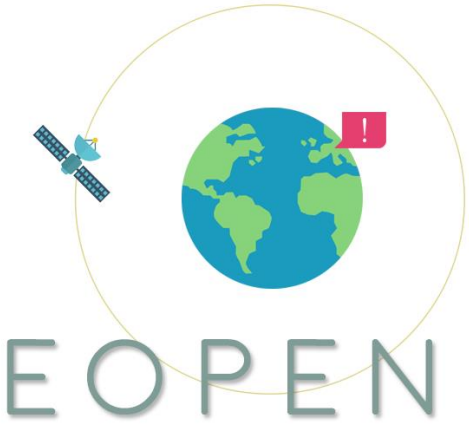

EOPEN

opEn interOperable Platform for unified access and analysis of Earth observatioN data

H2020-776019

D1.4

Data Management Plan

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Abstract	

The EOPEN Data Management Plan document (v1.1) has been revised, based on the comments received at the project 1st review, taking into account EC DMP guidelines, in particular, addressing aspects related to the FAIR (Findable, Accessible, Interoperable and Re-usable) paradigm, including information regarding:

- what data will be collected, processed and/or generated
- whether data will be shared/made open access

Note that the topics of data accessibility, standardisation and re-usability are addressed specifically in the deliverable D8.6 Long-Term Data Preservation Policy (M36, T8.3).

Also, high-level description of the data collection mechanisms is addressed in WP3 (T3.1, T3.2 and T3.3). Eventually, GDPR related issues are addressed in D9.1.

The current version includes some updates as stemming from latest product refinements; also, the NASA POWER product (section 6.2.6) and the ERA5 product (section 6.2.6) have been added (section 6.2.7); some updates are found in the section about security (section 3) and about product sustainability (sections 2.6.1 and 2.6.2), in addition to an updated overview of the data Quota obtained over the whole project; as this document provides some product specifications, it can be considered as a reference either for end users or for developers.

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History

Version	Date	Reason	Revised by	Approved By
0.1	28/09/2018	Passed Final Version to be revised		
	28/09/2018		Daniel Ferner (Serco)	
	02/10/2018		Enrico Cadau (Serco)	
	04/10/2018		Ilias Gialampoukidis (CERTH)	
1.1	08/10/2018			G. Vingione
1.2	30/05/2019 08/2019 10/2019	Update following 1st Review Meeting; adopted new template adopted as proposed by the PO. Updated version (M24), following PO comments Final revision	M. G. Scarpino (Serco) & EOPEN data providers (FMI, KU, AAWA) & SpaceApps	
1.3	15.09.2020	Alignment to the final version of the platform	M.G. Scarpino/developers	

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Executive Summary

The final version of the current document (1.3) is an update of the previous one, aligned to the final version of the platform (delivered at M34) to account for a few changes of the products generated in the platform; also, some notes about product/service sustainability are included in sections 6.2.1 and 6.2.2; some additional products are described in sections 6.2.6 and 6.2.7, and some updates are in sections 3, about security, and in section 6.3 about data obtained from Copernicus DWH.

In the previous version (1.2) the technical definition of the datasets, as stemming from the needs of the three PUCs, namely, the *PUC requested datasets* [AD1] has been addressed; among others, the technical definition is aimed at associating univocally the requested datasets to the products available either from some Copernicus thematic service or from some other sources, and to specify those that will be generated in the platform; moreover, in some cases, the requested datasets have turned out to correspond to more than one product, so they have been split; eventually the resulting selection of the derived EOPEN products is deemed to be suitable for further usage, beyond the project PUCs.

Also, in the 1.2 version, the product FAIR characteristics have been addressed, including usage constraints as well as LTDP needs; this topic has been included following some comments received at the first review, in view of product usage beyond the project Consortium and its duration.

The resulting document structure is as follows:

Chapter 1. Data Summary

Chapter 2. Allocation of resources

Chapter 3. Data security

Chapter 4. From PUC datasets to EOPEN products

Chapter 5. EOPEN Products Generated in the EOPEN Platform

Chapter 6. EO Datasets and Products from Archives and Services

Appendix A - ESA User Licence

Appendix B - FMI Research Data Policy

Appendix C - Data from social media (Tweets) vs FAIR data paradigm assessment

Appendix D - Datasets from Copernicus Services

The adopted approach is the “preservation by design approach” entailing the careful modelling of all data and metadata relevant to a given application. This way, it is expected that future uses of the data, in similar or new contexts, have a higher chance of success compared to a less all-embracing treatment of the digital content.” (GA, Annex I, Part B, p. 125)

Abbreviations and Acronyms

ARD	Association of public service broadcasters in Germany
AWS	Automatic Weather System
BMCO	Broadcast Mobile Convergence
CCM	Copernicus Contributing Missions
CollGS	Collaborative Ground Segment
DAML	DARPA Agent Markup Language
DAP	Data Access Portfolio (Copernicus DWH)
DID	Digital Item Definition
DII	Digital Item Identification
DRM	Digital Rights Management
DWH	Data Ware House
EBU	European Broadcast Union
ETSI	European Telecommunications Standards Institute
EO	Earth Observation
IEEE	Institute of Electrical and Electronics Engineers
IP	Integrated Project
IPTC	International Press Telecommunications Council
IST	Information Society Technologies
JPEG	Joint Photographic Experts Group
MAF	Multimedia Application Format
MPEG	Moving Picture Experts Group
NITF	News Industry Text Format
NoE	Network of Excellence
OWL	Ontology Web Language
OWL-QL	Ontology Web Language Query Language

OWL-DL	Ontology Web Language Description Language
PUC	Project Use Case
RDF	Resource Definition Framework
RSS	Really Simple Syndication
STREP	Specific Targeted Research Projects
W3C	World Wide Web Consortium
XML	eXtensible Markup Language
SWRL	Semantic Web Rule Language

Applicable and Reference Documents

[AD1] D2.2 User Requirements

[AD2] Copernicus Space Component Data Access Portfolio: Data Warehouse 2014 – 2020, prepared by G. Ottavianelli, COPE-PMAN-EOPG-TN-15-0004, 20/07/2018,

https://spacedata.copernicus.eu/documents/12833/14545/DAP+Document+-+current/c2449218-3ed9-434a-b32c-edfbb95b9362

[AD3] D7.1 Pilots implementation and 1st prototype evaluation report

[RD1] D3.1 Data acquisition report from the Collaborative Ground Segment.

