TD 14 - EUMETSAT Advanced Retransmission Service Technical Description
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## Document Change Record

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| V3B             | 12/04/2010 |         | Addition of Moscow station to EARS-ATOVS  
Addition of FDES data to EARS-ATOVS  
Addition of Metop-A data to EARS-AVHRR  
Addition of Moscow station to EARS-AVHRR  
Introduce EOPortal registration                                                                 |
| V3C             | 12/05/2010 |         | Template Modifications                                                                                                                                      |
Addition of Muscat station to EARS-ATOVS.  
Addition of FDES data to EARS-AVHRR.  
Addition of Pass Prediction message information.  
Removal of NOAA-17 data from EARS-AVHRR.                                                                 |
| V3E             | 15/05/2012 |         | Addition of EARS-ASCAT to EUMETCast C-Band Africa.  
Addition of HRPT data to EARS-ASCAT.  
Addition of Saint-Denis and Muscat to EARS-ASCAT.  
Removal of ERS-SCAT service.  
Addition of EARS-IASI.  
Introduction of EARS-NWC, EARS-ATMS, EARS-CrIS and EARS-VIIRS.  
Update phone and fax numbers in 8.2.                                                                 |
| V4A             | 30/03/2016 |         | Addition of EARS-NWC, EARS-ATMS and EARS-CrIS  
Inclusion of Metop-B  
Removal of NOAA-17 after decommissioning  
Addition of RMDCN/GTS naming convention  
Addition of EARS-VIIRS service.  
Addition of EARS-VASS service.  
Removal of NOAA-16 after decommissioning.  
Service information upgraded, source: Regional Service Baseline Update [EUM/C/84/15/DOC/17]                                                                 |
| V4C             | 08/06/2017 |         | Removal of Ewa Beach station.  
Inclusion of Novosibirsk, Khabarovsk and Ford Island stations.  
Removal of N15 and level 1a products from EARS-ATOVS.  
WMO Filenames for bufr products (ECPD724).  
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1 INTRODUCTION

1.1 EUMETSAT Advanced Retransmission Service Overview

The aim of the EUMETSAT Advanced Retransmission Service (EARS) is to provide polar satellite data from the EUMETSAT Metop, the National Oceanic and Atmospheric Administration (NOAA), and the China Meteorological Administration (CMA) satellites with a timeliness suited to the needs of European operational short-range regional numerical weather prediction models. The geographical coverage of EARS is primarily over data-sparse sea areas around Europe.

The EARS service comprises the following individual polar satellite instrument data services:

- EARS-ATOVS
- EARS-AVHRR
- EARS-ASCAT
- EARS-IASI
- EARS-NWC
- EARS-ATMS
- EARS-CrIS
- EARS-VIIRS
- EARS-VASS
- EARS-MERSI

Each of these EARS data services retransmits observations from an instrument or an instrument group, while aiming at providing homogeneous services across the NOAA, Metop and FY3 polar meteorological orbiting satellites. The target timeliness for delivery of data is in the range of 15 to 30 minutes from instrument sensing.

Traditionally polar satellite data has been received via two methods:

- via the once-per-orbit data download from the spacecraft to the central ground station;
- via the direct transmission from the satellite to a Direct Readout (aka HRPT) station on ground.

The first mechanism provides global coverage data to end users, but with delays of two to six hours after the time of measurement. The second mechanism provides the data virtually at the time of measurement, but the geographical coverage is limited to the region around the Direct Readout reception station. EARS provide improvements on both of these methods by offering a large geographical coverage combined with timely retransmission. This is achieved by having a network of Direct Readout stations around the Atlantic and Arctic Oceans and using it to rapidly distribute the collected instrument data to end users.

The three methods for receiving data are illustrated in Figure 1 with the EARS-ATOVS service being shown as an example in the centre.
The satellites and instruments supported by EARS are as follows:

<table>
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<td>AVHRR/3</td>
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<tr>
<td>EARS-MERSI</td>
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<td>MERSI-II (only for FY3D)</td>
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Table 1: Satellites and Instruments Supported by EARS

The system elements making up EARS are shown in Figure 2. The NOAA, Metop and FY3 spacecraft Direct Readout transmissions are received by a network of Direct Readout stations operated by partner organisations in the EARS project. These stations provide the raw data to a EUMETSAT Product Processing Node (PPN) computer located at the partner organisation’s site. The PPN handles and processes the data as necessary for the particular EARS service. For example in the EARS-ATOVS service the raw data is processed using the ATOVS and AVHRR Processing Package (AAPP). The resulting products are sent from the PPN to EUMETSAT where these are then forwarded to EUMETCast - EUMETSAT’s Broadcast System for Environmental Data. EUMETCast is a multi-service dissemination system based on standard Digital Video Broadcast (DVB-S2) technology. It uses commercial
telecommunication geostationary satellites to multicast files (data and products) to a wide user community.

**Figure 2: EARS System Elements**

### 1.2 Scope of this Document

This document provides a general description of EARS and also specific information on the data and products of each of the specific EARS data services.
1.3 Supporting Documents

The following documents are references within this document and provide supporting information that may be useful to users of the service.

[RD.1]: NWP SAF, AAPP Version 8 Product Specification, NWPSAF-MO-DS-033


[RD.4]: EPS Generic Product Format Specification, EPS/GGS/SPE/96167

[RD.5]: ASCAT Product Guide, EUM/OPS-EPS/MAN/04/0028

[RD.6]: Metop Space-to-Ground ICD, MO/IF/MMT/SY/0001

[RD.7]: NWP SAF, IASI Principal Components in AAPP: User Manual, NWPSAF-MO-UD-022

[RD.8]: IASI Level 1 Products Guide, EUM/OPS-EPS/MAN/04/0032

[RD.9]: Software User Manual for the SAFNWC/MSG application SAF/NWC/IOP/INM/SW/SUM/2

[RD.10]: Product User Manual for “Cloud Products” (CMa-PGE01 v3.2, CT-PGE02 v2.2 & CTTH-PGE03 v2.2), SAF/NWC/CDOP/MFL/SCI/PUM/01

[RD.11]: Compact VIIRS SDR Product Format User Guide, EUM/TSS/DOC/13/708025

[RD.12]: IASI Level 2 Product Guide, EUM/OPS-EPS/MAN/04/0033
2 EARS OVERVIEW

2.1 NOAA Satellites Providing ATOVS and AVHRR Data

The National Oceanic and Atmospheric Administration (NOAA) is responsible for the operation of the polar-orbiting meteorological satellite systems for the United States. EARS currently supports 2 NOAA polar-orbiting satellites of the POES series: NOAA 18 and 19.

The instrumentation on the operational NOAA KLM series of satellites includes the Advanced Very High Resolution Radiometer (AVHRR) and the Advanced TIROS Operational Vertical Sounders (ATOVs) consisting of the Advanced Microwave Sounding Units (AMSU-A and -B) and the High Resolution Infrared Radiation Sounder (HIRS). The NOAA N and N’ satellites have improved AVHRR and ATOVS instruments. The AMSU-B is replaced by the Microwave Humidity Sounder (MHS).

The AMSU/MHS instruments support a near all-weather capability to generate soundings of the atmosphere on a global scale. They enable the retrieval of sounding information in cloudy and partly cloudy regions as well as the detection of precipitation and the monitoring of ice and snow on the earth’s surface.

HIRS measures scene radiance in the infrared spectrum. Data from the instrument is used, in conjunction with the AMSU instruments, to calculate atmospheric vertical temperature profiles. The data is also used to determine ocean surface temperatures, total atmospheric ozone, precipitable water, cloud height and coverage, and surface radiance.

The AVHRR/3 instrument provides image data in the visible and infrared spectral bands. Data from this instrument provides information on cloud coverage within the footprints of the various sounding instruments.

The Microwave Humidity Sounder (MHS) is a self-calibrating microwave radiometer that together with the complementary AMSU-A instruments, provides the operational microwave sounding capability for the NOAA-N, -N’ meteorological satellites.

The L-band High Resolution Picture Transmission (HRPT) broadcast carries data from the satellite instruments at a rate of 665,400 bps, in real time. The broadcast consists of the digitised unprocessed output of five AVHRR/3 channels, plus the HIRS, AMSU-A and -B, MHS and other data. All information necessary to calibrate the output from the instruments is included in the data stream.

Further information about the NOAA satellites, their instrumentation, operational status and the HRPT broadcast can be obtained from the NOAA Website:

http://www.ospo.noaa.gov/Operations/POES/status.html
2.2 Metop Satellites Providing ATOVS, AVHRR, ASCAT and IASI Data

Metop satellites are part of the EUMETSAT Polar System (EPS), Europe’s first polar orbiting operational meteorological satellite system, and the European contribution to the Initial Joint Polar-Orbiting Operational Satellite System (IJPS). In this joint European-US polar satellite system, EUMETSAT has the operational responsibility for the "morning orbit" with their Metop satellites.

The Metop satellites carry a wide range of instruments including AVHRR and ATOVS instruments, the Advanced Scatterometer (ASCAT) instrument and the Infrared Atmospheric Sounding Interferometer (IASI) instrument.

The AVHRR and ATOVS instruments are of the same design as those carried on the NOAA N and N’ satellites (see section 2.1).

The ASCAT mission has been primarily designed to provide global ocean wind vectors operationally. The main application foreseen is the assimilation of those winds into numerical weather prediction models.

![Figure 3: ASCAT Viewing Geometry](image)

The ASCAT system geometry is based on the use of fan-beam antennas. The system covers two 550 km swaths that are separated from the satellite ground track by about 360 km for the minimum orbit height. The ASCAT incidence angle ranges from 25 to 65. For each swath, three antennae illuminate the sea surface, measuring the backscattered signal. At such incidence angles, the main backscattering mechanism is considered to be Bragg resonance, which describes the interaction of the radar signal with short gravity waves having a wavelength of a few centimetres. The wind speed and direction near the ocean surface with respect to the antenna look angles can be determined using an empirical geophysical model function, which relates these parameters to the observed backscatter normalized radar cross...
section. ASCAT collects data from three antennae with different look angles to retrieve a wind vector.

ASCAT being a C-band radar, is unaffected by cloud cover and rain, and provides both a day and night measurement capability. A detailed description of the instrument capabilities, measurement principle and data processing can be found in [RD.5].

