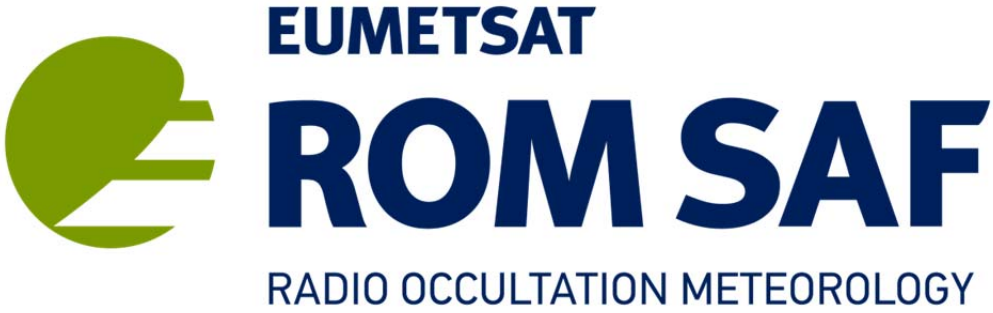

ROM SAF CDOP-3

Product Requirements Document

Version 3.4

26 January 2019

ROM SAF Consortium
Danish Meteorological Institute (DMI)
European Centre for Medium-Range Weather Forecasts (ECMWF)
Institut d'Estudis Espacials de Catalunya (IEEC)
Met Office (UKMO)

Ref: SAF/ROM/DMI/MGT/PRD/001

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DOCUMENT CHANGE RECORD

Version	***Date***	***By***	***Description***
0.1	6/8/08	DO	First draft based on Lothar Schueller's template and CM-SAF PRD, for discussion within GRAS SAF Team
0.2	5/11/08	DO	Incorporated comments from DMI after discussion at CDOP-PT4
0.3	19/12/08	DO	Incorporated more comments from KBL
1.0	18/6/09	DO	Incorporated suggestions from Lothar Schueller. Typo in PRD-7-07 and pressure accuracy values corrected. Version submitted to SG for comment; including updates as agreed at CDOP SG5 on 18 June 2009 (KBL)
1.1	13/1/2012	KBL	Cf. CDOP SG7 Decision 3 & SG8 Decision 5: Included Rec. 6 from PCR2: GRM-20 0-20 km; Included Rec. 7 from PCR2: PRD-4-01 and PRD-4-02 are updated, PRD-7-08 added; This version 1.1: used as reference for ORR2. **Approved as SG9-Dec-07 (wp Jan 2012**);

2.0	22/03/2013	KBL	First CDOP-2 version, based on the PRT table (Annex 1 from the CDOP-2 Proposal). GRAS SAF changed to ROM SAF, new chapters 2.10 & 2.11, new req. PRD-07-09, updates to req. PRD-03-01, 03-03, and 04-01, inclusion of CDOP-2 products in the product specification tables (Annex A); This version when approved will close SG actions SG9-A3, SG9-A4; for details see section 1.6; Sent to SG for approval; **Approved as SG12-Dec-04 (wp April 2013**)
2.1	8/5 2014	KBL	Version submitted for the ORR4 & ORR-B-backlog review; List of updates: i) Definitions updated in sec. 1.4 (OR6 action 12); ii) Format of accuracy figures in several GRM-nn tables adjusted; Detailed list of all changes related to actions and recommendations is included in section 1.7;
2.2	14/5 2014	KBL	Version submitted to RR4 review (after redefining scope of ORR4 & ORR-B-backlog and introducing a separate RR4 requirements review) and taking into account comments from P. Poli on May 14: (i) Clarified in PRD-02-03 and PRD-03-04 that the figures are for “1 day”; (ii) introduced the surface value requirement in GRM-04, 12, 43, 50. **Approved as SG14-Dec-08 (wp May 2014)**
2.3	30/11 2015	KBL	Version updated according to CDOP-2 SG15 and SG16 actions. Detailed list of all changes is included in section 1.8; **Approved as SG17-Dec-04 (wp Dec 2015)**
3.0draft	24/11 2017	KBL	First version of PRD for CDOP-3; based on the PRT tables from the CDOP-3 Proposal, Annex 1 (main changes: EPS-SG and Jason-CS requirements added throughout the document; GBGP software added; PBLH and Tdry products added; EPS-SG ionosphere products added); **Approved as SG23-Dec-03 (wp 6 Feb 2019)**

3.1draft	3/9 2018	KBL	Updated version implementing the following changes from the DRR-RE1 & ORRs review: - Recommendation 001: GRM-33-R1 inserted - Recommendation 006: Offline Level 3 TPH products added (GRM-191, 192, 193, 194) - Recommendation 007: Time periods added to all GRM-nn-R2 products In addition the following changes were made: - All GRM-nn-R1 products have been re-inserted (by mistake they were removed in the previous version) - Added Multimission offline Metop Level 3 products (GRM-83 to 89) **Approved as SG23-Dec-03 (wp 6 Feb 2019)**
3.2draft	17/10 2018	KBL	Updated version implementing the RIDs from the EPS-SG RR review: - 003: First paragraph in section 1.4 updated - 004: NRT definitions in section 1.4 updated - 005: PRD-02-03 updated (capability of system is captured in PRD-01-01 and 01-02) - 006: PRD-02-06 removed - 007: section A2 added in Annex A - 020: PRD-01-05, 01-06 updated - 021: PRD-02-01 updated - 022: PRD-02-02 updated - 023: PRD-02-05 updated - 024: PRD-03-01 updated - 025: PRD-03-02 updated - 026: PRD-03-03 updated - 027: PRD-03-05 updated - 028: PRD-04-03 updated - 029: PRD-05-01 updated - 030: PRD-05-07 updated - 031: PRD-05-03, 06-03, 07-03 updated - 033: PRD-11-02, 11-03, 11-04, 11-06, 11-08 updated **Approved as SG23-Dec-03 (wp 6 Feb 2019)**
3.3draft	26/10 2018	KBL	Updated version prepared for SG22: - Empty tables for Metop-SG (GRM-130 to 149, GRM-150 to 169) filled with similar product requirement values as used for Metop **Approved as SG23-Dec-03 (wp 6 Feb 2019)**

3.4	26/1 2019	KBL	Updated version implementing: - ICDR products GRM-29-I1, GRM-29-I2 in PRD requirements and in Annex A - Updated Sec. 1.4 Definitions **Approved as SG23-Dec-03 (wp 6 Feb 2019)**

ROM SAF

Radio Occultation Meteorology Satellite Application Facility (ROM SAF) is a decentralised processing centre under EUMETSAT which is responsible for operational processing of GRAS radio occultation (RO) data from the Metop 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 monthly-mean 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, and iii) Met Office in Exeter, United Kingdom. To get access to our products or to read more about the ROM SAF please go to: http://www.romsaf.org

Intellectual Property Rights

List of Contents

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 Jason-CS end-user requirements within the Third Continuous Development and Operations Phase (CDOP-3) 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 (Operational Readiness Reviews, Product Consolidation Reviews and Delivery Readiness Inspections) 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 derived from appropriate user-based requirements as specified in the 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 Jason-CS end-user requirements [AD.1, AD.2, AD.3] and within the Third Continuous Development and Operations Phase (CDOP-3) [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 (Operational Readiness Reviews, Product Consolidation Reviews and Delivery Readiness Inspections) 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, Jason-CS 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-3 Proposal: Proposal for the Third Continuous Development and Operations Phase (CDOP-3); Ref: SAF/ROM/DMI/MGT/CDOP3/001 Version 1.2 of 31 March 2016, Ref: EUM/C/85/16/DOC/15, approved by the EUMETSAT Council at its 85th meeting on on 28-29 June 2016

[AD.5] CDOP-3 Cooperation Agreement: Agreement between EUMETSAT and DMI on the Third Continuous Development and Operations Phase (CDOP-3) of the Radio Occultation Meteorology Satellite Applications Facility (ROM SAF), Ref. EUM/C/85/16/DOC/19, approved by the EUMETSAT Council and signed at its 86th meeting on 7 December 2016

1.2.2 Reference Documents

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

[RD.1] User Requirement Document Ref: SAF/GRAS/METOFFICE/RQ/URD/001

1.3 Acronyms and Abbreviations

BUFR	Binary Universal Format for the Representation of data (also FM94) (WMO)
CDR	Climate Data Record
CGS	Core Ground Segment (EUMETSAT)
DMI	Danish Meteorological Institute; ROM SAF Leading Entity
ECMWF	The European Centre for Medium-range Weather Forecasts; ROM SAF partner
EPS	EUMETSAT Polar satellite System (EUMETSAT)
EPS-SG	EUMETSAT Polar satellite System – Second Generation (EUMETSAT)
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 (ROM SAF)
GLONASS	Globalnaya Navigatsionnaya Sputnikovaya Sistema (GLObal Navigation Satellite System, Russia)

GM	Global Mission (EPS-SG)
GNSS	Global Navigation Satellite Systems (generic name for GPS + GLONASS)
GPAC	GNSS Processing and Archiving Center (ROM SAF)
GPS	Global Positioning System (USA)
GPS/MET	Global Positioning System / Meteorology Experiment on Microlab-1 (US)
GRAS	GNSS Receiver for Atmospheric Sounding (EPS/Metop)
GRIB	Gridded Binary format
GTS	Global Telecommunication System
IEEC	Institut d'Estudis Espacials de Catalunya; ROM SAF partner
LEO	Low Earth Orbit
Met Office	United Kingdom Meteorological Office; ROM SAF Partner
METOP	METeorological Operational Polar satellite (EUMETSAT)
NetCDF	Network Common Data Form
NRT	Near-Real Time
NWP	Numerical Weather Prediction
POD	Precise Orbit Determination
RO	Radio Occultation
ROM SAF	Radio Occultation Meteorology SAF (EUMETSAT), former GRAS SAF
ROPP	Radio Occultation Processing Package (ROM SAF)
RM	Regional Mission (EPS-SG)
RMDCN	Regional Meteorological Data Communications Network
SAF	Satellite Application Facility (EUMETSAT)
TBC	To Be Confirmed
TBD	To Be Determined or To Be Decided
VAR	VARiational analysis; 1D, 2D, 3D or 4D variants (NWP assimilation technique)
WIS	World Information System
WMO	World Meteorological Organisation

1.4 Definitions

RO data products from the GRAS instrument onboard Metop and RO data from other missions are grouped in *data levels* (level 0, 1, 2, or 3) and *product types* (NRT, offline, CDR, or ICDR). The data levels and product types are defined below[1]. 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:

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

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

Level 1B: Bending angles and impact parameters, tangent point location, and quality information;

Level 2: 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), quality information;

Level 3: 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:

NRT product: Data product delivered less than: (i) 3 hours after measurement (SAF Level 2 for EPS); (ii) 80 min after measurement (SAF Level 2 for EPS-SG Global Mission); (iii) 40 min after measurement (SAF Level 2 for EPS-SG Regional Mission);

Offline product: Data product delivered from less than 5 days to up to 6 months after measurement, depending on the requirements. The evolution of this type of product is driven by new scientific developments and subsequent product upgrades;

CDR: Climate Data Record generated from a dedicated reprocessing activity using a fixed set of processing software[2]. 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;

ICDR: 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[3].

