Spatial Coverage	e	Horizontal Resolution		Vertical Resolution		Temporal Re	esolution	
(1)		(1)		(1)		(1)		



GRM-33-L1-B-R1 R	eproces	ssed bending ar	igle	RBAGRA	CDOP4-PRD-1.1	
Туре		Reprocessed	Data Set			
Applications and Users		Climate and a	Climate and atmosphere researchers			
Characteristics and Me	thods	Hi-res wave o	optics retrieval			
Operational Satellite In	out Data	CSDP WP23	Reprocessed level 1a GRACE from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); NG-DRG Plan CF-017: GRACE L1 R1: 2007-2018			
Other Operational Input	t Data	ECMWF ERA	Interim fields			
Dissemination						
Format		Means		Timeliness	3	
netCDF BUFR		Web		n/a		
Accuracy						
Threshold		Target	arget			
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		8 – 35 km: 2%	5 – 60 km: 2 μrad 3 – 35 km: 2% 2 – – 8 km: 10% - 2%		35 – 60 km: 1 μrad 8 – 35 km: 1% 2 – 8 km: 5% - 1%	
Notes	two BA Pro	o values over the noise above 60	given vertical c km is expected educed information	to be abou to be abou	ng quantity between the nt 4 μrad; nt below 8–10 km due to	
Verification/Validation Methods		andard deviation mparison to EUN				
Coverage, Resolution						
Spatial Coverage	Spatial	Resolution	Vertical Resolu	ution	Temporal resolution	
Global					RO resolution	



			ed refractivity ed dry tempera		RRPGRA RDPGRA	CDOP4-PRD-1.1	
Туре			Reprocessed	Data Set			
Applications and Users	;		Climate and a	Climate and atmosphere researchers			
Characteristics and Me	thods		Hi-res wave o	ptics retrieval			
Operational Satellite In	put Da	a	CSDP WP230	Reprocessed level 1a GRACE from EUMETSAT CF, cf. Refs.: CSDP WP230 (EUM/STG/65/14/DOC/18); WG-DRG Plan CF-017: GRACE L1 R1: 2007-2018			
Other Operational Inpu	t Data		ECMWF ERA	Interim fields			
Dissemination							
Format		Me	eans		Timeliness		
netCDF BUFR		W	eb		n/a		
Accuracy							
Threshold		Та	Target		Optimal		
Refractivity Profile							
30 – 50 km: 0.06 N-uni 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		5	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		
Dry temperature Prof	ile						
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K – 2 K		5	20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K – 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes	tv P	νο ν rodι	accuracy interval means a linear values over the given vertical co duct may have reduced informa tations in the CHAMP closed loc		coordinate; ation conten		
Verification/Validation Star Methods		tano	dard deviation of	of (Product – E	RA Interim	forecasts)	
Coverage, Resolution	1						
Spatial Coverage	Spatia	l Re	esolution	Vertical Resolution	ution	Temporal resolution	
global	RO re	solı	ution	Hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolution	



GRM-33-L2-H-R1 R0 GRM-33-L2-P-R1 R0	eproces	ssed temperatur ssed specific hu ssed pressure ssed surface pre	midity	RTPGRA RHPGRA RPPGRA RSPGRA	CDOP4-PRD-1.1		
Туре		Reprocessed	Data Set				
Applications and Users		Climate and a	Climate and atmosphere researchers				
Characteristics and Me	thods	1D-Var algorit background	hm on model le	evels, ERA l	Interim forecast as		
Operational Satellite In	put Data	CSDP WP230	level 1a GRAC) (EUM/STG/65 n CF-017: GRA	5/14/DOC/18			
Other Operational Input	t Data	ECMWF ERA	Interim fields				
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web		n/a			
Accuracy							
Threshold		Target		Optimal			
Temperature Profile							
30 – 50 km: 3 K – 6 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 2 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 1 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K			
Specific Humidity Pro	file						
0 – 12 km: 1.8 g/kg or	30% *)	0 – 12 km: 0.6 g/kg or 10% *)		0 – 12 km: 0.3 g/kg or 10% *)			
Pressure Profile							
0 – 50 km: a) 0.03 hPa 0 – 50 km: b) 0.75% 0 – 50 km: c) 2.4 hPa [,]		0 – 50 km: b) 0.2	0 – 50 km: a) 0.01 hPa 0 – 50 km: b) 0.25% 0 – 50 km: c) 0.8 hPa **)		0 – 50 km: a) 0.005 hPa 0 – 50 km: b) 0.1% 0 – 50 km: c) 0.7 hPa **)		
Surface Pressure							
2.4 hPa		0.8 hPa		0.7 hPa			
Notes	tw Pr lin *)	o values over the oduct may have r nitations in the CH Whichever is grea	accuracy interval means a linearly changing quantity between the values over the given vertical coordinate; duct may have reduced information content below 8–10 km due to ations in the CHAMP closed loop data; /hichever is greater Whichever is greatest of (a) and (b) but not greater than (c);				
Verification/Validation Methods	St	andard deviation	ndard deviation of (1D-Var solution – ERA Interim analysis)				
Coverage, Resolution	1						
Spatial Coverage	Spatia	Resolution	Vertical Resol	ution	Temporal resolution		
global	RO res	olution	model levels		RO resolution		



GRM-33-L2-C-R1 R	eproc	esse	ed tropopause	e height	RCHGRA	CDOP4-PRD-1.1		
Туре			Reprocessed	Reprocessed Data Set				
Applications and Users	;		Climate and a	Climate and atmosphere researchers				
Characteristics and Me	thods		Dry temperat	ure lapse rate				
Operational Satellite In	put Da	ita	CSDP WP23	level 1a GRAC 0 (EUM/STG/6 in CF-017: GRA	5/14/DOC/1			
Other Operational Inpu	it Data		ECMWF ERA	A Interim fields				
Dissemination								
Format		Me	eans		Timeliness			
netCDF BUFR		W	Veb		n/a			
Accuracy		-			÷			
Threshold		Ta	arget		Optimal			
2 km		11	km		0.5 km			
Notes								
Verification/Validation Stand Methods			dard deviation of (Product - ERA Interim Analysis)			Analysis)		
Coverage, Resolution								
Spatial Coverage Spatial Re			esolution Vertical Resolution		ution	Temporal resolution		
global	RO re	esolu	ition	scalar		RO resolution		



GRM-33-L3-R-R1 GRM-33-L3-D-R1 GRM-33-L3-Y-R1 GRM-33-L3-Z-R1 GRM-33-L3-T-R1 GRM-33-L3-T-R1 GRM-33-L3-C-R1Reprocesso Reprocesso Reprocesso Reprocesso Reprocesso Reprocesso Reprocesso GRM-33-L3-C-R1TypeApplications and UsersCharacteristics and MethodsOperational Satellite Input Data	ed i ed o ed o ed o ed t ed i	bending angle grid refractivity grid dry temperature grid dry geopotential height grid temperature grid humidity grid ropopause height grid Reprocessed Data Set Climate and atmosphere reser Zonal monthly means on 200 Reprocessed level 1a GRACE CSDP WP230 (EUM/STG/65/ WG-DRG Plan CF-017: GRAC	RRGGRA RDGGRA RYGGRA RZGGRA RTGGRA RHGGRA RCGGRA archers m x 5 deg grids from EUMETSAT 14/DOC/18); CE L1 R1: 2007-20	018	
Other Operational Input Data	_	ECMWF ERA Interim (validati	on, sampling error	estimation)	
Dissemination Format netCDF Accuracy		eans eb	Timeliness n/a		
Threshold	Ta	arget	Optimal		
Bending angle 25 – 40 km: 0.8 % or 1.6 μrad*) 8 – 25 km: 0.8 % 0 – 8 km: –	8	5 – 40 km: 0.4 % or 0.8 μrad*) 5 – 25 km: 0.4 % 9 – 8 km: –	25 – 40 km: 0.20 % or 0.4 μrad*) 8 – 25 km: 0.20 % 0 – 8 km: –		
Refractivity 25 – 40 km: 0.4 % or 0.016 N- units*) 8 – 25 km: 0.4 % 0 – 8 km: –	8	5 – 40 km: 0.20 % or 0.008 N- units*) 5 – 25 km: 0.20 % 9 – 8 km: –	25 – 40 km: 0.10 units*) 8 – 25 km: 0.10 0 – 8 km: –		
Dry temperature					
25 – 40 km: 0.8 – 8 K 8 – 25 km: 0.8 K 0 – 8 km: –	8	5 – 40 km: 0.4 – 4 K 8 – 25 km: 0.4 K 9 – 8 km: –	25 – 40 km: 0.20 – 2.0 K 8 – 25 km: 0.20 K 0 – 8 km: –		
Dry pressure 25 – 40 km: 0.4 – 2.0 % 8 – 25 km: 0.4 % 0 – 8 km –		5 – 40 km: 0.2 – 1.0 % 5 – 25 km: 0.2 % 0 – 8 km: –	25 – 40 km: 0.10 – 0.50 % 8 – 25 km: 0.10 % 0 – 8 km: –		
Dry geopotential height					
25 – 40 km: 16 – 160 m 8 – 25 km: 16 m 0 - 8 km: – Temperature	8	5 – 40 km: 8 – 80 m 8 – 25 km: 8 m 9 – 8 km: –	25 – 40 km: 4– 40 m 8 – 25 km: 4 m 0 – 8 km: –		
25 – 40 km: 0.8 – 8 K 8 – 25 km: 0.8 K 0 – 8 km: –	8	5 – 40 km: 0.4 – 4 K 8 – 25 km: 0.4 K 9 – 8 km: –	25 – 40 km: 0.20 8 – 25 km: 0.20 0 – 8 km: –		



Specific humidity						
8 – 12 km: 12 % 0 – 8 km: –		8 – 12 km: 6.0 ^o 0 – 8 km: –	%	8 – 12 km: 3.0 % 0 – 8 km: –		
Tropopause Height						
0.6 km		0.3 km		0.15 km		
Notes	two v Produ limita	ccuracy interval means a linearly changing quantity between the values over the given vertical coordinate; luct may have reduced information content below 8–10 km due to ations in the CHAMP closed loop data; nichever is greater				
Verification/Validation Methods		tistics of differences relative to ECMWF ERA Interim. campling statistics: inter-comparison of RO data subsets.				
Coverage, Resolution						
Spatial Coverage	Horizonta	I Resolution	Vertical Resolut	ion	Temporal Resolution	
global	5 deg latit	ude	200 m		1 month	



			ulti-Mission C, CHAMP, G		te data record E L3)	REPMUL		CDOP4-PRD-1.1	
Туре			Climate	Climate Data Record					
Applications and	Users		Climate	and at	mosphere researc	hers			
Characteristics ar	nd Metho	ods	(1)						
Operational Satel	llite Input	Data	Reproce Secretar		evel 1A Metop, C⊦	IAMP, GRA	CE, COSMIC	from EUMETSAT	
Other Operationa	I Input D	ata	(1)						
Dissemination									
Format			Means	eans			Timeliness		
netCDF			Web	/eb					
Accuracy						-			
Threshold			Target	arget			Optimal		
(1)			(1)			(1)			
Notes			(1) Baseline) Baseline determined at RR for RE2					
Verification/Validation Methods (1)			(1))					
Coverage, Resolution									
Spatial Coverage Horizontal			ital Resolutio	Resolution Vertical Resolution		on Temporal Resolution		esolution	
(1)		(1)			(1)	(1)			



GRM-29-R2	Reproce L1, L2, L		etop clima	te data	record (Metop	REPMET		CDOP4-PRD-1.1	
Туре	-		Climate	Climate Data Record					
Applications and	Users		Climate	e and at	mosphere researc	hers			
Characteristics a	and Metho	ods	(1)						
Operational Sate	ellite Input	t Data	Reproo Secret		evel 1A Metop, CH	HAMP, GRA	CE, COSMIC	from EUMETSAT	
Other Operation	al Input D	ata	(1)						
Dissemination			<u> </u>						
Format			Means	leans			Timeliness		
netCDF BUFR			Web	Neb			n/a		
Accuracy						<u>.</u>			
Threshold			Target			Optimal			
(1)			(1)			(1)			
Notes			(1) Baselir	(1) Baseline determined at RR for RE2					
Verification/Validation Methods (1)			(1)	1)					
Coverage, Resolution			<u>-</u>						
Spatial Coverage Horizontal			ntal Resolut	al Resolution Vertical Resolution		on Temporal Re		esolution	
(1)		(1)			(1)	(1)			



GRM-30-R2	Reproce (COSMIC			-1 climate d	ata record	REPCO1		CDOP4-PRD-1.1	
Туре			Cli	Climate Data Record					
Applications and	Users		Cli	mate and atr	nosphere researc	hers			
Characteristics a	nd Metho	ods	(1))					
Operational Sate	ellite Input	t Data		processed le cretariat	evel 1A Metop, CH	IAMP, GRA	CE, COSMIC	From EUMETSAT	
Other Operationa	al Input D	ata	(1)						
Dissemination									
Format			Means	6		Timeliness			
netCDF BUFR			Web			n/a			
Accuracy						•			
Threshold			Target	Farget			Optimal		
(1)			(1)	1)			(1)		
Notes			(1) Bas	1) Baseline determined at RR for RE2					
Verification/Validation Methods (1)			(1))					
Coverage, Resolution									
Spatial Coverage Horizontal			ntal Res	I Resolution Vertical Resolution		ion Temporal Resolution		esolution	
(1)		(1)			(1)	(1)			



GRM-32-R2	Reproce (CHAMP			IP climate data	a record	REPCHA		CDOP4-PRD-1.1
Туре			(Climate Data Record				
Applications and	Users		(Climate and atr	nosphere researc	hers		
Characteristics a	nd Metho	ods	((1)				
Operational Sate	llite Input	Data		Reprocessed le Secretariat	evel 1A Metop, CH	IAMP, GRA	CE, COSMIC	from EUMETSAT
Other Operationa	al Input D	ata	((1)				
Dissemination								
Format			Mea	ins		Timeliness		
netCDF BUFR			Web	'eb		n/a		
Accuracy						• •		
Threshold			Targ	get	Optimal			
(1)			(1)		(1)			
Notes			(1) E	1) Baseline determined at RR for RE2				
Verification/Validation Methods (1)			(1)	1)				
Coverage, Resolution								
Spatial Coverage Horizontal			ntal F	Resolution Vertical Resolution		on Temporal Re		esolution
(1)		(1)			(1)		(1)	



GRM-33-R2	Reproce (GRACE		RACE clima L3)	te data	a record	REPGRA		CDOP4-PRD-1.1	
Туре			Climate	Climate Data Record					
Applications and	Users		Climate	and atı	mosphere researc	hers			
Characteristics a	and Metho	ods	(1)						
Operational Sate	ellite Input	t Data	Reproce Secretar		evel 1A Metop, CH	IAMP, GRA	CE, COSMIC	From EUMETSAT	
Other Operation	al Input D	ata	(1)						
Dissemination									
Format			Means	eans			Timeliness		
netCDF BUFR			Web	/eb		n/a			
Accuracy									
Threshold			Target	Farget			Optimal		
(1)			(1)	(1)			(1)		
Notes			(1) Baseline	1) Baseline determined at RR for RE2					
Verification/Validation Methods (1)			(1))					
Coverage, Resolution									
Spatial Coverage Horizontal			ital Resolutio	I Resolution Vertical Resolutio		on Temporal Re		esolution	
(1)		(1)			(1)	(1)			



GRM-28-R3			lulti-Mission clima C, CHAMP, GRAC		REPMUL		CDOP4-PRD-1.1		
Туре	-		Climate Data	Climate Data Record					
Applications and	d Users		Climate and a	tmosphere researc	hers				
Characteristics	and Metho	ods	(1)						
Operational Sat	ellite Input	t Data	(1)						
Other Operation	nal Input D	ata	(1)						
Dissemination									
Format			Means		Timeliness				
netCDF			Web		n/a				
Accuracy									
Threshold			Target		Optimal				
(1)			(1)		(1)				
Notes			(1) Baseline deter	Baseline determined at RR for RE3					
Verification/Validation Methods (1)			(1)						
Coverage, Resolution									
Spatial Coverage	Spatial Coverage Horizontal Resolution			Vertical Resolution		Temporal Resolution			
(1)		(1)		(1)	(1)				