[RD2] D6.2 Big Data Infrastructure and High Performance Computing

[RD3] D6.4 2nd prototype

[RD4] D3.2 Meteorological and climatological data acquisition report

[RD5] D3.3 EOPEN Social Media Crawlers

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1 DATA SUMMARY

1.1 Introduction

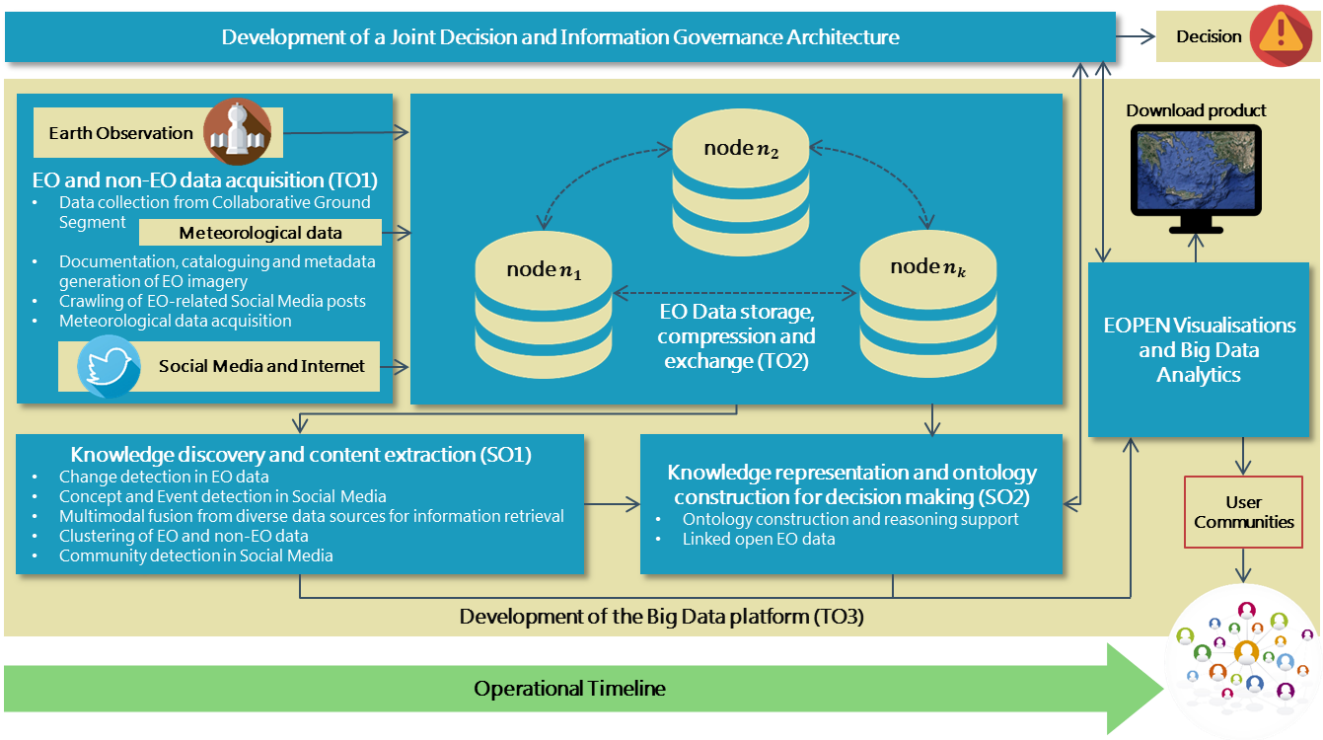
EOPEN provides a framework in which user applications are managed and are provided with the means to access datasets and perform processing. All of which allows interoperability supported by the EOPEN core capabilities.

In addition, EOPEN provides Service Extensions. They are developed by the EOPEN team and made available to all users of the EOPEN Framework typically fulfilling data preparation tasks or scientific algorithms and processing methodologies.

Generally, the EOPEN Framework does not retain data. EOPEN is "application agnostic", implying that it is transparent with regards to data characteristics, including access restrictions and data storage.

However, Service Extensions can take data, apply enhancements (processing and data fusion) to create data used by the user applications.

The following picture depicts the high level EOPEN operational concept and dataflow.



1.2 User Applications

All data collected and made available in the platform relates to user applications. In the EOPEN project the user applications are represented by three use cases.

In the case of PUC1-Flood Risk Assessment and Prevention, the partner involved is a public body (AAWA), currently not using satellite data systematically, interested to receive mapped information derived from EO satellite data which can be used to improve its models, data as well

as additional meteorological forecast data; normally such datasets are open and can be made available to identified stakeholders [AD1] or to other end users not yet reached.

In the case of PUC2-Food Security, several institutes, research or public agencies, are involved - this Use Case, located outside Europe, is connected to some national institutions of Korea; some datasets, provided by the stakeholders, appear of restricted usage, nevertheless some datasets generated in the platform (e.g. rice mapping) will be accessible. In addition to the datasets identified during the requirement analysis, PUC2 can also benefit from some meteorological data and data analyses available through the Korean Meteorological Service.

Finally, in the case of PUC3-Monitoring Climate Change, the partner responsible for its implementation is a national service - the identified datasets can serve a community of users which can be extended; also, a usage transversal to various user communities can be envisaged. Identified datasets are mainly of non-EO type; in addition to them some "EO based" datasets have been considered, following the 1st project review meeting. PUC3 datasets are normally open.

The datasets for the use cases handled in the platform belong to the following typologies:

1a. EO data products available from Copernicus Data Ware House (DWH), including proprietary datasets; (ref. 6.3)

1b. EO data from the EOPEN Umbrella Hub (former Collaborative Ground Segment, CollGS) [RD1];

2. Datasets stemming from Copernicus Thematic Services; (ref. 6.2.3)

3. Datasets stemming from Copernicus EMS services; (ref. D1.1)

4. Datasets stemming from other EC Project (Open Data); (ref. 6.2)

5. Non-EO datasets, including meteorological data; (ref. 6.2)

6. Datasets generated in the EOPEN platform; (ref. 5)

7. Datasets available from stakeholders, including proprietary datasets, or generated by them using resources available from the EOPEN platform. (ref. 6.2)

The needed datasets are mainly EO satellite data/products from Copernicus DWH; some environmental variables, derived from EO data - Essential Climate Variables (ECV) (e.g. LAI) - available from Copernicus Land Services and some non-EO data, such as climatic data and social media data, in addition to weather forecast (derived from models including satellite data).

EO data products from Copernicus Warehouse are mainly open data; some EO data from the Copernicus Contributing Missions are available in limited amounts (Quotas) during the Project lifetime (ref. 6.3).

The type of Requested Datasets, typical of the application area at the basis of the Use Cases, depend also on the stakeholders involved in the project. [AD3]

The FAIR paradigm is addressed in section 4, focused on the EOPEN product description.

Whereas the current deliverable deals with a general product description and management, other deliverables describe in detail how input data are accessed and handled - in particular,

[RD1] is focused on a unique Sentinel Data Hub access point, which is called Umbrella Hub; in addition to it, access to DVH data through DIAS is addressed in [RD3] (M26); [RD4] (M26) is focused on meteorological and climatological data acquisition; and [RD5] (M32) is focused on social media crawlers to handle social media data.

Standardization, Interoperability and long-term data preservation aspects are addressed in other WPs (WP6, WP8,) so they will be treated in detail in other deliverables (D6.1, D8.6).

Some information about allocated resources and data security is provided in the sections 2 and 3.

2 ALLOCATION OF RESOURCES

Data in the EOPEN project is acquired for, used by and produced by the user applications of the Use Cases. In many cases the data is from open and freely available sources such as Copernicus. Data produced by the use case applications in the EOPEN project is mainly in the public domain, however some data, for example social media-tweets, are constrained by specific ownership and privacy regulations.

As to costs, this will depend on the adopted solution; such topic is currently being addressed; also, an aspect to be clarified is which data can be classified as research thus chargeable to the project. Which data are subject to FAIR is described in section 4.

Serco, as responsible of DMS, is overseing this activity with the support of SPACEAPPS.

Some LTDP resources have been planned. Firstly, “EOPEN has the responsibility for providing the means to produce data that will survive (i.e. standards and formats applied)”. The concepts, design and implementation of the framework core ensure that users create well defined processes and data exchanges. Secondly, the EOPEN LTDP framework, deliverable D8.6, will ensure the accessibility and ability to re-use EOPEN datasets, in line with the EOPEN data management plan. “The LTDP framework will be based on the preservation by design approach researched in the PERICLES”. (GA, Annex 1, p. 124)

LTDP is also a prerequisite for long term sustainability of EOPEN.

3 DATA SECURITY

Overseeing security is part of SERCO’s leading tasks.

User management, privacy and security requirements are defined to establish procedures, software and infrastructure to ensure that the platform and its users is protected from unauthorised access; accidental revealing of privileged information and breaches by those with ill-intent are defined in D6.1.

EOPEN has in place user authentication. Communicating with other platforms uses the protocols and interfaces supported by the cloud platform. By far the most popular software is OpenStack. Based on community experience we consider the measures taken by the cloud providers to be

adequate for the purposes of EOPEN. Details of security with OpensStack can be found here: https://docs.openstack.org/security-guide/index.html

The EOPEN project uses only European cloud providers that have clearly defined security policies and implement precautions such as security solutions such as the anti-DDos service.

DIAS-ONDA is such a provider offering an anti-DDos service with operations designed to be security compliant with ISO/IEC 27000 and Data Protection Directive 95/46/EC."