The Infrared Atmospheric Sounding Interferometer (IASI) is composed of a Fourier transform spectrometer and an associated Integrated Imaging Subsystem (IIS). The Fourier transform spectrometer provides infrared spectra with high resolution between 645 and 2760 cm⁻¹ (3.6 µm to 15.5 µm). The IIS consists of a broad band radiometer with a high spatial resolution. However, the IIS information is only used for co-registration with the Advanced Very High Resolution Radiometer (AVHRR).

The main goal of the IASI instrument is to provide atmospheric emission spectra to derive temperature and humidity profiles with high vertical resolution and accuracy. Additionally, it is used for the determination of trace gases such as ozone, nitrous oxide, carbon dioxide and methane, as well as land- and sea surface temperature and emissivity and cloud properties. IASI has 8461 spectral samples, aligned in three bands between 645.0 cm⁻¹ and 2760 cm⁻¹ (15.5µm and 3.63 µm), with a spectral resolution of 0.5 cm⁻¹ (FWMH) after apodisation (L1c spectra). The spectral sampling interval is 0.25 cm⁻¹. The IASI sounder is coupled with the IIS, which consists of a broad band radiometer measuring between 833 cm⁻¹ and 1000 cm⁻¹ (12µm and 10µm) with a high spectral resolution. Table 2 summarises the spectral characteristics of IASI.

<table>
<thead>
<tr>
<th>Band</th>
<th>Wavenumbers (cm⁻¹)</th>
<th>Wavelength (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>645.0 – 1165.0</td>
<td>8.58 – 15.50</td>
</tr>
<tr>
<td>2</td>
<td>1165.0 – 1951.5</td>
<td>5.12 – 8.58</td>
</tr>
<tr>
<td>3</td>
<td>1951.5 – 2760.0</td>
<td>3.62 – 5.12</td>
</tr>
</tbody>
</table>

Table 2. Approximate IASI spectral bands

The IIS is used for collocation between IASI and the AVHRR and is only available during Level 1 processing.

IASI is an across track scanning system with a scan range of ±48°20´, symmetrically with respect to the nadir direction. A nominal scan line covers 30 scan positions towards the Earth and two calibration views. One calibration view is into deep space, the other is observing the internal black body. The scan starts on the left side with respect to the flight direction of the spacecraft.

The effective field of view (EFOV) is the useful field of view at each scan position. Each EFOV consists of a 2 x 2 matrix of so-called instantaneous fields of view (IFOV). Each IFOV has a diameter of 14.65 mrad (milliradians), which corresponds to a ground resolution of 12 km at nadir and a satellite altitude of 819 km. The 2 x 2 matrix is centred on the viewing direction. The IIS field of view is defined by a square area of 59.63 x 59.63 mrad, consisting of 64 x 64 pixels and covering the same area as the IASI EFOV.

The instrument scans in a step and stare modus. Each interferogram is acquired within 151 ms. The 30 Earth interferograms per scan line are taken in equally spaced time intervals every 8/37 seconds so that a synchronisation with AMSU is achieved.
A detailed technical description of the IASI instrument and further references can be found in [RD.8].

The Metop satellites transmit L-band High Resolution Picture Transmission (HRPT) broadcast of satellite instruments at a rate of 3 Mbps, in real time. This is the same transmission band as the NOAA satellites. The transmissions follow the data model recommended by the Consultative Committee for Space Data Systems (CCSDS), which is significantly different from the NOAA satellite transmissions. Details can be found in the Metop Space-to-Ground ICD [RD.6].

EARS provides the Metop Regional Data service allowing rapid access to Metop ATOVS, AVHRR, ASCAT and IASI data within the region covered by the EARS network of HRPT stations supporting the particular service. The Metop Global Data Service is also available to users of EUMETCast providing the complete set of products with global coverage from all of the satellites instruments, but with a slower access time.

The Metop Regional Data service combines AHRPT and Fast Dump Extract System (FDES) data. The FDES data comprise the most recent part of the X-band global dump for Metop-A received at Svalbard from the northbound passes, thus providing high-timeliness regional data. FDES data are currently used for EARS-ASCAT, EARS-ATOVS, EARS-AVHRR, and EARS-IASI data streams.

### 2.3 JPSS Satellites Providing ATMS, CrIS and VIIRS Data

The Joint Polar Satellite System (JPSS) is a collaborative programme between NOAA and NASA, comprising the follow-on missions to the NOAA POES series. There are currently 2 satellites in the JPSS constellation: Suomi NPP (S-NPP) and NOAA 20. These satellites carry five key instruments: the Advanced Technology Microwave Sounder (ATMS), the Cross-track Infrared Sounder (CrIS), the Ozone Mapping and Profiler Suite (OMPS), the Visible Infrared Imaging Radiometer Suite (VIIRS), and Clouds and the Earth's Radiant Energy System (CERES).

The Advanced Technology Microwave Sounder (ATMS) is a cross-track microwave sounder that combines the capabilities of current generation microwave temperature sounders (Advanced Microwave Sounding Unit, AMSU-A) and microwave humidity sounders (MHS) that are flying on EUMETSAT’s and NOAA’s JEPS satellites.

The Cross-track Infrared Sounder (CrIS), provides soundings of the atmosphere with 2211 spectral channels, over 3 wavelength ranges: LWIR (9.14 - 15.38um); MWIR (5.71 - 8.26um); and SWIR (3.92 - 4.64 um).

The Visible Infrared Imaging Radiometer Suite (VIIRS) is a scanning radiometer, which collects visible and infrared imagery and radiometric measurements of the land, atmosphere, cryosphere, and oceans.

VIIRS data is used to measure cloud and aerosol properties, ocean colour, sea and land surface temperature, ice motion and temperature, fires, and the Earth's albedo.

The direct broadcast of JPSS science data is performed only in the X-Band which makes the reception possible only on those reception stations of the EARS network which have already
the X-Band reception capability. Currently, the Direct Readout stations supporting the JPSS regional services are the five core European stations: Lannion, Maspalomas, Svalbard, Kangerlussuaq and Athens, and Moscow and Saint Denis (ATMS and CrIS only).

2.4 FY3 Satellites Providing VASS and MERSI Data

The FY-3 series of CMA/NSMC (China Meteorological Administration/National Satellite Meteorological Center) represents the second generation of Chinese polar-orbiting meteorological satellites (follow-on of the FY-1 series). The FY-3 series represents a cooperative program between CMA and CNSA (China National Space Administration). There are currently 2 satellites contributing to the EARS services: FY-3C (VASS only) and FY-3D (VASS and MERSI).

The FY-3 satellites carry a wide range of instruments including those that support the EARS Vertical Atmospheric Sounding Service (EARS-VASS):
- Microwave Humidity Sounder – II (MWHS-II),
- Microwave Temperature Sounder-II (MWTS-II). The MWTS-II onboard FY-3C no longer contributing to the EARS-VASS service due to an instrument permanent failure on 17/02/2015.
- Infrared Atmospheric Sounder (IRAS), only onboard FY-3C.

The IRAS instrument is a classical infrared sounder with similar characteristics to the HIRS instrument flown on the Metop and NOAA satellites. Its 20 bands provide information on the vertical structure of temperature and water vapour in a cloud-free atmosphere and above clouds.

The advantage of microwave sounders like the MWHS-II instrument is their ability to perform vertical atmosphere sounding in cloudy conditions. Like the MHS instrument on the Metop and NOAA satellites, it focuses on water vapour sounding of the upper troposphere but also provides information on temperature profiles.

The MWTS-II instrument provides temperature sounding in nearly-all-weather conditions. The instrument closely matches the channels of AMSU-A and ATMS. It does not include the AMSU-A2 channels around 23.8 and 31.4 GHz located around the 23.8 GHz oxygen absorption line. However, this is compensated by a new set of channels around the 118.75 GHz oxygen absorption line included in the MWHS-II sounder.

The MERSI-II instrument on board FY-3D is a 25-channel VIS/IR multispectral radiometer (replacing and merging the capabilities of MERSI-1 on FY-3A/3B and VIRR on FY-3A//3B/3C).

2.5 Network of Direct Readout Stations Used to Acquire Data

The aim of EARS has been achieved through the close co-operation of organisations willing to operate the network of Direct Readout stations. A major consideration has been to optimize the area of data coverage and to reduce system costs by making use of existing stations. The following organisations provide the Direct Readout station network:
- Centre de Méteorologie Spatiale – Météo-France (CMS), France;
- Danish Meteorological Institute (DMI), Denmark/Greenland;
- Directorate General of Meteorology and Air Navigation (DGMAN), Oman;
- Hellenic National Meteorological Service (HNMS), Greece;
- Instituto Nacional de Técnica Aerospacial (INTA), Spain;
- Kongsberg Satellite Services (KSAT), Norway/Spitsbergen;
- Environment Canada / Environnement Canada (EC), Canada;
- ROSHYDROMET - Scientific Research Center of Space Hydrometeorology "Planeta" (SRC Planeta), Russia.

All these organisations currently receive Direct Readout data and are actively making use of it for various purposes. The station’s locations contributing to EARS are given in Table 3.

<table>
<thead>
<tr>
<th>Station Name</th>
<th>Country</th>
<th>Operated by</th>
<th>Location (lat, long)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edmonton</td>
<td>Canada</td>
<td>EC</td>
<td>53.33°N, 113.5°W</td>
</tr>
<tr>
<td>Gander</td>
<td></td>
<td></td>
<td>48.95°N, 54.57°W</td>
</tr>
<tr>
<td>Maspalomas</td>
<td>Spain</td>
<td>INTA</td>
<td>27.78°N, 15.63°W</td>
</tr>
<tr>
<td>Kangerlussuauq</td>
<td>Greenland</td>
<td>DMI</td>
<td>66.98°N, 50.67°W</td>
</tr>
<tr>
<td>Svalbard</td>
<td>Norway</td>
<td>KSAT</td>
<td>78.13°N, 15.23°E</td>
</tr>
<tr>
<td>Athens</td>
<td>Greece</td>
<td>HNMS</td>
<td>37.815°N, 23.769°E</td>
</tr>
<tr>
<td>Lannion</td>
<td>France</td>
<td>CMS</td>
<td>48.75°N, 3.5°W</td>
</tr>
<tr>
<td>Saint-Denis (La Réunion)</td>
<td></td>
<td></td>
<td>20.91°S, 55.50°E</td>
</tr>
<tr>
<td>Moscow</td>
<td>Russian Federation</td>
<td>SRC Planeta</td>
<td>55.759°N, 37.569°E</td>
</tr>
<tr>
<td>Novosibirsk</td>
<td></td>
<td></td>
<td>54.8°N, 83.13°E</td>
</tr>
<tr>
<td>Khabarovsk</td>
<td></td>
<td></td>
<td>48.47°N, 135.35°E</td>
</tr>
<tr>
<td>Muscat</td>
<td>Sultanate of Oman</td>
<td>DGMAN</td>
<td>23.59°N, 58.29°E</td>
</tr>
</tbody>
</table>

*Table 3: Direct Readout Stations Contributing to EARS*

An overview of the stations & satellites supporting the EARS Services is provided in Table 4 and Table 5:
Table 4: EARS core stations and support to EARS Services

Table 5: EARS contributing stations and support to EARS services

The resulting geographical coverage for each of the EARS services is given in the relevant section of this document.

