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Swarm SPC to PDGS Interface Control Document

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CHANGE LOG

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CHANGE RECORD

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Correction of numbering of steps in Table 2 Added step 7 in Table 2 Amended step 4 in procedure	13/03/2019	12	Table 2
Changed system tag to “SPC” Changed creator tag to “SPC_<processing centre acronym>” Changed generator name tag to “SPC_<processing centre acronym>”	13/03/2019	15	APPENDIX B
Changed creator tag to “SPC_<processing centre acronym>”	13/03/2019	16	Table 4
Changed system tag to “SPC” Changed creator tag to “SPC_<processing centre acronym>” Changed generator tag to “SPC_<processing centre acronym>”	13/03/2019	18	APPENDIX C
Updated CDF DATA FORMAT document version Updated Appendix C.2, Table 4, Validity – Refer to single product	14/03/2019	6,16	Applicable Documents, Table4

DISTRIBUTION

Name/Organisational Unit
Swarm PDGS team, European Space Agency
DTU Space, Technical University of Denmark

Table of contents:

1 INTRODUCTION

1.1 Background

The public Swarm data comprises of Level 1b and Level 2 data. The first contains the instrument data expressed in physical units and the second contains data and models derived from the Level 1b data, e.g. magnetic field models or thermosphere neutral density along the Swarm orbit. The Swarm Payload Data Ground Segment (PDGS) generates the Level 1b data from the raw instrument data, collects Level 2 data and makes all Level 1b and Level 2 data available to users. The Level 2 data that can be generated automatically is produced by the Swarm PDGS, whereas the majority of Level 2 data are produced by the Swarm Scientific Processing Centres (SPC).

The Swarm SPC originate partly from the Level 2 Processing System (L2PS), where the preparations for producing Level 2 data started long before launch of the Swarm satellites and meanwhile several evolutions were implemented. New SPC are established through the Swarm Data, Innovation and Science Cluster (DISC), which is a consortium of experts who promote the development of new innovative Swarm data products or services with the aim of enhancing and broadening the Swarm scientific results. The Swarm DISC collects ideas from the scientific community and manages Invitations To Tender (ITT) on behalf of ESA for the selected ideas, with the aim of implementing the production of new, innovative Swarm data products or services.

1.2 Purpose and Scope

This document defines and describes the generic interface between the Swarm PDGS on one side and the SPC on the other side. It regards all Level 2 products that are generated by the SPC.

The objectives of the interface are

1. making available all Swarm products needed by the SPC for the generation of the Level 2 products and
2. collecting all Level 2 products generated by the SPC,

where PDGS serves as the central hub for data flow.

The retrieval of data that are needed for the generation of Swarm Level 2 products, but not part of the Swarm products, is not governed by this ICD. This could be for example data from other satellite missions such as the CHAMP mission.

1.3 Document Organization

The ICD comprises of a generic interface description and a supplement containing detailed information such as server addresses and account credentials. The generic interface description is provided in this public document, whereas the supplement is provided in a separate, non-public document.

1.4 Applicable Documents

This document incorporates provisions from other publications by dated or undated reference. The references are listed hereafter and are cited at the appropriate places in the text. For dated references, subsequent amendments to or revisions of any of these apply to this document only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

Document Title	Identifier	Reference
Earth Explorer Ground Segment File Format Standard	PE-TN-ESA-GS-0001, Issue 1.4, 13/06/2003	[FMT-GUIDE]
Tailoring of EE File Format Standard for SWARM G/S	SW-TN-ESA-GS-0074, Issue 1.5, 1/08/2009	[SW-FMT]
Swarm DQC Processor ICD	ST-ESA-SWARMICD-0002, Issue 1.10, 18/09/2012	[DQC-ICD]
CDF Data Format	SW-ID-GMV-GS-0006, Issue 3.12, 08/12/2017	[CDF-FMT]
Swarm Level 1b Product Definition	SW-RS-DSC-SY-0007, Issue 5.22, 24/08/2018	[L1b-FMT]
Product Specification for L2 products and Auxiliary Products	SW-DS-DTU-GS-0001, Issue 2W, 24/08/2017	[L2-FMT]
RINEX: The Receiver Independent Exchange Format Version 3.00	ftp://igs.org/pub/data/format/rinex300.pdf	[RINEX-FMT]
The Extended Standard Product 3 Orbit Format (SP3-c)	ftp://igs.org/pub/data/format/sp3c.txt	[SP3-FMT]
Swarm Cal/Val Users - Data Access Manual	SWAM-GSEG-EOPG-ID-12-0042, Issue 2.15, 19/06/2017	[CAL-VAL]
Supplement to Swarm SPC to PDGS interface control document	ESA-EOPG-MOM-IF-18, v1.0, 06/03/2019	[ICD-SUP]

1.5 Reference Documents

The following documents, though not formally part of this document, amplify or clarify its content.