[Anti-DDos (Distributed Denial of Service) protects against some informatics attacks (https://en.wikipedia.org/wiki/Denial-of-service_attack#Distributed_DoS_attack)]

Hereafter some information on data security is reported, by referring to the related deliverable.

Umbrella Hub

[RD1] describes such Umbrella, acting as a broker of existing hubs - it does not add any extra information value, but merely distributes existing metadata of the Sentinel Access points; below some features related to security are described.

Database Access

Establishing a database connection requires the following credentials: database name, username, password, host IP and port. These credentials are used by the application to interact with the database and securing them is quite important. Therefore, the database stored credentials are retrieved in the following ways:

- A JSON file stored in the working directory.

- Environmental variables.

REST API Access

The application allows users to retrieve resource representation/information, only while the modification of it is restricted in every way. As GET requests do not modify the state of the resource, these are considered to be safe methods.

Metadata harvesting and sharing

Metadata are harvested from the hubs by sending requests to the respective APIs. Requests are based on the hubs' individual security policy. This policy includes authorization via credentials for accessing the API of each hub. The hubs' generated credentials are stored in the database and retrieved every time the request is constructed. In this way, Umbrella hub collects and saves the metadata from different endpoints. As a result, the obtained metadata are made available for downloading by any user. The download process requires Umbrella hub users to be registered, in turn, to the different hubs connected, as this process requires also authorization. Finally, download integrity can be verified using the MD5 checksum provided by the Umbrella hub.

[RD2] Big Data Infrastructure and High Performance Computing is about setting up and providing access through the EOPEN platform to the Big Data and HPC infrastructure located at HLRS. Data locality is of utmost importance in order to achieve maximum performance, and thus both, the submission of new

processing jobs, and input data are required to be transferred in a secure and fast manner to these systems before processing can start. [RD2] detailed the setup of Cloudify, an orchestration tool to submit workflows via a RESTful service, between the EOPEN platform and HLRS. Allowing workflow submissions to the HPC system with Cloudify is achieved with milestone MS1, where security is guaranteed by using secure communication via SSL, meaning that all communication between client and server is encrypted. Further, confidential information is hidden in data that is sent through Cloudify by using Cloudify's own secret store. Further actions include enabling a secure and fast data transfer from and to HLRS infrastructure via FTP. FTP a standard network protocol for transferring data over network, which is built on a client-server model architecture using separate control and data connections between the client and the server. EOPEN is following here best practices for authentication and authorization, and the actual transfer will benefit from the FTP protocol to ensure a fast and secure data transfer between sites. HLRS and SpaceApps firewall is configured to allow valid IP for transferring data transfer between HPC and FTP system, so the malicious user access is restricted with the firewall to avoid the potential security attacks.

4 FROM PUC DATASETS TO EOPEN PRODUCTS

The PUC requested datasets [AD1] have been further considered in view to associate them to products available from some Copernicus service or from some other sources, or to identify suitable products to be generated in the platform by applying EO data analyses. In some cases, a dataset has been split in two as it turned out to include different data typologies (ref. section 1). A selection of EOPEN products has been derived, generalized for further usage, beyond the project PUCs.

PUC Requested Datasets and resulting products are summarized in the tables presented in the sections 4.1.3, 4.2.3 and 4.3.3 - a colour code has been associated to each data type as shown in the Legend below. Products are described in detail in sections 5 and 6.

Requested datasets Legend
EO datasets available from Copernicus Data Ware House
Datasets generated by the stakeholder at his premises or using resources available from the EOPEN platform
Datasets stemming from Copernicus Thematic Services
Datasets stemming from EMS services
Datasets generated in EOPEN
Datasets stemming from another service or EC Project (Open Data)
Non-EO datasets
Proprietary datasets from stakeholders

Initially, the PUC requested datasets have been analysed in terms of dataset scope, EO and Non-EO data needs, data sources, archiving location, time scope, and volumes. A summary of the EO data-products needed from the Copernicus DWH is reported in section 6.3.

Normally such information is aligned to the most recent available information, being chapters 5-6 the “living part” of the document.

Below is a list of the information collected by means of a google spreadsheet - the second and third rows refer to the EO data-products, made available through the Copernicus DWH, including data-products available under Quota amounts restrictions (ref. section 6.3) during the project life time.

1.	EO Missions
2.	DAP Datasets
3.	Product
4.	Format
5.	Source
6.	Access Restrictions
7.	Storage
8.	Area
9.	Time Interval
10.	Data Volume
11.	Scope
12.	Notes

Table 1: Requested Datasets information

PUC requested datasets and the derived products are reported in the sections 4.1-3, FAIR characteristics and LTDP needs are summarized in section 4.4.

4.1 PUC1 - Flood risk assessment and prevention datasets

4.1.1 PUC1 Requested Datasets

Use case D-id	Dataset Description
PUC1_DA1	DEM/DSM 1m (e.g. Airbus Pleiades) from DWH
PUC1_DA2	Snow maps with a resolution < 20m
PUC1_DA3	Soil moisture maps with resolution < 10m
PUC1_DA4	Flood maps (*)
PUC1_DA5	Damage maps (**)
PUC1_DA6	Water presence maps
PUC1_DA7	Bathymetry of coast, lakes, rivers
PUC1_DA8	Ortho-photo with resolution of 50 cm (e.g. WorldView4)
PUC1_DA9	Vegetation presence
PUC1_DA10	Land cover
PUC1_DA11	LAI and other vegetation indexes
PUC1_DA12	Other maps (thermal or multispectral data ready to be processed) with high resolution
PUC1_DA13	Weather forecast
PUC1_DA14	Social media

Table 2: PUC1 Requested Datasets [AD1]

(*) Generated by the stakeholder at his premises or exploiting EOPEN resources.

(**) From Copernicus EMS or generated by the stakeholder at his premises.

4.1.2 PUC1 Data Summary Information

Requested Datasets	EO Missions	DAP Datasets	Product	Format	Source	Access Restrictions	Storage	Area	Time Interval	Data Vol. (estimate)	Scope	Notes
PUC1_DA1	TerraSAR-X/TanDEM	SAR_VHR1			Copernicus DWH	Quota amount	AAWA/EOPEN	AAWA restricted AOI	update every 3 year		DEM/DTM for AMICO improvement	Upon assessment of high resolution (or update) need & DEM derivation based on Sentinel 1 data by AAWA
	contributing mission	Optical_VHR2			Copernicus DWH	Quota amount	AAWA/EOPEN	AAWA restricted AOI	update every 3 year		DEM/DTM for AMICO improvement	Upon assessment of high resolution (or update) need & DEM derivation based on Sentinel 1 data by AAWA
PUC1_DA7	Sentinel				SciHub or DIAS for Sentinels	no	AAWA/EOPEN	AAWA water district	frequently update (tbd)		AMICO improvement (boundary conditions for hydraulic models)	from Copernicus Thematic Services as available; generation on the platform not foreseen
PUC1_DA8	(e.g. WorldView4)	VHR1 product and sentinel			Copernicus DWH	Quota amount	AAWA/EOPEN	AAWA water district + AOI	frequently update sentinel (tbd) Long time product for VHR (1-2 year)		Vulnerability and exposure for risk calculation	end user processing; dataset to define the land use better with a particular focus on cities and heritage; VHR optical data can better identify building and as consequence the vulnerability and exposure
PUC1_DA2.1	Snow Water Equivalent (SWE)				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available		AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=512260;Collection=1000061;Time=NORMAL,NORMAL,-1,,,-1 grid resolution 0.05 deg - avaliable 12 hours after sensing (Summer months)
PUC1_DA2.2	Snow Cover Extent (SCE)				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available		AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=100001;Collection=29870071;Time=NORMAL,NORMAL,-1,,,-1,, grid resolution: 0.005 - European - daily
PUC1_DA3	SME					no	EOPEN	AAWA water district	frequently updated as available	variable 1-10 MB/Product	AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=710275;Collection=1000282;Time=NORMAL,NORMAL,-1,,,-1,, 1 km space resolution (1°/112) - one measurement every 1.5-4 days over Europe
PUC1_DA9	covered by D11.1-4					no	EOPEN	AAWA water district	frequently updated as available		AMICO improvement	from Copernicus Thematic Services as available
PUC1_DA10					Copernicus Corine Land Cover	no	AAWA/EOPEN	AAWA water district	Static layer		AMICO improvement	Generation on the platform not foreseen
PUC1_DA11.1	LAI				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available	~2-3 GB/Product	AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/datapool/Vegetation/Properties/LAI_300m_V1/2019/05/20/ grid resolution: 1/336 - global product - decadal update
PUC1_DA11.2	FCOVER				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available	~2-3 GB/Product	AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=512260;Collection=1000061;Time=NORMAL,NORMAL,-1,,,-1 grid resolution: 1/336 - global product - decadal update
PUC1_DA11.3	NDVI				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available	1 GB/Product	AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=513186;Collection=1000063;Time=NORMAL,NORMAL,-1,,,-1 grid resolution: 1/336 - 10 days composite (max 3 days lag in Near Real Time)
PUC1_DA11.4	VCI				Copernicus Global Land Service (CGLS)	no	EOPEN	AAWA water district	frequently updated as available	~150 MB/Product	AMICO improvement	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=513186;Collection=728779;Time=NORMAL,NORMAL,-1,,,-1 - grid resolution 1/112° - 10-days composite
PUC1_DA12	Other Copernicus service maps					no	EOPEN	AAWA water district	frequently update (tbd)		AMICO improvement	Other Copernicus service maps selected by the User and accessed through the platform
PUC1_DA5									rush/on call (*)		emergency	Copernicus EMS (on call) , both, Rapid Mapping and/or and Risk and Recovery