2.6 Pass Scheduling Priorities

EUMETSAT will coordinate (as far as possible) the scheduling of pass reception by the Direct Readout stations to achieve an efficient overall utilisation of the network in support of the defined EARS services.

To structure the prioritisation scheme, a Primary Morning Orbit Satellite and Primary Afternoon Orbit Satellite will be defined. The selection will be based on the status and
performance of the operational polar orbiting satellites. The selection will be revised in response to changes of status or performance and when a new satellite enters service. In particular over the European region, the aim is to give first priority to reception from the Primary Morning Orbit Satellite during the local morning and evening periods and to reception from the Primary Afternoon Orbit Satellite during the local afternoon and night periods.

This scheme will aid in the generation of Regional Passes, a sequence of consecutive station passes of a particular satellite.

Table 6 shows the current satellite priorities for the stations where EUMETSAT has the scheduling authority.

<table>
<thead>
<tr>
<th>Orbit</th>
<th>Satellite</th>
<th>Current Satellite Acquisition Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-morning</td>
<td>Metop-C</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Metop-B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Metop-A</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>FY-3C</td>
<td>6</td>
</tr>
<tr>
<td>Afternoon</td>
<td>NOAA-20 (JPSS-1)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>SNPP</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>FY-3D</td>
<td>9</td>
</tr>
<tr>
<td>Early Morning</td>
<td>NOAA-19</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>NOAA-18</td>
<td>7</td>
</tr>
</tbody>
</table>

*Table 6: Satellite Acquisition Priorities*
3  **EARS-ATOVS**

3.1  **ATOVS Data**

Sounder data is produced by a set of the instruments making up the Advanced TIROS Operational Vertical Sounder (ATOVS) and is used to obtain information about the vertical profile of temperature and humidity in the atmosphere. The radiation measurements from the ATOVS instruments can be assimilated directly into numerical models of the atmosphere using advanced techniques that have become operational over the last decade. This vertical profile information has a significant positive impact upon the performance of all meteorological numerical weather prediction models.

3.2  **EARS-ATOVS Service Specification**

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Satellites supported</strong></td>
</tr>
<tr>
<td>N18, N19, Metop-A, Metop-B, Metop-C as shown in Table 4</td>
</tr>
<tr>
<td><strong>Product Processing</strong></td>
</tr>
<tr>
<td>AAPP as provided by the NWP SAF, configured and run by EUMETSAT.</td>
</tr>
<tr>
<td><strong>Product Segmentation</strong></td>
</tr>
<tr>
<td>One file per station pass, instrument and processing level.</td>
</tr>
<tr>
<td><strong>Products via EUMETCast Europe</strong></td>
</tr>
<tr>
<td>Level 1c per ATOVS instrument, data on original instrument grid, BUFR format.</td>
</tr>
<tr>
<td>For N18, N19, Metop-A and Metop-B: Level 1d ATOVS product including AVHRR derived cloud mask, data on HIRS instrument grid, bzip2 compressed.</td>
</tr>
<tr>
<td><strong>Timeliness via EUMETCast</strong></td>
</tr>
<tr>
<td>30 minutes (45 minutes for FDES)</td>
</tr>
<tr>
<td><strong>Products via RMDCN/GTS</strong></td>
</tr>
<tr>
<td>Level 1c per ATOVS instrument, data on original instrument grid, BUFR format.</td>
</tr>
<tr>
<td><strong>Archived in EUMETSAT</strong></td>
</tr>
<tr>
<td>None.</td>
</tr>
</tbody>
</table>

**Table 7: EARS-ATOVS Service Specification**
3.3 EARS-ATOVS Product Processing

The products disseminated to end-users in the EARS-ATOVS transmissions are generated using the ATOVS and AVHRR Processing Package (AAPP) as provided by NWP-SAF.

3.3.1 Background Information on AAPP

The AAPP software package performs the end-to-end processing of Sounding and Imager Data from the High Resolution Picture Transmission (HRPT) direct broadcast of the NOAA-KLM, N-N’, and Metop satellites. Data from the following instruments can be processed:

- HIRS (on NOAA KLM, N-N’, Metop-A and Metop-B satellites);
- AMSU-A;
- AMSU-B (on NOAA KLM satellites);
- MHS (on NOAA N-N’ and Metop satellites);
- AVHRR/3.

The AAPP software performs the following tasks:

- de-commutation of the instrument data from the HRPT data frame;
- extraction of the calibration information;
- navigation of the data;
- calibration of the data;
- pre-processing of the data (cloud mask included);
- mapping of the data of the sounder instruments on a common instrument grid, presently the HIRS Field of View (FOV);
- deriving a set of statistical parameters from the AVHRR data in the HIRS FOVs.

During data processing the following files are created for each instrument:

- level 1a = separated data for each instrument;
- level 1b = Earth located and calibration coefficients (reversible: calibration coefficients are separated from raw data);
- level 1c = Earth located and converted to brightness temperature data (non-reversible: calibration coefficients are applied to data);
- level 1d = Mapped and filtered data (with optional cloud mask in the case of HIRS).

AAPP is supplied and maintained by the NWP Satellite Application Facility (SAF) of EUMETSAT. For further information on AAPP see the UK Met Office, NWP SAF AAPP Web pages at: [http://nwpsaf.eu/deliverables/aapp/index.html](http://nwpsaf.eu/deliverables/aapp/index.html)

3.4 EARS-ATOVS Product Dissemination

The ATOVS data is organised as a level 1c product per instrument (HIRS, MHS and AMSU-A), plus a level 1d product providing AVHRR cloud data on the HIRS grid. Note: for Metop-C only MHS and AMSU-A level 1c products are provided.
<table>
<thead>
<tr>
<th>Product (Level 1c BUFR)</th>
<th>Product Size/Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIRS</td>
<td>300 kbytes</td>
</tr>
<tr>
<td>AMSU-A</td>
<td>120 kbytes</td>
</tr>
<tr>
<td>MHS</td>
<td>650 kbytes</td>
</tr>
</tbody>
</table>

*Table 8 ATOVS Level 1c BUFR Product Sizes*

Note that FDES products are typically three times bigger than traditional Direct Readout products.

### 3.4.1 Level 1c BUFR products

The product file naming convention (WMO compliant) of level 1c BUFR files distributed by EUMETCast and RMDCN/GTS is as follows:

\[
\text{W}_\text{XX}-\text{EUMETSAT}-\text{<station>},\text{<instrument>},\text{DBNet+<satellite>+<station>}_\text{C}_\text{EUMS}_\text{<YYYYMMDDHHMISS}>_\text{<product>}_\text{<level>}_\text{<extension1>}.\text{<extension2>}, \text{where:}
\]

- **station** is the ground station short-name or Darmstadt;
- **instrument** is the instrument name: amsua, hirs, mhs;
- **satellite** is the satellite name: noaa18, noaa19, metopa, metopb, metopc;
- **YYYYMMDDHHMISS** is the creation time of the product;
- **product** is the previous EUMETCast product name without the level and compression extensions, see below;
- **level** is the product level: l1c;
- **extension1** is the 1st extension of the file:bufr;
- **extension2** is the 2nd extension of the file:bin.

Previous EUMETCast product name:

**INSTNAME**\_YYYYMMDDD\_HHMI\_SAT\_ORBIT\_STATION, where:

- **INSTNAME** is the instrument name: amsua, hirs, mhs
- **YYYYMMDDD\_HHMI** is the observation time of the first instrument scan line in the product.
SAT is the satellite name: noaa18, noaa19, metopa, metopb, metopc.

ORBIT is the orbit number since launch of the satellite

STATION is the ground station short-name (see Table 4)

Examples:

W_XX-EUMETSAT-kan,amsua,DBNet+noaa18+kan_C_EUMS_20170107072000_amsua_20161107_0717_noaa19_39934_kan_l1c_bufr.bin

W_XX-EUMETSAT-lan,mhs,DBNet+noaa19+lan_C_EUMS_20170207073000_mhs_20161108_0829_noaa19_18000_lan_l1c_bufr.bin

W_XX-EUMETSAT-sva,hirs,DBNet+metopb+sva_C_EUMS_20170308071000_hirs_20161207_1317_metopb_2031_sva_l1c_bufr.bin

3.4.2 Level 1d products

The file naming convention of the ATOVS level 1d products distributed by EUMETCast is as follows:

INSTNAME_YYYYMDDD HHMI SAT ORBIT STATION.Level.bz2, where:

INSTNAME is the instrument name: hirs, amsua, mhs

YYYYMDDD HHMI is the observation time of the first instrument scan line in the product.

SAT is the satellite name: noaa18, noaa19, metopa, metopb, metopc.

ORBIT is the orbit number since launch of the satellite

STATION is the ground station short-name (see Table 4)

Level is the product level: l1d
4 EARS-AVHRR

4.1 AVHRR Data

The EARS-AVHRR service collects AVHRR instrument data from the Metop and NOAA satellites via a network of Direct Readout stations and retransmits it via EUMETCast.

The Advanced Very High Resolution Radiometer (AVHRR) is a multi-purpose imaging instrument used for the global monitoring of cloud cover, sea surface temperature, ice, snow and vegetation characteristics.