Document Title	Identifier	Reference
Development of the Swarm Level 2 Algorithms and Associated Level 2 Processing Facility Volume 2 – Technical Proposal	Proposal in Response to ESA ITT AO 1-6125/09/NL/JA, 10/12/2009	[TECH-PROP]
Development of the Swarm Level 2 Algorithms and Associated Level 2 Processing Facility Technical Requirements	SW-RS-ESA-GS-0178, Issue 1.0, 17/07/2009	[SOW-RS]

1.6 Acronyms

Acronym	Description
APDF	Archive and processing Data Facility
AR	Acceptance review
CDF	Common Data Format
CHAMP	Challenging mini-satellite payload
DISC	Data Innovation and Science Cluster
EE	Earth Explorer
ESA	European Space Agency
FTP	File Transfer Protocol
ICD	Interface Control Document
I/F	Interface
ITT	Invitation to Tender
KO	Contract kick-off
L2PS	L2 Processing System
LAN	Local Area Network
MPPF	Monitoring and Payload Planning Facility
PDGS	Payload Data Ground Segment
SPC	Scientific Processing Centre
SFTP	Secure File Transfer Protocol
SSH	Secure Shell
UTC	Universal Time Coordinate
XML	Extensible Markup Language

2 INTERFACE ARCHITECTURE

The Swarm SPC are connected to the Swarm PDGS in a star-type architecture where the connections to the Swarm PDGS reflect bi-directional data flow. The PDGS acts as a central node and all data are exchanged via the Swarm dissemination server of the PDGS.

The PDGS composes of several facilities hosted in different locations. Two of these facilities are the APDF and the MPPF, which are located in the United Kingdom and in Italy, respectively. Likewise, the SPC are hosted in different locations.

Figure 1 illustrates the data flow between the SPC on one side and the PDGS on the other side. The SPC download from the Swarm dissemination server all Swarm data needed for the generation of the respective Level 2 products. The latter are then delivered by the SPC to the PDGS by uploading the Level 2 products and the corresponding dissemination reports to two dedicated folders on the Swarm dissemination server. Thus, the SPC are always the initiator of the file transfer and all files are transferred through PDGS.