GRM-29-R3	Reproce L1, L2, L		etop clima	te data	record (Metop	REPMET		CDOP4-PRD-1.1	
Туре	-		Climate	e Data R	Record				
Applications and	Users		Climate	e and at	mosphere researc	hers			
Characteristics a	and Metho	ods	(1)						
Operational Sate	ellite Input	t Data	(1)						
Other Operation	al Input D	ata	(1)						
Dissemination									
Format			Means			Timeliness	;		
netCDF BUFR			Web	Neb		n/a	n/a		
Accuracy									
Threshold			Target	rget		Optimal			
(1)			(1)			(1)			
Notes			(1) Baselin	aseline determined at RR for RE3					
Verification/Validation Methods (1)									
Coverage, Resolution									
Spatial Coverage Horizontal Resolution			ion	Vertical Resolution		Temporal Re	esolution		
(1)		(1)			(1) (1)				



GRM-30-R3 Reproc (COSM	essed C IC-1 L1,	OSMIC-1 climate L2, L3)	data record	REPCO1	CDOP4-PRD-1.1		
Туре		Climate Data I	Climate Data Record				
Applications and Users		Climate and a	tmosphere researc	hers			
Characteristics and Meth	ods	(1)					
Operational Satellite Inpu	ut Data	(1)					
Other Operational Input	Data	(1)					
Dissemination							
Format		Means		Timeliness			
netCDF BUFR		Web		n/a			
Accuracy				<u>.</u>			
Threshold		Target		Optimal			
(1)		(1)		(1)			
Notes		(1) Baseline deter) Baseline determined at RR for RE3				
Verification/Validation Me	(1))					
Coverage, Resolution							
Spatial Coverage	Horizoi	ntal Resolution	Resolution Vertical Resolutio		Temporal Resolution		
(1)	(1)		(1)		(1)		



GRM-31-R3	Reproce (COSMI		OSMIC-2 climate L2, L3)	data record	REPCO2		CDOP4-PRD-1.1		
Туре	-		Climate Data	Climate Data Record					
Applications and	d Users		Climate and a	itmosphere researc	chers				
Characteristics	and Metho	ods	(1)						
Operational Sat	ellite Input	t Data	(1)						
Other Operation	al Input D	ata	(1)						
Dissemination									
Format			Means		Timeliness				
netCDF BUFR			Web		n/a				
Accuracy					-				
Threshold			Target		Optimal				
(1)			(1)		(1)				
Notes			(1) Baseline dete) Baseline determined at RR for RE3					
Verification/Validation Methods (1)			(1)						
Coverage, Resolution									
Spatial Coverage Horizontal Res			ntal Resolution	ution Vertical Resolution		on Temporal Resolution			
(1)		(1)		(1)		(1)			



		eprocessed CHAMP climate data record CHAMP L1, L2, L3)					CDOP4-PRD-1.1	
Туре			Climate Data I	Climate Data Record				
Applications and	Users		Climate and a	tmosphere researc	hers			
Characteristics a	nd Metho	ods	(1)					
Operational Sate	llite Input	Data	(1)					
Other Operationa	al Input D	ata	(1)					
Dissemination	Dissemination							
Format	Format Me		Means	leans		Timeliness		
netCDF BUFR			Web	Veb		n/a		
Accuracy					•			
Threshold			Target	arget		Optimal		
(1)			(1)		(1)			
Notes			(1) Baseline deter	eline determined at RR for RE3				
Verification/Valid	ation Met	thods	(1)					
Coverage, Reso	Coverage, Resolution							
Spatial Coverage	9	Horizor	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
(1)		(1)		(1)		(1)		



	ocessed G CE L1, L2	RACE climate dat , L3)	a record	REPGRA	CDOP4-PRD-1.1		
Туре		Climate Data F	Climate Data Record				
Applications and Users	6	Climate and at	mosphere researc	hers			
Characteristics and Me	ethods	(1)					
Operational Satellite In	nput Data	(1)					
Other Operational Inpu	ut Data	(1)					
Dissemination							
Format		Means	leans		Timeliness		
netCDF BUFR			Veb				
Accuracy		•		•			
Threshold		Target	arget		Optimal		
(1)		(1)		(1)			
Notes		(1) Baseline deter	eline determined at RR for RE3				
Verification/Validation	Methods	(1)					
Coverage, Resolution	Coverage, Resolution						
Spatial Coverage	Horizo	ntal Resolution	Vertical Resolution		Temporal Resolution		
(1)	(1)		(1)		(1)		



GRM-34-R3	Reproce (Sentine		entinel-6 climate L2, L3)	data record	REPSEN		CDOP4-PRD-1.1	
Туре	-		Climate Data	Climate Data Record				
Applications and	d Users		Climate and a	itmosphere researc	chers			
Characteristics	and Metho	ods	(1)					
Operational Sat	ellite Input	t Data	(1)					
Other Operational Input Data			(1)					
Dissemination								
Format			Means	leans		Timeliness		
netCDF BUFR			Web	Web		n/a		
Accuracy					-			
Threshold			Target		Optimal			
(1)			(1)		(1)	(1)		
Notes			(1) Baseline deter	Baseline determined at RR for RE3				
Verification/Valio	dation Me	thods	(1)					
Coverage, Res	Coverage, Resolution							
Spatial Coverag	е	Horizor	ntal Resolution	Vertical Resoluti	Vertical Resolution		Temporal Resolution	
(1)		(1)		(1)		(1)		



GRM-35-R3	Reproce L2, L3)	essed F	Y-3 climate data ı	record (FY-3 L1,	REPFY3		CDOP4-PRD-1.1	
Туре			Climate Data	Climate Data Record				
Applications and	d Users		Climate and a	itmosphere researc	hers			
Characteristics	and Metho	ods	(1)					
Operational Sat	ellite Input	t Data	(1)					
Other Operation	al Input D	ata	(1)					
Dissemination								
Format			Means	leans		Timeliness		
netCDF BUFR			Web		n/a			
Accuracy					÷			
Threshold			Target	arget		Optimal		
(1)			(1)		(1)			
Notes			(1) Baseline deter	Baseline determined at RR for RE3				
Verification/Vali	dation Me	thods	(1)					
Coverage, Res	olution							
Spatial Coverag	е	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution	
(1)		(1)		(1)		(1)		



GRM-40 NRT Ref	ractivity	y Profile		NRPMEB		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
			hi-res wave optics sampling; interpolated to 247 fixed levels			
Operational Satellite Input	t Data	Metop-B/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness		
BUFR/netCDF	GTS EUMETCa Web		/IETCast			
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 0.09 N-units 5 – 30 km: 1.8% 0 – 5 km: 6% – 1.8%		30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		S
Notes		An accuracy intervation over the given vertion		y changing	quantity betw	een the two values
Verification/Validation Me	thods	Standard deviation	of (Product – EC	MWF foreca	ists)	
Coverage, Resolution	Ļ					
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS 1	resolution	hi-res wave optic sampling; interpolated to 24 levels		GRAS resolu	ution



GRM-41 NRT Ter	nperatu	re Profile		NTPMEB		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
Characteristics and Metho		model levels (with interpolation); interpolated to 247 fixed levels				
Operational Satellite Input	t Data	Metop-B/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	i	
EU		GTS EUMETCast Web		3 h		
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy intervation over the given vertion		y changing	quantity betw	een the two values
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS 1	resolution	model levels (wit interpolation); interpolated to 24 levels		GRAS resolu	ution



GRM-42 NRT Spe	ecific H	umidity Profile		NHPMEB		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users NWP			/P			
			<i>v</i> ith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-B/GRAS	6			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	;	
BUFR/netCDF	netCDF GTS EUMETCast Web		3 h			
Accuracy				•		
Threshold		Target		Optimal		
1.8 g/kg 30% *		0.6 g/kg 10% *		0.3 g/kg 10% *		
Notes		* whichever is grea The interval 0 – 12				
Verification/Validation Met	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizor	ital Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS	resolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resolu	ution



GRM-43 NRT Pre	ssure P	rofile		NPPMEB		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
Characteristics and Metho		vith interpolation); 247 fixed levels				
Operational Satellite Input	Data	Metop-B/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	i	
EU		GTS EUMETCast Web		3 h		
Accuracy						
Threshold		Target		Optimal		
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		b) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *		
Notes		* whichever is grea The interval 0 – 50) but not greater than (c); d		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS r	esolution	model levels (wit interpolation); interpolated to 24 levels		GRAS resolu	ution



GRM-44 NRT Su	rface Pre	essure		NSPMEB	CDOP4-PRD-1.1		
Туре		NRT Product					
Applications and Users		NWP					
Characteristics and Meth	ods	Scalar at surfa	се				
Operational Satellite Inpu	t Data	Metop-B/GRAS	S				
Other Operational Input I	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN					
Dissemination							
Format		leans		Timeliness			
BUFR/netCDF	EL		GTS EUMETCast Web				
Accuracy				•			
Threshold		Target	arget		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa			
Notes							
Verification/Validation Me	Standard deviatior	andard deviation of (1D-Var solution – ECMWF analysis)					
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution		Temporal Resolution		
Global	GRAS r	resolution	Scalar at surface	;	GRAS resolution		



GRM-46 Offline I	Bending	Angle		OBAMEB		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
			i-res wave optics sampling; nterpolated to 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-B/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	,	
netCDF BUFR	Web		5 - 30 d			
Accuracy				•		
Threshold		Target		Optimal		
35 – 60 km: 4 murad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		35 – 60 km: 2 mura 8 – 35 km: 2% 2 – 8 km: 10% -			35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%	
Notes		An accuracy interva over the given verti BA noise above 60	ical coordinate			veen the two values 5 (rad;
Verification/Validation Me	thods	Standard deviation	of (Product – EC	MWF foreca	ists)	
Coverage, Resolution						
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO res	olution	hi-res wave optic sampling; interpolated to 24 levels		GRAS resolu	ution



GRM-47 Offline F	Refractivi	ity Profile		ORPMEB		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	Climate and atmosphere researchers			
Characteristics and Metho		hi-res wave optics sampling; interpolated to 247 fixed levels				
Operational Satellite Input	t Data	Metop-B/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format	٢	Means		Timeliness		
netCDF BUFR	١	Web		5 - 30 d		
Accuracy						
Threshold	Ţ	Target		Optimal		
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%	3	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		
Notes		An accuracy intervation of the second s		ly changing quantity between the two values		
Verification/Validation Me	thods S	Standard deviation	n of (Product – ECMWF forecasts)			
Coverage, Resolution						
Spatial Coverage	Horizont	tal Resolution Vertical Reso		on	Temporal R	esolution
Global	RO reso	lution	hi-res wave optics sampling; interpolated to 247 fixed levels		GRAS resol	ution



GRM-48 Offline 1	Tempera	ature Profile		OTPMEB		CDOP4-PRD-1.1			
Туре		Offline Product	fline Product						
Applications and Users		Climate and atr	Climate and atmosphere researchers						
Characteristics and Metho		<i>v</i> ith interpolation); 247 fixed levels							
Operational Satellite Input	t Data	Metop-B/GRAS	3						
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN							
Dissemination	Dissemination								
Format		Means		Timeliness	i				
netCDF BUFR		Web		5 - 30 d					
Accuracy									
Threshold		Target		Optimal					
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K					
Notes		An accuracy intervation over the given vertion		ly changing quantity between the two values					
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)				
Coverage, Resolution									
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution			
Global	GRAS	resolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resolu	ution			



GRM-49 C	Offline Sp	oecific	Humidity Profile		OHPMEB		CDOP4-PRD-1.1
Туре			Offline Product	t			
Applications and L	Jsers		Climate and at	mosphere researc	hers		
Characteristics and	d Methoc	ds		vith interpolation); 247 fixed levels			
Operational Satelli	ite Input I	Data	Metop-B/GRAS	6			
Other Operational	Input Da	ita	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination							
Format			Means		Timeliness		
netCDF BUFR	-		Web		5 - 30 d		
Accuracy							
Threshold			Target		Optimal		
1.8 g/kg 30% *			0.6 g/kg 10% *		0.3 g/kg 10% *		
Notes			* whichever is grea The interval 0 – 12				
Verification/Validat	tion Meth	nods	Standard deviatior	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolu	ution						
Spatial Coverage	ŀ	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global		GRAS r	esolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resolu	ution



GRM-50 Offline F	Pressure	Profile		OPPMEB		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	ods		<i>v</i> ith interpolation); 247 fixed levels				
Operational Satellite Input	t Data	Metop-B/GRAS	3				
Other Operational Input D	GPS orbits (EU Metop orbits (E ECMWF FC, A	UM)					
Dissemination							
Format		Means		Timeliness	Timeliness		
netCDF BUFR	,	Web		5 - 30 d			
Accuracy							
Threshold		Target		Optimal			
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		b) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *			
Notes		* whichever is grea The interval 0 – 50		f (a) and (b) but not greater than (c); considered			
Verification/Validation Me	thods	Standard deviation	on of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution	
Global	GRAS r	esolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resolu	ution	



GRM-51 Offline	Surface	Pressure		OSPMEB		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	nods	Scalar at surface	се				
Operational Satellite Inp	ut Data	Metop-B/GRAS	6				
Other Operational Input	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN					
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web	Veb		5 - 30 d		
Accuracy				<u>.</u>			
Threshold		Target	arget		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa			
Notes							
Verification/Validation M	ethods	Standard deviation	n of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizoi	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
Global	GRAS	resolution	Scalar at surface GR/		GRAS resolu	ution	



GRM-53 Offline E	Bending	Angle Grid		OBGMEB		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	< 5 deg grid	S		
Operational Satellite Input	t Data	Metop-B/GRAS	3				
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	on)	
Dissemination		-					
Format		Means		Timeliness			
netCDF	Y	Web 30 d					
Accuracy				<u> </u>			
Threshold	-	Target		Optimal			
25 – 50 km: 0.6 % or 1.2 i *) 8 – 25 km: 0.6 % 0 – 8 km: 6 – 0.6 %	murad 2	25 – 50 km: 0.3 % or 0.6 murad*) 8 – 25 km: 0.3 % 0 – 8 km: 3 – 0.3 %		25 – 50 km: 0.15 % or 0.3 murad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %			
Notes * whichever is greater An accuracy interval mear over the given vertical coo				y changing o	quantity betw	een the two values	
			s of differences relative to ECMWF ERA Interim.Resampling statistics: nparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizont	al Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	titude	200 m 1 month				



GRM-54 Offline F	Refractivit	y Grid		ORGMEB		CDOP4-PRD-1.1
Туре		Offline Product	ct			
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s	
Operational Satellite Inpu	t Data	Metop-B/GRAS	6			
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	sampling e	error estimatio	on)
Dissemination		-				
Format	М	eans		Timeliness	i	
netCDF	W	Web 30 d				
Accuracy						
Threshold	Та	Target		Optimal		
25 – 50 km: 0.24 % or 0.0 units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	ur 8	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N-units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %		
Notes	iter ; al means a linearl <u>;</u> ical coordinate	y changing	quantity betw	veen the two values		
Verification/Validation Me		tistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.				
Coverage, Resolution						
Spatial Coverage	Horizonta	I Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg latit	tude	200 m		1 month	



GRM-55 Offline	ſempera	ture Grid		OTGMEB		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Inpu	t Data	Metop-B/GRAS	3				
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	, sampling e	rror estimatio	n)	
Dissemination							
Format		Means		Timeliness			
netCDF		Veb 3		30 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 K		25 – 50 km: 0.3 – 3 K 8 – 25 km: 0.3 K 0 – 8 km: 1.0 – 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: 0.50 – 0.15 K			
Notes		An accuracy intervation over the given vertion		arly changing quantity between the two values			
Verification/Validation Me			tatistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg la	ititude	200 m	1 month			



GRM-56 Offline	Specific H	lumidity Grid		OHGMEB		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and at	nosphere researc	hers		
Characteristics and Meth	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	S	
Operational Satellite Inpu	t Data	Metop-B/GRAS	3			
Other Operational Input D	Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	on)
Dissemination						
Format	١	leans		Timeliness		
netCDF V		Web		30 d		
Accuracy				•		
Threshold	Ţ	Target		Optimal		
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %	8	8 – 12 km: 4.0 % 0 – 8 km: 4.0 %		8 – 12 km: 2.0 % 0 – 8 km: 2.0 %		
Notes			ccuracy interval means a linearly changing quantity between the two values the given vertical coordinate			
Verification/Validation Me		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution	-					
Spatial Coverage	Horizont	al Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg lat	itude	200 m		1 month	