PUC1_DA4	S1, S2, CSK, etc.	HR2MR1_SAR_GLOBAL SAR_VHR2	SLC, etc.		Copernicus DWH and SciHub or DIAS for Sentinels	Quota amount for CSK	AAWA/E OPEN	AAWA water district	every time is necessary		Flood detection and flood forecasting	CSK products requested for calibration purposes; also can be available from Copernicus EMS (on call); on the 2nd and 3rd year project enabled for rush (*) data acquisition; initially foreseen to be generated at AAWA
PUC1_DA6	S1,S2, and VHR1 if available for city	sentinel + VHR1			Copernicus DWH and SciHub or DIAS for Sentinels	Quota amount	AAWA/E OPEN	AAWA water district	3 years or more		basemap for future elaborations	in the previous note referred to hydrography normal conditions
PUC1_DA13			Weather forecast		FMI		AAWA/E OPEN	AAWA water district	frequently update (tbd)		AMICO improvement	
PUC1_DA14			Social media (tweets) that contain preselected keywords	JSON	Twitter API	Open Data	CERTH/E OPEN	Northeastern Italy, incl. Vicenza	Every second	300MB/day	Relevancy estimation, event detection, community detection, concept extraction	
(*) rush request foreseen												

Table 3: PUC1 Data Summary

4.1.3 PUC1 Products (*)

Dataset ID.	Product Name/acronym	Web Location (**)
PUC1_DA2.1	Snow Water Equivalent/ SWE_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=512260;Collection=1000061;Time=NORMAL,NORMAL,-1,,,-1
PUC1_DA2.2	Snow Cover Extent/SCE_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=1000101;Collection=29870071;Time=NORMAL,NORMAL,-1,,,-1,,
PUC1_DA3	Surface Soil Moisture/SME_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=71027541;Collection=1000282;Time=NORMAL,NORMAL,-1,,,-1,, https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS1_PUM_SSM1km-V1_I1.30.pdf
PUC1_DA4	EOPEN AAWA AMICO Early Warning System Flood Forecast /AA_EWS_FF	
PUC1_DA5	EC EMS Damage Map (or others)/ EC_EMS_DM (tbc)	

PUC1_DA6_a	Water Presence Map/WPM	
PUC1_DA6_b	Water Presence Change Monitoring/ WPCM	
PUC1_DA11.1	Leaf Area Index/LAI_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/datapool/Vegetation/Properties/LAI_300m_V1/2019/05/20/
PUC1_DA11.2	Fraction of vegetation Cover /FCOVER_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=512260;Collection=1000061;Time=NORMAL,NORMAL,-1,,,-1
PUC1_DA11.3	Normalized Difference Vegetation Index /NDVI_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=513186;Collection=1000063;Time=NORMAL,NORMAL,-1,,,-1
PUC1_DA11.4	Vegetation Condition Index VCI_CGLS (**)	https://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Browse;Root=513186;Collection=728779;Time=NORMAL,NORMAL,-1,,,-1
PUC1_DA13.1	FMI Weather Forecast (HIRLAM_NWP)	
PUC1_DA13.2	Weather forecast ensemble	Requested afterword, turned out as not available from FMI
PUC1_DA14	Tweet collections (TC)	

Table 4: PUC1 Products

(*) Copernicus DWH data-products are not included in this table

(**) CGLS => Copernicus Land Service

4.2 PUC2: Food Security

4.2.1 PUC2 Requested Datasets

Use case D-id	Dataset Description
PUC2_DB1	High resolution remote sensing imagery
PUC2_DB2	Meteorological observation (a) and forecasting data (b)(*)
PUC2_DB3	In field inspection data (**)
PUC2_DB4	Farmers' claims data (**)
PUC2_DB5	Accurate yield statistics (***)
PUC2_DB6	EO based production status (****)
PUC2_DB7	Statistical data on national fertilizer usage (**)
PUC2_DB8	Social media

Table 5: PUC2 Requested Datasets [AD1]

(*) It has turned out of no use in PUC2

(**) After a crosscheck with the stakeholders, it has turned out that such data will not be available.

(***) See note Table 7.

(****) This dataset has been removed following the redefinition of PUC2_DB1 (see section 4.2.3)

4.2.2 PUC2 Data Summary Information

Requested Datasets	EO Missions	DAP Datasets	Product	Format	Source	Access Restrictions	Storage	Area	Time Interval	Data Volume (estimate)	Scope	Notes
PUC2_DB1	TerraSAR-X or COSMO-SkyMed, Sentinel-1,2	SAR_HR1 (ADD_13a and ADD_14a)			Copernicus DWH and SciHub or DIAS for Sentinels	Quota amount	NOA/EOPEN	Yearly time series (20-30 images per year) of a single stripmap frame in South Korea	2016 to 2018 (time-series for three years)	Approximately 80 stripmap frames	Comparison with Sentinel-1 data	Stripmap mode
PUC2_DB2			solar radiation, wind speed, vapour pressure etc.		South Korean stakeholders + Open access repositories (NASA Power Dataset)	Respective stakeholder data restrictions	NOA/EOPEN	Samples throughout South Korea			Input in crop yield estimation models	
PUC2_DB2			solar radiation, wind speed, vapour pressure etc.		Korean Meteorological Service (open)	Respective stakeholder data restrictions	NOA/EOPEN	Samples throughout South Korea			Input in crop yield estimation models	
PUC2_DB3			cultivated crop type, cropping practices, fertilizer usage etc.		South Korean stakeholders	Respective stakeholder data restrictions	NOA/EOPEN				Input in crop yield estimation models	In the form of shapefiles, spreadsheets, georeferenced maps and images
PUC2_DB4			Crop type declarations by the farmers		Public body implementing the agriculture subsidy scheme in South Korea	Public body data restrictions	NOA/EOPEN				Training of machine learning algorithms for crop type classification	
PUC2_DB5			Historical yield statistics for the country (municipality or province level)		South Korean stakeholders	Respective stakeholder data restrictions	NOA/EOPEN				Training of machine learning algorithms and initial conditions for regression models	
PUC2_DB6	TerraSAR-X or COSMO-SkyMed, Sentinel-1,2	SAR_HR1 (ADD_013a and ADD_014a)			Copernicus DWH and SciHub or DIAS for Sentinels	Quota amount	NOA/EOPEN	Yearly time series (20-30 images per year) of a single stripmap frame in South Korea	2016 to 2018 (time-series for three years)	Approximately 80 stripmap frames	Comparison with Sentinel-1 data	Stripmap mode
PUC2_DB7			Statistical data on fertilizer usage (municipality or province level)		South Korean stakeholders	Respective stakeholder data restrictions	NOA/EOPEN				Input in crop yield estimation models	
PUC2_DB8			Social media (tweets) that contain preselected keywords	JSON	Twitter API	Open Data	CERTH/EOPEN	South Korea	Every second	300MB/day	Relevancy estimation, event detection, community detection, concept extraction	

Table 6: PUC2 Data Summary

4.2.3 PUC2 Products

Regarding PUC2 some requested datasets, originally indicated, have been modified in accordance with [AD3] – below is the resulting product list.