4.2 EARS-AVHRR Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellites supported</td>
</tr>
<tr>
<td>Product Processing</td>
</tr>
<tr>
<td>Product Segmentation</td>
</tr>
<tr>
<td>Products via EUMETCast</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
</tr>
</tbody>
</table>

Table 9: EARS-AVHRR Service Specification

4.3 EARS-AVHRR Product Dissemination

Segment files contain data for 1 minute duration and are compressed using bzip2, resulting in a typical file size of less than 3.5 Mbytes.
To ensure the efficient and timely delivery of data the received Direct Readout data is handled in small chunks, or segments. This means that a more continuous flow of information can be passed through the communications network and EUMETCast dissemination system without significantly delaying it. The use of segments also allows the system to monitor the data provided from the various stations and select which data is to be disseminated on the basis of quality and avoiding unnecessary duplication of data that may have been acquired for the regions where more than one station has visibility of a spacecraft.

The stations acquire data as station segments of three-minute duration from the satellite as it passes over the station locations. These segments are sent to the EUMETSAT computers located at the partner organisation’s site. These computers then create user segments of one-minute duration. For each segment a message is sent reporting the availability of the segment and its completeness and quality to the central ‘decision maker’ computer at EUMETSAT. The decision maker will wait a short time to receive messages about available segments at the various remote computers and will identify if there are any duplicate segments for the same time slot (duplicates arise due to station coverage overlaps). Finally, a decision is made as to which station has the best segment and this decision is sent to the particular remote computer instructing it to send the segment to the EUMETCast uplink server and on to the users. This means that overlaps between stations are removed and end users should get a continuous set of ‘best quality’ segments for the regional pass.

Figure 4: EARS-AVHRR Segment Processing

The one-minute segments that are disseminated to users via EUMETCast can be concatenated together by users to construct a regional pass. The figure below gives an example of 25 segments acquired from Svalbard, Lannion and Maspalomas being recombined to a regional pass of 25 minutes.
4.3.1 EUMETCast

The product file naming convention of NOAA files distributed by EUMETCast is as follows:

```
INSTNAME_YYYYMMDD_HHMISS_SAT.Level.bz2
```

where

- **INSTNAME** is the instrument name: avhrr
- **YYYYMMDD_HHMISS** is the observation time of the nominal first instrument scan line in the product
- **SAT** is the satellite name: noaa19
- **Level** is the product level: hpr
- **bz2** is the compression extension

Example: avhrr_20090209_120600_noaa19.hrp.bz2

For NOAA KLM and N, N’ the files contain HRPT data in the raw format defined in the NOAA KLM User Guide [RD. 3], expanded to 16 bits, big endian, bzip2 compressed

The product file naming convention of Metop files distributed by EUMETCast is as follows:
INSTNAME_PRODUCTTYPE_SAT_SENSINGSTART_SENSINGEND_MODE_PROCTIME.bz2

Where:

INSTNAME is the instrument name: AVHR

PRODUCTTYPE is the product type and processing level: HRP_00

SAT is the spacecraft name: M03 (i.e. Metop-C), M02 (i.e. Metop-A), M01 (i.e. Metop-B)

SENSINGSTART is the observation time of the nominal first instrument scan line in the product

SENSINGEND is the observation time of the last instrument scan line in the product

MODE is the processing and disposition mode: N_O

PROCTIME is the processing time of the product

bz2 is the compression extension

Example:
AVHR_HRP_00_M02_20100329064100Z_20100329064200Z_N_O_20100329064455Z.bz2

For a detailed definition of EPS Level 0 format see [RD.4].
5 EARS-ASCAT

5.1 ASCAT Data

The EARS-ASCAT service collects ASCAT instrument data from Metop satellite passes via a network of Direct Readout stations and retransmits Level 2 products via EUMETCast. The prime objective of ASCAT is to measure wind speed and direction over the oceans.

The data is disseminated in two products:
- Regional Assimilation Wind (RAS) Product which has a 25 km grid
- ASCAT coastal winds which has a 12.5 km grid

5.2 EARS-ASCAT Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Map of Earth]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Satellites supported</th>
<th>Metop-A, Metop-B and Metop-C, as shown in Table 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Processing</td>
<td>Level 1 by EUMETSAT based on EPS Core Ground Segment processing s/w</td>
</tr>
<tr>
<td></td>
<td>Level 2 by KNMI using the operational OSI SAF processing s/w</td>
</tr>
<tr>
<td>Product Segmentation</td>
<td>Segments containing variable length of data</td>
</tr>
<tr>
<td>Products via EUMETCast Europe</td>
<td>Level 2 Ocean Winds, as per the OSI SAF ASCAT service, BUFR format Two products with 25 km and 12.5 km spaced grids respectively.</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
<td>30 minutes (45 minutes for FDES)</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
<td>As for EUMETCast</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
<td>None.</td>
</tr>
</tbody>
</table>

Table 10: EARS-ASCAT Service Specification

Note 1: EARS-ASCAT products will not be available when the instrument is in calibration or gain compression monitoring mode.
Note 2: The OSI SAF global Metop-A Hamming window based 12.5 km wind product was discontinued on 28th of April 2015. The 12.5 km winds have been replaced by the ASCAT coastal winds in the OSI SAF list of products. The Hamming winds product for Metop-A was only maintained in operations for continuity. For Metop-B and Metop-C, the 12.5 km Hamming window winds were never produced and the coastal winds were the default 12.5 km product from the beginning.

5.3 EARS-ASCAT Product Dissemination

5.3.1 EUMETCast

The product file naming convention of ASCAT files distributed by EUMETCast is as follows:

<Instrument>_<SensingStartDate>_<SensingStartTime>_<satellite>_<orbit>_<service>_<TypeOfProcessing>_<ProductSampling>_<Station>_<ProductContents>_<ProductLevel>_<ProductFormat>

The fields are as follows:

- **<Instrument>** instrument name: ascat
- **<SensingStartDate>** start of file date: YYYYMMDD
- **<SensingStartTime>** start of file time: HHMMSS
- **<satellite>** satellite name: metopa, metopb or metopc
- **<orbit>** orbit number (5 digits): metopa, metopb or metopc
- **<service>** EARS service = ear
- **<TypeOfProcessing>** o=operational, t=testing: o or t
- **<ProductSampling>** grid spacing, 125-coastal winds or 250 coastal winds: coa or 250
- **<Station>** reception station (blank for FDES): e.g.: lan, mus (see Table 4)
- **<ProductContents>** ovw = Ocean Vector Winds
- **<ProductLevel>** l2
- **<ProductFormat>** bufr

Example:

ascat_20070115_071325_metopa_00129_ear_o_250_mas_ovw.l2_bufr
ascat_20070115_071325_metopa_00129_ear_t_coa_ovw.l2_bufr

The file body is composed of one or several BUFR messages. Every BUFR message is composed of one or several lines of nodes. Every line of nodes contains 42 nodes in the case of the 25 km product and 82 in the case of the 12.5 km product.

Abbreviate Bulletin Header Allocation:

T1T2A1A2ii with:
T1 = 'T' (Observational data (binary coded) in BUFR)
T2 = 'S' (Surface/sea level) (table B3)
A1 = 'X' (Other surface data) (table C6)
A2 = 'N' (Northern hemisphere) for EARS (table C3)
ii = 01-06 for 25-km data or 11-16 for 12.5-km data

CCCC = 'EHDB' for De Bilt

For more details on the file format, see [RD.5].
6 EARS-IASI

6.1 IASI Data

IASI measures in the infrared part of the electromagnetic spectrum at a horizontal resolution of 12 km over a swath width of about 2,200 km.

The temperature of the troposphere and lower stratosphere is measured under cloud-free conditions with a vertical resolution of 1 km in the lower troposphere; a horizontal resolution of 25 km, and an accuracy of 1 K.

The humidity of the troposphere is measured under cloud-free conditions, with a vertical resolution of 1–2 km in the lower troposphere; a horizontal resolution of 25 km, with an accuracy of 10%. IASI also measures the fractional cloud cover and cloud top temperature and pressure.

The total amount of ozone under cloud-free conditions is measured with a horizontal resolution of 25 km and an accuracy of 5%, and total column-integrated content of CO, CH$_4$ and N$_2$O with an accuracy of 10% and a horizontal resolution of 100 km.

6.2 EARS-IASI L1 Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Satellites supported</th>
<th>Metop-A, Metop-B and Metop-C, as shown in Table 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Processing</td>
<td>Level 1 processing using OPS-LRS as provided by the NWP SAF. Principal Component Scores, channel selection and BUFR conversion using AAPP as provided by NWP SAF, configured and run by EUMETSAT.</td>
</tr>
<tr>
<td>Product Segmentation</td>
<td>One file per station per pass.</td>
</tr>
<tr>
<td>Products via EUMETCast Europe</td>
<td>Calibrated and geolocated IASI observations in a combined product containing both 300 Principal Component Scores and 500 original IASI Channels, cloud/scene analysis information, BUFR formatted.</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
<td>30 minutes (45 minutes for FDES)</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
<td>As for EUMETCast.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
<td>None.</td>
</tr>
</tbody>
</table>

Table 11: EARS-IASI L1 Service Specification
6.3 Pilot EARS-IASI L2 Service Specification

| Geographical Coverage |

<table>
<thead>
<tr>
<th>Satellites supported</th>
<th>Metop-A, Metop-B and Metop-C, as shown in Table 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Processing</td>
<td>Level 2 processing from the EARS-IASI L1 products and corresponding EARS-ATOVS AMSU-A and MHS products, using the same statistical retrieval function PWLR(^3) (Piece Wise Linear Regression -cube) as for the IASI L2 global products processor, developed by EUMETSAT.</td>
</tr>
<tr>
<td>Product Segmentation</td>
<td>One file per station per pass.</td>
</tr>
<tr>
<td>Products via EUMETCast Europe</td>
<td>Water vapour and temperature profiles as well as land surface temperature, sea surface temperature, land surface emissivity and surface pressure at individual IASI FoV resolution, together with corresponding quality indicators; in HDF-5 format, bzip2 compressed.</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
<td>30 minutes (45 minutes for FDES)</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
<td>None.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
<td>None.</td>
</tr>
</tbody>
</table>

Table 12: Pilot EARS-IASI L2 Service Specification

6.4 EARS-IASI Product Dissemination

6.4.1 EARS-IASI L1 products

The product file naming convention (WMO compliant) of files distributed by EUMETCast is as follows:

W_XX-EUMETSAT-
<station>,<instrument>,DBNet+<satellite>+<station>_C_EUMS_<YYYYMMDHHMISS>
_<product>_<_level>_extension1<_extension2>, where:

- station is the ground station short-name or Darmstadt;
- instrument is the instrument name: iasi;
- satellite is the satellite name: metopa, metopb, metopc;
YYYYMMDDHHMISS is the creation time of the product;

product is the previous EUMETCast product name without the level and compression extensions, see below;

level is the product level, optional;

extension1 is the 1st extension of the file: bufr;

extension2 is the 2nd extension of the file: bin.