GRM-57 Clima	te Dry Ge	opotential Height		OZGMEB	CDOP4-PRD-1.1		
Туре		Offline Product	t .				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Me	thods	Zonal monthly	means on 200 m	x 5 deg grid	s		
Operational Satellite In	put Data	Metop-B/GRAS	6				
Other Operational Inpu	t Data	ECMWF ERA	Interim (validation	, sampling e	error estimation)		
Dissemination							
Format		Means		Timeliness	3		
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target					
25 – 50 km: 12 – 120 m 8 – 25 km: 12 m 0 - 8 km: –	1	25 – 50 km: 6 – 60 8 – 25 km: 6 m 0 – 8 km: –			25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –		
Notes		An accuracy interv over the given vert		rly changing quantity between the two values			
Verification/Validation N	/lethods		tatistics of differences relative to ECMWF ERA Interim.Resampling statistics: iter-comparison of RO data subsets.				
Coverage, Resolution	l						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m 1 mo		1 month		



GRM-58 Offlin	ne Dry Tem	perature Grid		ODGMEB		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users	S	Climate and at	mosphere researc	hers			
Characteristics and Me	ethods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Ir	nput Data	Metop-B/GRAS	6				
Other Operational Inpu	ut Data	ECMWF ERA I	Interim (validation,	, sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target	arget		Optimal		
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –		25 – 50 km: 0.3 – 3 8 – 25 km: 0.3 K 0 – 8 km: –	– 25 km: 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Notes		An accuracy intervolution over the given vert		a linearly changing quantity between the two values linate;			
Verification/Validation	Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolutio	n						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month				



GRM-59 Offline	Dry Pres	sure Grid		OYGMEB		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Inpu	ıt Data	Metop-B/GRAS	6				
Other Operational Input I	Data	ECMWF ERA	nterim (validation	, sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.24 – 1.20 ^o 8 – 25 km: 0.24 % 0 – 8 km –	%	25 – 50 km: 0.12 – 0.60 % 8 – 25 km: 0.12 % 0 – 8 km: –		25 – 50 km: 0.06 – 0.30 % 8 – 25 km: 0.06 % 0 – 8 km: –			
Notes		An accuracy interv over the given vert	val means a linearly changing quantity between the two values tical coordinate;				
Verification/Validation Me	ethods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	/ertical Resolution		Temporal Resolution	
Global	5 deg la	atitude	200 m		1 month		



GRM-60 NRT Ref	ractivity	/ Profile		NRPMEC		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
			hi-res wave optics sampling; interpolated to 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	,	
BUFR/netCDF			EUMETCast		3 h	
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 0.09 N-units 5 – 30 km: 1.8% 0 – 5 km: 6% – 1.8%		30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		S
Notes		An accuracy intervanter over the given vertion		ly changing quantity between the two values		
Verification/Validation Me	thods	Standard deviation	of (Product – EC	MWF foreca	ists)	
Coverage, Resolution	1					
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Resolution	
Global	GRAS r	esolution	hi-res wave optics sampling; interpolated to 247 fixed levels		GRAS resolu	ution



GRM-61 NRT Ter	nperatu	re Profile		NTPMEC		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	WP			
			<i>i</i> ith interpolation); 247 fixed levels			
Operational Satellite Input	Data	Metop-C/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness	,	
BUFR/netCDF			UMETCast		3 h	
Accuracy				•		
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy interva over the given verti		ly changing quantity between the two values		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution	Ļ					
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS 1	resolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resolu	ution



GRM-62 NRT Spe	ecific Hu	umidity Profile		NHPMEC	C	DOP4-PRD-1.1
Туре		NRT Product				
Applications and Users	NWP	IWP				
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	6			
Metop			PS orbits (EUM) etop orbits (EUM) CMWF FC, AN			
Dissemination						
Format		Means		Timeliness		
BUFR/netCDF		GTS EUMETCast Web		3 h		
Accuracy				•		
Threshold		Target		Optimal		
1.8 g/kg 30% *		0.6 g/kg 10% *		0.3 g/kg 10% *		
Notes		* whichever is grea The interval 0 – 12				
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	ion – ECMWF analysis)		
Coverage, Resolution						
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Res	olution
Global	GRAS I	esolution	model levels (with interpolation); interpolated to 247 fixed levels		GRAS resoluti	on



GRM-63 NRT Pre	ssure P	rofile		NPPMEC		CDOP4-PRD-1.1	
Туре		NRT Product					
Applications and Users NWP							
			vith interpolation); 247 fixed levels				
Operational Satellite Input	Data	Metop-C/GRAS	3				
Other Operational Input D		iPS orbits (EUM) letop orbits (EUM) CMWF FC, AN					
Dissemination							
Format		Means		Timeliness	i		
BUFR/netCDF			EUMETCast		3 h		
Accuracy							
Threshold		arget		Optimal			
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		a) 0.01 hPa b) 0.25% c) 0.8 hPa *) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *		
Notes		* whichever is grea The interval 0 – 50) but not greater than (c);			
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)		
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution	
Global	GRAS r	solution model levels (w interpolation); interpolated to levels			GRAS resolu	ution	



GRM-64 NRT Su	rface Pro	essure		NSPMEC		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods	Scalar at surface	се			
Operational Satellite Inpu	t Data	Metop-C/GRAS	6			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness		
BUFR/netCDF	EU		GTS EUMETCast Web			
Accuracy						
Threshold		Target		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa		
Notes						
Verification/Validation Methods Standard d			ard deviation of (1D-Var solution – ECMWF analysis)			
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	al Resolution Vertical Resolution		ion Temporal Resolution	
Global	GRAS r	resolution	Scalar at surface		GRAS resolu	ition



GRM-66 Offline	Bending	Angle		OBAMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Methods hi-res wave op interpolated to			tics sampling; 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-C/GRAS	6			
Metop			iPS orbits (EUM) letop orbits (EUM) CMWF FC, AN			
Dissemination						
Format		Means		Timeliness	,	
netCDF BUFR		Web		5 - 30 d		
Accuracy				•		
Threshold		Target		Optimal		
35 – 60 km: 4 murad 8 – 35 km: 4% 2 – 8 km: 20% - 4%		35 – 60 km: 2 mura 8 – 35 km: 2% 2 – 8 km: 10% -	8 – 35 ki		n: 1 murad n: 1% n: 5% - 1%	
Notes		An accuracy interv over the given vert BA noise above 60	ical coordinate			een the two values
Verification/Validation Me	thods	Standard deviation	of (Product – ECI	MWF foreca	ists)	
Coverage, Resolution						
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS I	resolution	hi-res wave optic sampling; interpolated to 24 levels		GRAS resolu	ution



GRM-67 Offline F	Refractivi	ty Profile		ORPMEC		CDOP4-PRD-1.1
Туре		Offline Product	Offline Product			
Applications and Users		Climate and atr	Climate and atmosphere researchers			
			i-res wave optics sampling; iterpolated to 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	3			
Other Operational Input Data GPS orbits Metop orbi ECMWF F			UM)			
Dissemination						
Format	Ν	leans		Timeliness		
netCDF BUFR	V	Web		5 - 30 d		
Accuracy						
Threshold	Т	Target		Optimal		
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		
Notes		An accuracy intervative the given vertion		y changing quantity between the two values		
Verification/Validation Me	thods S	Standard deviation	of (Product – ECI	MWF foreca	ists)	
Coverage, Resolution						
Spatial Coverage	Horizonta	al Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS re	esolution	hi-res wave optics sampling; interpolated to 247 fixed levels		GRAS resolu	ution



GRM-68 Offline 1	Tempera	ature Profile		OTPMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Metho	ods	model levels (w interpolated to a	<i>i</i> ith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	3			
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness		
netCDF BUFR		Web		5 - 30 d		
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy interva over the given verti		ly changing quantity between the two values		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMWF analysis)		
Coverage, Resolution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal R	esolution
Global	GRAS	esolution model levels interpolation interpolated levels			GRAS resol	ution



GRM-69 Off	iline Specific	Humidity Profile		OHPMEC		CDOP4-PRD-1.1
Туре		Offline Product	t			
Applications and Us	ers	Climate and at	tmosphere researchers			
			vith interpolation); 247 fixed levels			
Operational Satellite	e Input Data	Metop-C/GRAS	S			
Metop orbi			PS orbits (EUM) etop orbits (EUM) CMWF FC, AN			
Dissemination						
Format		Means	Means -			
netCDF BUFR	-		eb 5 - 30 d			
Accuracy						
Threshold		Target	Opt			
1.8 g/kg 30% *		0.6 g/kg 10% *			0.3 g/kg 10% *	
Notes		* whichever is grea The interval 0 – 12				
Verification/Validation	on Methods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolut	ion					
Spatial Coverage	Horizo	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS	resolution	esolution model levels (with interpolation); interpolated to 24 levels		GRAS resolu	ution



GRM-70 Offline F	Pressure	Profile		OPPMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Metho	ods		<i>v</i> ith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	3			
Other Operational Input D	GPS orbits (EU Metop orbits (E ECMWF FC, A	UM)				
Dissemination						
Format		Means		Timeliness	;	
netCDF BUFR	,	Web		5 - 30 d		
Accuracy						
Threshold		Target		Optimal		
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		b) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *		
Notes		* whichever is grea The interval 0 – 50) but not greater than (c);		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	GRAS r	esolution model levels interpolation) interpolated to levels			GRAS resolu	ution



GRM-71 Offline	Surface	Pressure		OSPMEC		CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	iods	Scalar at surface	се				
Operational Satellite Inp	ut Data	Metop-C/GRAS	6				
Other Operational Input Data GPS orbit Metop orb ECMWF F			EUM)				
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web	Neb		5 - 30 d		
Accuracy		<u>.</u>		-			
Threshold		Target	rget		Optimal		
2.4 hPa		0.8 hPa	8 hPa		0.7 hPa		
Notes							
Verification/Validation M	ethods	Standard deviation	n of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
Global	GRAS	resolution	Scalar at surface		GRAS resolu	ution	



GRM-73 Offline	Bending /	Angle Grid		OBGMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Methe	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	S	
Operational Satellite Inpu	t Data	Metop-C/GRAS	3			
Other Operational Input D	Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	on)
Dissemination						
Format	Ν	Means		Timeliness	,	
netCDF	٧	Neb 30 d				
Accuracy				I		
Threshold	٦	Target		Optimal		
25 – 50 km: 0.6 % or 1.2 *) 8 – 25 km: 0.6 % 0 – 8 km: 6 – 0.6 %	murad 2	25 – 50 km: 0.3 % or 0.6 murad*) 8 – 25 km: 0.3 % 0 – 8 km: 3 – 0.3 %		25 – 50 km: 0.15 % or 0.3 murad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %		
Notes	A	whichever is grea An accuracy interva over the given verti	al means a linearl	y changing	quantity betw	een the two values
Verification/Validation Me		Statistics of different of the statistics of the state of			Interim.Resa	ampling statistics:
Coverage, Resolution	÷					
Spatial Coverage	Horizont	al Resolution	Vertical Resolution	on	Temporal Resolution	
Global	5 deg lat	itude	200 m	1 month		



GRM-74 Offline	Refractivit	ty Grid		ORGMEC		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s		
Operational Satellite Inpu	it Data	Metop-C/GRAS	6				
Other Operational Input [Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	n)	
Dissemination							
Format	N	leans		Timeliness	,		
netCDF	V	/eb 30 d					
Accuracy							
Threshold	Т	arget		Optimal			
25 – 50 km: 0.24 % or 0.0 units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	u	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N-units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %			
Notes	A	whichever is grea n accuracy interva ver the given verti	al means a linearl	y changing	quantity betw	een the two values	
			cs of differences relative to ECMWF ERA Interim.Resampling statistics: mparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizonta	al Resolution Vertical Resolu		on	Temporal Re	Temporal Resolution	
Global	5 deg lati	tude	200 m	1 month			



GRM-75 Offline	Tempera	ature Grid		OTGMEC		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	k 5 deg grid	s		
Operational Satellite Inpu	ut Data	Metop-C/GRAS	6				
Other Operational Input I	Data	ECMWF ERA I	Interim (validation,	sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 K		8 – 25 km: 0.3 K	25 – 50 km: 0.3 – 3 K 8 – 25 km: 0.3 K 0 – 8 km: 1.0 – 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: 0.50 – 0.15 K		
Notes		An accuracy intervolution over the given vert		y changing	quantity betw	een the two values	
Verification/Validation Me	ethods	Statistics of different inter-comparison o			Interim.Resa	ampling statistics:	
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	solution Vertical Resolution		on Temporal Resolution		
Global	5 deg la	atitude	200 m	1 month			



GRM-76 Offline	e Specific	Humidity Grid		OHGMEC		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Me	thods	Zonal monthly	means on 200 m x	x 5 deg grid	s		
Operational Satellite In	out Data	Metop-C/GRAS	S				
Other Operational Input	t Data	ECMWF ERA	Interim (validation,	, sampling e	error estimatio	on)	
Dissemination							
Format		Means		Timeliness	i		
netCDF		Web	Web		30 d		
Accuracy		L					
Threshold		Target	Optimal				
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %		8 – 12 km: 4.0 % 0 – 8 km: 4.0 %		8 – 12 km: 2.0 % 0 – 8 km: 2.0 %			
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
			nces relative to E0 of RO data subsets		Interim.Resa	ampling statistics:	
Coverage, Resolution							
Spatial Coverage	Horizoi	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m		1 month		



GRM-77 Clima	ate Dry Ge	opotential Height		OZGMEC	CDOP4-PRD-1.1	
Туре		Offline Product	t			
Applications and Users	3	Climate and at	mosphere researc	hers		
Characteristics and Me	thods	Zonal monthly	means on 200 m :	x 5 deg grid	s	
Operational Satellite In	put Data	Metop-C/GRAS	6			
Other Operational Inpu	it Data	ECMWF ERA	Interim (validation,	, sampling e	error estimation)	
Dissemination						
Format		Means		Timeliness		
netCDF		Web		30 d		
Accuracy				•		
Threshold		Target	Optimal			
25 – 50 km: 12 – 120 r 8 – 25 km: 12 m 0 - 8 km: –	n	25 – 50 km: 6 – 60 8 – 25 km: 6 m 0 – 8 km: –	0 m 25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –			
Notes		An accuracy interv over the given vert		y changing	quantity between the two values	
			ences relative to ECMWF ERA Interim.Resampling statistics: of RO data subsets.			
Coverage, Resolution	า					
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg l	atitude	200 m 1		1 month	



GRM-78 Offli	ne Dry Tem	perature Grid		ODGMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and User	ſS	Climate and at	mosphere researc	hers		
Characteristics and M	ethods	Zonal monthly	means on 200 m :	k 5 deg grid	s	
Operational Satellite I	nput Data	Metop-C/GRAS	6			
Other Operational Inp	ut Data	ECMWF ERA	nterim (validation,	sampling e	rror estimatio	n)
Dissemination						
Format		Means		Timeliness		
netCDF		Web	30 d			
Accuracy				•		
Threshold		Target	Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –		25 – 50 km: 0.3 – 3 8 – 25 km: 0.3 K 0 – 8 km: –	3 K 25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –			<
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values
			rences relative to ECMWF ERA Interim.Resampling statistics: of RO data subsets.			
Coverage, Resolutio						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg la	atitude	200 m 1		1 month	



GRM-79 Offline	Dry Pres	sure Grid		OYGMEC		CDOP4-PRD-1.1
Туре		Offline Product	t			
Applications and Users		Climate and at	mosphere researc	hers		
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s	
Operational Satellite Inpu	ut Data	Metop-C/GRAS	6			
Other Operational Input	Data	ECMWF ERA	Interim (validation	, sampling e	rror estimatio	on)
Dissemination						
Format		Means		Timeliness		
netCDF		Web	30 d			
Accuracy				•		
Threshold		Target	Optimal			
25 – 50 km: 0.24 – 1.20 8 – 25 km: 0.24 % 0 – 8 km –	%	25 – 50 km: 0.12 – 8 – 25 km: 0.12 % 0 – 8 km: –	– 25 km: 0.12 % 8 – 25 km		0 km: 0.06 – 0.30 % 5 km: 0.06 % 5 km: –	
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values
			s of differences relative to ECMWF ERA Interim.Resampling statistics: nparison of RO data subsets.			
Coverage, Resolution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg la	atitude	200 m 1 mo		1 month	