[1] Note that the level definitions differ partly from the WMO definitions: http://www.wmo.int/pages/prog/sat/dataandproducts_en.php

[2] (i) GCOS 2016 Implementation Plan; (ii) http://climatemonitoring.info/home/terminology/

[3] http://climatemonitoring.info/home/terminology/ (the ICDR definition was endorsed at the 9th session of 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 and ICDR sounding product
04 Gridded products
05 Near-real time validation
06 Offline and ICDR validation
07 Gridded validation
08 Software deliverables
09 User and supporting services
10 Re-analysis dataset
11 Reprocessed data records

1.6 Changes in version 2.0

This section contains a description of the actions and recommendations which have been incorporated in version 2.0 of the PRD.

1. Action CDOP-1 SG9-A3:
   ORR2 Recommendation 1 on PRD update: Team to update the PRD according to points i, ii, iii, vi, vii.

   Suggestion presented for SG11:
   i. We propose to make the Level 3 data products instrument-specific, i.e. to separate into COSMIC-only and Metop-only data products. They would have different GRM numbers, and as a consequence, different requirements. Initially the requirements will have the same numerical values. However, following studies in CDOP-2 we would be able to further constrain them.
   ii. We plan to assess the requirements, particularly the altitude dependence, prior to the first CDOP-2 reprocessing cycle planned for 2014. Until then, the requirements will remain unaltered.
   iii. The requirements for the humidity climate products will be restricted to below 15 kilometers (to be in line with the data product altitude coverage).
   vi. A requirement to generate time series for the web site will be added.
   vii. The ASCII format requirement will be removed.

   Decision SG11-Dec-15:
   The SG approved the suggestion in action SG9-A3 related to PRD updates for level 3 products. The update should take into account the related discussions at the SG11 meeting.

2. Action CDOP-1 SG9-A4:
   ORR2 Recommendation 1 on PRD update: Team to assess points iv and v and suggest what can be done.

Suggestion presented for SG11:
iv. We suggest changing the timeliness requirement from 30 days to 3-6 months. In the case of COSMIC data, this would allow us to use reprocessed data most of the time (estimated delay of the UCAR processing up to excess-phase data is around 6 weeks, although this cannot be considered a strict requirement).
v. We suggest continuing using ECMWF as a priori data from the up to the first CDOP-2 reprocessing cycle planned for 2014. For that reprocessing we will consider to use ERA-Interim instead of ECMWF.

Decision SG11-Dec-16:
The SG approved the suggestion in action SG9-A4 related to PRD updates for level 3 products based on COSMIC offline data and ECMWF a priori fields.

3. Regarding ORR2 Recommendation 1 on PRD update: point ii (see 1 above), we have in the current version suggested an update of the bending angle requirement, and related to this made an adjustment of some of the refractivity requirements in order to have consistent bending angle and refractivity requirements (see GRM-17, 18 and 53, 54, 93, 94).

1.7 Changes in version 2.1

This section contains a description of the actions and recommendations which have been incorporated in version 2.1 of the PRD.

1. PRD-02-03 updated to be in line with SeSp version 2.3 (this closes OR5 actions 7 and 25; Ref: EUM/PPS/MIN/13/694051).

2. PRD-03-04 updated to be consistent with the updated formulation in PRD-02-03.

3. A wrong data level number in PRD-01-02, PRD-03-02, PRD-03-04, PRD-11-01 have been corrected (the offline processing is done from level 1a whereas NRT processing is done from level 1b).

4. Accuracy values for 1D-Var products (GRM-02,03,04,05; 10,11,12,13; 41,42,43,44; 48,49,50,51) have been re-assessed based on wave optics data and new values are suggested (Ref: SAF/ROM/DMI/MGT/DOC/010). This closes SG action SG5-A1 (Ref: SAF/GRAS/DMI/MGT/MIN/CSG5/001) and ORR-B Closeout Minutes, Recommendation 2 (Ref: EUM/PPS/MIN/11/0043). Verification method is based on comparing to analysis fields.

5. Added the product requirements for GRM-22,23, GRM-58,59, GRM-98,99 as recommended at the PCR5 Review for these products (Ref: EUM/PPS/MIN/13/700261) and endorsed at SG12 the decision SG12-Dec-06 (Ref: SAF/ROM/DMI/MGT/SG12/002).

6. ORR2 Closeout action 1 (point 11 [by P.P.] in Annex 2 of the Minutes from the ORR2 Closeout) closed by adding to the GRM-nn requirements tables the following note: “An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate”.

7. In Annex A: removed the GRM-nn numbers and tables for the non-committed products: GRM-31, 34, 35, 36, 37, 38, 39 (which had been included as placeholders for possible future data sets).

1.8 Changes in version 2.3

This section contains a description of the actions and recommendations which have been incorporated in version 2.3 of the PRD.

1. Section 1.4: Minor update to text in the definition of Level 1a and added definition of CDR
2. TBD requirements on third party missions removed (SG15-Dec-14)
3. TBD requirements on EPS-SG removed (not applicable for CDOP-2 but addressed in the CDOP-3 proposal)
4. PRD-01-01 and PRD-01-02: GRM-07, 15, 45, 52 removed. These are Error-Covariance Matrices and are removed as formal products by CDOP-1 SG8-Dec-11 and transferred to requirement PRD-08-02 on ROPP
5. PRD-01-02: Minor change to text to clarify that data and datasets for offline and reprocessed data includes level 1b, 2, and 3
6. PRD-05-01 and PRD-06-01: ROSA removed from list of other measurements (SG15-Dec-14)
7. PRD-08-01: Release of ROPP-10 (GRM-16_v10) removed (SG15-Dec-15)
8. PRD-08-02: References to formal product ids GRM-07, 15, 45, 52 (Error-Covariance Matrices) removed (CDOP-1 SG8-Dec-11)
9. PRD-11-01: GRM ids updated as agreed at the RR-RE1 review (SG15-Dec-18)
10. PRD-11-02: Text updated to clarify the climate data records covers level 1b, 2, and 3
11. PRD-11-09: Text updated to clarify offline means climate data records
12. PRD-11-12: New requirement as agreed at RR-RE1 review (SG15-Dec-19)
13. PRD-11-13: New requirement as agreed at RR-RE1 review (SG15-Dec-19)
14. Annex A: Updated product tables for GRM-08, 09, 17 – 23, 24, 28-R1 – 32-R1, 46,47, 53-59, 93-93 as agreed at RR-RE1 review (SG15-Dec-19)
15. SG15-Act-09: Implemented through above points 12, 13, and 14 (SG15-Dec-19)
16. SG16-Act-04: Implemented through updated product ids GRM-28-R1 – 32-R1 (SG16-Dec-09)
17. SG15-Act-01: GRM-07, 15, 45, 51 deleted noting these requirements have previously been reclassified as PRD requirements PRD-08-02 on ROPP (CDOP-1 SG8-Dec-11)
18. SG15-Act-05: Implemented through deleting GRM-16_v10 (ROPP-10) (SG15-Dec-15), GRM-26 (PBLH) (SG15-Dec-16) and GRM-27 (RO Reanalysis) (SG15-Dec-17)
19. SG15-Act-08: Section 2.10 updated to reflect that the RO reanalysis product GRM-27 is deleted but that a similar product is planned to be produced with the ERA-5 system at ECMWF (SG15-Dec-17)

1.9 Overview of this document

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

Chapter 1 contains the introduction. It also contains detailed lists of changes to some of the previous versions of the document.
Chapter 2 contains the list of all product requirements.
Chapter 3 contains the list of TBCs and TBDs.
Annex A contains tables with detailed 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-01 to 05, 24, 26, 40-44, 60-64, 130-135, 150-155.

PRD-01-02 The ROM SAF shall have an offline capability to process EUMETSAT Secretariat CGS Level 1A data from the RO instruments on Metop, Metop-SG and Jason-CS to Level 1B and Level 2 products according to specifications in Annex A, Tables GRM-08 to 13, 24, 26, 46-51, 66-71, 136-142, 156-162. This capability shall be used to regularly generate offline 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 gridded products from data from the RO instruments on Metop, Metop-SG, Jason-CS, COSMIC-1 and COSMIC-2 for climate applications, according to the product specifications in Annex A, Tables GRM-17 to 23, 53-59, 73-79, 83-89, 93-99, 107-113, 123-129, 143-149, 163-169, 191-194, 29-I1, 29-I2.

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_v10, 16_v11.

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-01 to 05, 40-44, 60-64, 130-135, 150-155.