Previous EUMETCast product name:

<Instrument>_<SensingStartDate>_<SensingStartTime>_<satellite>_<orbit>_<service>_<TypeOfProcessing>_<ProductContents>_<AcquisitionStation>_<ProductLevel>_<ProductFormat>

The fields are as follows:

<Instrument> Instrument name iasi
<SensingStartDate> Product start date YYYYMMDD
<SensingStartTime> Product start time HHMMSS
<satellite> Satellite name metop, metopb or metopc
<orbit> Orbit number (5 digits)
<service> EARS service = ear ear
<TypeOfProcessing> o=operational, t=testing o or t
<ProductContents> pcs = Principal Component Scores
<AcquisitionStation> Station where the satellite raw data was (see Table 4) acquired
<ProductLevel> L1
<ProductFormat> bufr

Example:
W_XX-EUMETSAT-sva,iasi,DBNet+metopa+sva_C_EUMS_20161107062000_iasi_20161107_061309_metopb_21475_ear_o_pcs_sva_l1c_bufr.bin

The file body is composed of one or several BUFR messages.

For more details on the file format, see [RD.7].
6.4.2 Pilot EARS-IASI L2 products

The product file naming convention (WMO compliant) of IASI L2 files distributed by EUMETCast is as follows:

\[ W_{XX}\text{-EUMETSAT-}<\text{station}>,\text{iasi,<satellite>}+<\text{station}>_C_{EUMS}_<YYYYMMDDHHMISS>_<\text{IASI_PW3}_02_ M0x_<YYYYMMDDHHMISS>Z_<YYYYMMDDHHMISS>Z.hdf.bz2 \]

where:
- \text{station} is the ground station short-name;
- \text{satellite} is the satellite name: metopa, metopb;
- 1st \text{YYYYMMDDHHMISS} is the creation time;
- 2nd \text{YYYYMMDDHHMISS} is the data start time;
- 3rd \text{YYYYMMDDHHMISS} is the data end time;
- \text{M0x} is the satellite, M01, M02 or M03.

Example filename:

\[ W_{XX}\text{-EUMETSAT-sva,iasi,metopb+sva}_C_{EUMS}_20180814054412_{\text{IASI_PW3}_02_ M01}_20180814052413Z_20180814053700Z.hdf.bz2 \]

For more details on the file format see [RD.12].
7 EARS-NWC

7.1 Nowcasting Products

For the nowcasting and very short range weather forecasting, the near-real time availability of high resolution cloud products is essential. The three cloud products of the EARS-NWC service complement the cloud products from geostationary-satellites like MSG, especially for the high-latitudes where the coverage from the geo-stationary orbit is limited. The distributed products are: Cloud Mask (CM), Cloud Type (CT) and Cloud Top Temperature and Height (CTTH).

7.2 EARS-NWC Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Satellites supported</th>
<th>N19 and Metop-B, as shown in Table 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Processing</td>
<td>AAPP (L1c data for AVHRR) as provided by the NWP-SAF and PPS as provided by NWC-SAF, both configured and run by EUMETSAT.</td>
</tr>
<tr>
<td>Product Segmentation</td>
<td>Segments each containing one minute of observations. Duplicate segments removed before dissemination.</td>
</tr>
</tbody>
</table>
| Products via EUMETCast Europe | Cloud products derived for each segment:  
- Cloud Type (CT: including cloud phase flag and processing flag)  
- Cloud Top Temperature & height (CTTH: height, pressure, temperature), including processing flag – both for opaque and for semi-transparent clouds  
- Cloud Mask (CM: aerosol flag only)  
Geo-location information represented as tie-points contained in the products. All products on original instrument grid, netCDF4 format, bz2-compressed. |
| Timeliness via EUMETCast | 30 minutes |
| Products via RMDCN/GTS  | None. |
| Archived in EUMETSAT | All disseminated products. |

Table 13: EARS-NWC Service Specification
7.3 EARS-NWC Product Processing

The input data for EARS-NWC comes from the EARS-AVHRR service. The current satellites providing AVHRR data to the service are Metop-B and NOAA 19. Product processing is performed using the ATOVS and AVHRR Processing Package (AAPP) for the processing of L1c data for AVHRR and using the Polar Platform System Package (PPS) of the SAF on support to NoWCasting and VSRF (NWC-SAF) for the generation of the actual cloud products.

The figures below show sample images of the EARS-NWC CTTH and CT products. These images are not projected and displayed with the colour-map that is part of the netCDF product. The products are described in detail in [RD.10]

![Sample EARS-NWC Cloud Top Height image derived from NOAA-19, 16 October, 02:11:00](image1)

![Sample EARS-NWC Cloud Type image, derived from Metop-A AVHRR, 31 October 2012](image2)
7.4 EARS-NWC Product Dissemination

The EARS-NWC Product Dissemination follows the same strategy as the EARS-AVHRR service, as described in section 4.3.

A set of Python-based tools for the concatenation and further processing of the EARS-NWC products have been developed by the pytroll community: https://nbviewer.jupyter.org/github/pytroll/pytroll-examples/blob/master/satpy/ears-nwc.ipynb.

7.4.1 EUMETCast

The filenames of the EARS-NWC products are constructed in the following way:

W_XX-EUMETSAT-Darmstadt,SING+LEV+SAT,<satid>+<producttype>_C_EUMS_<sensingstart>_orbit_.nc.bz2

The variable fields are as follows:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;satid&gt;</td>
<td>Satellite</td>
<td>NOAA19, METOPB</td>
</tr>
<tr>
<td>&lt;producttype&gt;</td>
<td>Product Type</td>
<td>CMA, CT, CTTH</td>
</tr>
<tr>
<td>&lt;sensingstart&gt;</td>
<td>Product start sensing date and time (YYMMDDHHmmSS)</td>
<td>20141125120724</td>
</tr>
<tr>
<td>&lt;orbit&gt;</td>
<td>Orbit Number</td>
<td>11349</td>
</tr>
</tbody>
</table>

Examples:

- W_XX-EUMETSAT-Darmstadt,SING+LEV+SAT,METOPB+CMA_C_EUMS_20141125120724_11349.nc
- W_XX-EUMETSAT-Darmstadt,SING+LEV+SAT,METOPB+CT_C_EUMS_20141125120724_11349.nc
- W_XX-EUMETSAT-Darmstadt,SING+LEV+SAT,METOPB+CTTH_C_EUMS_20141125120724_11349.nc
- W_XX-EUMETSAT-Darmstadt,SING+LEV+SAT,NOAA19+CMA_C_EUMS_20141125120000_29875.nc
8 EARS-ATMS

8.1 ATMS Data

The Advanced Technology Microwave Sounder (ATMS) is a cross-track microwave sounder that combines the capabilities of current generation microwave temperature sounders (Advanced Microwave Sounding Unit, AMSU-A) and microwave humidity sounders (MHS) that are flying on EUMETSAT’s and NOAA’s IJPS satellites. It measures at 22 frequency bands in the range from 23 GHz through 183 GHz. The measurements from the ATMS instrument can be assimilated directly into numerical models of the atmosphere using advanced techniques that have become operational over the last decade.

8.2 EARS-ATMS Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellites supported</td>
</tr>
<tr>
<td>Suomi-NPP, NOAA-20, as shown in Table 4.</td>
</tr>
<tr>
<td>Product Processing</td>
</tr>
<tr>
<td>RT-STPS as provided by the NASA and CSPP as provided by CIMSS; AAPP as provided by NWP SAF, all configured and run by EUMETSAT.</td>
</tr>
<tr>
<td>Product Segmentation</td>
</tr>
<tr>
<td>One file per station per pass.</td>
</tr>
<tr>
<td>Products via EUMETCast</td>
</tr>
<tr>
<td>Europe</td>
</tr>
<tr>
<td>SDR, all 22 ATMS spectral channels, all Fields of View, calibrated and geolocated, BUFR format.</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
</tr>
<tr>
<td>30 minutes.</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
</tr>
<tr>
<td>As for EUMETCast.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
</tr>
<tr>
<td>None.</td>
</tr>
</tbody>
</table>

| **Table 14: EARS-ATMS Service Specification** |

8.3 EARS-ATMS Product Processing

The products disseminated to end-users in the EARS-ATMS service are generated using the Real-time Software Telemetry Processing System (RT-STPS) to generate RDR data (L0) followed by the Community Satellite Processing Package (CSPP) to produce SDR data (L1).
The ATOVS and AVHRR Processing Package (AAPP) is then used to encode the SDR data in BUFR format.

### 8.3.1 Background Information on the applied software packages

RT-STPS has been developed by NASA-DRL (Direct Readout Laboratory) to process raw CCSDS-compliant frames from the JPSS satellites to RDR level (comparable to L0). It is a freely available JAVA application.

CSPP is a standalone software package, developed by the University of Wisconsin (UW-CIMMS), which is based on the Algorithm Development Library (ADL) software developed by Raytheon for the JPSS Project. This approach enables CSPP to run the same algorithms that are used in the NOAA IDPS operations. Using this concept ensures the consistency between products generated globally at NOAA and those generated from direct broadcast.