GRM-83 GRM-84 GRM-85 GRM-86 GRM-87 GRM-88 GRM-89 GRM-194	Offline bending angle grid Offline refractivity grid Offline dry geopotential height grid Offline temperature grid Offline specific humidity grid Offline dry temperature grid Offline dry pressure grid Offline tropopause height grid			RBGMET RRGMET RZGMET RTGMET RHGMET RYGMET RCGMET	CDOP4- PRD-1.1
Туре		0	ffline Product		
Applications and Use	ers	С	limate and atmosphere resea	archers	
Characteristics and I	Methods	Zo	onal monthly means on 200 i	m x 5 deg grids	
Operational Satellite	Input Data	0	ffline Level 1A Metop (Multin	nission Metop)	
Other Operational In	put Data	E	CMWF ERA Interim (validation	on, sampling error e	estimation)
Dissemination					
Format	I	Mear	ns	Timeliness	
netCDF	N N	Web		n/a	
Accuracy					
Threshold	-	Targe	et	Optimal	
Bending angle					
25 – 50 km: 0.4 % or 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 °		25 – 50 km: 0.2 % or 0.4 μrad*) 8 – 25 km: 0.2 % 0 – 8 km: 2.0– 0.20 %		25 – 50 km: 0.10 % or 0.2 μrad*) 8 – 25 km: 0.10 % 0 – 8 km: 1.0 – 0.10 %	
Refractivity					
25 – 50 km: 0.16 % o units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.1		25 – 50 km: 0.08 % or 0.004 N- units*) 8 – 25 km: 0.08 % 0 – 8 km: 0.8 – 0.08 %		25 – 50 km: 0.04 % or 0.002 N- units*) 8 – 25 km: 0.04 % 0 – 8 km: 0.4 – 0.04 %	
Dry temperature					
25 – 50 km: 0.4 – 4 k 8 – 25 km: 0.4 K 0 – 8 km: –	K 2	8 –	50 km: 0.2 – 2 K 25 km: 0.2 K 8 km: –	25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K 0 – 8 km: –	
Dry pressure					
25 – 50 km: 0.16 – 0 8 – 25 km: 0.16 % 0 – 8 km –	8 – 25 km: 0.16 %		50 km: 0.08 – 0.40 % 25 km: 0.08 % 8 km: –	25 – 50 km: 0.04 – 0.20 % 8 – 25 km: 0.04 % 0 – 8 km: –	
Dry geopotential height					
8 – 25 km: 8 m 8		25 - 50 km: 4 - 40 m 25 - 50 km: 2 - 20 n 8 - 25 km: 4 m 8 - 25 km: 2 m 0 - 8 km: - 0 - 8 km: -		m	
Temperature					
25 – 50 km: 0.4 – 4 k 8 – 25 km: 0.4 K 0 – 8 km: 2.0 – 0.4		25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K 0 – 8 km: 1.0 – 0.2 K		25 – 50 km: 0.10 – 8 – 25 km: 0.10 K 0 – 8 km: 0.50 –	(



Specific humidity					
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %		8 – 12 km: 3.0 0 – 8 km: 3.0		8 – 12 km 0 – 8 km	
Tropopause Height					
0.2 km		0.1 km		0.05 km	
Notes	two v	ccuracy interval m values over the giv ichever is greater	en vertical coor		antity between the
Verification/Validation Methods		stics of differences ampling statistics:	-		
Coverage, Resolutior	ı				
Spatial Coverage	Horizonta	I Resolution	Vertical Resolut	tion	Temporal Resolution
global	5 deg lati	tude	200 m		1 month



GRM-183 GRM-184 GRM-185	Offline bending angle grid Offline refractivity grid Offline dry geopotential height grid			RBGMES RRGMES RZGMES	CDOP4- PRD-1.1
GRM-186 GRM-187 GRM-188 GRM-189 GRM-198	Offline tempe Offline specie Offline dry te Offline dry p Offline tropo	fic hum mperat œssure	idity grid ure grid grid	RTGMES RHGMES RDGMES RYGMES RCGMES	
Туре	-	-	e Product		
Applications and Use	ers	Clima	ate and atmosphere rese	archers	
Characteristics and I	Methods	Zona	I monthly means on 200	m x 5 deg grids	
Operational Satellite	Input Data	Offlin	e Level 1A Metop (Multi	mission Metop-SG))
Other Operational In	put Data	ECM	WF ERA Interim (validat	ion, sampling error	estimation)
Dissemination					· · · · ·
Format	١	Means		Timeliness	
netCDF	١	Veb		n/a	
Accuracy					
Threshold	7	Farget		Optimal	
Bending angle					
25 – 50 km: 0.4 % or 0.8 μrad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %		25 – 50 km: 0.2 % or 0.4 μrad*) 8 – 25 km: 0.2 % 0 – 8 km: 2.0– 0.20 %		25 – 50 km: 0.10 % or 0.2 μrad*) 8 – 25 km: 0.10 % 0 – 8 km: 1.0 – 0.10 %	
Refractivity					
25 – 50 km: 0.16 % o units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.7		25 – 50 km: 0.08 % or 0.004 N- units*) 8 – 25 km: 0.08 % 0 – 8 km: 0.8 – 0.08 %		25 – 50 km: 0.04 % or 0.002 N- units*) 8 – 25 km: 0.04 % 0 – 8 km: 0.4 – 0.04 %	
Dry temperature					
25 – 50 km: 0.4 – 4 k 8 – 25 km: 0.4 K 0 – 8 km: –	K 2		km: 0.2 – 2 K km: 0.2 K km: –	25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K 0 – 8 km: –	
Dry pressure					
8 – 25 km: 0.16 %			km: 0.08 – 0.40 % km: 0.08 % km: –	25 – 50 km: 0.04 – 0.20 % 8 – 25 km: 0.04 % 0 – 8 km: –	
Dry geopotential height					
8 – 25 km: 8 m 8		25 – 50 km: 4 – 40 m 8 – 25 km: 4 m 0 – 8 km: –		25 – 50 km: 2 – 2 8 – 25 km: 2 m 0 – 8 km: –	0 m
Temperature					
25 – 50 km: 0.4 – 4 k 8 – 25 km: 0.4 K 0 – 8 km: 2.0 – 0.4		25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K 0 – 8 km: 1.0 – 0.2 K		25 – 50 km: 0.10 8 – 25 km: 0.10 0 – 8 km: 0.50	К



Specific humidity						
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %					n: 1.5 % n: 1.5 %	
Tropopause Height						
0.2 km		0.1 km		0.05 km		
Notes	two v	ccuracy interval m alues over the giv ichever is greater	en vertical coord		antity between the	
Verification/Validation Methods		stics of differences mpling statistics:				
Coverage, Resolution						
Spatial Coverage	Horizonta	I Resolution	Vertical Resolut	ion	Temporal Resolution	
global	5 deg latit	ude	200 m		1 month	



GRM-92 Grou	Ground Based GNSS Package				CDOP4-PRD-1.1		
Туре		Software Proc	Software Product				
Applications and Users	;	Analysis Cent	tres and NWP				
Characteristics and Me	thods	Routines for h	nandling ground-ba	sed GNSS (ZTD, IWV)		
Operational Satellite In	put Data	Output of gro	und-based GNSS p	processing			
Other Operational Inpu	t Data						
Dissemination							
Format		Means	leans		Timeliness		
tarballs		Web	Veb		N/A		
Accuracy		-		-			
Threshold		Target	Target		Optimal		
N/A		N/A	I/A		N/A		
Notes							
Verification/Validation I	Methods	Test Folder	est Folder				
Coverage, Resolution	ı						
Spatial Coverage	Coverage Horizontal Resolution			on	Temporal Resolution		
N/A	N/A						



GRM-103 Offline I	Dry Tem	perature Profile		ODPMEB		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods		-res wave optics sampling; terpolated to 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-B/GRAS	3			
Other Operational Input D	oata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness		
BUFR netCDF		Web		5 - 30 d		
Accuracy						
Threshold		Target	Optimal			
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K - 0.5 K		
Notes		An accuracy intervation over the given vertion		y changing	quantity betw	een the two values
Verification/Validation Me	thods	Standard deviation	of (Product – ECI	MWF foreca	asts)	
Coverage, Resolution						
Spatial Coverage	overage Horizontal Resolution			Vertical Resolution		esolution
Global	GRAS resolution		hi-res wave optics sampling; interpolated to 247 fixed levels		GRAS resolu	ution



GRM-105 Offline E	Dry Tem	perature Profile		ODPMEC		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods		i-res wave optics sampling; terpolated to 247 fixed levels			
Operational Satellite Input	t Data	Metop-C/GRAS	6			
Other Operational Input D	ata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness		
BUFR netCDF		Web		5 - 30 d		
Accuracy				•		
Threshold		Target	arget Optima		al	
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K - 0.5 K		
Notes		An accuracy intervation over the given verti		y changing	quantity betw	een the two values
Verification/Validation Me	thods	Standard deviation	deviation of (Product – ECMWF forecasts)			
Coverage, Resolution						
Spatial Coverage	overage Horizontal Resolution			on	Temporal R	esolution
Global	GRAS resolution		hi-res wave optics sampling; interpolated to 247 fixed levels		GRAS resol	ution



GRM-107 Offline B	Bending	Angle Grid		OBGCO2		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	< 5 deg grid	s	
Operational Satellite Inpu	t Data	COSMIC-2 Pos	st-processed data			
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	sampling e	error estimatio	on)
Dissemination						
Format	1	Veans		Timeliness		
netCDF	netCDF We			30 - 180 d	180 d	
Accuracy	I			ł		
Threshold	-	Target		Optimal		
25 – 50 km: 0.4 % or 0.8 murad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	2	25 – 50 km: 0.2 % or 0.4 murad*) 8 – 25 km: 0.2 % 0 – 8 km: 2.0– 0.20 %		25 – 50 km: 0.10 % or 0.2 murad*) 8 – 25 km: 0.10 % 0 – 8 km: 1.0 – 0.10 %		
Notes				y changing	quantity betw	een the two values
			nces relative to E0 f RO data subsets		Interim.Resa	ampling statistics:
Coverage, Resolution						
Spatial Coverage Horizontal Resolution			Vertical Resolution Temporal Resolution			esolution
Global	5 deg la	titude	200 m 1 month			



GRM-108 Offline	Refractiv	ity Grid		ORGCO2		CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s		
Operational Satellite Inpu	ut Data	COSMIC-2 Pos	st-processed data				
Other Operational Input I	Data	ECMWF ERA I	nterim (validation,	sampling e	error estimatio	on)	
Dissemination							
Format		Means		Timeliness	;		
netCDF	1	Web	30 - 180 d				
Accuracy							
Threshold	·	Target		Optimal			
25 – 50 km: 0.16 % or 0. units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	1	25 – 50 km: 0.08 % or 0.004 N- units*) 8 – 25 km: 0.08 % 0 – 8 km: 0.8 – 0.08 %		25 – 50 km: 0.04 % or 0.002 N-units*) 8 – 25 km: 0.04 % 0 – 8 km: 0.4 – 0.04 %			
Notes		* whichever is grea An accuracy interva over the given verti	al means a linearl	y changing	quantity betw	een the two values	
Verification/Validation Me		atistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.					
Coverage, Resolution	İ						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	titude	200 m		1 month		



GRM-109 Offline	Tempera	ature Grid		OTGCO2		CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	k 5 deg grid	s		
Operational Satellite Inpu	ıt Data	COSMIC-2 Pos	st-processed data				
Other Operational Input I	Data	ECMWF ERA	Interim (validation,	sampling e	error estimatio	on)	
Dissemination							
Format		Means		Timeliness	;		
netCDF		Neb		30 - 180 d			
Accuracy							
Threshold		Target		Optimal			
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 8 km: 2.0 – 0.4 K		25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K 0 – 8 km: 1.0 – 0.2 K		25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K 0 – 8 km: 0.50 – 0.10 K			
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
Verification/Validation Me	ethods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month				



GRM-110 Offline S	Specific H	lumidity Grid		OHGCO2		CDOP4-PRD-1.1
Туре		Offline Product	t			
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	S	
Operational Satellite Inpu	t Data	COSMIC -2Pos	st-processed data			
Other Operational Input D	Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	n)
Dissemination						
Format	١	leans		Timeliness		
netCDF		Web		30 - 180 d		
Accuracy				•		
Threshold	Ţ	Target		Optimal		
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %	8	8 – 12 km: 3.0 % 0 – 8 km: 3.0 %		8 – 12 km: 1.5 % 0 – 8 km: 1.5 %		
Notes			accuracy interval means a linearly changing quantity between the two values er the given vertical coordinate			
Verification/Validation Me		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution						
Spatial Coverage	Horizont	al Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg lat	itude	200 m 1 month		1 month	



GRM-111 C	limate Dry Ge	opotential Height		OZGCO2		CDOP4-PRD-1.1	
Туре		Offline Product	ffline Product				
Applications and U	lsers	Climate and at	mosphere researc	hers			
Characteristics and	d Methods	Zonal monthly	means on 200 m	k 5 deg grid	s		
Operational Satelli	te Input Data	COSMIC-2 Pos	st-processed data				
Other Operational	Input Data	ECMWF ERA I	Interim (validation,	sampling e	error estimatio	n)	
Dissemination							
Format		Means		Timeliness	i		
netCDF V		Web		30 - 180 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 8 – 80 8 – 25 km: 8 m 0 - 8 km: –	m	25 – 50 km: 4 – 40 m 8 – 25 km: 4 m 0 – 8 km: –		25 – 50 km: 2 – 20 m 8 – 25 km: 2 m 0 – 8 km: –			
Notes			nterval means a linearly changing quantity between the two values				
Verification/Validat	ion Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolu	ution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m		1 month		



GRM-112 Offline	Dry Tem	perature Grid		ODGCO2	CDOP4-PRD-1.1		
Туре		Offline Product	ne Product				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Inpu	t Data	COSMIC-2 Pos	st-processed data				
Other Operational Input [Data	ECMWF ERA	Interim (validation,	, sampling e	error estimation)		
Dissemination							
Format		Means		Timeliness	;		
netCDF		Web		30 - 180 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 8 km: –		25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K 0 – 8 km: –		25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K 0 – 8 km: –			
Notes		An accuracy interv over the given vert	rval means a linearly changing quantity between the two values ertical coordinate;				
Verification/Validation Me	thods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month		1 month		



GRM-113 Offline	Dry Pres	sure Grid		OYGCO2		CDOP4-PRD-1.1	
Туре		Offline Product	ct				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m x	x 5 deg grid	s		
Operational Satellite Inpu	ut Data	COSMIC-2 Pos	st-processed data				
Other Operational Input I	Data	ECMWF ERA	Interim (validation,	, sampling e	error estimatio	on)	
Dissemination							
Format		Means		Timeliness	;		
netCDF		Web		30 - 180 d			
Accuracy				•			
Threshold		Target	arget		Optimal		
25 – 50 km: 0.16 – 0.80 ⁰ 8 – 25 km: 0.16 % 0 – 8 km –	%	25 – 50 km: 0.08 – 0.40 % 8 – 25 km: 0.08 % 0 – 8 km: –		25 – 50 km: 0.04 – 0.20 % 8 – 25 km: 0.04 % 0 – 8 km: –			
Notes			nterval means a linearly changing quantity between the two values n vertical coordinate;				
Verification/Validation Me	ethods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month				



GRM-117 NTC Ref	ractivity	Profile		ORPS6		CDOP4-PRD-1.1
Туре		NTC Level 2 Pr	NTC Level 2 Product			
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho		hi-res wave optics sampling; interpolated to 247 fixed levels				
Operational Satellite Input	t Data	Sentinel-6 serie	es (EUMETSAT S	ecretariat L	evel 1B Bend	ling Angle Data)
Other Operational Input D	ata	ECMWF NWP	operational fields			
Dissemination						
Format		Means		Timeliness		
netCDF W BUFR		Web		60 d		
Accuracy				<u>.</u>		
Threshold		Target		Optimal		
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		
Notes		An accuracy intervation over the given vertion	val means a linearly changing quantity between the two values rtical coordinate			
Verification/Validation Me	thods	Standard deviation	andard deviation of (Product – ECMWF forecasts)			
Coverage, Resolution	<u> </u>					
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal R	esolution
Global	RO reso	plution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	n