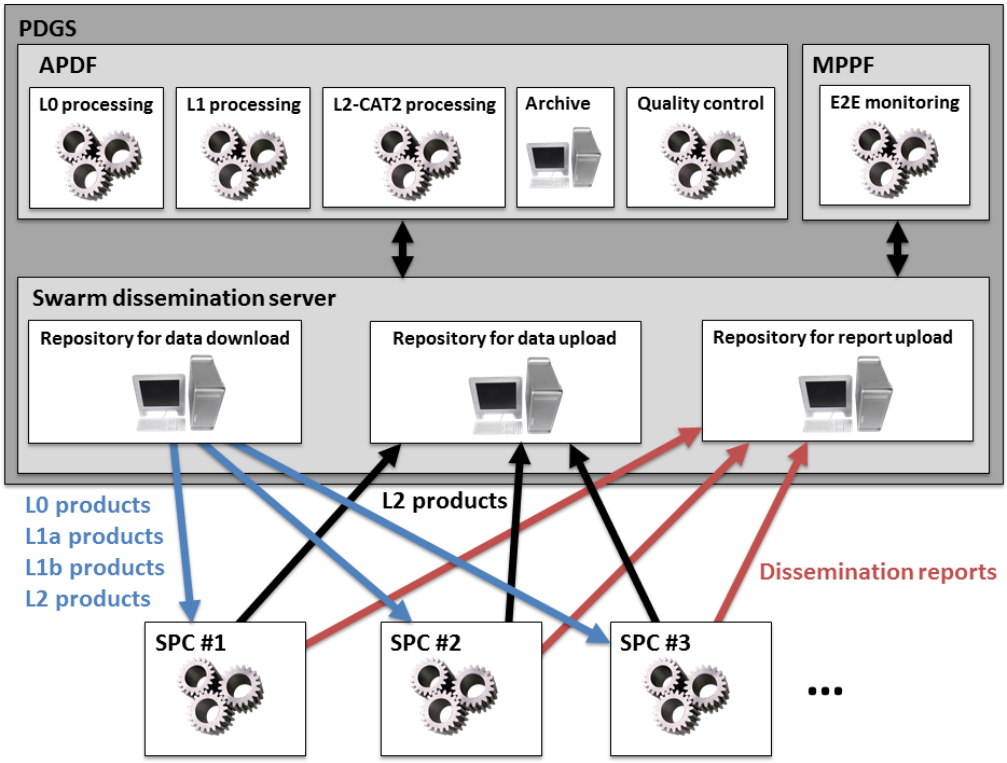

Figure 1 Data flow between PDGS and SPC. The SPC is always the initiator of data transfer, i.e. they download the needed products from the Swarm dissemination server and upload the generated Level 2 products and corresponding dissemination reports to two dedicated repositories on the Swarm dissemination server.

3 FILE CHARACTERISTICS

The PDGS makes available all Swarm data including Level 0, Level 1a, Level 1b and Level 2 data to all SPC.

Level 0 data contains the raw measurements and housekeeping data from the instruments and the spacecraft. Level 1a data contains the decoded and de-multiplexed instrument data. Since the Level 0 and Level 1a data are not publicly accessible, the format is not user friendly and the documentation of the contents is written for experts.

Level 1b and Level 2 data are described in more detail in Sections 3.1 and 3.2, respectively.

3.1 Level 1b products

The Level 1b data are provided as compressed ZIP files that contain

- one data file with the native file extension (e.g. .cdf) and described in [L1b-FMT],
- one header file with extension .HDR and described in [L1b-FMT] and
- one data quality report file with extension .EEF and described in [DQC-ICD].

The Level 1b data is disseminated directly after production, i.e. with a latency of approximately four days after making the measurement on board of the satellite.

All L1b data files are CDF files with file extension .cdf (rf. [CDF-FMT]), except the GPS receiver observations and the ephemeris (position and velocity) of the satellites, which are RINEX files with file extension .rnx (rf. [RINEX-FMT]) and SP3 files with file extension .sp3 (rf. [SP3-FMT]), respectively.

3.2 Level 2 products

The contents and format of the Level 2 products are specified in [L2-FMT]. The Level 2 products are provided as compressed ZIP files that contain

- one data file with the native file extension (e.g. .cdf),
- one header file with extension .HDR and,
- if produced automatically at PDGS, one data quality report file with extension .EEF and described in [DQC-ICD]

There are two main aspects for the characterisation the Level 2 products. One aspect is the subdivision into products that are available internally and publicly. The internally available products are identified by “i2” in the product type (16th and 17th characters of the file name) and accessible only by all SPC and PDGS. Since their validation is not completed, they are not made publicly available. Publicly available products are identified by “_2” in the product type (16th and 17th characters of the file name). They are validated to the extent possible and therefore released to the public.

The second aspect is the distinction between Level 2 products of category CAT-1 and CAT-2. The Level 2 CAT-1 products require supervision during generation, which can thus not be automated. These are the products generated by the SPC. By contrast, the Level 2 CAT-2

products can be generated automatically. They are produced at PDGS, supplemented with the quality report, and made publicly available directly after production.

3.3 Dissemination reports

Each delivery of Level 2 products by SPC to PDGS shall be accompanied by the delivery of the respective dissemination reports to the designated repository on the Swarm dissemination server. The file naming, contents and format of dissemination reports is specified in APPENDIX C. There are two options for the delivery of dissemination reports. The first is to generate one dissemination report per Level 2 product and the second is to generate one dissemination reports for multiple Level 2 products.

4 PROCEDURE FOR INTRODUCING NEW SPC

It is in the nature of the Swarm DISC that new SPC are introduced. Table 1 specifies the procedure for establishing the interface of the new SPC to PDGS that shall be followed as soon as possible after KO.