AAPP is supplied and maintained by the NWP Satellite Application Facility (SAF) of EUMETSAT. It contains tools to convert JPSS SDRs from the original HDF-5 format into BUFR format. For further information on AAPP see the UK Met Office’s NWP SAF AAPP webpages:

https://www.nwpsaf.eu/site/software/aapp/

### 8.3.2 Sample EARS-ATMS product

The figure on the next page shows some sample images of ATMS data received as part of the EARS-ATMS service at the reception station in Svalbard. The images show three different channels which sound the atmosphere at different heights.
8.3.3 Data Processing in EARS-ATMS

ATMS instrument data are collected from the satellite passes in their original resolution. Then the data are processed according to the following data-flow scheme:

![Data Flow Diagram]

**Figure 8: Sample of EARS-ATMS Product from S-NPP, Data over Greenland from EARS-ATMS data received at Svalbard. Left: channel 4 (51.8 GHz); Middle: channel 7 (54.9 GHz); Right channel 19 (183.3 GHz).**
8.4 EARS-ATMS Products Dissemination

The product file naming convention (WMO compliant) of files distributed by EUMETCast and GTS/RMDCN is as follows:

\[ \text{W}_\text{XX-}\text{EUMETSAT-}<\text{station}>,<\text{instrument}>,\text{DBNet+}<\text{satellite}>+<\text{station}>_\text{C_EUMS_<YYYYMMDDHHMISS} >._<\text{product}>_._<\text{level}>>._<\text{extension1}>,.<\text{extension2}>, \]

where:

- \text{station} is the ground station short-name (see Table 4);
- \text{instrument} is the instrument name: atms;
- \text{satellite} is the satellite name: snpp or noaa20;
- \text{YYYYMMDDHHMISS} is the creation time of the product;
- \text{product} is the previous EUMETCast product name without the level and compression extensions, see below;
- \text{level} is the product level: sdr;
- \text{extension1} is the 1st extension of the file: bufr;
- \text{extension2} is the 2nd extension of the file: bin.
Previous EUMETCast product name:

\texttt{atms\_YYYYMMDD\_HHMISE\_SATELLITE\_ORBIT\_STATION}

where:

- \texttt{YYYYMMDD\_HHMISE} is the observation time of the first instrument scan line in the product.
- \texttt{SATELLITE} is the original satellite name: npp or j01.
- \texttt{ORBIT} is the orbit number since launch of the satellite
- \texttt{STATION} is the ground station short-name (see Table 4)

Example:
\texttt{W\_XX-EUMETSAT-kan.atms,DBNet+snpp+kan\_C\_EUMS\_20161107050200\_atms\_20161107\_045651\_npp\_26061\_ear\_kan\_sdr\_bufr.bin}
9 EARS-CRIS

9.1 EARS-CrIS Data

The Cross-track Infrared Sounder (CrIS), provides soundings of the atmosphere with 2211 spectral channels, over 3 wavelength ranges: LWIR (9.14 - 15.38um); MWIR (5.71 - 8.26um); and SWIR (3.92 - 4.64 um). The CrIS instrument, a Fourier transform spectrometer, scans a 2200km swath width (+/- 50 degrees), with 30 Earth-scene views. Each field consists of 9 fields of view, arrayed as 3x3 array of 14km diameter spots (nadir spatial resolution). The CrIS instrument is based on the heritage of AIRS.

Data from CrIS are providing the IR sounding component for the afternoon orbit and are therefore complimentary to the IASI data in the morning orbit which have a similar characteristic. IR sounder data play a crucial role for the evaluation of the atmospheric state in NWP models of all scales.

9.2 EARS-CrIS Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellites supported</td>
</tr>
<tr>
<td>Suomi-NPP, NOAA-20</td>
</tr>
<tr>
<td>Product Processing</td>
</tr>
<tr>
<td>RT-STPS as provided by NASA and CSPP as provided by CIMSS, configured and run by EUMETSAT; AAPP as provided by NWP SAF, configured and run by EUMETSAT.</td>
</tr>
<tr>
<td>Product Segmentation</td>
</tr>
<tr>
<td>One file per station per pass.</td>
</tr>
<tr>
<td>Products via EUMETCast Europe</td>
</tr>
<tr>
<td>SDR, 399(S-NPP)/431(N20) CrIS spectral channels as selected by NOAA, all Fields of View, calibrated and geolocated.</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
</tr>
<tr>
<td>30 minutes.</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
</tr>
<tr>
<td>As for EUMETCast.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
</tr>
<tr>
<td>None.</td>
</tr>
</tbody>
</table>

*Table 15: EARS-CrIS Service Specification*
9.3 EARS-CrIS Product Processing

9.3.1 Generation of CrIS products

The products disseminated to end-users in the EARS-CrIS service are generated using the Real-time Software Telemetry Processing System (RT-STPS) to generate RDR data (L0) followed by the Community Satellite Processing Package (CSPP) to produce SDR data (L1). Due to bandwidth limitations and the specific needs of the NWP user community, not all 1305 CrIS channels are disseminated. In the CrIS EARS-service only a selection of channels is disseminated (399 channels for S-NPP and 431 channels for NOAA-20). The ATOVS and AVHRR Processing Package (AAPP) is used for the channel selection and to encode the SDR data in BUFR format.

9.3.2 Background Information on the applied software packages

The processing performed for CrIS is equivalent to the ATMS processing. Please see section 8.3.1.

9.3.3 Sample CrIS product

The figure below shows a typical spectrum of the selected 399 channels of CrIS for S-NPP. The data were received as part of the EARS-CrIS service at the reception station in Svalbard.

![Figure 10: Typical spectrum from the EARS-CrIS Product (399 channels); Data over Greenland from EARS-CrIS data received at Svalbard.](image)

9.4 Data Processing

CrIS instrument data are collected from the satellite passes in their original resolution. Then the data are processed according to the following data-flow scheme:
Figure 11: EARS-CrIS data processing flow

9.5 EARS-CrIS Products Dissemination

The product file naming convention (WMO compliant) of files distributed by EUMETCast and GTS/RMDCN is as follows:
W_XX-EUMETSAT-<station>,<instrument>,DBNet++<satellite>+<station>_C_EUMS_<YYYYMMDDHHMISS>_<product>_<level>_<extension1>._<extension2>, where:

*station* is the ground station short-name (see Table 4);

*instrument* is the instrument name: cris;

*satellite* is the satellite name: snpp or noaa20;

*YYYYMMDDHHMISS* is the creation time of the product;

*product* is the previous EUMETCast product name without the level and compression extensions, see below;

*level* is the product level: sdr;

*extension1* is the 1st extension of the file: bufr;

*extension2* is the 2nd extension of the file: bin.

Previous EUMETCast product name:

**cris**_<YYYYMMDD_HHMISE_SATELLITE_ORBIT_STATION>

where:

*YYYYMMDD_HHMISE* is the observation time of the first instrument scan line in the product.

*SATELLITE* is the original satellite name: npp or j01.

*ORBIT* is the orbit number since launch of the satellite

*STATION* is the ground station short-name (see Table 4)

Example:

W_XX-EUMETSAT-kan,cris,DBNet+snpp+kan_C_EUMS_20161107065100_cris_20161107_063920_npp_26062_ear_kan_sdr_bufr.bin
10 EARS-VIIRS

10.1 VIIRS Data

The EARS-VIIRS service collects data from the VIIRS instrument onboard the JPSS spacecraft, operated by NASA and NOAA. The Visible Infrared Imaging Radiometer Suite (VIIRS) is a scanning radiometer, which collects visible and infrared imagery and radiometric measurements of the land, atmosphere, cryosphere, and oceans.

VIIRS data is used to measure cloud and aerosol properties, ocean colour, sea and land surface temperature, ice motion and temperature, fires, and the Earth's albedo.

Climatologists use VIIRS data to improve our understanding of global climate change. The JPSS webpages have more details:
https://www.jpss.noaa.gov/viirs.html

The provision of VIIRS data in the form of an EARS-service is a logical extension of the EARS-AVHRR service, providing operational imager data with high timeliness for nowcasting applications.

Due to the high volume of the VIIRS products, only VIIRS products from the primary operational JPSS satellite are disseminated on EUMETCast Basic Service. VIIRS products from the secondary JPSS satellite are disseminated on EUMETCast High Volume Service

10.2 EARS-VIIRS Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellites supported: Suomi-NPP, NOAA-20</td>
</tr>
<tr>
<td>Product Processing: RT-STPS as provided by the NASA and CSPP as provided by CIMSS, configured and run by EUMETSAT. CVIIRS as provided by EUMETSAT for compaction of data.</td>
</tr>
<tr>
<td>Product Segmentation: Segments each containing one granule of observations (~85.6s). Duplicate segments removed before dissemination.</td>
</tr>
<tr>
<td>Products via EUMETCast: Two separate products:</td>
</tr>
</tbody>
</table>
Europe

- All 16 VIIRS M-Band channels;
- The VIIRS Day/Night Band covering dusk, dawn and night time scenes, but excluding day time scenes.

Compact VIIRS SDR (Sensor Data Record) HDF5 product format containing calibrated radiances and geolocation information on tie-point grid. Geolocation to reference ellipsoid and not to terrain model. No observation thinning, lossless compression. See more details in [RD.11]

Tool (CVIIRS) made available by EUMETSAT enabling users to reconstruct the original NOAA VIIRS SDR product format from the Compact VIIRS SDR. To download the tool visit: [http://www.eumetsat.int/website/home/Data/DataDelivery/SupportSoftwareandTools/index.html](http://www.eumetsat.int/website/home/Data/DataDelivery/SupportSoftwareandTools/index.html)

<table>
<thead>
<tr>
<th>Timeliness via EUMETCast</th>
<th>30 minutes, target 15 minutes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products via RMDCN/GTS</td>
<td>None.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
<td>None.</td>
</tr>
</tbody>
</table>

**Table 16: EARS-VIIRS Service Specification**

10.3 EARS-VIIRS Product Processing

10.3.1 Generation of VIIRS products

VIIRS M-Band and Day/Night Band (DNB) instrument data are collected from the satellite passes in their original resolution. The products disseminated to end-users in the EARS-VIIRS service are generated using the Real-time Software Telemetry Processing System (RT-STPS) to generate RDR data (L0) followed by the Community Satellite Processing Package (CSPP) to produce SDR data (L1). Due to the size of the products only the M-Band and DNB data are disseminated. In addition, they are compressed using the EUMETSAT CVIIRS tool and disseminated to the user in the Compact VIIRS SDR format. Data is disseminated according to the NASA VIIRS granule grid of approx. 85.6s length. This allows a process running at EUMETSAT, similar to AVHRR, to remove duplicates. See section 4.3 for more details on this process.

10.3.2 Background Information on the applied software packages

RT-STPS has been developed by NASA-DRL (Direct Readout Laboratory) to process raw CCSDS-compliant frames from Suomi-NPP to RDR level (comparable to L0). It is a freely available JAVA application.

CSPP is a standalone software package, developed by the University of Wisconsin (UW-CIMMS), which is based on the Algorithm Development Library (ADL) software developed by Raytheon for the JPSS Project. This approach enables CSPP to run the same algorithms that are used in the NOAA IDPS operations. Using this concept ensures the consistency between products generated globally at NOAA and those generated from direct broadcast.