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 15 min (EPS), (ii) 70 min (EPS-SG GM; 95% availability), (iii) 30 min (EPS-SG RM; 95% availability), more than (i) 500, (ii) 2000, (iii) 500, shall daily 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) 80 min, (iii) 40 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 ICDR Sounding Products

PRD-03-01 Offline and ICDR products shall be generated to take advantage of RO NRT data not meeting the timeliness requirements for NRT products and with the offline and ICDR products fulfilling Level 1B and 2 product parameter specifications as presented in Annex A, Tables GRM-08 to 13, 24, 26, 46-51, 66-71, 136-142, 156-162, 29-I1, 29-I2.

PRD-03-02 The ROM SAF shall have the capability to process data from RO instruments other than onboard EUMETSAT missions (COSMIC, COSMIC-2A) in order to generate offline and ICDR 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 ICDR products shall at least contain identical parameters to the near-real time products.

PRD-03-04 More than (i) 500 (EPS), (ii) 1000 (EPS-SG GM), (iii) TBD (EPS-SG RM), of all available occultation events with correct instrument operation shall daily be processed to Level 1B and Level 2 sounding products and shall be available to users within 30 days of observation time. This availability rate shall be calculated over a 1 month period.

PRD-03-05 Offline and ICDR products shall be made available to users via HTTP using the file formats netCDF and BUFR.

PRD-03-06 The offline and ICDR sounding products shall be archived within the ROM SAF leading entity.

2.4 Gridded Products

PRD-04-01 Gridded products shall be generated from best-quality offline products from Metop/GRAS, Metop-SG, Jason-CS, COSMIC-1, COSMIC-2 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-17 to 23, 53-59, 73-79, 83-89, 93-99, 107-113, 123-129, 143-149, 163-169, 191-194, 29-I1, 29-I2.

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, COSMIC, COSMIC-2, CHAMP, GRACE, TanDEM-X, TerraSAR-X, GNOS, ROSA/Megha-Tropiques.

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 RO instruments on COSMIC, COSMIC-2, GRACE, TanDEM-X, TerraSAR-X, GNOS and present the same information, and in the same way, as for Metop/GRAS.

PRD-05-08 The NRT product validation information shall be archived within the ROM SAF leading entity.

2.6 Offline and ICDR Validation

PRD-06-01 The ROM SAF shall generate, and make publicly available, validation information supporting available RO offline and ICDR sounding products using information obtained from NWP fields and other measurements (COSMIC, COSMIC-2,

CHAMP, GNOS, GRACE, TanDEM-X, TerraSAR-X)

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 ICDR 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 ICDR 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 ICDR product validation information shall be made available via the project's website.

PRD-06-07 The offline and ICDR 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_v10, 16_v11. 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..

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 plan to generate 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 will be provided by ECMWF as part of the ERA CLIM project.

PRD-10-02 The processing will use 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 will be archived.

PRD-10-03 The quality of the dataset will be 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, will be derived from the daily reanalyses. Time-series of climate indicators will be computed, stored and made available to users.

PRD-10-05 The dataset and derived data will be archived at ECMWF.

PRD-10-06 The dataset and derived data will be made available to users in standard formats, such as GRIB fields, via appropriate links such as at the ROM SAF web site.

2.11 Reprocessed 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 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, 32-R2, 33-R2.

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.

3. List of TBD's and TBC's

PRD-03-04 More than (i) 500 (EPS), (ii) 1000 (EPS-SG GM), (iii) TBD (EPS-SG RM), of all available occultation events with correct instrument operation shall daily be processed to Level 1B and Level 2 sounding products and shall be available to users within 30 days of observation time. This availability rate shall be calculated over a 1 month period.

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 product is 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-08, 46, 66, 136, 116, 156)
- Level 2A Refractivity (GRM-01, 09, 40, 47, 60, 67, 117, 130, 137, 150, 157)
- Level 2B, 2C Temperature, Pressure, and Humidity (GRM-02 to 05, 10-13, 41-44, 48-51, 61-64, 68-71, 118-121, 131-134, 138-141, 151-154, 158-161)
- Level 2C Tropopause Height (GRM-24)
- Level 2C Planetary Boundary Layer Height (GRM-26)
- Level 3 Gridded Data (GRM-17 to 23, 53-59, 73-79, 83-89, 93-99, 107-113, 123-129, 143-149, 163-169, 191-194)Reprocessed Data Records (Climate Data Records) (GRM-28-R1, 29-R1, 30-R1, 32-R1, 33-R1; GRM-28-R2, 29-R2, 30-R2, 31-R2, 32-R2, 33-R2)
- ICDR products (GRM-29-I1, 29-I2)
- ROPP Software (GRM-16, 16_v10, 16_v11)
- GBGP Software (GRM-92)
- Ionosphere Products (GRM-170 to 173)

A2. Product Sizes:

EPS: BUFR files over EUMETCast:
- one file is about 15 KB
- total for Metop-A and B: 20 MB/day

EPS-SG: estimated size of BUFR files over EUMETCast:
- one file is about 15 KB
- total for two satellites with GPS and Galileo: 40 MB/day
- total for two satellites with GPS, Galileo, Beidou, GLONASS: 80 MB/day

A3. Overview list of all GRM-ids for reprocessed data records:

Product ID	*Product Name*	*Product Acronym*
GRM-28-R1	**Reprocessed Multi-Mission climate data record (Metop, COSMIC, CHAMP, GRACE L3)**	**REPMUL**
GRM-28-L3-B-R1	Reprocessed Bending Angle Grid	RBGMUL
GRM-28-L3-R-R1	Reprocessed Refractivity Grid	RRGMUL
GRM-28-L3-D-R1	Reprocessed Dry Temperature Grid	RDGMUL
GRM-28-L3-Y-R1	Reprocessed Dry Pressure Grid	RYGMUL
GRM-28-L3-Z-R1	Reprocessed Dry Geopotential Height Grid	RZGMUL
GRM-28-L3-T-R1	Reprocessed Temperature Grid	RTGMUL
GRM-28-L3-H-R1	Reprocessed Specific Humidity Grid	RHGMUL
GRM-28-L3-C-R1	Reprocessed Tropopause Height Grid	RCGMUL
GRM-29-R1	**Reprocessed Metop climate data record (Metop-A/B L1, L2, L3)**	**REPMET**
GRM-29-L1-B-R1	Reprocessed Bending Angle	RBAMET
GRM-29-L2-R-R1	Reprocessed Refractivity Profile	RRPMET
GRM-29-L2-D-R1	Reprocessed Dry Temperature Profile	RDPMET
GRM-29-L2-T-R1	Reprocessed Temperature Profile	RTPMET
GRM-29-L2-H-R1	Reprocessed Specific Humidity Profile	RHPMET
GRM-29-L2-P-R1	Reprocessed Pressure Profile	RPPMET
GRM-29-L2-S-R1	Reprocessed Surface Pressure	RSPMET
GRM-29-L2-C-R1	Reprocessed Tropopause Height	RCHMET
GRM-29-L3-B-R1	Reprocessed Bending Angle Grid	RBGMET
GRM-29-L3-R-R1	Reprocessed Refractivity Grid	RRGMET
GRM-29-L3-D-R1	Reprocessed Dry Temperature Grid	RDGMET
GRM-29-L3-Y-R1	Reprocessed Dry Pressure Grid	RYGMET
GRM-29-L3-Z-R1	Reprocessed Dry Geopotential Height Grid	RZGMET
GRM-29-L3-T-R1	Reprocessed Temperature Grid	RTGMET
GRM-29-L3-H-R1	Reprocessed Specific Humidity Grid	RHGMET
GRM-29-L3-C-R1	Reprocessed Tropopause Height Grid	RCGMET
GRM-30-R1	**Reprocessed COSMIC climate data record (COSMIC L1, L2, L3)**	**REPCO1**
GRM-30-L1-B-R1	Reprocessed Bending Angle	RBACO1
GRM-30-L2-R-R1	Reprocessed Refractivity Profile	RRPCO1
GRM-30-L2-D-R1	Reprocessed Dry Temperature Profile	RDPCO1
GRM-30-L2-T-R1	Reprocessed Temperature Profile	RTPCO1
GRM-30-L2-H-R1	Reprocessed Specific Humidity Profile	RHPCO1
GRM-30-L2-P-R1	Reprocessed Pressure Profile	RPPCO1
GRM-30-L2-S-R1	Reprocessed Surface Pressure	RSPCO1