Dataset ID.	Description	Product Short Name/Acronym
PUC2_DB1_a	Timeseries of vegetation indices and crop growth indicators	Rice Status Indicator (RSI)
PUC2_DB1_b	Timeseries of rice maps at 10 m spatial resolution	Paddy Rice Mapping (PRM)
PUC2_DB2_a	Meteorological observation (*)	KMA Open API See also section 6.2.6 NASA POWER product.

PUC2_DB2_b	Weather forecast (*)	KMA Open API (No longer considered)
PUC2_DB3	In field inspection data	NA
PUC2_DB4	Farmers' claims data	NA
PUC2_DB5	Accurate yield statistics (**)	Rice Yield Estimation (RYE)
PUC2_DB6	removed	
PUC2_DB7	Statistical data on national fertilizer usage	NA
PUC2_DB8	Social media	Tweet collections (TC)

Table 7: PUC2 Products

(*) Although of no use for PUC2, as originally foreseen, they can be kept as available products in the EOPEN platform

(**) Ultimate product is considered "high risk high gain". The product refers to the national scale rice yield estimation for South Korea. Since, ground truth data, such as fertilization usage, cultivating practices, high resolution meteorological or soil data, are not freely available we will only make use of Sentinel data. We will attempt to use advanced machine learning and regression techniques for the estimation of yield based on multi-year time series of Sentinel data, correlated with the freely available district-level yield statistics. Nonetheless, the accuracy and overall usefulness of the ultimate product is not guaranteed.

4.3 PUC3: Monitoring Climate Change

4.3.1 PUC3 Requested Datasets

Use case D-id	Dataset Description
PUC3_DC1	Snow cover observations
PUC3_DC2	Ground (soil) temperature data
PUC3_DC3	Air temperature at 2 m height
PUC3_DC4	Snow accumulation maps
PUC3_DC5	Climatological data for meteorological observations
PUC3_DC6	Social media
PUC3_DC7	Climate change scenario projections
PUC3_DC8	Weather observation time-series
PUC3_DA9	Numerical weather prediction model forecasts
PUC3_DC10	Region and municipality borders
PUC3_DC11	Herding area borders
PUC3_DC12	Road maintenance classification

Table 8: PUC3 Requested Datasets

4.3.2 PUC3 Data Summary Information

Requested Datasets	EO Missions	DAP Datasets	Product	Format	Source	Access Restrictions	Storage	Area	Time Interval	Data Volume (estimate)	Scope	Notes
PUC3_DC1		N/A	GlobSnow SWE	NetCDF	FMI	Open Data	EOPEN	Finland	Daily	(up to) 3.3MB/day	Estimate snow cover extent, analyse changes in snow coverage	The product covers larger area than we need, so data volume can be reduced by discarding regions outside AoI.
PUC3_DC2	Sentinel 3		S3A_SL_2_LST		(tbc)			Finland			Detect frozen ground	Sentinel-3 LST can be added. (e.g. S3A_SL_2_LST)
PUC3_DC3			Grid-interpolated temperature observations (daily average)	NetCDF	FMI	Restricted	EOPEN	Finland	Daily	700 MB	Analyse changes in air temperature, current and forecast weather	Data is given as-is, no automatic updating provided (tbc)
PUC3_DC4			Grid-interpolated snow depth observations	NetCDF	FMI	Restricted	EOPEN	Finland	Daily	700 MB	Estimate snowfall, analyse changes in snow accumulation	
PUC3_DC5			Monthly average temperature and rain accumulation calculated from 30-year period	XML, NetCDF	FMI	Open Data	EOPEN	Finland	N/A	50 MB	Reference statistics	
PUC3_DC6			Social media (tweets) that contain preselected keywords	JSON	Twitter API	Open Data	CERTH/EOPEN	Finland	Every second	300MB/day	Relevancy estimation, event detection, community detection, concept extraction	
PUC3_DC7				XML	FMI	Open Data	EOPEN	Finland	N/A		Visualise potential future changes in temperature and snowfall	**To be confirmed for inclusion in D1.4 and EOPEN platform.** Data available from FMI Open Data: "Climate change forecasts for the 30-year periods 2010, 2040 and 2070 (model forecast; average changes for temperature and rain)"
PUC3_DC8			Time series from automatic weather stations	XML	FMI	Open Data	EOPEN	Finland	Daily		Use weather observations to support analysis	More frequent observation data is also available from FMI Open Data Service (data available only from year 2010 onwards)
PUC3_DC9			Numerical weather prediction model output (forecast)	NetCDF	FMI	Open Data	EOPEN, Amazon AWS, FMI	Finland	Every 6 hours	50 MB / forecast; 200 MB / day		Weather model forecasts give hourly values. New run is available every 6 hours. Only the most recent run is available from FMI Open Data Service. Past forecasts (from 04/2015 onwards) are available from FMI's Amazon AWS S3 buckets.

Table 9: PUC3 Data Summary

4.3.3 PUC3 Products

Dataset ID.	Product Name / acronym	Web Location
PUC3_DC1	GlobSnow Snow Water Extent (GlobSnow_SWE)	http://nsdc.fmi.fi/data/data_globsnow_swe
PUC3_DC2.1	SMOS Level 3 Soil Freeze and Thaw Service (SMOS_L3FT)	http://nsdc.fmi.fi/data/data_smos [see also https://confluence.ecmwf.int/display/CKB/ERA5%3A+data+documentation#ERA5:datadocumentation-Parameterlistings ref. 6.2.7]
PUC3_DC2.2	Sentinel-3 SLSTR Level-2 LST (Sentinel3_LST)	https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-3-slstr/product-types/level-2-lst See also 6.2.7

PUC3_DC3	Air Temperature (FMIClimGrid_Tair)	https://etsin.fairdata.fi/dataset/63b58d1a-dc23-44eb-87e6-d3c31b9a57f9 See also 6.2.7
PUC3_DC4	Snow depth (FMIClimGrid_Snow)	https://etsin.fairdata.fi/dataset/d72b6068-9ff2-4e82-90b3-057d145a274f See also 6.2.7
PUC3_DC5	Climatological data for meteorological observations (AWS_CLIM_FIN)	https://en.ilmatieteenlaitos.fi/open-data-sets-available
PUC3_DC6	Tweet collections (TC)	
PUC3_DC7	Climate change scenario projections (CCS_FIN)	https://en.ilmatieteenlaitos.fi/open-data-sets-available
PUC3_DC8	Historical and current weather observations from Finnish automatic weather stations (AWS_OBS_FIN)	https://en.ilmatieteenlaitos.fi/open-data-sets-available
PUC3_DC9	HIRLAM Weather Forecast (HIRLAM_NWP)	https://en.ilmatieteenlaitos.fi/open-data-sets-available
PUC3_DC10	Finnish regions and municipalities	https://kartta.paikkatietoikkuna.fi/?lang=en
PUC3_DC11	Reindeer herding districts	N/A
PUC3_DC12	FTIA Road Maintenance Classification (FTIA_RoadMC)	https://julkinen.vayla.fi/oskari/

Table 10: PUC3 Products

4.4 EOPEN Products - FAIR (Findable, Accessible, Interoperable, Re-usable) characteristics and LTDP needs

In the following EOPEN Products FAIR characteristics are briefly summarized. They have been derived, based on the EC DMP guidelines - as an example, Twitter datasets analysis is reported in Appendix C.