Data is then compacted by a EUMETSAT developed tool: CVIIRS. CVIIRS removes all reflectances and brightness temperatures from the product, converts all 32 floating point numbers radiance data into a dual scale 16 bit unsigned integer representation, and for M-
Band compacts the geolocation data onto a 16x16 pixel tie-point grid, or for DNB onto a variable sized pixel tie-point grid, respectively. For DNB, the 32 bits floating point numbers radiance data is compacted into customized floating point numbers of variable bit lengths, automatically determined exponents and a mantissa size of 8 bits.

The figure below shows an image of a true color composite of the M-band channels (channels 5, 4 and 3) of VIIRS. The data were received as part of the EARS-VIIRS service at the reception station in Kangerlussuaq.

![Figure 12: EARS-VIIRS S-NPP M-band channels, 10 November 2013](image)

The figure below shows an image from multiple granules of the DNB channel of VIIRS over Europe.
10.4 Data Processing

VIIRS instrument data are collected from the satellite passes in their original resolution. Then the data are processed according to the following dataflow scheme:

```
CCSDS raw data

RT-STPS

VIIRS RDR
```
10.5 EARS-VIIRS Product Dissemination

10.5.1 EUMETCast

The product file naming convention of M-Band products distributed via EUMETCast is as follows:

SVMC_SATELLITE_dYYYYMMDD_tHHMMSSS_eHHMMSSS_b#####_cYYYYMMDDHHMMSSSSSSSS_eum_ops.h5

Where:

SATELLITE is the original satellite name: npp or j01.
dYYYYMMDD is the date of the observation time of the first instrument scan line in the product.
tHHMMSSS is the time of the observation time of the first instrument scan line in the product.
eHHMMSSS is the time of the observation time of the last instrument scan line in the product.
b##### is the orbit number.
cYYYYMMDDHHMMSSSSSSSS is the creation timestamp of the product.
Example:
SVMC_npp_d20140916_t1135253_e1136498_b14955_c20140916114443474130_eum_ops.h5

The product file naming convention of DNB products distributed via EUMETCast is as follows:

SVDNBC_SATELLITE_dYYYYMMDD_tHHMMSSS_eHHMMSSS_b#####_cYYYYMMDDHHMMSSSSSSSS_eum_ops.h5

Where:

SATELLITE is the original satellite name: npp or j01.
dYYYYMMDD is the date of the observation time of the first instrument scan line in the product.
tHHMMSSS is the time of the observation time of the first instrument scan line in the product.
eHHMMSSS is the time of the observation time of the last instrument scan line in the product.
b##### is the orbit number.
cYYYYMMDDHHMMSSSSSSSS is the creation timestamp of the product.

Example:
SVDNBC_npp_d20140916_t1135253_e1136498_b14955_c20140916114443474130_eum_ops.h5
11 EARS-VASS

11.1 VASS Data

The EARS-VASS service collects data from the following instruments:
- Microwave Humidity Sounder –II (MWHS-II), on board the FY-3C and FY-3D spacecrafts, operated by CMA
- Microwave Temperature Sounder –II (MWTS-II), on board FY-3D
- Infrared Atmospheric Sounder (IRAS) on board FY-3C.

The IRAS instrument is a classical infrared sounder with similar characteristics to the HIRS instrument flown on the Metop and NOAA satellites. Its 20 bands provide information on the vertical structure of temperature and water vapour in a cloud-free atmosphere and above clouds.

The advantage of microwave sounders like the MWHS-II instrument is their ability to perform vertical atmosphere sounding in cloudy conditions. Like the MHS instrument on the Metop and NOAA satellites, it focuses on water vapour sounding of the upper troposphere, but also provides information on temperature profiles. The information on the three-dimensional distribution of temperature and water vapour provided by the combination of these two instruments is one of the most valuable inputs for forecast models of all scales.

The MWTS-II instrument provides temperature sounding in nearly-all-weather conditions. The instrument closely matches the channels of AMSU-A and ATMS. It does not include the AMSU-A2 channels around 23.8 and 31.4 GHz located around the 23.8 GHz oxygen absorption line. However, this is compensated by a new set of channels around the 118.75 GHz oxygen absorption line included in the MWHS-II sounder.

11.2 EARS-VASS Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
<th>FY3_IPP as provided by the CMA, configured and run by EUMETSAT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Processing</td>
<td>AAPP as provided by NWP-SAF, configured and run by EUMETSAT.</td>
</tr>
</tbody>
</table>
### Table 17: EARS-VASS Service Specification

<table>
<thead>
<tr>
<th>Product Segmentation</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products via EUMETCast</td>
<td>Level 1b MWHS-II (FY-3C, FY-3D), MWTS-II (FY-3D) and IRAS (FY-3C). All spectral channels, all Fields of View Calibrated and geolocated. BUFR format</td>
</tr>
<tr>
<td>Timeliness via EUMETCast</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Products via RMDCN/GTS</td>
<td>As for EUMETCast.</td>
</tr>
<tr>
<td>Archived in EUMETSAT</td>
<td>None.</td>
</tr>
</tbody>
</table>

### 11.3 EARS-VASS Product Processing

The VASS data (MWHS-II, MWTS-II and IRAS) are collected from the satellite passes in their original resolution. Then the data are processed according to the following data-flow scheme:

![Data Flow Diagram]

- **HRPT raw data**
  - **FY3CL0pp**
    - Level-0 Data
      - **FY3CL1pp**
        - Level-1b HDF-5
          - **Auxiliary data**
            - Fy3cline.dat
            - Utcpole.dat
            - Leapsec.dat

Figure 15: EARS-VASS data processing flow

11.4 EARS-VASS Product Dissemination

The product file naming convention (WMO compliant) of files distributed by EUMETCast and RMDCN/GTS is as follows:

\[ W_{XX}\text{-EUMETSAT-} <\text{station}>,<\text{instrument}>,\text{DBNet+}<\text{satellite}>+<\text{station}>_C_{\text{EUMS}_-}<\text{YYYYMMDDHHMISS}} >_\text{_<product>}_<_\text{level}><_\text{extension1}>.<_\text{extension2}> , \text{where:} \]

- \text{station} is the ground station short-name (see Table 4);
- \text{instrument} is the instrument name: iras, mwhs, mwts;
- \text{satellite} is the satellite name: fy3c, fy3d;
- \text{YYYYMMDDHHMISS} is the creation time of the product;
- \text{product} is the previous EUMETCast product name without the level and compression extensions, see below;
- \text{level} is the product level: l1b;
- \text{extension1} is the 1st extension of the file: bufr;
- \text{extension2} is the 2nd extension of the file: bin.

Examples:
- W_{XX}\text{-EUMETSAT-sva,iras,DBNet-fy3c+sva_C_EUMS_20161107062800_iras_20161107_0620_fy3c_16190_e ar_sva_l1b_bufr.bin}
- W_{XX}\text{-EUMETSAT-sva,mwhs,DBNet-fy3c+sva_C_EUMS_20161107062800_mwhs_20161107_0620_fy3c_161 90_ear_sva_l1b_bufr.bin}
- W_{XX}\text{-EUMETSAT-sva,mwts,DBNet-fy3d+sva_C_EUMS_20190802134348_mwts_20190802_1327_fy3d_8881 _ear_sva_l1b_bufr.bin}
12 EARS-MERSI

12.1 MERSI Data

The EARS-MERSI service collects data from the MERSI-II instrument on board FY-3D. MERSI-II is a 25-channel VIS/IR multispectral radiometer (replacing and merging MERSI-1 on FY-3A/3B and VIRR on FY-3A/3B/3C). Six of the channels have a 250m resolution and the remaining 19 channels have a resolution of 1 km.

Scanning technique: Cross-track: 2048 detectors for channels at 1000 m resolution, or 8192 detectors for channels at 250 m resolution, swath 2900 km; Along-track: ten 10 km lines every 1.5 s.

12.2 EARS-MERSI Service Specification

<table>
<thead>
<tr>
<th>Geographical Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Geographical Coverage" /></td>
</tr>
</tbody>
</table>

| Product Processing | FY3_IPP as provided by the CMA, configured and run by EUMETSAT. |
| Product Segmentation | Segments each containing one minute of observations. Duplicate segments removed before dissemination. |
| Products via EUMETCast Europe | Two separate products: |
| | - One product containing science and calibration data, 1km resolution |
| | - One product containing geolocation data. |
| Timeliness via EUMETCast | 30 minutes |
| Products via RMDCN/GTS | None. |
| Archived in EUMETSAT | None. |

| Table 18: EARS-MERSI Service Specification |
12.3 EARS-MERSI Product Processing

MERSI-II instrument data are collected from the satellite passes in their original resolution. Then the data are processed according to the following data-flow in Figure 16. To reduce overlap and total volume, segmentation into 1-minute segments has been introduced, following the same process described in Section 4.3. The final products contain data for 1 minute duration and are compressed using the HDF5 functionalities shuffle and gzip.

![Figure 16: EARS-MERSI data processing flow](image-url)
Figure 17 EARS-MERSI Regional Pass March 2020
12.4 EARS-MERSI Product Dissemination

The product file naming convention of the EARS-MERSI products distributed via EUMETCast is as follows:

FY3D_<startDate>_<startTime>_<endTime>_<orbitNumber>_MERSI_1000M_L1B.HDF
(for the scientific data)

FY3D_<startDate>_<startTime>_<endTime>_<orbitNumber>_MERSI_GEO1K_L1B.HDF
(for the geolocation data)

Example filenames:
FY3D_20190517_111100_111200_7786_MERSI_1000M_L1B.HDF
FY3D_20190517_111100_111200_7786_MERSI_GEO1K_L1B.HDF
13 PROCESS FOR RECEIVING THE SERVICE

13.1 EARS Data via EUMETCast

The primary delivery mechanism for EARS is EUMETCast, the EUMETSAT Broadcast Distribution System for Environmental Data. EUMETCast utilises the satellite services of a satellite operator and telecommunications service provider to distribute data files using Digital Video Broadcast (DVB-S2) to a wide audience located within a geographical coverage zone which includes most of Europe, Africa and parts of the American continent. All EARS services are available via the Europe Ku-band transmission. EARS-ASCAT is also available via Africa C-band transmission.