Table 1 Procedure for introducing new SPC

Step	Actionee	Action
1	DTU/DISC	a) Inform PDGS about new ITT
2	PDGS	a) Provide the name, email address, and phone number of the technical point of contact of PDGS to new SPC
3	SPC	a) Provide the name, email address, and phone number of the technical point of contact of the SPC to PDGS b) Suggest an acronym for the SPC (for example, the acronym for Technical University of Denmark is DTU) c) Generate an SSH key pair and send the public key to the point of contact of PDGS. The SSH key pair shall be used for authentication when accessing the Swarm dissemination server d) Provide the public IP-address(es) of servers accessing PDGS
4	PDGS	a) PDGS confirms the acronym of the new SPC (in case it is unique) or requests an alternative acronym (in case the suggested acronym is already in use) b) Generate an account for the new SPC and provide the credentials (username) to the new SPC (this account shall be used for download/upload of Swarm data) c) Install the public key that was provided by the SPC d) Provide the server host name of the Swarm dissemination server to the new SPC and inform about the folders where data files and dissemination reports shall be uploaded
5	PDGS and SPC	a) Agree on the tool that will be used by the SPC for data upload/download to/from the Swarm dissemination server (e.g. rsync, sftp client). The tool shall ensure file integrity, see Section 6.3 b) SPC will perform together with PDGS a test to verify that interface was established successfully
6	PDGS	a) Inform DTU/DISC and SPC when the interface test is concluded successfully

5 PROCEDURE FOR INTRODUCING NEW PRODUCTS

New products can be introduced to the interface between the SPC and PDGS following the procedure in Table 2.

In case of a regeneration or reprocessing of the Level 2 products, the product baseline and version numbers shall be discussed and agreed with the DISC project office prior to the dissemination.

Table 2 Procedure for introducing new Swarm Level 2 products

Step	Actionee	Action
1	SPC	a) Provide all information required by [L2-FMT] for the product definition (refer to APPENDIX A for an example). This includes in particular: i. Definition of unique file name in line with the EE filename convention tailored for Swarm [SW-FMT] (see APPENDIX D for examples) ii. Format and contents of the new Level 2 product following the standards defined in [L2-FMT] iii. Data volume per file iv. Number of files per time interval and satellite (e.g. 1 file per day for each of the three satellites) v. Delivery rate (e.g. 1 delivery every month)
2	DTU/DISC	a) Update the script for header and dissemination report generation b) Provide the updated script to the SPC
3	SPC	a) Generate a sample Level 2 product, i.e. the ZIP containing the header and data file, and dissemination report b) Provide sample Level 2 product and dissemination report to DTU and PDGS for inspection
4	DTU/PDGS	a) Inspect sample Level 2 product (header and data file) and dissemination report b) Report all detected problems to SPC and go back to step 3 of this procedure. Otherwise report that the inspection did not reveal problems and proceed with step 5 of this procedure.
5	PDGS	a) Update the PDGS software b) Confirm to DTU and SPC readiness for dissemination of Level 2 products and dissemination reports to PDGS
6	SPC	a) Perform initial dissemination of a limited set of ZIP files and corresponding dissemination reports b) Inform PDGS about the disseminated products (number of files and their names)

7	PDGS	a) Verfiy if disseminated set of ZIP files were correctly ingested into PDGS and report success or problems observed to DTU/SPC

6 PROTOCOL FOR DATA TRANSFER

All Swarm products shall be exchanged by the SPC via the Swarm dissemination server, i.e. the SPC shall download all needed Swarm products from the Swarm dissemination server and upload the generated Level 2 products to the Swarm dissemination server.

6.1.1 Download of Swarm products

PDGS shall make all Level 0, Level 1a, Level 1b and Level 2 products available for download to all SPC on the Swarm dissemination server.

The SPC shall download all needed Swarm data from the Swarm dissemination server using the credentials provided by PDGS and the file transfer utility agreed with ESA.

6.1.2 Upload of Swarm Level 2 products

The Level 2 products generated by the SPC shall contain the data files and the headers file as specified in [L2-FMT], where for each Level 2 product one data file and one header file are compressed together into one ZIP file. The ZIP files shall be uploaded by the SPC to the specified repository on the Swarm dissemination server using the credentials provided by PDGS and the file transfer utility agreed with ESA. Each upload of Level 2 products (ZIP files) shall be accompanied with an upload of the respective dissemination reports to the specified repository on the Swarm dissemination server. The repositories for upload of Level 2 products and dissemination reports are specified in [ICD-SUP].

6.2 Quality control

The quality control for the Level 2 products is the responsibility of the SPC, who shall check the format and content of the Level 2 products (data and header files, rf. Section 3.2) prior to the upload to the Swarm dissemination server. In addition, the SPC shall perform a validation of the Level 2 products prior to the upload to the Swarm dissemination server, such that they can be released to the public without any quality control by PDGS.