Product ID	Product Name	Product Acronym
GRM-30-L2-C-R1	Reprocessed Tropopause Height	RCHCO1
GRM-30-L3-B-R1	Reprocessed Bending Angle Grid	RBGCO1
GRM-30-L3-R-R1	Reprocessed Refractivity Grid	RRGCO1
GRM-30-L3-D-R1	Reprocessed Dry Temperature Grid	RDGCO1
GRM-30-L3-Y-R1	Reprocessed Dry Pressure Grid	RYGCO1
GRM-30-L3-Z-R1	Reprocessed Dry Geopotential Height Grid	RZGCO1
GRM-30-L3-T-R1	Reprocessed Temperature Grid	RTGCO1
GRM-30-L3-H-R1	Reprocessed Specific Humidity Grid	RHGCO1
GRM-30-L3-C-R1	Reprocessed Tropopause Height Grid	RCGCO1
GRM-32-R1	**Reprocessed CHAMP climate data record (CHAMP L1, L2, L3)**	**REPCHA**
GRM-32-L1-B-R1	Reprocessed Bending Angle	RBACHA
GRM-32-L2-R-R1	Reprocessed Refractivity Profile	RRPCHA
GRM-32-L2-D-R1	Reprocessed Dry Temperature Profile	RDPCHA
GRM-32-L2-T-R1	Reprocessed Temperature Profile	RTPCHA
GRM-32-L2-H-R1	Reprocessed Specific Humidity Profile	RHPCHA
GRM-32-L2-P-R1	Reprocessed Pressure Profile	RPPCHA
GRM-32-L2-S-R1	Reprocessed Surface Pressure	RSPCHA
GRM-32-L2-C-R1	Reprocessed Tropopause Height	RCHCHA
GRM-32-L3-B-R1	Reprocessed Bending Angle Grid	RBGCHA
GRM-32-L3-R-R1	Reprocessed Refractivity Grid	RRGCHA
GRM-32-L3-D-R1	Reprocessed Dry Temperature Grid	RDGCHA
GRM-32-L3-Y-R1	Reprocessed Dry Pressure Grid	RYGCHA
GRM-32-L3-Z-R1	Reprocessed Dry Geopotential Height Grid	RZGCHA
GRM-32-L3-T-R1	Reprocessed Temperature Grid	RTGCHA
GRM-32-L3-H-R1	Reprocessed Specific Humidity Grid	RHGCHA
GRM-32-L3-C-R1	Reprocessed Tropopause Height Grid	RCGCHA
GRM-33-R1	**Reprocessed GRACE climate data record (CHAMP L1, L2, L3)**	**REPGRA**
GRM-33-L1-B-R1	Reprocessed Bending Angle	RBAGRA
GRM-33-L2-R-R1	Reprocessed Refractivity Profile	RRPGRA
GRM-33-L2-D-R1	Reprocessed Dry Temperature Profile	RDPGRA
GRM-33-L2-T-R1	Reprocessed Temperature Profile	RTPGRA
GRM-33-L2-H-R1	Reprocessed Specific Humidity Profile	RHPGRA
GRM-33-L2-P-R1	Reprocessed Pressure Profile	RPPGRA
GRM-33-L2-S-R1	Reprocessed Surface Pressure	RSPGRA
GRM-33-L2-C-R1	Reprocessed Tropopause Height	RCHGRA
GRM-33-L3-B-R1	Reprocessed Bending Angle Grid	RBGGRA
GRM-33-L3-R-R1	Reprocessed Refractivity Grid	RRGGRA
GRM-33-L3-D-R1	Reprocessed Dry Temperature Grid	RDGGRA
GRM-33-L3-Y-R1	Reprocessed Dry Pressure Grid	RYGGRA

Product ID	Product Name	Product Acronym
GRM-33-L3-Z-R1	Reprocessed Dry Geopotential Height Grid	RZGGRA
GRM-33-L3-T-R1	Reprocessed Temperature Grid	RTGGRA
GRM-33-L3-H-R1	Reprocessed Specific Humidity Grid	RHGGRA
GRM-33-L3-C-R1	Reprocessed Tropopause Height Grid	RCGGRA

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

Product ID	Product Name	Product Acronym
GRM-30-R2	**Reprocessed COSMIC-1 climate data record (COSMIC-1 L1, L2, L3)**	**REPCO1**
GRM-30-L1-B-R2	Reprocessed Bending Angle	RBACO1
GRM-30-L2-R-R2	Reprocessed Refractivity Profile	RRPCO1
GRM-30-L2-D-R2	Reprocessed Dry Temperature Profile	RDPCO1
GRM-30-L2-T-R2	Reprocessed Temperature Profile	RTPCO1
GRM-30-L2-H-R2	Reprocessed Specific Humidity Profile	RHPCO1
GRM-30-L2-P-R2	Reprocessed Pressure Profile	RPPCO1
GRM-30-L2-S-R2	Reprocessed Surface Pressure	RSPCO1
GRM-30-L2-C-R2	Reprocessed Tropopause Height	RCHCO1
GRM-30-L2-L-R2	Reprocessed Planetary Boundary Layer Height	RLHCO1
GRM-30-L3-B-R2	Reprocessed Bending Angle Grid	RBGCO1
GRM-30-L3-R-R2	Reprocessed Refractivity Grid	RRGCO1
GRM-30-L3-D-R2	Reprocessed Dry Temperature Grid	RDGCO1
GRM-30-L3-Y-R2	Reprocessed Dry Pressure Grid	RYGCO1
GRM-30-L3-Z-R2	Reprocessed Dry Geopotential Height Grid	RZGCO1
GRM-30-L3-T-R2	Reprocessed Temperature Grid	RTGCO1
GRM-30-L3-H-R2	Reprocessed Specific Humidity Grid	RHGCO1
GRM-30-L3-C-R2	Reprocessed Tropopause Height Grid	RCGCO1
GRM-30-L3-L-R2	Reprocessed Planetary Boundary Layer Height Grid	RLGCO1
GRM-31-R2	**Reprocessed COSMIC-2 climate data record (COSMIC-2 L1, L2, L3)**	**REPCO2**
GRM-31-L1-B-R2	Reprocessed Bending Angle	RBACO2
GRM-31-L2-R-R2	Reprocessed Refractivity Profile	RRPCO2
GRM-31-L2-D-R2	Reprocessed Dry Temperature Profile	RDPCO2
GRM-31-L2-T-R2	Reprocessed Temperature Profile	RTPCO2
GRM-31-L2-H-R2	Reprocessed Specific Humidity Profile	RHPCO2
GRM-31-L2-P-R2	Reprocessed Pressure Profile	RPPCO2
GRM-31-L2-S-R2	Reprocessed Surface Pressure	RSPCO2
GRM-31-L2-C-R2	Reprocessed Tropopause Height	RCHCO2
GRM-31-L2-L-R2	Reprocessed Planetary Boundary Layer Height	RLHCO2
GRM-31-L3-B-R2	Reprocessed Bending Angle Grid	RBGCO2
GRM-31-L3-R-R2	Reprocessed Refractivity Grid	RRGCO2
GRM-31-L3-D-R2	Reprocessed Dry Temperature Grid	RDGCO2
GRM-31-L3-Y-R2	Reprocessed Dry Pressure Grid	RYGCO2
GRM-31-L3-Z-R2	Reprocessed Dry Geopotential Height Grid	RZGCO2
GRM-31-L3-T-R2	Reprocessed Temperature Grid	RTGCO2
GRM-31-L3-H-R2	Reprocessed Specific Humidity Grid	RHGCO2
GRM-31-L3-C-R2	Reprocessed Tropopause Height Grid	RCGCO2
GRM-31-L3-L-R2	Reprocessed Planetary Boundary Layer Height Grid	RLGCO2
GRM-32-R2	**Reprocessed CHAMP climate data record**	**REPCHA**

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

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

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

A4. Product Requirements Tables

(On the following pages)

GRM-01	**NRT Refractivity Profile**	**NRPMEA**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	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%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-02	**NRT Temperature Profile**	**NTPMEA**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-03	NRT Specific Humidity Profile	NHPMEA	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-A/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF 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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-04	**NRT Pressure Profile**	**NPPMEA**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-05	**NRT Surface Pressure**	**NSPMEA**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-08	**Offline Bending Angle**	**OBAMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	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 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-09	**Offline Refractivity Profile**	**ORPMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-10	**Offline Temperature Profile**	**OTPMEA**	**PRD_v3.4**

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-A/GRAS
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-11	**Offline Specific Humidity Profile**	**OHPMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-12	**Offline Pressure Profile**	**OPPMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	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 *	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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-13	**Offline Surface Pressure**	**OSPMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 30 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-16	Radio Occultation Processing Package	ROPP	PRD_v3.4

Type	Software Product
Applications and Users	NWP, RO data suppliers, scientific users
Characteristics and Methods	Routines for handling RO data (input/output, pre-processing, forward modelling, corrections, assimilation)
Operational Satellite Input Data	Metop-A/GRAS Metop-SG COSMIC COSMIC-2 CHAMP GPS/MET GRACE TerraSAR-X TanDEM-X Oceansat-2/ROSA Megha-Tropiques PAZ GNOS
Other Operational Input Data	N/A

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-16_v7	**Radio Occultation Processing Package**	**ROPP_v7**	**PRD_v3.4**
Type	Software Product		
Applications and Users	NWP, RO data suppliers, scientific users		
Characteristics and Methods	See GRM-16		
Operational Satellite Input Data	See GRM-16		
Other Operational Input Data	N/A		

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-16_v8	**Radio Occultation Processing Package**	**ROPP_v8**	**PRD_v3.4**
Type	Software Product		
Applications and Users	NWP, RO data suppliers, scientific users		
Characteristics and Methods	See GRM-16		
Operational Satellite Input Data	See GRM-16		
Other Operational Input Data	N/A		

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-16_v9	**Radio Occultation Processing Package**	**ROPP_v9**	**PRD_v3.4**
Type	Software Product		
Applications and Users	NWP, RO data suppliers, scientific users		
Characteristics and Methods	See GRM-16		
Operational Satellite Input Data	See GRM-16		
Other Operational Input Data	N/A		

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-16_v10	**Radio Occultation Processing Package**	**ROPP_v10**	**PRD_v3.4**
Type	Software Product		
Applications and Users	NWP, RO data suppliers, scientific users		
Characteristics and Methods	See GRM-16		
Operational Satellite Input Data	See GRM-16		
Other Operational Input Data	N/A		

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-16_v11	**Radio Occultation Processing Package**	**ROPP_v11**	**PRD_v3.4**
Type	Software Product		
Applications and Users	NWP, RO data suppliers, scientific users		
Characteristics and Methods	See GRM-16		
Operational Satellite Input Data	See GRM-16		
Other Operational Input Data	N/A		