EOPEN Products are normally open data, also, Copernicus DWH data used in the platform is regulated through ESA Data User Licence (see Appendix A). The FMI research Data Policy is illustrated in Appendix B. The data policy for Copernicus Emergency Management Service and Land Service products accessed through the platform are presented in the Appendix D2.

EOPEN Product specifications, including accessibility and archiving, are reported in sections 5 and 6.

4.4.1 PUC1 products vs FAIR characteristics

PUC1 products are mainly open, derived from Copernicus DWH open data or available through Land Services and from FMI.

Products generated in the platform for the stakeholder (AAWA) usage or generated by AAWA by exploiting EOPEN resources are also open, as stemming from a public authority; hereafter some information related to the AAWA product, namely the AAWA AMICO Early Warning System Flood Forecast (ref. 6.2.5) codification and accessibility is provided.

Normally AAWA (AMICO) products follow AAAWA internal codification as well as European codification (for basin, river): metadata can be generated upon request - they include information on the environment and date of generation; search keywords can be provided if needed.

AAWA products will be made available and open (openGL license) in the platform without time limitations; moreover, they will be also available through AAWA website in a dedicated repository; several formats are available, namely, PDF, geo-tiff and ASCII, as needed in GIS software.

Open readable format (not compiled) and standard vocabulary make them re-usable.

4.4.2 PUC2 products vs FAIR characteristics

PUC2 products are mainly open, either derived from Copernicus DWH data or from the Korean Meteorological Service; some crop data collected locally can be proprietary data.

In-field inspection data is open only for domestic researchers; Korean land cover data can be accessed only by logging in to the Ministry of Environment web site (one needs Korean phone number for user authentication); farmers' claims data are not accessible; Korean rice yield data is open access, but only city level in-situ data; statistical data on national fertilizer usage is available only at national level.

PUC2 products, namely, Rice Status Indicators and Paddy Rice mapping (ref. 5.2) are FAIR compliant.

4.4.3 PUC3 products vs FAIR characteristics

PUC3 products are normally open data provided by FMI; they are available from three different sources: FMI Open Data; GlobSnow from the Sodankylä National Satellite Data Centre, and grid-interpolated temperature and snow depth maps. The GlobSnow and the SMOS level 3 Freeze/thaw products are officially unlicensed open data and their usage is unrestricted. The FTIA road maintenance classification is open and unrestricted data and can be obtained from the FTIA Open Data API. The datasets are provided as NetCDF archives. At the moment, these datasets are available from an ftp server, but, in the near future they can also be obtained from the GeoServer. If needed, metadata for these datasets can be obtained from the Sodankylä National Satellite Data Centre portal and later from the GeoServer.

The grid-interpolated maps are part of the FMI ClimGrid dataset and can be obtained from the Paituli data portal (https://etsin.fairdata.fi/). Metadata for these can also be obtained from the portal. They adhere to the Creative Commons Attribution 4.0 International (CC-BY 4.0) license similarly to the FMI Open Data.

All these datasets can be re-used and modified in the EOPEN platform by third parties. They are fully compliant with the FAIR paradigm.

4.4.4 Twitter products vs FAIR characteristics

Twitter data product FAIR characteristics are reported in Appendix C.

4.4.5 EOPEN LTDP data needs

As discussed in 1.2 all data collected and made available in the platform relates to user applications. EOPEN LTDP needs have therefore been analysed with reference to PUCs.

Based on the data the following guidelines have been established.

Data description	**Category**	**FAIR and LTDP considerations**
Data from Copernicus sources (Data Warehouse, Thematic Services, Emergency Management Services) that are free to access and managed by Copernicus.	1	At source. No action required in EOPEN other than to identify the data
Data from other services or EC projects providing open data	2	At source. No action required in EOPEN other than to identify
Public domain non-EO data sets	3	Evaluation of the access rights and utilisation required
Non-Public domain non-EO data sets	4	Evaluation of the access rights and utilisation required
Data generated in EOPEN and shared to all users	5	Responsibility of EOPEN

Data generated in EOPEN by stakeholders (Use Cases)	6	Responsibility of the stakeholder
Proprietary datasets	7	Restricted and dependent on the stakeholder

Normally EO data from Copernicus DWH are not archived (only metadata are saved); also, LTDP is not considered in the case of non-EO data provided by FMI and coming from Twitter; in particular, in the case of FMI, they have already in place their own procedures whereas CERTH is taking care of twitter archiving.

LTDP needs are limited to PUC1 (AAWA) which is exploiting the platform resources for generating some of their products although archiving is also foreseen at their premises.

About 250 GB have been estimated for LTDP of high resolution EO data, obtained from Copernicus DWH, in limited amounts, under Quota restrictions (including possibly Copernicus EMS data-products on flood event occurrence during the second half of the project as rush datasets) as well as weather forecast data (not archived at FMI) and AAWA products, generated on the platform as EOPEN Products.

5 EOPEN PRODUCTS GENERATED IN THE PLATFORM

EOPEN products generated in the platform are related to PUC1 and PUC2 as PUC3 products are provided by FMI (ref. 6.2.1).

The products described in this section have not any constraint - they can be generated on demand or, routinely, as a service, running the platform operationally.

PUC products specifications are presented through a table such as that shown below, suitable for describing Geospatial layers.

Dataset ID.	
Dataset Name	
Purpose	
Description (Content Specification)	
Output Layers	
Measurement Unit	

Temporal/spatial applicable domains[1]	
Temporal coverage	
Spatial Coverage / Area	
Spatial Resolution / Scale (Data Grid)	
Geographic projection / Reference system	
Input Data/Sources	
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	
Format	
Naming convention	
Archiving and preservation	
Data sharing	
Standards and metadata	

5.1 PUC1 Products

As from 4.1.3 the PUC1 products generated in the platform are three: Water Presence Map and Water Presence Change Monitoring, in addition to the EOPEN AAWA AMICO Early Warning System Flood Forecast which is described in 6.2.5 as it is generated by the stakeholder, based on EOPEN products, by exploiting some EOPEN resources. The first two are presented in the following tables.

Dataset ID.	PUC1_DA6_a
Dataset Name/Acronym	Water Presence Map/WPM
Purpose	Mapping of flooded areas at a given time

[1] This field includes end-user administrative information if any.

Description (Content Specification):	Water mask of flooded areas extracted over a single image (ref. D4.1, section 2.4)
Output Layers:	Raster file
Measurement Unit:	NA
Temporal/spatial applicable domains:	Eastern Alps Water Basin District
Temporal coverage	1 day
Spatial Coverage / Area:	Eastern Alps Water Basin District
Spatial Resolution / Scale (Data Grid):	10 m
Geographic projection / Reference system:	WGS84 (Sentinel-1) WGS84 / UTM (Sentinel-2)
Input Data/Sources:	**Input:** Sentinel-1 (GRDH-IW) Sentinel-2 (S2MSI2A, S2MSI2Ap) Source: EOPEN Umbrella Sentinel hub; additional data available as QUOTA amounts from Copernicus DWH are accessed through ESA CSCDA.
Input Data Archiving and rolling policies	AAWA/CERTH; EOPEN Platform (Archiving of EO satellite open data not foreseen)
Frequency of update (refresh rate):	on request/continual update over a given period; availability: 3-6 days or less (RUSH) as available, following a given event
Format:	Geotiff
Naming convention:	Sentinel-1: <Satellite Platform>_<Sensor Mode>_<Product Type>_<Sensing Date>_<Polarisation>_<Area Code>_water_bodies (e.g. S1A_IW_GRDH_20190103T165812_VV_VICENZA_water_bodies) Sentinel-2: <Satellite Platform>_<Product Type>_<Sensing Date>_<Area Code>_water_bodies (e.g. S2A_MSIL2A_20180817T101021_VICENZA_water_bodies)
Archiving and preservation	EOPEN Platform, CERTH /AAWA archive