GRM-118 NTC Te	emperati	ire Profile		OTPS6	CDOP4-PRD-1.1	
Туре		NTC Level 2 P	NTC Level 2 Product			
Applications and Users		Climate and at	mosphere researc	hers		
Characteristics and Meth	nods	NWP model lev	vels			
Operational Satellite Inp	ut Data		es (ROM SAF Lev vel 1B Bending An		t derived from EUMETSAT	
Other Operational Input	Data	ECMWF NWP	operational fields			
Dissemination		·				
Format		Means		Timeliness		
netCDF W BUFR		Web		60 d		
Accuracy				<u>.</u>		
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy interv over the given vert		rly changing quantity between the two values		
Verification/Validation M	ethods	Standard deviation	of (1D-Var solution	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizo	ntal Resolution	Vertical Resolution	tion Temporal Resolution		
Global	RO res	olution	NWP model levels		RO resolution	



GRM-119 NTC S	pecific H	umidity Profile		OHPS6		CDOP4-PRD-1.1	
Туре		NTC Level 2 P	roduct				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Met	hods	NWP model lev	vels				
Operational Satellite Inp	ut Data		es (ROM SAF Lev vel 1B Bending An		t derived from	EUMETSAT	
Other Operational Input	Data	ECMWF NWP	operational fields				
Dissemination							
Format		Means		Timeliness	i		
netCDF BUFR			Web		60 d		
Accuracy				<u>.</u>			
Threshold		Target	et Optim		otimal		
1.8 g/kg 30% *		0.6 g/kg 10% *			0.3 g/kg 10% *		
Notes		* whichever is grea The interval 0 – 12					
Verification/Validation Methods Standard devia			ation of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
Global	RO res	olution	NWP model levels		RO resolutio	n	



GRM-120	NTC Pres	ssure P	rofile		OPPS6		CDOP4-PRD-1.1
Туре			NTC Level 2 F	Product			
Applications and	Users		Climate and at	tmosphere researc	hers		
Characteristics ar	nd Metho	ds	NWP model le	vels			
Operational Satel	lite Input	Data		ies (ROM SAF Lev vel 1B Bending An		t derived from	EUMETSAT
Other Operationa	l Input Da	ata	ECMWF NWP	operational fields			
Dissemination							
Format			Means		Timeliness	i	
netCDF V BUFR			Web		60 d		
Accuracy					-		
Threshold			Target		Optimal		
a) 0.03 hPa b) 0.75% c) 2.4 hPa *			o) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *		
Notes			•	chever is greatest of (a) and (b) but not greater than (c); interval 0 – 50 km is considered			
Verification/Valida	ation Metl	hods	Standard deviation	n of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Reso	lution	Ţ					
Spatial Coverage		Horizon	tal Resolution	Vertical Resolution	Vertical Resolution		esolution
Global		RO reso	olution	NWP model levels		RO resolution	



GRM-121 NTC Su	rface Pro	essure		OSPS6		CDOP4-PRD-1.1	
Туре		NTC Level 2 Pi	roduct				
Applications and Users		Climate and atr	mosphere researc	hers			
Characteristics and Metho	ods	Scalar at surface	ce				
			es (ROM SAF Lev vel 1B Bending An		derived from	I EUMETSAT	
Other Operational Input D	Data	ECMWF NWP	operational fields				
Dissemination							
Format		Means	leans		Timeliness		
netCDF BUFR		Web	Veb		60 d		
Accuracy	-			<u>.</u>			
Threshold		Target	rget		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa			
Notes							
Verification/Validation Methods Standard devia			ion of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution		Temporal R	esolution	
Global	RO resolution			Scalar at surface RO resolution		on	



GRM-122 NTC Dr	y Temper	ature Profile		ODPS6	C	CDOP4-PRD-1.1	
Туре		NTC Level 2 P	TC Level 2 Product				
Applications and Users		Climate and at	Climate and atmosphere researchers				
Characteristics and Meth	hi-res wave op interpolated to	tics sampling; 247 fixed levels					
Operational Satellite Inpu	t Data		es (ROM SAF Lev vel 1B Bending An		t derived from I	EUMETSAT	
Other Operational Input I	Data	ECMWF NWP	operational fields				
Dissemination							
Format	ſ	Means		Timeliness			
netCDF BUFR			Web		60 d		
Accuracy				•			
Threshold	-	Farget	Optimal				
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K	2	5 – 20 km: 1 K	0 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K - 0.5 K		
Notes							
Verification/Validation Me	thods S	Standard deviation	ard deviation of (Product – ECMWF forecasts)				
Coverage, Resolution							
Spatial Coverage	Horizont	al Resolution	Vertical Resolution	on	Temporal Res	solution	
Global	RO reso	lution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolution		



GRM-123 NTC Ber	nding An	gle Grid		OBGS6		CDOP4-PRD-1.1
Туре		NTC Level 3 Pr	roduct			
Applications and Users		Climate and atr	nosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid:	S	
Operational Satellite Input	Data	Sentinel-6 serie	es (EUMETSAT S	ecretariat Le	evel 1B Bend	ling Angle Data)
Other Operational Input D	ata	ECMWF NWP	operational and re	eanalyses fie	elds	
Dissemination						
Format	Ν	leans		Timeliness		
netCDF	٧	Veb		60 d		
Accuracy						
Threshold	Т	Farget		Optimal		
25 – 50 km: 0.6 % or 1.2 murad*) 8 – 25 km: 0.6 % 0 – 8 km: 6.0 – 0.6 %		25 – 50 km: 0.3 % or 0.6 murad*) 8 – 25 km: 0.3 % 0 – 8 km: 3.0 – 0.30 %		25 – 50 km: 0.15 % or 0.3 murad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %		,
Notes	A	whichever is grea an accuracy intervative over the given vertion	al means a linearl	y changing o	quantity betw	een the two values
Verification/Validation Met	atitude-height regio Ititudes). Complia	istics of differences relative to ECMWF operational data within 9 bro ude-height regions (low, middle, and high latitudes; low, middle, and udes). Compliance requires that 60% of the absolute differences are in the corresponding accuracy value.			hiddle, and high	
Coverage, Resolution						
Spatial Coverage	Horizont	al Resolution	Vertical Resolution Temporal Resolution			esolution
Global	5 deg lat	itude	200 m	1 month		



GRM-124 NTC Ref	ractivity G	rid		ORGS6	C	DOP4-PRD-1.1	
Туре		NTC Level 3 Pr	TC Level 3 Product				
Applications and Users		Climate and atr	nosphere researc	hers			
Characteristics and Metho	ods	Zonal monthly r	means on 200 m >	c 5 deg grid	S		
Operational Satellite Input	t Data		es (ROM SAF Level el 1B Bending Ang		derived from E	EUMETSAT	
Other Operational Input D	ata	ECMWF NWP	operational and re	analyses fie	elds		
Dissemination		• •					
Format	Me	ans		Timeliness			
netCDF	We	ep.		60 d			
Accuracy				<u>-</u>			
Threshold	Ta	arget		Optimal			
25 – 50 km: 0.24 % or 0.0 units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	uni 8	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N-units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %		,	
Notes	An	hichever is grea accuracy intervation ar the given verti	al means a linearly	rly changing quantity between the two values			
Verification/Validation Me	tude-height regio tudes). Complia	istics of differences relative to ECMWF operational data within 9 bro ude-height regions (low, middle, and high latitudes; low, middle, and udes). Compliance requires that 60% of the absolute differences are the corresponding accuracy value.			ldle, and high		
Coverage, Resolution	<u>.</u>						
Spatial Coverage Horizontal Resolution			Vertical Resolution Temporal Resolution			olution	
Global	5 deg latitu	ıde	200 m		1 month		



GRM-125 NTC Ter	nperature	Grid		OTGJA!	CDOP4-PRD-1.1	
Туре		NTC Level 3 P	roduct			
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m >	< 5 deg grid	S	
Operational Satellite Inpu	t Data		es (ROM SAF Lev vel 1B Bending An		t derived from EUMETSAT	
Other Operational Input D	ata	ECMWF NWP	operational and re	analyses fie	elds	
Dissemination		•				
Format	М	leans		Timeliness		
netCDF	V	/eb		60 d		
Accuracy	<u>-</u>			<u>.</u>		
Threshold	Т	arget		Optimal		
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 K	1	5 – 50 km: 0.3 – 8 – 25 km: 0.3 K 0 – 8 km: 1.0 –	8 – 25 km: 0.15 K		n: 0.15 K	
Notes		n accuracy interv ver the given vert		arly changing quantity between the two values		
latitude-height altitudes). Com			ons (low, middle, a	and high lati 60% of the a	ational data within 9 broad itudes; low, middle, and high absolute differences are smaller	
Coverage, Resolution						
Spatial Coverage	Horizonta	I Resolution	Vertical Resolution	on Temporal Resolution		
Global	5 deg lati	tude	200 m	1 month		



GRM-126 NTC Spe	ecific Hur	midity Grid		OHGS6		CDOP4-PRD-1.1
Туре		NTC Level 3 P	roduct			
Applications and Users		Climate and at	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s	
Operational Satellite Input	Data		es (ROM SAF Lev vel 1B Bending An		t derived from	I EUMETSAT
Other Operational Input D	ata	ECMWF NWP	operational and re	analyses fi	elds	
Dissemination						
Format	N	leans		Timeliness	i	
netCDF	V	Web 60 d				
Accuracy	<u> </u>			<u>.</u>		
Threshold	Т	arget		Optimal		
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %	•	– 12 km: 4.0 % – 8 km: 4.0 %		8 – 12 km: 2.0 % 0 – 8 km: 2.0 %		
Notes		n accuracy interv ver the given vert		rly changing quantity between the two values		
Verification/Validation Methods latitude-height regions (latitudes). Compliance re than the corresponding a			ons (low, middle, a nce requires that 6	and high lat 60% of the a	itudes; low, m	niddle, and high
Coverage, Resolution						
Spatial Coverage	Horizonta	tal Resolution Vertical Resolu		ution Temporal Resolution		esolution
Global	5 deg lat	itude	200 m	1 month		



GRM-127 NTC Dry	/ Geopote	ential Height Grid	ł	OZGS6	CDOP4-PRD-1.1	
Туре		NTC Level 3 P	roduct			
Applications and Users		Climate and at	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m >	c 5 deg grid	S	
Operational Satellite Inpu	t Data		es (ROM SAF Lev vel 1B Bending An		t derived from EUMETSAT	
Other Operational Input D	ata	ECMWF NWP	operational and re	analyses fi	elds	
Dissemination						
Format	N	leans		Timeliness		
netCDF	V	Veb		60 d		
Accuracy	<u> </u>					
Threshold	Т	arget	rget Optimal			
25 – 50 km: 12 – 120 m 8 – 25 km: 12 m 0 – 8 km: –		25 – 50 km: 6 – 60 m 8 – 25 km: 6 m 0 – 8 km: –		25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –		
Notes		n accuracy interv ver the given vert		rly changing quantity between the two values		
Verification/Validation Me	atitude-height regi Ititudes). Complia	stics of differences relative to ECMWF operational data within 9 bro ide-height regions (low, middle, and high latitudes; low, middle, and ides). Compliance requires that 60% of the absolute differences are the corresponding accuracy value.				
Coverage, Resolution						
Spatial Coverage	Horizonta	al Resolution	Vertical Resolution	ion Temporal Resolution		
Global	5 deg lati	itude	200 m	1 month		



GRM-128 NTC I	Ory Tempe	rature Grid		ODGS6	CDOP4-PRD-1.1	
Туре		NTC Level 3 P	roduct			
Applications and Users	i	Climate and at	mosphere researc	hers		
Characteristics and Me	thods	Zonal monthly	means on 200 m	k 5 deg grid	S	
Operational Satellite In	put Data		es (ROM SAF Lev vel 1B Bending An		t derived from EUMETSAT	
Other Operational Inpu	t Data	ECMWF NWP	operational and re	eanalyses fi	elds	
Dissemination						
Format		Means		Timeliness		
netCDF		Web		60 d		
Accuracy				<u>.</u>		
Threshold		Target		Optimal		
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –		25 – 50 km: 0.3 – 3 8 – 25 km: 0.3 K 0 – 8 km: –	3 K	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Notes		An accuracy interv over the given vert		ly changing quantity between the two values		
latitude-height altitudes). Com			ences relative to ECMWF operational data within 9 broad gions (low, middle, and high latitudes; low, middle, and high ance requires that 60% of the absolute differences are smaller onding accuracy value.			
Coverage, Resolution						
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	ion Temporal Resolution		
Global	5 deg la	atitude	200 m	1 month		



GRM-129 NTC Dry	Pressure	Grid		OYGS6	CDOP4-PRD-1.1	
Туре		NTC Level 3 P	roduct			
Applications and Users		Climate and at	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	< 5 deg grid	S	
Operational Satellite Input	t Data		es (ROM SAF Lev vel 1B Bending An		t derived from EUMETSAT	
Other Operational Input D	ata	ECMWF NWP	operational and re	analyses fi	elds	
Dissemination						
Format	Me	eans		Timeliness		
netCDF	W	eb		60 d		
Accuracy				<u>.</u>		
Threshold	Та	rget		Optimal		
25 – 50 km: 0.24 – 1.20 % 8 – 25 km: 0.24 % 0 – 8 km –	8	– 50 km: 0.12 – 0.60 % – 25 km: 0.12 % – 8 km: –		25 – 50 km: 0.06 – 0.30 % 8 – 25 km: 0.06 % 0 – 8 km: –		
Notes		accuracy intervention accuracy interventinterventintervention accuracy intervention accu		y changing	quantity between the two values	
latitude-heigh altitudes). Co			ifferences relative to ECMWF operational data within 9 broad t regions (low, middle, and high latitudes; low, middle, and high mpliance requires that 60% of the absolute differences are sma esponding accuracy value.			
Coverage, Resolution						
Spatial Coverage	Horizontal	al Resolution Vertical Resolu		on	Temporal Resolution	
Global	5 deg latit	ude	200 m	1 month		



GRM-130 NRT Ref	ractivity	Profile		NRPMA1	CDOP4-PRD-1.1	
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods	hi-res wave opt interpolated to	tics sampling; 247 fixed levels			
Operational Satellite Input	t Data	Metop-SG A1				
Other Operational Input D	ata		PS orbits (EUM) etop orbits (EUM) CMWF FC, AN			
Dissemination						
Format		Means		Timeliness		
BUFR/netCDF		GTS EUMETCast Web		Global: Th: 150 mi B: 80 min (Regional: ⁻	(95%)	
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 0.09 N-units 5 – 30 km: 1.8% 0 – 5 km: 6% – 1.8%		30 – 50 km: 0.03 N 5 – 30 km: 0.6% 0 – 5 km: 2% – 0		5 – 30 km	n: 0.02 N-units n: 0.3% n: 1% – 0.3%	
Notes		An accuracy intervation over the given vertion		y changing	quantity between the two values	
Verification/Validation Met	thods	Standard deviation	of (Product – ECI	MWF foreca	asts)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Resolution	
Global, Regional (TBD)	RO res	olution	hi-res wave optic sampling; interpolated to 24 levels		RO resolution	



GRM-131 NRT Ten	nperatu	re Profile		NTPMA1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Input	Data	Metop-SG A1				
Other Operational Input D	ata	GPS orbits (EU Metop orbits (E ECMWF FC, A	UM)			
Dissemination						
Format		Means		Timeliness	,	
BUFR/netCDF		GTS EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy				<u>.</u>		
Threshold		Target	Optimal			
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 1 5 – 30 km: 1 K 0 – 5 km: 2 K – 1		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy interva		y changing	quantity betw	een the two values
Verification/Validation Met	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global, Regional (TBD)	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-132 NRT Spe	ecific Hu	umidity Profile		NHPMA1	CDOP4-PRD-1.1
Туре	NRT Product				
Applications and Users	Applications and Users NWP				
Characteristics and Metho	ods		vith interpolation); 247 fixed levels		
Operational Satellite Input	t Data	Metop-SG A1			
Other Operational Input D	ata	GPS orbits (EU Metop orbits (E ECMWF FC, A	EUM) (EUM)		
Dissemination					
Format		Means		Timeliness	
BUFR/netCDF	GTS EUMETCast Web			Global: Th: 150 mi B: 80 min (Regional: ⁻	(95%)
Accuracy	•			-	
Threshold		Target	Optimal		
1.8 g/kg 30% *		0.6 g/kg 10% *		0.3 g/kg 10% *	
Notes		* whichever is grea The interval 0 – 12			
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)
Coverage, Resolution					
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Resolution
Global, Regional (TBD)	RO res	olution	model levels (wit interpolation); interpolated to 24 levels		RO resolution