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A	N/A	N/A

GRM-17	**Offline Bending Angle Grid**	**OBGCO1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.4 % or 0.8 murad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	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	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-18	**Offline Refractivity Grid**	**ORGCO1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.16 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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 greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-19	**Offline Temperature Grid**	**OTGCO1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling 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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-20	**Offline Specific Humidity Grid**	**OHGCO1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %	8 – 12 km: 3.0 % 0 – 8 km: 3.0 %	8 – 12 km: 1.5 % 0 – 8 km: 1.5 %
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-21	**Climate Dry Geopotential Height**		**OZGCO1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		COSMIC Post-processed data		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
Dissemination				
Format	Means	Timeliness		
netCDF	Web	30 - 180 d		
Accuracy				
Threshold	Target	Optimal		
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –	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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-22	**Offline Dry Temperature Grid**		**ODGCO1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		COSMIC Post-processed data		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-23	Offline Dry Pressure Grid	OYGCO1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.16 – 0.80 % 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-24	**Tropopause Height**		**TPH**	**PRD_v3.4**
Type		NRT Product Offline Product Reprocessed Product		
Applications and Users		NWP, Climate and atmosphere researchers		
Characteristics and Methods		One scalar value based on the dry temperature lapse rate		
Operational Satellite Input Data		All ROM SAF RO products		
Other Operational Input Data		ECMWF fields		
Dissemination				
Format		Means	Timeliness	
netCDF		Web	NRT: 80 min - 3 h Offline: 5 - 30 d	
Accuracy				
Threshold		Target	Optimal	
2 km		1 km	0.5 km	
Notes				
Verification/Validation Methods		Standard deviation of (TPH product ERA Interim analysis)		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	RO resolution	Scalar	RO resolution	

GRM-26	**Planetary Boundary Layer Height**	**PBLH**	**PRD_v3.4**
Type	NRT Product Offline Product Reprocessed Product		
Applications and Users	NWP, Climate and atmosphere researchers		
Characteristics and Methods	TBD		
Operational Satellite Input Data	All ROM SAF RO products		
Other Operational Input Data	ECMWF fields		

Dissemination		
Format	Means	Timeliness
netCDF	Web	NRT: 80 min - 3 h Offline: 5 - 30 d

Accuracy		
Threshold	Target	Optimal
TBD	TBD	TBD
Notes		
Verification/Validation Methods	TBD	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	Scalar	RO resolution

GRM-28-L3-B-R1 **GRM-28-L3-R-R1** **GRM-28-L3-D-R1** **GRM-28-L3-Y-R1** **GRM-28-L3-Z-R1** **GRM-28-L3-T-R1** **GRM-28-L3-H-R1** **GRM-28-L3-C-R1**	**Reprocessed bending angle grid** **Reprocessed refractivity grid** **Reprocessed dry temperature grid** **Reprocessed dry pressure grid** **Reprocessed dry geopotential height grid** **Reprocessed temperature grid** **Reprocessed specific humidity grid** **Reprocessed tropopause height grid**	**RBGMUL** **RRGMUL** **RDGMUL** **RYGMUL** **RZGMUL** **RTGMUL** **RHGMUL** **RCGMUL**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
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 (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	n/a
Accuracy		
Threshold	Target	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 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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: –	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: –
Dry pressure		
25 – 50 km: 0.16 – 0.80 % 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: –
Dry geopotential height		
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –	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: –

Temperature		
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
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: 1.5 % 0 – 8 km: 1.5 %
Tropopause Height		
0.2 km	0.1 km	0.05 km

Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate. *) whichever is greater
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim. Resampling statistics: inter-comparison of RO data subsets.

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
global	5 deg latitude	200 m	1 month

GRM-29-L1-B-R1	Reprocessed bending angle	RBAMET	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics 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 Input Data	ECMWF ERA Interim fields

Dissemination

Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy

Threshold	Target	Optimal
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	35 – 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 μrad;
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts) Comparison to EUMETSAT reprocessed bending angle

Coverage, Resolution

Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
Global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-29-L2-R-R1 **GRM-29-L2-D-R1**	**Reprocessed refractivity profile** **Reprocessed dry temperature profile**	**RRPMET** **RDPMET**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics 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 Input Data	ECMWF ERA Interim fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	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%	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 profile		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-29-L2-T-R1 **GRM-29-L2-H-R1** **GRM-29-L2-P-R1** **GRM-29-L2-S-R1**	**Reprocessed temperature profile** **Reprocessed specific humidity profile** **Reprocessed pressure profile** **Reprocessed surface pressure**	**RTPMET** **RHPMET** **RPPMET** **RSPMET**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	1D-Var algorithm on model levels, ERA Interim forecast as background
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 Input 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 profile		
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: 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate *) Whichever is greater **) Whichever is greatest of (a) and (b) but not greater than (c);
Verification/Validation Methods	Standard deviation of (1D-Var solution – ERA Interim analysis)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	model levels	RO resolution

GRM-29-L2-C-R1	Reprocessed tropopause height	RCHMET	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Dry temperature lapse rate
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 Input Data	ECMWF ERA Interim fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy		
Threshold	Target	Optimal
2 km	1 km	0.5 km

Notes	
Verification/Validation Methods	Standard deviation of (Product - ERA Interim analysis)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	scalar	RO resolution

GRM-29-L3-B-R1 **GRM-29-L3-R-R1** **GRM-29-L3-D-R1** **GRM-29-L3-Y-R1** **GRM-29-L3-Z-R1** **GRM-29-L3-T-R1** **GRM-29-L3-H-R1** **GRM-29-L3-C-R1**	**Reprocessed bending angle grid** **Reprocessed refractivity grid** **Reprocessed dry temperature grid** **Reprocessed dry pressure grid** **Reprocessed dry geopotential height grid** **Reprocessed temperature grid** **Reprocessed specific humidity grid** **Reprocessed tropopause height grid**	**RBGMET** **RRGMET** **RDGMET** **RYGMET** **RZGMET** **RTGMET** **RHGMET** **RCGMET**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
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 Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	n/a
Accuracy		
Threshold	Target	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: –	25 – 50 km: 0.3 – 3 K 8 – 25 km: 0.3 K 0 – 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 –	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: –
Dry geopotential height		
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: –
Temperature		
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

Specific humidity		
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 %
Tropopause height		
0.4 km	0.2 km	0.1 km

Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate. *) whichever is greater
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim. Resampling statistics: inter-comparison of RO data subsets.

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
global	5 deg latitude	200 m	1 month

GRM-30-L1-B-R1	Reprocessed bending angle	RBACO1	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics retrieval
Operational Satellite Input Data	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 ERA Interim fields

Dissemination

Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy

Threshold	Target	Optimal
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	35 – 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 1 and 2.5 μrad;
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts) Comparison to EUMETSAT reprocessed bending angle

Coverage, Resolution

Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
Global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-30-L2-R-R1 **GRM-30-L2-D-R1**	**Reprocessed refractivity profile** **Reprocessed dry temperature profile**	**RRPCO1** **RDPCO1**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics retrieval
Operational Satellite Input Data	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 ERA Interim fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	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%	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 Profile		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-30-L2-T-R1 **GRM-30-L2-H-R1** **GRM-30-L2-P-R1** **GRM-30-L2-S-R1**	**Reprocessed temperature profile** **Reprocessed specific humidity profile** **Reprocessed pressure profile** **Reprocessed surface pressure**	**RTPCO1** **RHPCO1** **RPPCO1** **RSPCO1**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	1D-Var algorithm on model levels, ERA Interim forecast as background
Operational Satellite Input Data	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 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 Profile		
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: 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate *) Whichever is greater **) Whichever is greatest of (a) and (b) but not greater than (c);
Verification/Validation Methods	Standard deviation of (1D-Var solution – ERA Interim analysis)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	model levels	RO resolution

GRM-30-L2-C-R1	Reprocessed tropopause height	RCHCO1	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Dry temperature lapse rate
Operational Satellite Input Data	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 ERA Interim fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy		
Threshold	Target	Optimal
2 km	1 km	0.5 km

Notes	
Verification/Validation Methods	Standard deviation of (Product - ERA Interim Analysis)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	scalar	RO resolution

GRM-30-L3-B-R1 **GRM-30-L3-R-R1** **GRM-30-L3-D-R1** **GRM-30-L3-Y-R1** **GRM-30-L3-Z-R1** **GRM-30-L3-T-R1** **GRM-30-L3-H-R1** **GRM-30-L3-C-R1**	**Reprocessed bending angle grid** **Reprocessed refractivity grid** **Reprocessed dry temperature grid** **Reprocessed dry pressure grid** **Reprocessed dry geopotential height grid** **Reprocessed temperature grid** **Reprocessed specific humidity grid** **Reprocessed tropopause height grid**	**RBGCO1** **RRGCO1** **RDGCO1** **RYGCO1** **RZGCO1** **RTGCO1** **RHGCO1** **RCGCO1**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	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 ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	n/a
Accuracy		
Threshold	Target	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 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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: –	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: –
Dry pressure		
25 – 50 km: 0.16 – 0.80 % 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: –
Dry geopotential height		
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –	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: –
Temperature		
25 – 50 km: 0.4 – 4 K 8 – 25 km: 0.4 K	25 – 50 km: 0.2 – 2 K 8 – 25 km: 0.2 K	25 – 50 km: 0.10 – 1.0 K 8 – 25 km: 0.10 K

0 – 8 km: 2.0 – 0.4 K	0 – 8 km: 1.0 – 0.2 K	0 – 8 km: 0.50 – 0.10 K
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: 1.5 % 0 – 8 km: 1.5 %
Tropopause Height		
0.2 km	0.1 km	0.05 km

Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate. *) whichever is greater
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim. Resampling statistics: inter-comparison of RO data subsets.