6.3 File integrity

The integrity of files provided by PDGS to the SPC is the responsibility of PDGS. Once files are present on the Swarm dissemination server, they shall be complete and not corrupted.

For the transfer of files to PDGS, the SPC shall use a temporary file name during upload, which is changed into the final file name only when the transfer is completed. This can be accomplished automatically e.g. with the rsync utility and ensures that the PDGS retrieves files from the repositories for upload only when the file transfer is completed.

6.4 New file detection

PDGS regularly polls the incoming files repositories on the Swarm dissemination server to detect new files. In nominal conditions, the frequency of polling will be one hour.

6.5 File deletion

PDGS is responsible for file deletion and cleaning of its repositories.

6.6 Error handling

When PDGS detects an error, PDGS shall notify the contact point of the respective SPC that is specified in [ICD-SUP] via email.

When SPC detect an error, the SPC shall notify the contact point of the PDGS that is specified in [ICD-SUP] via email.

APPENDIX A EXAMPLE PRODUCT DEFINITION TABLE

An example of a product definition table is provided in Table 3.

Table 3 Example Product Definition Table

<table>
<tr><td>Product identifier</td><td>ACCxPOD_2_</td></tr>
<tr><td>Definition</td><td>Time series of non-gravitational accelerations obtained by precise orbit determination</td></tr>
<tr><td>Input data</td><td>SP3xCOM_2_, GPSx_RO_1B, STRxATT_1B, SC_xDYN_1B
External data from CODE</td></tr>
<tr><td>Input time span</td><td>30 hr (daily batches with overlap)</td></tr>
<tr><td>Spatial resolution</td><td>N/A</td></tr>
<tr><td>Time representation</td><td>UTC (seconds – s), time step = 30 sec</td></tr>
<tr><td>Units</td><td>m/s^2</td></tr>
<tr><td>Resolution</td><td>64 bit double precision floating point number format</td></tr>
<tr><td>Uncertainty</td><td>10^{-7} m/s^2 variance for along-track and cross-track direction</td></tr>
<tr><td>Quality indicator</td><td>Validation report DNSxVAL_2_</td></tr>
<tr><td>Data volume</td><td>< 10 Kb per satellite per day</td></tr>
<tr><td>Data format</td><td>CDF
<table>
<tr><td>Field name</td><td>Type</td><td>Dimension</td><td>Unit</td><td>Contents</td></tr>
<tr><td>time</td><td>CDF_EPOCH</td><td>1</td><td>ms</td><td>Observation time</td></tr>
<tr><td>acc_pod</td><td>CDF_REAL8</td><td>3</td><td>m/s^2</td><td>Estimated non-gravitational acceleration (X,Y,Z)</td></tr>
<tr><td>validity_flag</td><td>CDF_INT1</td><td>1</td><td>-</td><td>Flag: 0 = nominal data, 1 = anomalous data</td></tr>
</table></td></tr>
<tr><td>Output data</td><td>CDF file with time series of accelerations</td></tr>
<tr><td>Output time span</td><td>1 day</td></tr>
<tr><td>Latency</td><td>21 days</td></tr>
<tr><td>Update rate</td><td>1 day</td></tr>
</table>

Notes	The reduced-dynamic orbit is used as a priori reference orbit.

APPENDIX B EXAMPLE OF A SWARM HEADER FILE

The header file format and contents are defined in [L2-FMT]. For convenience, an example for a header file is provided here.