GRM-133 NRT Pre	ssure P	rofile		NPPMA1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-SG A1				
Other Operational Input D	ata	GPS orbits (EL Metop orbits (E ECMWF FC, A	ts (EUM)			
Dissemination						
Format		Means		Timeliness	;	
BUFR/netCDF		GTS EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy	<u>.</u>			-		
Threshold		Target	Optimal			
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		a) 0.01 hPa b) 0.25% c) 0.8 hPa *	a) 0.005 hPa b) 0.1% c) 0.7 hPa *			
Notes		* whichever is grea The interval 0 – 50) but not greater than (c); d		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global, Regional (TBD)	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-134 NRT Su	face Pre	essure		NSPMA1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods	Scalar at surfa	се			
Operational Satellite Input	t Data	Metop-SG A1				
Other Operational Input D	ata	GPS orbits (EL Metop orbits (E ECMWF FC, A	EUM)			
Dissemination		-				
Format		Means		Timeliness		
BUFR/netCDF		GTS EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy						
Threshold		Target		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa		
Notes						
Verification/Validation Methods Standard deviation			n of (1D-Var solution – ECMWF analysis)			
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	I Resolution Vertical Resolution		ion Temporal Resolution	
Global, Regional (TBD)	RO res	olution	Scalar at surface	•	RO resolution	on



GRM-135 NRT D	ry Tempe	erature Profile		NDPMA1	CDOP4-PRD-1.1		
Туре		NRT Product					
Applications and Users		NWP	NWP				
Characteristics and Met	hods	hi-res wave op interpolated to	tics sampling; 247 fixed levels				
Operational Satellite Inp	out Data	Metop-SG A1					
Other Operational Input	Data	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination							
Format		Means		Timeliness	;		
E		EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD			
Accuracy		<u>.</u>		•			
Threshold		Target		Optimal			
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		5 – 20 km: 1 K	0 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		n: 0.5 K – 5 K n: 0.5 K : 1 K - 0.5 K		
Notes		An accuracy interv over the given vert		ly changing quantity between the two values			
Verification/Validation M	lethods	Standard deviation	of (Product – EC	MWF foreca	asts)		
Coverage, Resolution		<u></u>					
Spatial Coverage	Horizo	ntal Resolution	Vertical Resolution	on	Temporal Resolution		
Global, Regional (TBD)	RO re	solution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolution		



GRM-136 Offline E	Bending A	Angle		OBAMA1		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	mosphere researc	hers			
			tics sampling; 247 fixed levels				
Operational Satellite Input	t Data	Metop-SG A1					
Metop c			PS orbits (EUM) letop orbits (EUM) CMWF FC, AN				
Dissemination							
Format	Ν	leans		Timeliness			
netCDF BUFR	V	Veb		5 - 30 d			
Accuracy							
Threshold	Т	arget	Optimal				
35 – 60 km: 4 murad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	-	5 – 60 km: 2 mura 8 – 35 km: 2% 2 – 8 km: 10% -			35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%		
Notes	o	an accuracy intervative over the given verti A noise above 60	ical coordinate			een the two values	
Verification/Validation Me	thods S	standard deviation	n of (Product – ECMWF forecasts)				
Coverage, Resolution							
Spatial Coverage	Horizonta	al Resolution	Vertical Resolution	on	Temporal Re	esolution	
Global	RO reso	lution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on	



GRM-137 Offline F	Refractiv	vity Profile		ORPMA1		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	ods	hi-res wave opt interpolated to	tics sampling; 247 fixed levels				
Operational Satellite Input	t Data	Metop-SG A1					
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN					
Dissemination							
Format		Means		Timeliness	Timeliness		
netCDF BUFR		Web		5 - 30 d			
Accuracy							
Threshold		Target	Optimal				
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%		30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%			
Notes		An accuracy intervation over the given vertion		y changing	quantity betw	een the two values	
Verification/Validation Me	thods	Standard deviation	of (Product – ECI	MWF foreca	asts)		
Coverage, Resolution							
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Re	esolution	
Global	RO res	solution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on	



GRM-138 Offline	Fempera	ature Profile		OTPMA1		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and atr	mosphere researc	hers			
Characteristics and Metho	ods		vith interpolation); 247 fixed levels				
Operational Satellite Inpu	t Data	Metop-SG A1					
Other Operational Input E)ata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination							
Format		Means		Timeliness	Timeliness		
netCDF BUFR			Web		5 - 30 d		
Accuracy							
Threshold		Target	et Optimal				
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		5 – 30 km: 1 K			30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy intervation over the given vertion		ly changing quantity between the two values			
Verification/Validation Me	thods	Standard deviation	n of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution	
Global	RO res	solution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on	



GRM-139 0	Offline S	pecific	Humidity Pro	ofile		OHPMA1		CDOP4-PRD-1.1
Туре			Offline Pr	oduct	i .			
Applications and l	Users		Climate a	nd at	mosphere researc	hers		
				vith interpolation); 247 fixed levels				
Operational Satell	lite Input	Data	Metop-SC	6 A 1				
Meto			Metop ort	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination								
Format Me			Means		Timeliness	;		
netCDF BUFR	-		Web	/eb 5 - 30 d		5 - 30 d		
Accuracy								
Threshold			Target	jet (Optimal	Optimal	
1.8 g/kg 30% *			0.6 g/kg 10% *		0.3 g/kg 10% *			
Notes			* whichever is The interval 0		ater; km is considered			
Verification/Valida	ation Met	hods	Standard dev	iation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resol	lution							
Spatial Coverage		Horizor	tal Resolution Vertical Resolu			on	Temporal Re	esolution
Global		RO res	solution n ir ir		model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-140 Offline I	Pressure	Profile		OPPMA1		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Metho	ods		vith interpolation); 247 fixed levels				
Operational Satellite Inpu	t Data	Metop-SG A1					
Metop c			PS orbits (EUM) etop orbits (EUM) CMWF FC, AN				
Dissemination							
Format		Means		Timeliness	i		
netCDF BUFR			Web		5 - 30 d		
Accuracy							
Threshold		Target	Optimal				
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		b) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *			
Notes		* whichever is grea The interval 0 – 50	• • • • • • • •) but not greater than (c);			
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)		
Coverage, Resolution							
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal R	esolution	
Global	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resoluti	on	



GRM-141 Offline	Surface	Pressure		OSPMA1		CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users Climate and atr			mosphere researc	hers			
Characteristics and Meth	ods	Scalar at surface	ce				
Operational Satellite Inpu	t Data	Metop-SG A1					
Other Operational Input Data GPS orbits (EU Metop orbits (E ECMWF FC, A			EUM)				
Dissemination		-					
Format		leans		Timeliness			
netCDF BUFR		Web	5 - 30 d				
Accuracy				-			
Threshold		Target	rget		Optimal		
2.4 hPa		0.8 hPa	0.7 hPa				
Notes							
Verification/Validation Me	thods	Standard deviation	n of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
Global	RO res	solution	Scalar at surface		RO resolutio	on	



GRM-142 Offline I	Dry Tem	perature Profile		ODPMA1		CDOP4-PRD-1.1	
Туре		Offline Product	:				
Applications and Users		Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	hi-res wave opt interpolated to	tics sampling; 247 fixed levels					
Operational Satellite Inpu	t Data	Metop-SG A1					
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN					
Dissemination							
Format		Means		Timeliness	i		
netCDF BUFR			Web		5 - 30 d		
Accuracy				•			
Threshold		Target	Optimal				
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K - 0.5 K			
Notes		An accuracy intervation over the given vert		ly changing quantity between the two values			
Verification/Validation Me	thods	Standard deviation	o of (Product – ECMWF forecasts)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal R	esolution	
Global	RO res	solution	hi-res wave optic sampling; interpolated to 24 levels		RO resoluti	on	



GRM-143 Offline E	Bending A	Angle Grid		OBGMA1	CDOP4-PRD-1.1	
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	< 5 deg grid	s	
Operational Satellite Input	t Data	Metop-SG A1				
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	sampling e	error estimation)	
Dissemination						
Format	Ν	leans		Timeliness	3	
netCDF	٧	Veb		30 d		
Accuracy	I			ł		
Threshold	1	Target		Optimal		
25 – 50 km: 0.6 % or 1.2 i *) 8 – 25 km: 0.6 % 0 – 8 km: 6 – 0.6 %	murad 2	25 – 50 km: 0.3 % or 0.6 murad*) 8 – 25 km: 0.3 % 0 – 8 km: 3 – 0.3 %		25 – 50 km: 0.15 % or 0.3 murad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %		
Notes * whichever is greater; An accuracy interval mea over the given vertical co			al means a linearl	y changing	quantity between the two values	
Verification/Validation Me		tistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.				
Coverage, Resolution	•					
Spatial Coverage	Horizont	al Resolution	Vertical Resolution		Temporal Resolution	
Global	5 deg lat	itude	200 m	1 month		



GRM-144 Offline F	Refractivit	y Grid		ORGMA1	CDOP4-PRD-1.1		
Туре		Offline Product					
Applications and Users		Climate and atr	nosphere researc	hers			
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s		
Operational Satellite Input	t Data	Metop-SG A1					
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	sampling e	rror estimation)		
Dissemination		÷					
Format	М	eans		Timeliness			
netCDF	Web			30 d			
Accuracy							
Threshold	Τa	Target		Optimal			
25 – 50 km: 0.24 % or 0.0 units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	ur 8	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N-units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %			
Notes	Ar	whichever is grea n accuracy interva ver the given verti	al means a linearly	y changing	quantity between the two values		
			of differences relative to ECMWF ERA Interim.Resampling statistics: nparison of RO data subsets.				
Coverage, Resolution	Coverage, Resolution						
Spatial Coverage	Horizonta	Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg latit	ude	200 m	200 m 1 month			



GRM-145 Offlir	e Tempera	ature Grid		OTGMA1		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users	6	Climate and at	mosphere researc	hers			
Characteristics and Me	ethods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Ir	iput Data	Metop-SG A1					
Other Operational Inpu	ıt Data	ECMWF ERA	Interim (validation,	, sampling e	error estimatio	on)	
Dissemination							
Format		Means		Timeliness	i		
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 I	<	8 – 25 km: 0.3 K	25 – 50 km: 0.3 – 3 K 8 – 25 km: 0.3 K 0 – 8 km: 1.0 – 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: 0.50 – 0.15 K		
Notes		An accuracy interv over the given vert		rly changing quantity between the two values			
Verification/Validation		atistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.					
Coverage, Resolution	n	·					
Spatial Coverage	Horizoi	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m		1 month		



GRM-146 Offline	Specific	Humidity Grid		OHGMA1		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	k 5 deg grid	S		
Operational Satellite Inpu	ut Data	Metop-SG A1					
Other Operational Input	Data	ECMWF ERA	Interim (validation,	sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF		Web		30 d			
Accuracy				1			
Threshold		Target	arget		Optimal		
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %		8 – 12 km: 4.0 % 0 – 8 km: 4.0 %		8 – 12 km: 2.0 % 0 – 8 km: 2.0 %			
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
Verification/Validation Me		atistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m		1 month		



GRM-147 Climate	Dry Ge	opotential Height		OZGMA1	CDOP4-PRD-1.1		
Туре		Offline Product					
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Inpu	it Data	Metop-SG A1					
Other Operational Input [Data	ECMWF ERA I	nterim (validation	, sampling e	error estimation)		
Dissemination							
Format		Means		Timeliness			
netCDF		Web	30 d				
Accuracy				•			
Threshold		Target	Optimal				
25 – 50 km: 12 – 120 m 8 – 25 km: 12 m 0 - 8 km: –		25 – 50 km: 6 – 60 8 – 25 km: 6 m 0 – 8 km: –	– 25 km: 6 m		25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –		
Notes		An accuracy intervolution over the given vert		early changing quantity between the two values			
			f differences relative to ECMWF ERA Interim.Resampling statistics: arison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month		1 month		



GRM-148 Offline	Dry Tem	perature Grid		ODGMA1		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite Inpu	it Data	Metop-SG A1					
Other Operational Input [Data	ECMWF ERA I	Interim (validation,	, sampling e	error estimatior	ו)	
Dissemination							
Format		Means		Timeliness	i		
netCDF		Web	30 d				
Accuracy							
Threshold		Target	Optimal				
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –		25 – 50 km: 0.3 – 3 8 – 25 km: 0.3 K 0 – 8 km: –	8 – 25 km: 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Notes		An accuracy intervolution over the given vert		y changing	quantity betwe	en the two values	
			differences relative to ECMWF ERA Interim.Resampling statistics: rison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m	1 month			



GRM-149 Offli	Offline Dry Pressure Grid					CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Use	rs	Climate and at	mosphere researc	hers			
Characteristics and N	lethods	Zonal monthly	means on 200 m x	x 5 deg grid	s		
Operational Satellite I	nput Data	Metop-SG A1					
Other Operational Inp	out Data	ECMWF ERA	Interim (validation,	, sampling e	error estimatio	on)	
Dissemination		ł					
Format		Means		Timeliness	i		
netCDF		Veb 3		30 d			
Accuracy		•		•			
Threshold		Target	Optimal				
25 – 50 km: 0.24 – 1. 8 – 25 km: 0.24 % 0 – 8 km –	20 %		8 – 25 km: 0.12 %		25 – 50 km: 0.06 – 0.30 % 8 – 25 km: 0.06 % 0 – 8 km: –		
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
Verification/Validation		istics of differences relative to ECMWF ERA Interim.Resampling statistics: -comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m	1 month			



GRM-150 NRT Ref	ractivity	Profile		NRPMB1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
Characteristics and Metho	hi-res wave opt interpolated to	ics sampling; 247 fixed levels				
Operational Satellite Input	Data	Metop-SG B1				
Other Operational Input D	ata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format	I	Means		Timeliness	,	
BUFR/netCDF	GTS EUMETCast Web			Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy				<u>.</u>		
Threshold	-	Target		Optimal		
30 – 50 km: 0.09 N-units 5 – 30 km: 1.8% 0 – 5 km: 6% – 1.8%	(30 – 50 km: 0.03 N 5 – 30 km: 0.6% 0 – 5 km: 2% – 0		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		S
Notes	/	An accuracy intervation of the second s	al means a linearl cal coordinate	y changing	quantity betw	een the two values
Verification/Validation Met	hods	Standard deviation	of (Product – ECI	MWF foreca	ists)	
Coverage, Resolution						
Spatial Coverage	Horizont	al Resolution	Vertical Resolution	on	Temporal Re	esolution
Global, Regional (TBD)	RO reso	olution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on



GRM-151 NRT Ter	nperatu	re Profile		NTPMB1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	IWP			
Characteristics and Metho	ods		<i>v</i> ith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-SG B1				
Other Operational Input D	ata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness	,	
BUFR/netCDF GTS EUMETCa Web		EUMETCast	UMETCast /eb		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD	
Accuracy				<u>.</u>		
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – ⁷ 5 – 30 km: 1 K 0 – 5 km: 2 K – ⁷		5 – 30 km	30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K	
Notes		An accuracy intervation over the given vert		ly changing quantity between the two values		
Verification/Validation Me	thods	Standard deviation	o of (1D-Var solution – ECMWF analysis)			
Coverage, Resolution						
Spatial Coverage	Horizor	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global, Regional (TBD)	RO res	solution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-152 NRT Spe	ecific Hu	umidity Profile		NHPMB1	CDOP4-PRD-1.1	
Туре	Type NRT Product					
Applications and Users NWP						
Characteristics and Metho	ods		/ith interpolation); 247 fixed levels			
Operational Satellite Input	Data	Metop-SG B1				
Other Operational Input D	ata		iPS orbits (EUM) letop orbits (EUM) CMWF FC, AN			
Dissemination						
Format		Means		Timeliness		
BUFR/netCDF		GTS EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy				<u>.</u>		
Threshold		Target		Optimal		
1.8 g/kg 30% *		0.6 g/kg 10% *		0.3 g/kg 10% *		
Notes		* whichever is grea The interval 0 – 12				
Verification/Validation Me	thods	Standard deviation	n of (1D-Var solution – ECMWF analysis)			
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Resolution	
Global, Regional (TBD)	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolution	