Data sharing:	Open
Standards and metadata:	NA
Relevant Deliverable	D4.1

Table 11: EOPEN Water Presence Map

Dataset ID.	PUC1_DA6_b
Dataset Name/ Acronym	Water Presence Change Monitoring (WPCM)
Purpose	Monitoring flooded area during an event or a given period.
Description (Content Specification):	Difference between water masks extracted at different times (tbc) (It will be described in forthcoming D4.4, M33)
Output Layers:	Raster file(s)
Measurement Unit:	NA
Temporal/spatial applicable domains:	Eastern Alps Water Basin District
Temporal coverage	3-6 days (satellite revisit time) 30 days (timeseries of 5 satellite imagery)
Spatial Coverage / Area:	Eastern Alps Water Basin District
Spatial Resolution / Scale (Data Grid):	10 m
Geographic projection / **Reference system:**	WGS84 (Sentinel-1) WGS84 / UTM (Sentinel-2)

Input Data/Sources:	Input: Sentinel-1 (GRDH-IW) Sentinel-2 (S2MSI2A, S2MSI2Ap) Source: EOPEN Umbrella Sentinel hub; additional data available as QUOTA amounts from Copernicus DWH are accessed through ESA CSCDA.
Input Data Archiving and rolling policies	AAWA/CERTH; EOPEN Platform (Archiving of EO satellite open data not foreseen)
Frequency of update (refresh rate):	on request/continual update over a given period; availability: 3-6 days or less (RUSH) as available, following a given event
Format:	Geotiff
Naming convention:	Sentinel-1: <Satellite Platform>_<Sensor Mode>_<Product Type>_<Starting Sensing Date>_<Ending Sensing Date>_<Polarisation>_<Area Code>_water_bodies (e.g. S1A_IW_GRDH_20190103T165812_20190203T174137_VV_VICENZA_water_bodies) Sentinel-2: <Satellite Platform>_<Product Type>_>_<Starting Sensing Date>_<Ending Sensing Date >_<Area Code>_water_bodies (e.g. S2A_MSIL2A_20180817T101021_20180917T151157_VICENZA_water_bodies)
Archiving and preservation	EOPEN Platform, CERTH /AAWA archive
Data sharing:	Open
Standards and metadata:	NA
Relevant Deliverable	D4.4

Table 12: EOPEN Water Presence Change Monitoring

5.2 PUC2 Products

As from 4.2.3, the PUC2 products generated in the platform are the Rice (crop) Status Indicator and the Paddy Rice Mapping, as presented in the following tables.

Dataset ID.	PUC2_DB1_a
Dataset Name	Rice (crop) Status Indicator (RSI)
Purpose	Monitoring phenology evolution and land cover changes
Description (Content Specification):	Time-series of vegetation indices and crop growth indicators; time-series of S-1 and S-2 imagery (reflectance) together with pertinent vegetation indices describing the growth status of rice and other crops
Output Layers:	Time-series of Sentinel images and vegetation indices
Measurement Unit:	NA
Temporal/spatial applicable domains:	
Temporal coverage	Every cloud free acquisition for S-2, two S-1 images per month
Spatial Coverage / Area:	Regional and/or national scale
Spatial Resolution / Scale (Data Grid):	10-60 m spatial resolution
Geographic projection / Reference system:	WGS84/UTM
Input Data/Sources:	EOPEN Umbrella Sentinel Hub
Input Data Archiving and rolling policies	NA
Frequency of update (refresh rate):	Monthly
Format:	Geotiff
Naming convention/Acronym	Rice (crop) Status Indicator/RSI
Archiving and preservation	
Data sharing:	
Standards and metadata:	
Relevant Deliverables	D7.1 & D7.2

Table 13: EOPEN Rice (crop) Status Indicator

Dataset ID.	PUC2_DB1_b
Dataset Name	Paddy Rice Mapping (PRM)
Purpose	Accurately classify rice extent in South Korea to ultimately estimate the yield
Description (Content Specification):	Rice classification based on distributed Random Forest and Recurrent Neural Networks (two different products), using updated past land cover maps for training.
Output Layers:	Pixel based rice maps
Measurement Unit:	NA
Temporal/spatial applicable domains:	

Temporal coverage	Once per cultivating season
Spatial Coverage / Area:	Dangjing and Seosan (South Korea) provinces for Random Forest based classification; nationwide (South Korea) for Recurrent Neural Networks based classification
Spatial Resolution / Scale (Data Grid):	10m spatial resolution
Geographic projection / Reference system:	WGS84/UTM
Input Data/Sources:	EOPEN Umbrella Sentinel Hub Updated past land cover maps for training
Input Data Archiving and rolling policies	NA
Frequency of update (refresh rate):	Multiple times throughout the year/ starting from early in the year (late June) and providing more accurate maps with every new acquisition
Format:	Geotiff
Naming convention/Acronym	Paddy Rice Mapping/PRM
Archiving and preservation	
Data sharing:	
Standards and metadata:	
Relevant Deliverables	D7.1 & D7.2 & D4.1

Table 14: EOPEN Paddy Rice Mapping

6 EO DATASETS AND PRODUCTS FROM ARCHIVES AND SERVICES

6.1 EO data from the EOPEN Umbrella Hub

An EOPEN Umbrella Hub has been implemented to access EO Sentinel-data [RD1]; below some EO data access Copernicus components are listed - such topic is the focus of [RD1] in which updated additional information can be found.

1. Copernicus Open Access Hub: Provides access to all Sentinel missions via: i) the interactive graphical user interface; ii) no graphical interface with dedicated API's. CopHub provides complete, free and open access to Sentinel-1, Sentinel-2 and Sentinel-3 user products, starting from the In-Orbit Commissioning Review (IOCR). Additionally, provides access to pre-operational data from Sentinel-3A, Sentinel-5P & Sentinels GNSS Rinex.

2. Copernicus Services Data Hub: The Copernicus Services Data Hub provides a dedicated access to Sentinels user products and the access to this hub is restricted to the Copernicus Service Projects.

3. Sentinels International Access Hub: The International Access Hub provides a dedicated access to a Rolling Archive of 21 days of Sentinels user products and the access is restricted to the international partners (e.g. NASA) having established agreements with the European Commission.

4. Collaborative Ground Segment: The SENTINEL collaborative ground segment is intended to allow complementary access to SENTINEL data and/or to specific data products or distribution channels. Since 2014, NOA and ESA have signed the (Copernicus) Cooperation agreement in May 2014. Greece set-up, operates and maintains the Hellenic National Sentinel Data Mirror Site,

providing fast and secure discovery and access of Sentinel data over the Region of Mediterranean and Black Sea through the same graphical user interface.

- Collaborative Data Hub: The Sentinels Collaborative Data Hub provides a dedicated access to a Rolling Archive of user products. It provides access to Collaborative Ground Segments through 3 Nodes. Each Node has a different retention policy for rolling archive data: Node-1: 1 month; Node-2: 2 weeks; Node-3: 3 weeks

- DIAS[2] Providers: There are 4 consortia focusing on the development of Copernicus cloud-based platforms for Data and Information Access Services (DIAS). This could provide to the wider community both the quick access to Sentinel data and the cloud resources and tools so as to easily develop and deploy EO based products and services.

The abovementioned access points are using the same search and access protocols to ease the process for the GeoIT user community to develop and produce EO based products and services. Therefore, tailored APIs are provided for browsing and accessing the EO data stored in the rolling archive.

6.2 Products from other Services

This section addresses the PUC products which are not generated in the platform or are generated by stakeholders (e.g. PUC1_DA4); they include products provided by the Finnish Meteorological Service and from the Copernicus Land service (see Appendix D), in addition to social media product. Additional information on the modality of access and retrieval of some of these products is available in the [RD3], [RD4] and [RD5].

6.2.1 FMI Climatological and Meteorological Products

Below is the description of FMI provided products as from 4.3.3.