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
global	5 deg latitude	200 m	1 month

GRM-32-L1-B-R1	Reprocessed bending angle	RBACHA	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics retrieval
Operational Satellite Input Data	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 Input Data	ECMWF ERA Interim fields

Dissemination

Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy

Threshold	Target	Optimal
35 – 60 km: 4 μrad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	35 – 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate; BA noise above 60 km is expected to be about 4 μrad; Product may have reduced information content below 8–10 km due to limitations in the CHAMP closed loop data;
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts) Comparison to EUMETSAT reprocessed bending angle

Coverage, Resolution

Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
Global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-32-L2-R-R1 **GRM-32-L2-D-R1**	**Reprocessed refractivity profile** **Reprocessed dry temperature profile**	**RRPCHA** **RDPCHA**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Hi-res wave optics retrieval
Operational Satellite Input Data	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 Input Data	ECMWF ERA Interim fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	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%	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 Profile		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate; Product may have reduced information content below 8–10 km due to limitations in the CHAMP closed loop data;
Verification/Validation Methods	Standard deviation of (Product – ERA Interim forecasts)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	Hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-32-L2-T-R1 **GRM-32-L2-H-R1** **GRM-32-L2-P-R1** **GRM-32-L2-S-R1**	**Reprocessed temperature** **Reprocessed specific humidity** **Reprocessed pressure** **Reprocessed surface pressure**	**RTPCHA** **RHPCHA** **RPPCHA** **RSPCHA**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	1D-Var algorithm on model levels, ERA Interim forecast as background
Operational Satellite Input Data	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 Input 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 Profile		
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: 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate; Product may have reduced information content below 8–10 km due to limitations in the CHAMP closed loop data; *) Whichever is greater **) Whichever is greatest of (a) and (b) but not greater than (c);
Verification/Validation Methods	Standard deviation of (1D-Var solution – ERA Interim analysis)

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	model levels	RO resolution

GRM-32-L2-C-R1	Reprocessed tropopause height	RCHCHA	PRD_v3.4

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Dry temperature lapse rate
Operational Satellite Input Data	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 Input Data	ECMWF ERA Interim fields

Dissemination

Format	Means	Timeliness
netCDF BUFR	Web	n/a

Accuracy

Threshold	Target	Optimal
2 km	1 km	0.5 km

Notes	
Verification/Validation Methods	Standard deviation of (Product - ERA Interim Analysis)

Coverage, Resolution

Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
global	RO resolution	scalar	RO resolution

GRM-32-L3-B-R1 **GRM-32-L3-R-R1** **GRM-32-L3-D-R1** **GRM-32-L3-Y-R1** **GRM-32-L3-Z-R1** **GRM-32-L3-T-R1** **GRM-32-L3-H-R1** **GRM-32-L3-C-R1**	**Reprocessed bending angle grid** **Reprocessed refractivity grid** **Reprocessed dry temperature grid** **Reprocessed dry pressure grid** **Reprocessed dry geopotential height grid** **Reprocessed temperature grid** **Reprocessed humidity grid** **Reprocessed tropopause height grid**	**RBGCHA** **RRGCHA** **RDGCHA** **RYGCHA** **RZGCHA** **RTGCHA** **RHGCHA** **RCGCHA**	**PRD_v3.4**

Type	Reprocessed Data Set
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	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 Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	n/a
Accuracy		
Threshold	Target	Optimal
Bending angle		
25 – 40 km: 0.8 % or 1.6 μrad*) 8 – 25 km: 0.8 % 0 – 8 km: –	25 – 40 km: 0.4 % or 0.8 μrad*) 8 – 25 km: 0.4 % 0 – 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: –	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: –	25 – 40 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 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 –	25 – 40 km: 0.2 – 1.0 % 8 – 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: –	25 – 40 km: 8 – 80 m 8 – 25 km: 8 m 0 – 8 km: –	25 – 40 km: 4– 40 m 8 – 25 km: 4 m 0 – 8 km: –
Temperature		
25 – 40 km: 0.8 – 8 K 8 – 25 km: 0.8 K 0 – 8 km: –	25 – 40 km: 0.4 – 4 K 8 – 25 km: 0.4 K 0 – 8 km: –	25 – 40 km: 0.20 – 2.0 K 8 – 25 km: 0.20 K 0 – 8 km: –

Specific humidity		
8 – 12 km: 12 % 0 – 8 km: –	8 – 12 km: 6.0 % 0 – 8 km: –	8 – 12 km: 3.0 % 0 – 8 km: –
Tropopause Height		
0.6 km	0.3 km	0.15 km

Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate; Product may have reduced information content below 8–10 km due to limitations in the CHAMP closed loop data; *) whichever is greater
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim. Resampling statistics: inter-comparison of RO data subsets.

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
global	5 deg latitude	200 m	1 month

GRM-28-R2	**Reprocessed Multi-Mission climate data record (Metop, COSMIC, CHAMP, GRACE L3)**	**REPMUL**	**PRD_v3.4**

Type	Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	(1)
Operational Satellite Input Data	(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 Data	(1)

Dissemination		
Format	Means	Timeliness
netCDF	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)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-29-R2	**Reprocessed Metop climate data record (Metop L1, L2, L3)**	**REPMET**	**PRD_v3.4**

Type	Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	(1)
Operational Satellite Input Data	(a) Reprocessed level 1A Metop from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; Metop: 10/2006 – 12/2018
Other Operational Input Data	(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)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-30-R2	**Reprocessed COSMIC-1 climate data record (COSMIC-1 L1, L2, L3)**	**REPCO1**	**PRD_v3.4**

Type	Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	(1)
Operational Satellite 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 Operational Input Data	(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)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-31-R2	**Reprocessed COSMIC-2 climate data record (COSMIC-2 L1, L2, L3)**	**REPCO2**	**PRD_v3.4**

Type	Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	(1)
Operational Satellite Input Data	(a) Reprocessed level 1A COSMIC-2 from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; COSMIC-2: TBD
Other Operational Input Data	(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)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-32-R2	**Reprocessed CHAMP climate data record (CHAMP L1, L2, L3)**	**REPCHA**	**PRD_v3.4**

Type	Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	(1)
Operational Satellite Input Data	(a) Reprocessed level 1A CHAMP from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; CHAMP: 09/2001 – 10/2008
Other Operational Input Data	(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)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-33-R2	**Reprocessed GRACE climate data record (GRACE L1, L2, L3)**	**REPGHA**	**PRD_v3.4**
Type	Climate Data Record		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	(1)		
Operational Satellite Input Data	(a) Reprocessed level 1A GRACE from EUMETSAT Secretariat (CSDP: WP230, WP230C3S); (b) Reprocessed Level 1A data from CDAAC; GRACE: 03/2007 – 12/2018		
Other Operational Input Data	(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)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
(1)	(1)	(1)	(1)

GRM-40	**NRT Refractivity Profile**	**NRPMEB**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	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%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-41	**NRT Temperature Profile**	**NTPMEB**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-42	NRT Specific Humidity Profile	NHPMEB	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-B/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF 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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-43	**NRT Pressure Profile**	**NPPMEB**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-44	**NRT Surface Pressure**	**NSPMEB**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-46	**Offline Bending Angle**	**OBAMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-47	**Offline Refractivity Profile**	**ORPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-48	**Offline Temperature Profile**	**OTPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-49	**Offline Specific Humidity Profile**	**OHPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-50	**Offline Pressure Profile**	**OPPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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 *	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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-51	**Offline Surface Pressure**	**OSPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 30 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-53	**Offline Bending Angle Grid**	**OBGMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.6 % or 1.2 murad *) 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 %
Notes	* whichever is greater An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-54	**Offline Refractivity Grid**	**ORGMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
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 %
Notes	* whichever is greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-55	**Offline Temperature Grid**		**OTGMEB**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-B/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
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		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 interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-56	**Offline Specific Humidity Grid**	**OHGMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-57	**Climate Dry Geopotential Height**		**OZGMEB**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-B/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 m 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 interval means a linearly changing quantity between the two values over the given vertical coordinate			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-58	**Offline Dry Temperature Grid**		**ODGMEB**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-B/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
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 K 8 – 25 km: 0.3 K 0 – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –		
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-59	Offline Dry Pressure Grid	OYGMEB	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 – 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-60	NRT Refractivity Profile	NRPMEC	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	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%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-61	**NRT Temperature Profile**	**NTPMEC**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-62	NRT Specific Humidity Profile	NHPMEC	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF 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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-63	**NRT Pressure Profile**	**NPPMEC**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-64	**NRT Surface Pressure**	**NSPMEC**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-66	Offline Bending Angle	OBAMEC	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	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 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-67	**Offline Refractivity Profile**	**ORPMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-68	**Offline Temperature Profile**	**OTPMEC**	**PRD_v3.4**

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-69	**Offline Specific Humidity Profile**	**OHPMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-70	**Offline Pressure Profile**	**OPPMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	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 *	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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	model levels (with interpolation); interpolated to 247 fixed levels	GRAS resolution

GRM-71	**Offline Surface Pressure**	**OSPMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 30 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	Scalar at surface	GRAS resolution

GRM-73	**Offline Bending Angle Grid**	**OBGMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.6 % or 1.2 murad *) 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 %
Notes	* whichever is greater An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-74	**Offline Refractivity Grid**		**ORGMEC**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-C/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
Dissemination				
Format		Means	Timeliness	
netCDF		Web	30 d	
Accuracy				
Threshold		Target	Optimal	
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 %	
Notes		* whichever is greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-75	**Offline Temperature Grid**		**OTGMEC**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-C/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
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		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 interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-76	**Offline Specific Humidity Grid**	**OHGMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-77	Climate Dry Geopotential Height			OZGMEC	PRD_v3.4
Type		Offline Product			
Applications and Users		Climate and atmosphere researchers			
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids			
Operational Satellite Input Data		Metop-C/GRAS			
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 m 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 interval means a linearly changing quantity between the two values over the given vertical coordinate			
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution					
Spatial Coverage	Horizontal Resolution		Vertical Resolution		Temporal Resolution
Global	5 deg latitude		200 m		1 month

GRM-78	**Offline Dry Temperature Grid**	**ODGMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 K 8 – 25 km: 0.3 K 0 – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-79	Offline Dry Pressure Grid	OYGMEC	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

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 – 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	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** **RDGMET** **RYGMET** **RCGMET**	**PRD_v3.4**

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Offline Level 1A Metop (Multimission Metop)
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	n/a
Accuracy		
Threshold	Target	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 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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: –	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: –
Dry pressure		
25 – 50 km: 0.16 – 0.80 % 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: –
Dry geopotential height		
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –	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: –
Temperature		
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

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: 1.5 % 0 – 8 km: 1.5 %
Tropopause Height		
0.2 km	0.1 km	0.05 km

Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate. *) whichever is greater
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim. Resampling statistics: inter-comparison of RO data subsets.