GRM-153 NRT Pre	essure P	rofile		NPPMB1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP	NWP			
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-SG B1				
Other Operational Input D	oata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness	,	
BUFR/netCDF GTS EUME Web		EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy	-			<u>.</u>		
Threshold		Target		Optimal		
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		a) 0.01 hPa b) 0.25% c) 0.8 hPa *	0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *	
Notes		* whichever is grea The interval 0 – 50		b) but not greater than (c); d		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution	L					
Spatial Coverage	Horizon	tal Resolution Vertical Resoluti		on	Temporal Re	esolution
Global, Regional (TBD)	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	วท



GRM-154 NRT Su	face Pre	essure		NSPMB1		CDOP4-PRD-1.1
Туре		NRT Product				
Applications and Users		NWP				
Characteristics and Metho	ods	Scalar at surfa	се			
Operational Satellite Input	t Data	Metop-SG B1				
Other Operational Input Data GPS orb Metop or ECMWF			EUM)			
Dissemination		-				
Format		Means		Timeliness		
BUFR/netCDF	JFR/netCDF GTS EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD			
Accuracy						
Threshold		Target		Optimal		
2.4 hPa		0.8 hPa		0.7 hPa		
Notes						
Verification/Validation Methods Standard deviatio			n of (1D-Var solution – ECMWF analysis)			
Coverage, Resolution						
Spatial Coverage	Horizon	tal Resolution Vertical Resolut		tion Temporal Reso		esolution
Global, Regional (TBD)	RO res	olution	Scalar at surface		RO resolution	on



GRM-155 NRT Dr	y Tempe	erature Profile		NDPMB1	CDOP4-PRD-1.1	
Туре		NRT Product				
Applications and Users		NWP	NWP			
Characteristics and Meth	iods	hi-res wave opt interpolated to	tics sampling; 247 fixed levels			
Operational Satellite Inp	ut Data	Metop-SG B1				
Other Operational Input	Data	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness	3	
EU		EUMETCast Web		Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD		
Accuracy				-		
Threshold		Target		Optimal		
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		5 – 20 km: 1 K	0 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		n: 0.5 K – 5 K n: 0.5 K : 1 K - 0.5 K	
Notes		An accuracy intervation over the given vert		ly changing quantity between the two values		
Verification/Validation M	ethods	Standard deviation	of (Product – EC	MWF foreca	asts)	
Coverage, Resolution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Resolution	
Global, Regional (TBD)	RO res	solution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolution	



GRM-156 Offline E	Bending /	Angle		OBAMB1		CDOP4-PRD-1.1
Туре	Offline Product					
Applications and Users Climate and atn			mosphere researc	hers		
Characteristics and Methods hi-res wave op interpolated to			tics sampling; 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-SG B1				
Other Operational Input D	lata	GPS orbits (EU Metop orbits (E ECMWF FC, A	UM)			
Dissemination						
Format	Ν	leans		Timeliness		
netCDF BUFR	٧	Veb		5 - 30 d	5 - 30 d	
Accuracy				•		
Threshold	T	arget		Optimal		
35 – 60 km: 4 murad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	-	85 – 60 km: 2 mura 8 – 35 km: 2% 2 – 8 km: 10% -	8 – 35 km: 1%			
Notes	c	An accuracy intervative over the given verti 3A noise above 60	ical coordinate			een the two values i (rad;
Verification/Validation Me	thods S	Standard deviation	of (Product – ECI	of (Product – ECMWF forecasts)		
Coverage, Resolution						
Spatial Coverage	Horizont	al Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO reso	olution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on



GRM-157 Offline F	Refractivi	ity Profile		ORPMB1		CDOP4-PRD-1.1
Туре		Offline Product	Offline Product			
Applications and Users	Climate and atr	Climate and atmosphere researchers				
Characteristics and Metho	ods		hi-res wave optics sampling; interpolated to 247 fixed levels			
Operational Satellite Input	t Data	Metop-SG B1				
Other Operational Input D	ata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format	٢	Means		Timeliness	Timeliness	
netCDF BUFR	١	Web		5 - 30 d		
Accuracy						
Threshold	Ţ	Farget	Optimal			
30 – 50 km: 0.06 N-units 5 – 30 km: 1.2% 0 – 5 km: 4% – 1.2%	3	30 – 50 km: 0.03 N-units 5 – 30 km: 0.6% 0 – 5 km: 2% – 0.6%		30 – 50 km: 0.02 N-units 5 – 30 km: 0.3% 0 – 5 km: 1% – 0.3%		s
Notes		An accuracy intervation of the second s		y changing	quantity betw	een the two values
Verification/Validation Me	thods S	Standard deviation	of (Product – ECI	MWF foreca	ists)	
Coverage, Resolution						
Spatial Coverage	Horizont	al Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO reso	blution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on



GRM-158 Offline	Fempera	ature Profile		OTPMB1		CDOP4-PRD-1.1
Туре		Offline Product				
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-SG B1				
Other Operational Input D)ata	GPS orbits (EU Metop orbits (E ECMWF FC, A	EUM)			
Dissemination						
Format		Means		Timeliness	Timeliness	
netCDF BUFR		Web		5 - 30 d		
Accuracy						
Threshold		Target		Optimal		
30 – 50 km: 3 K – 30 K 5 – 30 km: 3 K 0 – 5 km: 6 K – 3 K		30 – 50 km: 1 K – 10 K 5 – 30 km: 1 K 0 – 5 km: 2 K – 1 K		30 – 50 km: 0.5 K – 5 K 5 – 30 km: 0.5 K 0 – 5 km: 1 K – 0.5 K		
Notes		An accuracy intervation over the given vertion		ly changing quantity between the two values		
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO res	solution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-159 C	Offline S	pecific	Humidity Profile	9	OHPMB1		CDOP4-PRD-1.1	
Туре			Offline Produ	uct				
Applications and Users C		Climate and	atmosphere researc	hers				
Characteristics and	d Metho	ds		(with interpolation); to 247 fixed levels				
Operational Satelli	ite Input	Data	Metop-SG B	1				
			Metop orbits	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination								
Format			Means		Timeliness	5		
netCDF BUFR	-		Web		5 - 30 d			
Accuracy								
Threshold			Target		Optimal			
1.8 g/kg 30% *			0.6 g/kg 10% *		0.3 g/kg 10% *			
Notes			* whichever is gr The interval 0 –	eater; 12 km is considered	1			
Verification/Valida	tion Metl	hods	Standard deviati	on of (1D-Var solutio	on of (1D-Var solution – ECMWF analysis)			
Coverage, Resol	ution							
Spatial Coverage		Horizor	tal Resolution	Vertical Resoluti	on	Temporal Re	esolution	
Global		RO res	solution	interpolation);	interpolated to 247 fixed		on	



GRM-160 Offline F	Pressure	Profile		OPPMBA	1	CDOP4-PRD-1.1
Туре		Offline Product	:			
Applications and Users C		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods		vith interpolation); 247 fixed levels			
Operational Satellite Input	t Data	Metop-SG B1				
Other Operational Input D	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN				
Dissemination						
Format		Means		Timeliness		
netCDF BUFR	,	Web		5 - 30 d		
Accuracy				•		
Threshold		Target		Optimal		
a) 0.03 hPa b) 0.75% c) 2.4 hPa *		b) 0.25%		a) 0.005 hPa b) 0.1% c) 0.7 hPa *		
Notes		* whichever is grea The interval 0 – 50	., .,	but not gre	ater than (c);	
Verification/Validation Me	thods	Standard deviation	of (1D-Var solutio	on – ECMW	F analysis)	
Coverage, Resolution	•					
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO res	olution	model levels (with interpolation); interpolated to 247 fixed levels		RO resolutio	on



GRM-161 Offline	Surface	Pressure		OSPMB1		CDOP4-PRD-1.1	
Туре	Offline Product						
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Scalar at surface	се				
Operational Satellite Inpu	t Data	Metop-SG B1					
Other Operational Input I	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN					
Dissemination		-					
Format		Means		Timeliness			
netCDF BUFR		Web	Veb		5 - 30 d		
Accuracy				-			
Threshold		Target	Гarget		Optimal		
2.4 hPa		0.8 hPa	.8 hPa		0.7 hPa		
Notes							
Verification/Validation Methods Standard devia			on of (1D-Var solution – ECMWF analysis)				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Re	esolution	
Global	RO res	solution	Scalar at surface		RO resolutio	on	



GRM-162 Offline I	Dry Tem	perature Profile		ODPMB1		CDOP4-PRD-1.1
Туре		Offline Product	ffline Product			
Applications and Users		Climate and atr	mosphere researc	hers		
Characteristics and Metho	ods		hi-res wave optics sampling; interpolated to 247 fixed levels			
Operational Satellite Inpu	t Data	Metop-SG B1				
Other Operational Input D	oata	Metop orbits (E	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN			
Dissemination						
Format		Means		Timeliness	Timeliness	
netCDF BUFR		Web		5 - 30 d		
Accuracy						
Threshold		Target		Optimal		
20 – 40 km: 2 K – 20 K 5 – 20 km: 2 K 0 – 5 km: 4 K - 2 K		20 – 40 km: 1 K – 10 K 5 – 20 km: 1 K 0 – 5 km: 2 K - 1 K		20 – 40 km: 0.5 K – 5 K 5 – 20 km: 0.5 K 0 – 5 km: 1 K - 0.5 K		
Notes		An accuracy intervation over the given vert		y changing	quantity betw	een the two values
Verification/Validation Me	thods	Standard deviation	of (Product – ECI	MWF foreca	asts)	
Coverage, Resolution						
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution	on	Temporal Re	esolution
Global	RO res	solution	hi-res wave optics sampling; interpolated to 247 fixed levels		RO resolutio	on



GRM-163 Offline I	Bending A	Angle Grid		OBGMB1		CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers			
Characteristics and Metho	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	s		
Operational Satellite Inpu	t Data	Metop-SG B1					
Other Operational Input D)ata	ECMWF ERA I	nterim (validation,	sampling e	error estimatio	on)	
Dissemination							
Format	N	leans		Timeliness	;		
netCDF	V	Veb		30 d			
Accuracy	I			I			
Threshold	Т	Target		Optimal			
25 – 50 km: 0.6 % or 1.2 *) 8 – 25 km: 0.6 % 0 – 8 km: 6 – 0.6 %		25 – 50 km: 0.3 % or 0.6 murad*) 8 – 25 km: 0.3 % 0 – 8 km: 3 – 0.3 %		25 – 50 km: 0.15 % or 0.3 murad*) 8 – 25 km: 0.15 % 0 – 8 km: 1.5 – 0.15 %			
An accurac			chever is greater; curacy interval means a linearly changing quantity between the two values the given vertical coordinate				
Verification/Validation Me			tatistics of differences relative to ECMWF ERA Interim.Resampling statistics: nter-comparison of RO data subsets.				
Coverage, Resolution	<u>.</u>						
Spatial Coverage	Horizonta	al Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg lat	itude	200 m		1 month		



GRM-164 Offline	Refractivi	ty Grid		ORGMB1		CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and atr	nosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m ›	k 5 deg grid	S		
Operational Satellite Inpu	t Data	Metop-SG B1					
Other Operational Input [Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	on)	
Dissemination							
Format	Ν	leans		Timeliness			
netCDF	netCDF We		30 d				
Accuracy				l .			
Threshold	Т	Target		Optimal			
25 – 50 km: 0.24 % or 0.0 units*) 8 – 25 km: 0.24 % 0 – 8 km: 2.4 – 0.24 %	u	25 – 50 km: 0.12 % or 0.006 N- units*) 8 – 25 km: 0.12 % 0 – 8 km: 1.2 – 0.12 %		25 – 50 km: 0.06 % or 0.003 N-units*) 8 – 25 km: 0.06 % 0 – 8 km: 0.6 – 0.06 %			
Notes * whichever is great An accuracy intervoiver the given vert			al means a linearl	y changing o	quantity betw	veen the two values	
Verification/Validation Me		istics of differences relative to ECMWF ERA Interim.Resampling statistics: -comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	patial Coverage Horizontal Resolution		Vertical Resolution		Temporal Resolution		
Global	5 deg lati	tude	200 m 1 month				



GRM-165 Offline	fline Temperature Grid					CDOP4-PRD-1.1	
Туре		Offline Product	Offline Product				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Meth	ods	Zonal monthly	means on 200 m :	k 5 deg grid	s		
Operational Satellite Inpu	t Data	Metop-SG B1					
Other Operational Input	Data	ECMWF ERA	Interim (validation,	sampling e	error estimatior	1)	
Dissemination							
Format	Format			Timeliness	i		
netCDF	netCDF W		30 d				
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: 2.0 – 0.6 K		8 – 25 km: 0.3 K	25 – 50 km: 0.3 – 3 K 8 – 25 km: 0.3 K 0 – 8 km: 1.0 – 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: 0.50 – 0.15 K		
Notes		An accuracy interv over the given vert		means a linearly changing quantity between the two values al coordinate			
Verification/Validation Me		tatistics of differences relative to ECMWF ERA Interim.Resampling statistics: ter-comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month		1 month		



GRM-166 Offline	M-166 Offline Specific Humidity Grid					CDOP4-PRD-1.1	
Туре		Offline Product					
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Methe	ods	Zonal monthly	means on 200 m :	k 5 deg grid	S		
Operational Satellite Inpu	t Data	Metop-SG B1					
Other Operational Input D	Data	ECMWF ERA I	nterim (validation,	sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF	netCDF W		Web		30 d		
Accuracy				1			
Threshold	-	Target		Optimal			
8 – 12 km: 8.0 % 0 – 8 km: 8.0 %	1	8 – 12 km: 4.0 % 0 – 8 km: 4.0 %		8 – 12 km: 2.0 % 0 – 8 km: 2.0 %			
Notes		An accuracy intervolution of the given vert	val means a linearly changing quantity between the two values tical coordinate				
Verification/Validation Me		itistics of differences relative to ECMWF ERA Interim.Resampling statistics: er-comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizon	al Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	titude	200 m		1 month		



GRM-167 Climat	e Dry Ge	opotential Height		OZGMB1	CDOP4-PRD-1.1		
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Metl	nods	Zonal monthly	means on 200 m	x 5 deg grid	s		
Operational Satellite Inp	ut Data	Metop-SG B1					
Other Operational Input	Data	ECMWF ERA	Interim (validation	, sampling e	error estimation)		
Dissemination							
Format		Means		Timeliness	3		
netCDF	F V		Web		30 d		
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 12 – 120 m 8 – 25 km: 12 m 0 - 8 km: –		25 – 50 km: 6 – 60 8 – 25 km: 6 m 0 – 8 km: –	– 25 km: 6 m		25 – 50 km: 3 – 30 m 8 – 25 km: 3 m 0 – 8 km: –		
Notes		An accuracy interv over the given vert		inearly changing quantity between the two values ate			
Verification/Validation M		istics of differences relative to ECMWF ERA Interim.Resampling statistics: r-comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m		1 month		



GRM-168 Offline	Offline Dry Temperature Grid					CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Me	thods	Zonal monthly	means on 200 m :	k 5 deg grid	s		
Operational Satellite Inp	out Data	Metop-SG B1					
Other Operational Input	Data	ECMWF ERA	Interim (validation,	sampling e	rror estimatio	on)	
Dissemination							
Format		Means		Timeliness			
netCDF		Web		30 d			
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.6 – 6 K 8 – 25 km: 0.6 K 0 – 8 km: –		25 – 50 km: 0.3 – 3 8 – 25 km: 0.3 K 0 – 8 km: –	– 25 km: 0.3 K		25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
Verification/Validation N		istics of differences relative to ECMWF ERA Interim.Resampling statistics: r-comparison of RO data subsets.					
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg la	atitude	200 m 1 month				



GRM-169 Offline	Offline Dry Pressure Grid					CDOP4-PRD-1.1	
Туре		Offline Product	ffline Product				
Applications and Users		Climate and at	mosphere researc	hers			
Characteristics and Me	hods	Zonal monthly	means on 200 m :	x 5 deg grid	s		
Operational Satellite In	out Data	Metop-SG B1					
Other Operational Input	Data	ECMWF ERA	Interim (validation,	, sampling e	rror estimatio	n)	
Dissemination							
Format		Means		Timeliness			
netCDF	etCDF W		Web		30 d		
Accuracy				•			
Threshold		Target		Optimal			
25 – 50 km: 0.24 – 1.20 8 – 25 km: 0.24 % 0 – 8 km –	%		8 – 25 km: 0.12 %		25 – 50 km: 0.06 – 0.30 % 8 – 25 km: 0.06 % 0 – 8 km: –		
Notes		An accuracy interv over the given vert		y changing	quantity betw	een the two values	
Verification/Validation N	lethods		tatistics of differences relative to ECMWF ERA Interim.Resampling statistics: ter-comparison of RO data subsets.				
Coverage, Resolution		·					
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude	200 m		1 month		