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<Earth_Explorer_Header xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <Fixed_Header>
        <File_Name>SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202</File_Name>
        <File_Description>Model of the main (core) field and its temporal variation.</File_Description>
        <Notes/>
        <Mission>Swarm</Mission>
        <File_Class>OPER</File_Class>
        <File_Type>MCO_SHA_2C</File_Type>
        <Validity_Period>
            <Validity_Start>UTC=2013-11-26T00:00:00</Validity_Start>
            <Validity_Stop>UTC=2016-01-01T00:00:00</Validity_Stop>
        </Validity_Period>
        <File_Version>0202</File_Version>
        <Source>
            <System>SPC</System>
            <Creator>SPC_DTU</Creator>
            <Creator_Version>03.01</Creator_Version>
            <Creation_Date>UTC=2016-04-13T08:51:08</Creation_Date>
        </Source>
    </Fixed_Header>
    <Variable_Header>
        <MPH>
            <Product>SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202</Product>
            <Product_Format>ASCII</Product_Format>
            <Proc_Stage_Code>OPER</Proc_Stage_Code>
            <Ref_Doc>SW-DS-DTU-GS-0001</Ref_Doc>
            <Proc_Center>DTU</Proc_Center>
            <Proc_Time>UTC=2016-04-10T01:00:00.000000</Proc_Time>
            <Software_Version>CI/03.01</Software_Version>
            <Product_Err>0</Product_Err>
            <Tot_Size unit="bytes">+00000000000000033658</Tot_Size>
            <CRC>+1643194022</CRC>
        </MPH>
        <SPH>
            <SPH_Descriptor>MCO_SHA_2C</SPH_Descriptor>
            <Original_Filename>SW_OPER_MCO_SHAi2C_20131126T000000_20160101T000000_0202.shc</Original_Filename>
            <Sensing_Time_Interval>
                <Sensing_Start>UTC=2013-11-26T00:00:00.000000</Sensing_Start>
                <Sensing_Stop>UTC=2015-12-31T23:59:59.000000</Sensing_Stop>
            </Sensing_Time_Interval>
            <Product_Confidence_Data>
                <Quality_Indicator>000</Quality_Indicator>
            </Product_Confidence_Data>
            <List_of_Input_File_Names count="Nr of Input files">
                <File_Name>SW_OPER_Q3D_CI_i2__00000000T000000_99999999T999999_0101</File_Name>
                <File_Name>D_45_5_60_12_eq40000_2010_w64.txt</File_Name>
            </List_of_Input_File_Names>
            <List_of_Output_File_Names count="5">
                <File_Name>SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202</File_Name>
            </List_of_Output_File_Names>
        </SPH>
    </Variable_Header>
</Earth_Explorer_Header>
```

APPENDIX C DISSEMINATION REPORTS

C.1 Filename convention

The file naming of the dissemination reports shall be

Product_Filename_DR_*ACRO*_YYYYMMDD_HHMMSSmmm.xml

where "Product_Filename" is the file name of the data file of the Level 2 product, *ACRO* is the acronym of the SPC and "_YYYYMMDD_HHMMSSmmm" is the date and time at which the dissemination was concluded (YYYY = year, HH = hour, MM = minute, SS = second, mmm = millisecond).

C.2 File format and contents

The dissemination reports are in XML format and their contents is described in Table 4, noting that the format and contents of the header is specified in [SW-FMT]. The dissemination reports contain a single "Earth_Explorer_Header" tag and one "Data_Block" tag per Level 2 product that is delivered to PDGS.

Table 4 Definition of the dissemination reports (S = string, M = mandatory, O = optional)

XML Attribute	Level	Attribute Description, Limitation and Mapping	Type	Mult.	Role
Earth_Explorer_File	1	Tag	-	1	M
Earth_Explorer_Header	2	Tag	-	1	M
Fixed_Header	3	Tag	-	1	M
File_Name	4	This is the filename of the dissemination report	S	1	M
File_Description	4	This tag contains the following string: "Dissemination Report"	S	1	M
Notes	4	Text	S	1	O
Mission	4	This tag contains the name of the mission, in this case: "Swarm"	S	1	M
File_Class	4	This tag contains the file class of the Dissemination Report, i.e. one of the following values: OPER or RPRO	S	1	M
File_Type	4	This tag contains the File Type of the Dissemination Report	S	1	M
Validity_Period	4	Tag	-	1	M
Validity_Start	5	This tag contains the Validity Start Time of the ProductCDF Format: UTC=yyyy-mm-ddThh:mm:ss	S	1	M
Validity_Stop	5	This tag contains the Validity Stop Time of the Product	S	1	M

XML Attribute	Level	Attribute Description, Limitation and Mapping	Type	Mult.	Role
		Format: UTC=yyyy-mm-ddThh:mm:ss			
File_Version	4	This tag contains the File Version of the Dissemination Report	S	1	M
Source	4	Tag	-	1	M
System	5	This tag contains the Creating System: “SPC”	S	1	M
Creator	5	This tag contains the Creator: “SPC_<processing centre acronym>”	S	1	M
Creator_Version	5	This tag contains the Creator Version	S	1	M
Creator_Date	5	This tag contains the Dissemination Report Creation Date Format: UTC=yyyy-mm-ddThh:mm:ss	S	1	M
Variable_Header	3	Empty Tag	-	1	M
Data_Block	2	Tag	-	1	M
DisseminationReport	3	Tag	-	1	M
DateTime	4	This element indicates the date and time at which the dissemination was concluded. Format: UTC=yyyy-mm-ddThh:mm:ss	S	1	M
Generator Name	4	This tag defines the origin centre from where the product is generated. In this case the value will be “SPC_<processing centre acronym>”	S	1	M
Dissemination	4	Tag	-	1	M
Id	5	This is an optional tag and defines the Dissemination Identifier	S	1	O
Target	5	This xml tag contains an attribute “Type” and defines the type of dissemination. This attribute will have the following value: “Url” The content of the tag will be as follows: “Swarm APDF”	S	1	M
Product	4	Tag	-	1	M
Name	5	This is the filename of the disseminated product.	S	1	M
Type	5	The product type of the disseminated data	S	1	M
SensingStart	5	The product sensing start time. In case of Auxiliary Files this field is equivalent to the Validity Start. Format: UTC=yyyy-mm-ddThh:mm:ss	S	1	M
SensingStop	5	The product sensing stop time..In case of Auxiliary Files this field is equivalent to the Validity Stop.	S	1	M

XML Attribute	Level	Attribute Description, Limitation and Mapping	Type	Mult.	Role
		Format: UTC=yyyy-mm-ddThh:mm:ss			
Baseline	5	The Baseline of the disseminated product	S	1	M

C.3 Example of a Swarm dissemination report

An example of a dissemination report is provided below.