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
global	5 deg latitude	200 m	1 month

GRM-92	**Ground Based GNSS Package**	**GBGP**	**PRD_v3.4**
Type	Software Product		
Applications and Users	Analysis Centres and NWP		
Characteristics and Methods	Routines for handling ground-based GNSS (ZTD, IWV)		
Operational Satellite Input Data	Output of ground-based GNSS processing		
Other Operational Input Data			

Dissemination		
Format	Means	Timeliness
tarballs	Web	N/A

Accuracy		
Threshold	Target	Optimal
N/A	N/A	N/A
Notes		
Verification/Validation Methods	Test Folder	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
N/A	N/A		

GRM-93	**Offline Bending Angle Grid**	**OBGMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.6 % or 1.2 murad *) 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 %
Notes	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-94	**Offline Refractivity Grid**	**ORGMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
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 %
Notes	* whichever is greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-95	**Offline Temperature Grid**		**OTGMEA**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-A/GRAS		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
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	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 interval means a linearly changing quantity between the two values over the given vertical coordinate			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-96	**Offline Specific Humidity Grid**	**OHGMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-97	Climate Dry Geopotential Height	OZGMEA	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling 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 m 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-98	**Offline Dry Temperature Grid**	**ODGMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 K 8 – 25 km: 0.3 K 0 – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-99	Offline Dry Pressure Grid	OYGMEA	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-A/GRAS
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

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 – 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-100	NRT Dry Temperature Profile	NDPMEA	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-A/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-101	**Offline Dry Temperature Profile**	**ODPMEA**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-102	NRT Dry Temperature Profile	NDPMEB	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-B/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-103	**Offline Dry Temperature Profile**	**ODPMEB**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-B/GRAS		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-104	NRT Dry Temperature Profile	NDPMEC	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	3 h

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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-105	**Offline Dry Temperature Profile**	**ODPMEC**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-C/GRAS		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	GRAS resolution

GRM-107	Offline Bending Angle Grid	OBGCO2	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC-2 Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.4 % or 0.8 murad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	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	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-108	**Offline Refractivity Grid**	**ORGCO2**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	COSMIC-2 Post-processed data		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.16 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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 greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-109	**Offline Temperature Grid**		**OTGCO2**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		COSMIC-2 Post-processed data		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-110	Offline Specific Humidity Grid	OHGCO2	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	COSMIC -2Post-processed data
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination

Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy

Threshold	Target	Optimal
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %	8 – 12 km: 3.0 % 0 – 8 km: 3.0 %	8 – 12 km: 1.5 % 0 – 8 km: 1.5 %
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-111	**Climate Dry Geopotential Height**		**OZGCO2**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		COSMIC-2 Post-processed data		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
Dissemination				
Format		Means	Timeliness	
netCDF		Web	30 - 180 d	
Accuracy				
Threshold		Target	Optimal	
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –		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		An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-112	**Offline Dry Temperature Grid**		**ODGCO2**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		COSMIC-2 Post-processed data		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-113	Offline Dry Pressure Grid	OYGCO2	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	COSMIC-2 Post-processed data
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination

Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy

Threshold	Target	Optimal
25 – 50 km: 0.16 – 0.80 % 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-116	**Offline Bending Angle**	**OBAJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 d

Accuracy		
Threshold	Target	Optimal
35 – 60 km: 4 murad 8 – 35 km: 4% 2 – 8 km: 20% - 4%	35 – 60 km: 2 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-117	**Offline Refractivity Profile**	**ORPJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-118	**Offline Temperature Profile**	**OTPJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-119	Offline Specific Humidity Profile	OHPJA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Jason-CS A1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 d

Accuracy

Threshold	Target	Optimal
1.8 g/kg 30% *	0.6 g/kg 10% *	0.3 g/kg 10% *
Notes	* whichever is greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-120	**Offline Pressure Profile**	**OPPJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 d

Accuracy		
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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-121	**Offline Surface Pressure**	**OSPJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	Scalar at surface	RO resolution

GRM-122	**Offline Dry Temperature Profile**	**ODPJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 60 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		
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-123	**Offline Bending Angle Grid**	**OBGJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.4 % or 0.8 murad*) 8 – 25 km: 0.4 % 0 – 8 km: 4 – 0.4 %	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	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-124	**Offline Refractivity Grid**	**ORGJA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.16 % or 0.008 N-units*) 8 – 25 km: 0.16 % 0 – 8 km: 1.6 – 0.16 %	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 greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-125	**Offline Temperature Grid**	**OTGJA!**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Jason-CS A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling 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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-126	Offline Specific Humidity Grid	OHGJA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Jason-CS A1
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination

Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy

Threshold	Target	Optimal
8 – 12 km: 6.0 % 0 – 8 km: 6.0 %	8 – 12 km: 3.0 % 0 – 8 km: 3.0 %	8 – 12 km: 1.5 % 0 – 8 km: 1.5 %
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-127	**Climate Dry Geopotential Height**		**OZGJA1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Jason-CS A1		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
Dissemination				
Format		Means	Timeliness	
netCDF		Web	30 - 180 d	
Accuracy				
Threshold		Target	Optimal	
25 – 50 km: 8 – 80 m 8 – 25 km: 8 m 0 - 8 km: –		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		An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-128	**Offline Dry Temperature Grid**		**ODGJA1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Jason-CS A1		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-129	Offline Dry Pressure Grid	OYGJA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Jason-CS A1
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination

Format	Means	Timeliness
netCDF	Web	30 - 180 d

Accuracy

Threshold	Target	Optimal
25 – 50 km: 0.16 – 0.80 % 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	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-130	NRT Refractivity Profile	NRPMA1	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

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%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-131	**NRT Temperature Profile**	**NTPMA1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-132	**NRT Specific Humidity Profile**	**NHPMA1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

Accuracy		
Threshold	Target	Optimal
1.8 g/kg 30% *	0.6 g/kg 10% *	0.3 g/kg 10% *
Notes	* whichever is greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-133	NRT Pressure Profile	NPPMA1	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

Accuracy

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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-134	**NRT Surface Pressure**	**NSPMA1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

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 of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	Scalar at surface	RO resolution

GRM-135	NRT Dry Temperature Profile	NDPMA1	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS 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	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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-136	**Offline Bending Angle**	**OBAMA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	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 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-137	**Offline Refractivity Profile**	**ORPMA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-138	**Offline Temperature Profile**	**OTPMA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-139	Offline Specific Humidity Profile	OHPMA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-140	Offline Pressure Profile	OPPMA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	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 *	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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-141	**Offline Surface Pressure**	**OSPMA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 30 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	Scalar at surface	RO resolution

GRM-142	Offline Dry Temperature Profile	ODPMA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-143	Offline Bending Angle Grid	OBGMA1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.6 % or 1.2 murad *) 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 %
Notes	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-144	**Offline Refractivity Grid**	**ORGMA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
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 %
Notes	* whichever is greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-145	Offline Temperature Grid	OTGMA1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-146	Offline Specific Humidity Grid	OHGMA1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-147	Climate Dry Geopotential Height	OZGMA1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling 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 m 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-148	Offline Dry Temperature Grid	ODGMA1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-SG A1
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

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 K 8 – 25 km: 0.3 K 0 – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-149	Offline Dry Pressure Grid	OYGMA1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG A1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 – 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-150	**NRT Refractivity Profile**	**NRPMB1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

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%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-151	**NRT Temperature Profile**	**NTPMB1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-152	**NRT Specific Humidity Profile**	**NHPMB1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

Accuracy		
Threshold	Target	Optimal
1.8 g/kg 30% *	0.6 g/kg 10% *	0.3 g/kg 10% *
Notes	* whichever is greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-153	NRT Pressure Profile	NPPMB1	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG B1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS EUMETCast Web	Global: Th: 150 min (90%) B: 80 min (95%) Regional: TBD

Accuracy

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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-154	**NRT Surface Pressure**	**NSPMB1**	**PRD_v3.4**
Type	NRT Product		
Applications and Users	NWP		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

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 of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	Scalar at surface	RO resolution

GRM-155	NRT Dry Temperature Profile	NDPMB1	PRD_v3.4

Type	NRT Product
Applications and Users	NWP
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG B1
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN

Dissemination

Format	Means	Timeliness
BUFR/netCDF	GTS 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	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 interval means a linearly changing quantity between the two values over the given vertical coordinate
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global, Regional (TBD)	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-156	**Offline Bending Angle**	**OBAMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	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 murad 8 – 35 km: 2% 2 – 8 km: 10% - 2%	35 – 60 km: 1 murad 8 – 35 km: 1% 2 – 8 km: 5% - 1%
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate BA noise above 60 km is expected to be between 0.5 and 1.5 (rad;	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-157	**Offline Refractivity Profile**	**ORPMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	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: 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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-158	**Offline Temperature Profile**	**OTPMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-159	Offline Specific Humidity Profile	OHPMB1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels
Operational Satellite Input Data	Metop-SG B1
Other Operational Input Data	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 greater; The interval 0 – 12 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-160	**Offline Pressure Profile**	**OPPMBA1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	model levels (with interpolation); interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	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 *	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 greatest of (a) and (b) but not greater than (c); The interval 0 – 50 km is considered	
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	model levels (with interpolation); interpolated to 247 fixed levels	RO resolution

GRM-161	**Offline Surface Pressure**	**OSPMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Scalar at surface		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	5 - 30 d

Accuracy		
Threshold	Target	Optimal
2.4 hPa	0.8 hPa	0.7 hPa
Notes		
Verification/Validation Methods	Standard deviation of (1D-Var solution – ECMWF analysis)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	Scalar at surface	RO resolution

GRM-162	**Offline Dry Temperature Profile**	**ODPMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	hi-res wave optics sampling; interpolated to 247 fixed levels		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	GPS orbits (EUM) Metop orbits (EUM) ECMWF FC, AN		

Dissemination		
Format	Means	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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Standard deviation of (Product – ECMWF forecasts)	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	RO resolution	hi-res wave optics sampling; interpolated to 247 fixed levels	RO resolution