GRM-170 Electr	ron Densi	y Profile		EDPMA1	CDOP4-PRD-1.1		
Туре		TBD	TBD				
Applications and Users	i	Space weathe	er and ionosphere r	researchers			
Characteristics and Me	thods						
Operational Satellite In	put Data	Metop-SG A1					
Other Operational Inpu	t Data						
Dissemination							
Format Me		Means	leans		Timeliness		
TBD		TBD	BD				
Accuracy		•		-			
Threshold		Target	Target		Optimal		
TBD		TBD	ſBD		TBD		
Notes							
Verification/Validation	Nethods	TBD	iD				
Coverage, Resolution	1						
Spatial Coverage	Horizo	ntal Resolution	Vertical Resolution	on	Temporal Resolution		
Global	GRAS-	SG resoltuion					



GRM-171 Electro	on Densi	y Profile		EDPMB1	CDOP4-PRD-1.1			
Туре		TBD	TBD					
Applications and Users		Space weath	Space weather and ionosphere researchers					
Characteristics and Met	hods							
Operational Satellite Inp	ut Data	Metop-SG B	1					
Other Operational Input	Data							
Dissemination		÷						
Format		Means		Timeliness				
TBD		TBD	3D		ТВD			
Accuracy		-		-				
Threshold		Target		Optimal				
TBD		TBD	BD		твр			
Notes								
Verification/Validation N	lethods	TBD	D					
Coverage, Resolution								
Spatial Coverage	Horizo	ntal Resolution	Vertical Resoluti	on	Temporal Resolution			
Global	GRAS	SG resoltuion						



GRM-172	Scintillat	tion Ind	ex			SINMA1	CDOP4-PRD-1.1		
Туре			TBD	TBD					
Applications and	Users		Space v	veather	r and ionosphere r	esearchers			
Characteristics a	nd Metho	ds							
Operational Sate	llite Input	Data	Metop-S	SG A1					
Other Operationa	al Input Da	ata							
Dissemination									
Format Me			Means	leans			Timeliness		
TBD			TBD	3D		TBD			
Accuracy						<u>.</u>			
Threshold			Target	arget		Optimal			
TBD			TBD	BD		твр			
Notes									
Verification/Validation Methods TB			TBD	D					
Coverage, Reso									
Spatial Coverage	9	Horizor	tal Resolutio	on	Vertical Resolution	on	Temporal Resolution		
Global		GRAS-SG resoltuion							



GRM-173	Scintilla	tion Ind	ex		SINMB1	CDOP4-PRD-1.1			
Туре			TBD	TBD					
Applications and	Users		Space weat	Space weather and ionosphere researchers					
Characteristics a	and Metho	ods							
Operational Sate	ellite Input	Data	Metop-SG E	31					
Other Operation	al Input D	ata							
Dissemination									
Format Me			Means		Timelines	Timeliness			
TBD			TBD	BD					
Accuracy									
Threshold			Target	arget					
TBD			TBD	BD		твр			
Notes									
Verification/Validation Methods TB			TBD	D					
Coverage, Reso	olution	·							
Spatial Coverage	e	Horizon	tal Resolution	Vertical Resolu	ition	Temporal Resolution			
Global	GRAS-SG resoltuion								



GRM-192 Offline 1	ropopau	ise Height Grid		OCGMEB		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users	Climate and atr	mosphere researc	hers				
Characteristics and Metho	ods	Zonal monthly	means on 200 m :	x 5 deg grid	S		
Operational Satellite Input	t Data	Metop-B/GRAS	3				
Other Operational Input D	ata	ECMWF ERA I	nterim (validation,	, sampling e	rror estimatio	on)	
Dissemination							
Format	ſ	Means		Timeliness			
netCDF	١	Web		30 d			
Accuracy							
Threshold	-	Target		Optimal			
2 km		1 km	km		0.5 km		
Notes							
			tics of differences relative to ECMWF ERA Interim.Resampling statistics: comparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizont	al Resolution	Vertical Resolution		Temporal R	esolution	
Global	5 deg la	titude			1 month		



GRM-193 Offlin	e Tropopa	use Height Grid		OCGMEC		CDOP4-PRD-1.1	
Туре		Offline Product	t				
Applications and Users	Climate and at	mosphere researc	hers				
Characteristics and Me	thods	Zonal monthly	means on 200 m :	x 5 deg grid	S		
Operational Satellite In	put Data	Metop-C/GRAS	S				
Other Operational Inpu	t Data	ECMWF ERA	Interim (validation,	, sampling e	rror estimatio	on)	
Dissemination							
Format		Means	Means		Timeliness		
netCDF		Web	Neb		30 d		
Accuracy							
Threshold		Target		Optimal			
2 km		1 km	km		0.5 km		
Notes							
			ics of differences relative to ECMWF ERA Interim.Resampling statistics: omparison of RO data subsets.				
Coverage, Resolution							
Spatial Coverage	Horizor	ntal Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg l	atitude			1 month		



GRM-195 NTC Tro	popause	Height Grid (Ser	ntinel-6)	OCG	S6	CDOP4-PRD-1.1	
Туре		NTC Level 3 Pr	TC Level 3 Product				
Applications and Users		Climate and at	mosphere researchers				
Characteristics and Metho	ods	Zonal monthly	means on 5 deg grids				
Operational Satellite Inpu	t Data		es (ROM SAF Level 2 p vel 1B Bending Angle Da		derived fron	n EUMETSAT	
Other Operational Input D	lata	ECMWF NWP	operational and reanaly	/ses fie	elds		
Dissemination							
Format	М	leans			Timeliness		
netCDF	W	/eb		60 d			
Accuracy	ł			<u>.</u>			
Threshold	Ta	arget		Optimal			
0.4 km	0.	.2 km		0.1 km			
Notes							
Verification/Validation Me	la [:] al	atistics of differences relative to ECMWF operational data within 9 broad itude-height regions (low, middle, and high latitudes; low, middle, and high itudes). Compliance requires that 60% of the absolute differences are smaller an the corresponding accuracy value.					
Coverage, Resolution	*						
Spatial Coverage	Horizonta	I Resolution	Vertical Resolution		Temporal Resolution		
Global	5 deg latit	ude	Scalar		1 month		



			e Height Grid (E e Height Grid (E		OCG OCG		CDOP4-PRD-1.1		
Туре			NTC Level 3	NTC Level 3 Product					
Applications and U	Jsers		Climate and a	atmosphere researchers					
Characteristics an	d Metho	ds	Zonal monthl	y means on 5 deg grids					
Operational Satell	ite Input	Data	EPS-SG miss	sion Level 1A from EUM	TSAT	Secreatariat			
Other Operational	Input D	ata	ECMWF NW	P operational and reanal	yses fi	elds			
Dissemination									
Format			Means	eans					
netCDF We			Web	/eb		60 d			
Accuracy					•				
Threshold			Target	arget					
0.4 km			0.2 km	2 km			0.1 km		
Notes									
lati alti			latitude-height realtitudes). Compl	atistics of differences relative to ECMWF operational data within 9 broad itude-height regions (low, middle, and high latitudes; low, middle, and high itudes). Compliance requires that 60% of the absolute differences are smaller an the corresponding accuracy value.					
Coverage, Resolution									
Spatial Coverage		Horizor	ital Resolution	Vertical Resolution	Vertical Resolution		Temporal Resolution		
Global		5 deg la	atitude	Scalar	Scalar		1 month		



GRM-200 NRT Ver	ificatior	Product		NVPMET		CDOP4-PRD-1.1		
Туре		NRT demonst	NRT demonstration product					
Applications and Users		NWP and atm	osphere researche	ers				
Characteristics and Metho	ods	times of 0 - Each data interval sp - The GNS interpolat	 Temperature and geopotential height datasets twice per day, valid at the times of 00Z and 12Z. Each dataset will contain batched GNSS-RO data from the 6 hour time interval spanning ±3 hours of the validity time. The GNSS-RO data, which has passed the ROM SAF QC, will be interpolated onto a set of fixed pressure levels, from 100 hPa up to 5 hPa (Possibly 100, 70, 50, 30, 20, 10, and 5 hPa, TBD). 					
Operational Satellite Input	Data	Metop and Me	etop-SG					
Other Operational Input D	ata	ECMWF NWF	ECMWF NWP operational and reanalyses fields					
Dissemination								
Format		Means	leans		Timeliness			
TBD		TBD		TBD				
Accuracy								
Threshold		Target		Optimal				
TBD		TBD		TBD				
Notes								
Verification/Validation Met	thods	BD						
Coverage, Resolution								
Spatial Coverage	Horizon	tal Resolution	Vertical Resolution		Temporal Resolution			
Global	RO			Fixed pressure levels (TBD) RO				



			limate Da 3, L2, L3)	ata Record	ICDRMET	-	CDOP4-PRD-1.1	
GRM-29-L2-R-I1 I GRM-29-L2-D-I1 I GRM-29-L2-T-I1 I GRM-29-L2-H-I1 I GRM-29-L2-F-I1 I GRM-29-L2-S-I1 I GRM-29-L2-C-I1 I GRM-29-L3-B-I1 I GRM-29-L3-R-I1 I GRM-29-L3-P-I1 I GRM-29-L3-R-I1 I GRM-29-L3-Z-I1 I GRM-29-L3-Z-I1 I GRM-29-L3-T-I1 I	CDR Re CDR Dr CDR Te CDR Sp CDR Pr CDR Su CDR Tr CDR Be CDR Re CDR CDR Dr CDR Dr CDR Dr CDR Te CDR Sp	y Tempe mperatu ecific H essure F inface Pr opopaus ending A fractivit y Tempe y Pressu y Geopo mperatu ecific H	y Profile erature P ire Profile Profile ressure se Height angle Grid y Grid erature G ure Grid btential H	e Profile : d rid eight Grid Grid	IBAMET IRPMET IDPMET ITPMET IPPMET ISPMET ICHMET ICHMET IDGMET IZGMET ITGMET ILGMET ICGMET			
Туре		Inte	rim Clima	te Data Record				
Applications and User	S	Clim	Climate and atmosphere researchers					
Characteristics and Methods			 Regularly extends in time CDR GRM-29-R1 using a system having optimum consistency with the system used to generate CDR GRM-29-R1; The extension in time will continue until the release of CDR GRM-29-R2 which will cover both the GRM-29-R1 and GRM-29- I1 time periods; 					
Operational Satellite I	nput Dat	a Ope	Operational Level 1A/1B Metop files from EUMETSAT Secretariat					
Other Operational Inp	ut Data	ECN	ECMWF ERA Interim fields and ERA5 fields					
Dissemination								
Format		Means			Timeliness	38		
netCDF BUFR		Web			Two mont	าร		
Accuracy								
Threshold		Target			Optimal	Optimal		
GRM-29-R1		GRM-2	9-R1		GRM-29-F	GRM-29-R1		
Notes	es							
Verification/Validation Methods				used for CDR G	RM-29-R1			
Coverage, Resolution								
Spatial Coverage	ial Coverage Spatial Re			Vertical Resolu	ution	Tempora	al resolution	
GRM-29-R1	GRM-29-R1 GRM-29-R1					GRM-29)-R1	



		1				•		
GRM-29-12			im Climate Da s L1B, L2, L3)		ICDRMET		CDOP4-PRD-1.1	
GRM-29-L1-B-I2 GRM-29-L2-R-I2 GRM-29-L2-D-I2 GRM-29-L2-T-I2 GRM-29-L2-T-I2 GRM-29-L2-P-I2 GRM-29-L2-S-I2 GRM-29-L2-C-I2 GRM-29-L3-B-I2 GRM-29-L3-R-I2 GRM-29-L3-R-I2 GRM-29-L3-Y-I2 GRM-29-L3-Y-I2 GRM-29-L3-T-I2 GRM-29-L3-H-I2 GRM-29-L3-C-I2 GRM-29-L3-L-I2	ICDR F ICDR 1 ICDR 5 ICDR 7 ICDR 7 IC	Refrac Dry Te Specif Press Surfac Fropo Planet Sendi Refrac Dry Te Dry Go Specif Fropo Planet	ng Angle ctivity Profile emperature Profile fic Humidity F ure Profile ce Pressure pause Height tary Boundary ng Angle Grid emperature G ressure Grid eopotential H erature Grid fic Humidity C pause Height tary Boundary	e Profile y Layer d rid eight Grid Srid : Grid	IBAMET IRPMET IDPMET ITPMET IPPMET ISPMET ICHMET ILHMET IBGMET IRGMET IDGMET ITGMET ICGMET ILGMET			
Туре			Interim Clima	te Data Record				
Applications and Use	ers		Climate and a	Climate and atmosphere researchers				
Characteristics and N	/lethods	3	 Regularly extends in time CDR GRM-29-R2 using a system having optimum consistency with the system used to generate CDR GRM-29-R2; The extension in time will continue until the release of CDR GRM-29-R3 which will cover both the GRM-29-R2 and GRM-29- I2 time periods; 					
Operational Satellite	Input D	ata	Operational Level 1A/1B Metop files from EUMETSAT Secretariat					
Other Operational In	out Data	а	-	ECMWF ERA5 fields and TBD				
Dissemination			<u>+</u>					
Format		Me	eans		Timeliness			
netCDF BUFR		W	eb		Two mont	าร		
Accuracy								
Threshold		Та	irget		Optimal	Optimal		
GRM-29-R2		GF	RM-29-R2		GRM-29-F	R2		
Notes								
Verification/Validation Same methods as used for CDI Methods				ised for CDR G	RM-29-R2			
Coverage, Resoluti	on							
Spatial Coverage	Spat	tial Re	esolution	Vertical Resolu	ution	Tempor	al resolution	
GRM-29-R2	GRM	/I-29-F	R2	GRM-29-R2		GRM-29)-R2	



			m Climate Da L1B, L2, L3)		ICDRMET	-	CDOP4-PRD-1.1	
GRM-29-L2-R-I3 GRM-29-L2-D-I3 GRM-29-L2-T-I3 GRM-29-L2-H-I3 GRM-29-L2-P-I3 GRM-29-L2-S-I3 GRM-29-L2-C-I3 GRM-29-L2-C-I3 GRM-29-L3-B-I3 GRM-29-L3-R-I3 GRM-29-L3-Y-I3 GRM-29-L3-Z-I3 GRM-29-L3-T-I3 GRM-29-L3-T-I3 GRM-29-L3-T-I3 GRM-29-L3-L-I3	ICDR F ICDR T ICDR T ICDR S ICDR S ICDR F ICDR S ICDR T ICDR E ICDR C ICDR T ICDR T ICDR S ICDR T	Sendin Se	ng Angle ctivity Profile emperature Profile fic Humidity F ure Profile ce Pressure pause Height ary Boundary ng Angle Grid emperature G ressure Grid eopotential H erature Grid fic Humidity C pause Height ary Boundary	e Profile y Layer d rid eight Grid Grid	IBAMET IRPMET IDPMET IHPMET IPPMET ISPMET ICHMET ILHMET ILHMET IDGMET IZGMET ITGMET ILGMET ILGMET			
Туре			Interim Clima	te Data Record				
Applications and Use	rs		Climate and a	atmosphere res	earchers			
Characteristics and M	lethods	i	 Regularly extends in time CDR GRM-29-R3 using a system having optimum consistency with the system used to generate CDR GRM-29-R3; The extension in time will continue until the release of CDR GRM-29-R4 which will cover both the GRM-29-R3 and GRM-29- I3 time periods; 					
Operational Satellite	nput D	ata	Operational Level 1A/1B Metop files from EUMETSAT Secretariat					
Other Operational Inp	ut Data	a	-	ECMWF ERA5 fields and TBD				
Dissemination			<u></u>					
Format		Me	eans		Timelines	Timeliness		
netCDF BUFR		We	eb		Two mont	Two months		
Accuracy								
Threshold		Та	rget		Optimal			
GRM-29-R3		GF	RM-29-R3		GRM-29-F	3		
Notes								
Verification/Validation Methods					RM-29-R3			
Coverage, Resolution	on							
Spatial Coverage	Spat	ial Re	solution	Vertical Resolu	Ition	Tempora	al resolution	
GRM-29-R3	GRM	1-29-F	२३	GRM-29-R3		GRM-29	9-R3	