```
<?xml version="1.0" encoding="UTF-8"?>
<Earth_Explorer_File>
    <Earth_Explorer_Header>
        <Fixed_Header>
            <File_Name>SW_OPER_AUX_COR_2__20131126T000000_20180101T000000_0001_DR_GFZ__20161130_01011550
            7</File_Name>
            <File_Description>Dissemination Report</File_Description>
            <Notes/>
            <Mission>Swarm</Mission>
            <File_Class>OPER</File_Class>
            <File_Type>AUX_COR_2_</File_Type>
            <Validity_Period>
                <Validity_Start>UTC=2013-11-26T00:00:00</Validity_Start>
                <Validity_Stop>UTC=2018-01-01T00:00:00</Validity_Stop>
            </Validity_Period>
            <File_Version>0001</File_Version>
            <Source>
                <System>SPC</System>
                <Creator>SPC_GFZ</Creator>
                <Creator_Version>01.13</Creator_Version>
                <Creation_Date>UTC=2016-11-30T01:01:15</Creation_Date>
            </Source>
        </Fixed_Header>
        <Variable_Header/>
    </Earth_Explorer_Header>
    <Data_Block>
        <DisseminationReport>
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            <GeneratorName>SPC_GFZ</GeneratorName>
            <Dissemination>
                <Id/>
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            </Dissemination>
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                <Type>AUX_COR_2_</Type>
                <SensingStart>UTC=2013-11-26T00:00:00</SensingStart>
                <SensingStop>UTC=2018-01-01T00:00:00</SensingStop>
                <Baseline>00</Baseline>
            </Product>
        </DisseminationReport>
    </Data_Block>
</Earth_Explorer_File>
```

APPENDIX D EXAMPLES OF FILENAMES OF SWARM DATA AND HEADER FILES

The Swarm file naming is specified in [SW-FMT]. For convenience, we provide below a few examples of file names.

D.1 Example 1: Non-gravitational accelerations from precise orbit determination

Zip compressed file:

- SW_OPER_ACCCPOD_2__20140614T000000_20140614T235000_0101.ZIP

Contains data and header files:

- SW_OPER_ACCCPOD_2__20140614T000000_20140614T235000_0101.cdf
- SW_OPER_ACCCPOD_2__20140614T000000_20140614T235000_0101.HDR

D.2 Example 2: Validation report for precise science orbits

Zip compressed file:

- SW_OPER_SP3AVAL_2__20161115T235943_20161116T235943_0101.ZIP

Contains data and header files:

- SW_OPER_SP3AVAL_2__20161115T235943_20161116T235943_0101.pdf
- SW_OPER_SP3AVAL_2__20161115T235943_20161116T235943_0101.HDR

D.3 Example 3: Spherical harmonic model of the core field

Zip compressed file:

- SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202.ZIP

Contains data and header files:

- SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202.shc
- SW_OPER_MCO_SHA_2C_20131126T000000_20160101T000000_0202.HDR