For further information on EUMETCast and the reception equipment requirements please consult the EUMETCast Technical Description, EUM TD 15. The document is available from the EUMETSAT Website.

13.2 EARS EUMETCast Registration

Access to EARS data via EUMETCast is without licence. Users are however required to register in order to receive the service via EUMETCast. New EUMETCast users also need to order EUMETCast Client Software and EKU as part of the registration process.

Users should register via the EO Portal (https://eoportal.eumetsat.int/userMgmt/login.faces) using their login details. If you do not yet have an EO Portal account, you can create one via the link provided above.

Once logged-in, you will be able to register for the EARS service. This will provide you access to METOP, NOAA and FY3 data distributed under the relevant EARS services.

13.3 EARS Data via the Global Telecommunications System

In addition to the EUMETCast, EARS-ATOVS, EARS-ASCAT, EARS-IASI, EARS-ATMS, EARS-CrIS and EARS-VASS data are also available via the Global Telecommunications System (GTS) encoded in FM-94 BUFR.

To gain access to these data users should contact their GTS Regional Telecommunication Hub (RTH) to request that the data be forwarded to the user site.
The table below summarises the GTS header information for the EARS products:

<table>
<thead>
<tr>
<th>Service</th>
<th>Instrument</th>
<th>Abbreviate Bulletin Header Allocation</th>
<th>Typical Range of Bulletin Headers</th>
<th>Typical Size per Satellite Pass (bytes)</th>
<th>BUFR Table D Sequence Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>EARS-ATOVS</td>
<td>AMSU-A</td>
<td>INAXii EUMS (for N19, N18)</td>
<td>ii = 01 to 08</td>
<td>120000</td>
<td>3-10-009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEAXii EUMS (for M01, M02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EARS-ATOVS</td>
<td>MHS</td>
<td>INMXii EUMS (for N19, N18)</td>
<td>ii = 01 to 43</td>
<td>650000</td>
<td>3-10-010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEMXii EUMS (for M01, M02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EARS-ATOVS</td>
<td>HIRS</td>
<td>INHXii EUMS (for N19, N18)</td>
<td>ii = 01 to 20</td>
<td>300000</td>
<td>3-10-008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEHXii EUMS (for M01, M02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EARS-ASCAT</td>
<td>ASCAT</td>
<td>ISXNii EHDB</td>
<td>ii = 01 to 06 (25 km spacing grid)</td>
<td>300000 (25 km grid)</td>
<td>3-12-061</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ii = 11 to 16 (12.5 km spacing grid)</td>
<td>1300000 (12.5 km grid)</td>
<td></td>
</tr>
<tr>
<td>EARS-IASI</td>
<td>IASI</td>
<td>IEQXii EUMS</td>
<td>ii = 01 to 50</td>
<td>1500000</td>
<td>3-40-008</td>
</tr>
<tr>
<td>EARS-ATMS</td>
<td>ATMS</td>
<td>INSXii EUMS</td>
<td>ii = 01 to 10</td>
<td>2000000</td>
<td>3-10-061</td>
</tr>
<tr>
<td>EARS-CrIS</td>
<td>CrIS</td>
<td>INCXii EUMS</td>
<td>ii = 01 to 50</td>
<td>12000000</td>
<td>3-10-060</td>
</tr>
<tr>
<td>EARS-VASS</td>
<td>IRAS</td>
<td>ININii EUMS</td>
<td>ii = 01 to 10</td>
<td>300000</td>
<td>N/A</td>
</tr>
<tr>
<td>EARS-VASS</td>
<td>MWHS</td>
<td>INKNii EUMS</td>
<td>ii = 01 to 10</td>
<td>1200000</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 19: BUFR Encoded EARS products on GTS

<table>
<thead>
<tr>
<th>EARS-VASS</th>
<th>MWTS</th>
<th>INTNi EUMS</th>
<th>ii = 01 to 10</th>
<th>500000</th>
<th>N/A</th>
</tr>
</thead>
</table>

The precise range of bulletin headers required for a particular satellite pass will depend on the extent of the pass, and the number of usable scan lines that are locally received at a particular station.
14 FURTHER INFORMATION

The EUMETSAT Website provides operational information and news concerning all available data, products and services. www.eumetsat.int

14.1 Notification of EARS System Outages and Pass Predictions

Information about the planned interruptions to any of the EARS services and about the planned passes for EARS-ATOVS and EARS-AVHRR is displayed on the EUMETSAT User Notification Service (https://uns.eumetsat.int). To automatically receive service news information you will need to contact the User Service Helpdesk to obtain a user name and password for a login to the system. You will then be able to configure which news messages you wish to receive.

14.2 User Service Helpdesk

For further information, please contact the EUMETSAT User Service Helpdesk:

Mail:

EUMETSAT User Service
Eumetsat Allee 1
D - 64295 Darmstadt
Germany

Telephone: +49 (0) 6151 807 3660 / 3770
Fax: +49 (0) 6151 807 3790
E-mail: ops@eumetsat.int

Website: http://www.eumetsat.int
15 ABBREVIATIONS AND GLOSSARY

AAPP ATOVS and AVHRR Processing Package
AD Applicable Document
ADL Algorithm Development Library
AHRPT Advanced HRPT
AIRS Atmospheric Infrared Sounder
AMSU Advanced Microwave Sounding Units
ASCAT Advanced Scatterometer
ATH Athens
ATMS Advanced Technology Microwave Sounder
ATOVS Advanced TIROS Operational Vertical Sounder
AVHRR Advanced Very High Resolution Radiometer
BUFR Binary Universal Form for the Representation of meteorological data
CCSDS Consultative Committee for Space Data Systems
CDOP Continuous Development and Operations Phase
CERES Clouds and the Earth's Radiant Energy System
CIMSS Cooperative Institute for Meteorological Satellite Studies
CM Cloud Mask
CMA China Meteorological Association
CMS Centre de Météorologie Spatiale
CNSA China National Space Administration
CrIS Cross-track Infrared Sounder
CSPP Community Satellite Processing Package
CT Cloud Type
CTTH Clout Top Temperature and Height
CVIIRS EUMETSAT tool for compacting VIIRS data into the Compact VIIRS format
DB Direct Broadcast
DGMAN Directorate General of Meteorology and Air Navigation
DMI Danish Meteorological Institute
DNB Day and Night Band
DVB Digital Video Broadcast
DVB-S2 DVB Standard 2
EARS EUMETSAT Advanced Retransmission Service
EC Environment Canada / Environnement Canada
EDM Edmonton
EFOV Effective Field Of View
EKU EUMETSAT Key Unit
EO Earth Observation
EPS EUMETSAT Polar System
EUMETCast EUMETSAT Multicast Distribution System
EUMETSAT European Organisation For the Exploitation of Meteorological Satellites
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDES</td>
<td>Fast Dump Extract System</td>
</tr>
<tr>
<td>FOV</td>
<td>Field of View</td>
</tr>
<tr>
<td>FY3</td>
<td>Chinese series of polar orbiting meteorological satellites</td>
</tr>
<tr>
<td>GAN</td>
<td>Gander</td>
</tr>
<tr>
<td>GHz</td>
<td>Giga Hertz</td>
</tr>
<tr>
<td>GMT</td>
<td>Generic Mapping Tool</td>
</tr>
<tr>
<td>GTS</td>
<td>Global Telecommunications System</td>
</tr>
<tr>
<td>HDF5</td>
<td>Hierarchical Data Format (version 5)</td>
</tr>
<tr>
<td>HIRS</td>
<td>High Resolution Infrared Radiation Sounder</td>
</tr>
<tr>
<td>HNMS</td>
<td>Hellenic National Meteorological Service</td>
</tr>
<tr>
<td>HRPT</td>
<td>High-Rate Picture Transmission</td>
</tr>
<tr>
<td>IASI</td>
<td>Infrared Atmospheric Sounding Interferometer</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>IDPS</td>
<td>Interface Data Processing Segment</td>
</tr>
<tr>
<td>IFOV</td>
<td>Instantaneous Fields Of View</td>
</tr>
<tr>
<td>IIS</td>
<td>Integrated Imaging Subsystem</td>
</tr>
<tr>
<td>IJPS</td>
<td>Initial Joint Polar-Orbiting Operational Satellite System</td>
</tr>
<tr>
<td>INTA</td>
<td>Instituto Nacional de Técnica Aerospatial</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>IRAS</td>
<td>Infrared Atmospheric Sounder</td>
</tr>
<tr>
<td>JPSS</td>
<td>Joint Polar Satellite System</td>
</tr>
<tr>
<td>KAN</td>
<td>Kangerlussuaq</td>
</tr>
<tr>
<td>KLM</td>
<td>NOAA satellite series</td>
</tr>
<tr>
<td>KNMI</td>
<td>The Royal Netherlands Meteorological Institute</td>
</tr>
<tr>
<td>KSAT</td>
<td>Kongsberg Satellite Services</td>
</tr>
<tr>
<td>L</td>
<td>Level, e.g. L0, Level 0, etc.</td>
</tr>
<tr>
<td>LAN</td>
<td>Lannion</td>
</tr>
<tr>
<td>LWIR</td>
<td>Long Wave Infra-Red</td>
</tr>
<tr>
<td>M01</td>
<td>Metop B</td>
</tr>
<tr>
<td>M02</td>
<td>Metop A</td>
</tr>
<tr>
<td>M03</td>
<td>Metop C</td>
</tr>
<tr>
<td>MAS</td>
<td>Maspalomas</td>
</tr>
<tr>
<td>Metop</td>
<td>EUMETSAT meteorological satellite series</td>
</tr>
<tr>
<td>MERSI</td>
<td>Medium Resolution Spectral Imager</td>
</tr>
<tr>
<td>MHS</td>
<td>Microwave Humidity Sounder</td>
</tr>
<tr>
<td>MOS</td>
<td>Moscow</td>
</tr>
<tr>
<td>Mrad</td>
<td>milliradian</td>
</tr>
<tr>
<td>MSG</td>
<td>Meteosat Second Generation</td>
</tr>
<tr>
<td>MUS</td>
<td>Muscat</td>
</tr>
<tr>
<td>MWHS-II</td>
<td>Microwave Humidity Sounder</td>
</tr>
<tr>
<td>MWIR</td>
<td>Medium Wave Infrared</td>
</tr>
<tr>
<td>MWTS-II</td>
<td>Microwave Temperature Sounder</td>
</tr>
</tbody>
</table>