GRM-163	Offline Bending Angle Grid	OBGMB1	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
25 – 50 km: 0.6 % or 1.2 murad *) 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 %
Notes	* whichever is greater; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-164	**Offline Refractivity Grid**	**ORGMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
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 %
Notes	* whichever is greater ; An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-165	**Offline Temperature Grid**		**OTGMB1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-SG B1		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling error estimation)		
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		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 interval means a linearly changing quantity between the two values over the given vertical coordinate		
Verification/Validation Methods		Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-166	Offline Specific Humidity Grid	OHGMB1	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-SG B1
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination

Format	Means	Timeliness
netCDF	Web	30 d

Accuracy

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 interval means a linearly changing quantity between the two values over the given vertical coordinate	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution

Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-167	**Climate Dry Geopotential Height**		**OZGMB1**	**PRD_v3.4**
Type		Offline Product		
Applications and Users		Climate and atmosphere researchers		
Characteristics and Methods		Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data		Metop-SG B1		
Other Operational Input Data		ECMWF ERA Interim (validation, sampling 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 m 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 interval means a linearly changing quantity between the two values over the given vertical coordinate			
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.			
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	5 deg latitude	200 m	1 month	

GRM-168	**Offline Dry Temperature Grid**	**ODGMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 K 8 – 25 km: 0.3 K 0 – 8 km: –	25 – 50 km: 0.15 – 1.5 K 8 – 25 km: 0.15 K 0 – 8 km: –
Notes	An accuracy interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-169	**Offline Dry Pressure Grid**	**OYGMB1**	**PRD_v3.4**
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

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 – 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 interval means a linearly changing quantity between the two values over the given vertical coordinate;	
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude	200 m	1 month

GRM-170	**Electron Density Profile**		**EDPMA1**	**PRD_v3.4**
Type		TBD		
Applications and Users		Space weather and ionosphere researchers		
Characteristics and Methods				
Operational Satellite Input Data		Metop-SG A1		
Other Operational Input Data				
Dissemination				
Format		Means	Timeliness	
TBD		TBD	TBD	
Accuracy				
Threshold		Target	Optimal	
TBD		TBD	TBD	
Notes				
Verification/Validation Methods		TBD		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	GRAS-SG resoltuion			

GRM-171	**Electron Density Profile**	**EDPMB1**	**PRD_v3.4**
Type	TBD		
Applications and Users	Space weather and ionosphere researchers		
Characteristics and Methods			
Operational Satellite Input Data	Metop-SG B1		
Other Operational Input Data			

Dissemination		
Format	Means	Timeliness
TBD	TBD	TBD

Accuracy		
Threshold	Target	Optimal
TBD	TBD	TBD
Notes		
Verification/Validation Methods	TBD	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	GRAS-SG resoltuion		

GRM-172	Scintillation Index		SINMA1	PRD_v3.4
Type		TBD		
Applications and Users		Space weather and ionosphere researchers		
Characteristics and Methods				
Operational Satellite Input Data		Metop-SG A1		
Other Operational Input Data				
Dissemination				
Format		Means	Timeliness	
TBD		TBD	TBD	
Accuracy				
Threshold		Target	Optimal	
TBD		TBD	TBD	
Notes				
Verification/Validation Methods		TBD		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	GRAS-SG resoltuion			

GRM-173	Scintillation Index		SINMB1	PRD_v3.4
Type		TBD		
Applications and Users		Space weather and ionosphere researchers		
Characteristics and Methods				
Operational Satellite Input Data		Metop-SG B1		
Other Operational Input Data				
Dissemination				
Format		Means	Timeliness	
TBD		TBD	TBD	
Accuracy				
Threshold		Target	Optimal	
TBD		TBD	TBD	
Notes				
Verification/Validation Methods		TBD		
Coverage, Resolution				
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution	
Global	GRAS-SG resoltuion			

GRM-191	Offline Tropopause Height Grid	OCGMEA	PRD_v3.4
Type	Offline Product		
Applications and Users	Climate and atmosphere researchers		
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids		
Operational Satellite Input Data	Metop-A/GRAS		
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)		

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
2 km	1 km	0.5 km
Notes		
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude		1 month

GRM-192	Offline Tropopause Height Grid	OCGMEB	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-B/GRAS
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
2 km	1 km	0.5 km
Notes		
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude		1 month

GRM-193	Offline Tropopause Height Grid	OCGMEC	PRD_v3.4

Type	Offline Product
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	Zonal monthly means on 200 m x 5 deg grids
Operational Satellite Input Data	Metop-C/GRAS
Other Operational Input Data	ECMWF ERA Interim (validation, sampling error estimation)

Dissemination		
Format	Means	Timeliness
netCDF	Web	30 d

Accuracy		
Threshold	Target	Optimal
2 km	1 km	0.5 km
Notes		
Verification/Validation Methods	Statistics of differences relative to ECMWF ERA Interim.Resampling statistics: inter-comparison of RO data subsets.	

Coverage, Resolution			
Spatial Coverage	Horizontal Resolution	Vertical Resolution	Temporal Resolution
Global	5 deg latitude		1 month

GRM-29-I1	**Metop Interim Climate Data Record (Data Levels L1B, L2, L3)**	**ICDRMET**	**PRD_v3.4**
GRM-29-L1-B-I1	**ICDR Bending Angle**	**IBAMET**	
GRM-29-L2-R-I1	**ICDR Refractivity Profile**	**IRPMET**	
GRM-29-L2-D-I1	**ICDR Dry Temperature Profile**	**IDPMET**	
GRM-29-L2-T-I1	**ICDR Temperature Profile**	**ITPMET**	
GRM-29-L2-H-I1	**ICDR Specific Humidity Profile**	**IHPMET**	
GRM-29-L2-P-I1	**ICDR Pressure Profile**	**IPPMET**	
GRM-29-L2-S-I1	**ICDR Surface Pressure**	**ISPMET**	
GRM-29-L2-C-I1	**ICDR Tropopause Height**	**ICHMET**	
GRM-29-L3-B-I1	**ICDR Bending Angle Grid**	**IBGMET**	
GRM-29-L3-R-I1	**ICDR Refractivity Grid**	**IRGMET**	
GRM-29-L3-D-I1	**ICDR Dry Temperature Grid**	**IDGMET**	
GRM-29-L3-Y-I1	**ICDR Dry Pressure Grid**	**IYGMET**	
GRM-29-L3-Z-I1	**ICDR Dry Geopotential Height Grid**	**IZGMET**	
GRM-29-L3-T-I1	**ICDR Temperature Grid**	**ITGMET**	
GRM-29-L3-H-I1	**ICDR Specific Humidity Grid**	**IHGMET**	
GRM-29-L3-C-I1	**ICDR Tropopause Height Grid**	**ICGMET**	

Type	Interim Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	1) Regularly extends in time CDR GRM-29-R1 using a system having optimum consistency with the system used to generate CDR GRM-29-R1; 2) 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 Input Data	Operational Level 1A/1B Metop files from EUMETSAT Secretariat
Other Operational Input Data	ECMWF ERA Interim fields and ERA5 fields

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	Two months

Accuracy		
Threshold	Target	Optimal
GRM-29-R1	GRM-29-R1	GRM-29-R1

Notes	
Verification/Validation Methods	Same methods as used for CDR GRM-29-R1

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
GRM-29-R1	GRM-29-R1	GRM-29-R1	GRM-29-R1

GRM-29-I2	**Metop Interim Climate Data Record (Data Levels L1B, L2, L3)**	**ICDRMET**	**PRD_v3.4**
GRM-29-L1-B-I2	**ICDR Bending Angle**	**IBAMET**	
GRM-29-L2-R-I2	**ICDR Refractivity Profile**	**IRPMET**	
GRM-29-L2-D-I2	**ICDR Dry Temperature Profile**	**IDPMET**	
GRM-29-L2-T-I2	**ICDR Temperature Profile**	**ITPMET**	
GRM-29-L2-H-I2	**ICDR Specific Humidity Profile**	**IHPMET**	
GRM-29-L2-P-I2	**ICDR Pressure Profile**	**IPPMET**	
GRM-29-L2-S-I2	**ICDR Surface Pressure**	**ISPMET**	
GRM-29-L2-C-I2	**ICDR Tropopause Height**	**ICHMET**	
GRM-29-L3-B-I2	**ICDR Bending Angle Grid**	**IBGMET**	
GRM-29-L3-R-I2	**ICDR Refractivity Grid**	**IRGMET**	
GRM-29-L3-D-I2	**ICDR Dry Temperature Grid**	**IDGMET**	
GRM-29-L3-Y-I2	**ICDR Dry Pressure Grid**	**IYGMET**	
GRM-29-L3-Z-I2	**ICDR Dry Geopotential Height Grid**	**IZGMET**	
GRM-29-L3-T-I2	**ICDR Temperature Grid**	**ITGMET**	
GRM-29-L3-H-I2	**ICDR Specific Humidity Grid**	**IHGMET**	
GRM-29-L3-C-I2	**ICDR Tropopause Height Grid**	**ICGMET**	

Type	Interim Climate Data Record
Applications and Users	Climate and atmosphere researchers
Characteristics and Methods	1) Regularly extends in time CDR GRM-29-R2 using a system having optimum consistency with the system used to generate CDR GRM-29-R2; 2) 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 Data	Operational Level 1A/1B Metop files from EUMETSAT Secretariat
Other Operational Input Data	ECMWF ERA5 fields and TBD

Dissemination		
Format	Means	Timeliness
netCDF BUFR	Web	Two months

Accuracy		
Threshold	Target	Optimal
GRM-29-R2	GRM-29-R2	GRM-29-R2

Notes	
Verification/Validation Methods	Same methods as used for CDR GRM-29-R2

Coverage, Resolution			
Spatial Coverage	Spatial Resolution	Vertical Resolution	Temporal resolution
GRM-29-R2	GRM-29-R2	GRM-29-R2	GRM-29-R2