Dataset ID	PUC3_DC1, PUC3_DC4
Dataset Name	GlobSnow Snow Water Extent (GlobSnow_SWE) (*)
Purpose	Show snow cover and accumulation observations based on measurements by various EO missions.
Description (Content Specification)	Daily Snow Water Equivalent (Daily L3A SWE). Contains snow water equivalent (in mm) for each grid cell. Evaluated only on land areas in the Northern Hemisphere.
Output Layers	
Measurement Unit	mm
Temporal/spatial applicable domains	Northern hemisphere (35°N - 85°N)
Temporal coverage	Daily, 1980 - current

[2] EOPEN Access to DIAS is addressed in [RD3]

Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	25 km
Geographic projection / Reference system	EASE-grid
Input Data/Sources	GlobSnow SWE
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	Daily
Source Format	NetCDF
Naming convention/Acronym	GlobSnow Snow Water Extent/GlobSnow_SWE
Archiving and preservation	Sodankylä National Satellite Data Centre
Data sharing	Open data
Standards and metadata	
License	**Unlicensed open data**
Attribution	GlobSnow[3] project consortium

Table 15: EOPEN Globsnow Snow Water Extent
(*) This product is also available beyond the project.

Dataset ID	PUC3_DC2.1
Dataset Name	SMOS Level 3 Soil Freeze and Thaw Service (SMOS_L3FT) (*)
Purpose	Visualise ground frost
Description (Content Specification)	SMOS_L3FT estimates the soil state regarding ground frost. The soil can be classified as “Frozen”, “Partially Frozen” or “Thaw”.
Output Layers	Estimated soil state (L3FT); Processing mask (PM); quality flag
Measurement Unit	N/A

[3] Luojus, K., J. Pulliainen, M. Takala, M. Kangwa, T. Smolander, A. Wiesmann, C. Derksen, S. Metsämäki, M. Salminen, R. Solberg, T. Nagler, G. Bippus, S. Wunderle, F. Hüsler, 2013: GlobSnow-2 Product User Guide Version 1.0. http://www.globsnow.info/swe/GlobSnow2_SE_SWE_Product_User_Guide_v1_r1.pdf

Temporal/spatial applicable domains	
Temporal coverage	July 2010 – present, daily values
Spatial Coverage / Area	0°-85°N, 180°W - 180°E
Spatial Resolution / Scale (Data Grid)	25 km horizontal resolution, EASE-2 grid
Geographic projection / Reference system	Polar-stereographic
Input Data/Sources	SMOS daily gridded level 3 brightness temperature; ECMWF 2m air temperature data; NSIDC IMS snow cover data
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	Daily
Source Format	NetCDF
Naming convention/Acronym	SMOS Level 3 Soil Freeze and Thaw Service (SMOS_L3FT)
Archiving and preservation	Sodankylä National Satellite Data Centre
Data sharing	Open data
Standards and metadata	See documentation http://nsdc.fmi.fi/services/SMOSService/docs/FTS-PDD.pdf
License	Unlicensed open data
Attribution	Rautiainen, K., Parkkinen, T., Lemmetyinen, J., Schwank, M., Wiesmann, A., Ikonen, J., Derksen, C., Davydov, S., Davydova, A., Boike, J., Langer, M., Drusch, M., and Pulliainen, J. 2016. SMOS prototype algorithm for detecting autumn soil freezing, Remote Sensing of Environment, 180, 346-360. DOI: 10.1016/j.rse.2016.01.012

Table 16: SMOS Level 3 Freeze and Thaw Service
(*) This product is also available beyond the project.

Dataset ID	PUC3_DC3
Dataset Name	Air Temperature (grid) (FMIClimGrid_Tair) (*)
Purpose	Show air temperature at 2 m height based on ground observations
Description (Content Specification)	Mean daily temperature from Finnish weather stations interpolated to grid
Output Layers	
Measurement Unit	°C
Temporal/spatial applicable domains	Daily, Finland
Temporal coverage	1961 - 2016
Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	10 km
Geographic projection / Reference system	EPSG:3067 (ETRS-TM35FIN)
Input Data/Sources	Individual NetCDF files, Paituli Service
Input Data Archiving and rolling policies	EOPEN
Frequency of update (refresh rate)	N/A
Source Format	NetCDF
Naming convention/Acronym	Air Temperature (grid)/FMIClimGrid_Tair
Archiving and preservation	EOPEN
Data sharing	Open data
Standards and metadata	
License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Attribution	Finnish Meteorological Institute

Table 17: EOPEN FMI Air Temperature

(*) This is a static dataset which can be offered.

Dataset ID	PUC3_DC4

Dataset Name	Snow depth observations (grid) (FMIClimGrid_Snow) (*)
Purpose	Show snow accumulation based on ground observations
Description (Content Specification)	Observed snow depth, grid-interpolated from Finnish weather stations
Output Layers	
Measurement Unit	cm
Temporal/spatial applicable domains	Daily, measured at 06UTC, Finland
Temporal coverage	1961 - 2016
Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	10 km
Geographic projection / Reference system	EPSG:3067 (ETRS-TM35FIN)
Input Data/Sources	Individual NetCDF files, Paituli Service
Input Data Archiving and rolling policies	EOPEN
Frequency of update (refresh rate)	N/A
Source Format	NetCDF
Naming convention/Acronym	Snow depth observations (grid)/FMIClimGrid_Snow
Archiving and preservation	EOPEN
Data sharing	Open data
Standards and metadata	
License	**Creative Commons Attribution 4.0 International (CC BY 4.0)**
Attribution	Finnish Meteorological Institute

Table 18: EOPEN FMI Snow Depth Observations

(*) FMI ClimGrid is a static dataset which can be offered.

Dataset ID.	PUC3_DC5
Dataset Name	FMI climatological data AWS (AWS_CLIM_FIN) (*)
Purpose	Climatological data is used as a reference to identify changes, trends, deviations and anomalies in the observation data.

Description (Content Specification)	Climatological reference values for temperature and snow depth. Two available reference datasets: 1971-2000 and 1981-2010.
Output Layers	
Measurement Unit	°C, cm
Temporal/spatial applicable domains	Monthly averages. Individual automatic weather observation stations in Finland.
Temporal coverage	12 months
Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	Not gridded
Geographic projection / Reference system	Selectable, default: EPSG:4258
Input Data/Sources	FMI Open Data
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	N/A
Source Format	XML
Naming convention/Acronym	AWS FMI climatological data/AWS_CLIM_FIN
Archiving and preservation	FMI Open Data Service
Data sharing	Open data
Standards and metadata	
License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Attribution	Finnish Meteorological Institute

Table 19: EOPEN FMI Climatological data AWS

(*) As part of FMI Open Data products they are available beyond project duration.

Dataset ID	PUC3_DC7
Dataset Name	Climate Change Scenarios (CCS_FIN) (*)

Purpose	Show average changes in temperature and precipitation based on multiple climate change scenarios and climate models
Description (Content Specification)	Climate change scenarios for 30-year periods (2010-2039, 2040-2069 and 2070-2099). Contains average changes in temperature and precipitation (based on 19 climate models)
Output Layers	
Measurement Unit	°C for temperature, % for precipitation
Temporal/spatial applicable domains	
Temporal coverage	Monthly values for three periods (2010-2039, 2040-2069, 2070-2099)
Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	1 km
Geographic projection / Reference system	EPSG:4326
Input Data/Sources	FMI Open Data
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	N/A
Source Format	NetCDF
Naming convention/Acronym	Climate Change Scenarios/CCS_FIN
Archiving and preservation	FMI Open Data Service
Data sharing	Open data
Standards and metadata	
License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Attribution	Finnish Meteorological Institute

Table 20: EOPEN Finnish Climate Change Scenario

(*) Finnish Climate Change Scenarios are out of date and will be replaced at some point, but can be offered beyond project duration.

Dataset ID	PUC3_DC8
Dataset Name	Weather observations time-series (AWS_OBS_FIN) (*)

Purpose	Support other datasets with long time series from automatic weather stations
Description (Content Specification)	Time series of daily average, minimum and maximum air temperature at 2 meters height and daily rainfall accumulation.
Output Layers	
Measurement Unit	°C for temperature, mm for rainfall accumulation
Temporal/spatial applicable domains	
Temporal coverage	Daily values from 1959 onwards
Spatial Coverage / Area	Finland
Spatial Resolution / Scale (Data Grid)	Not gridded
Geographic projection / Reference system	Selectable, default EPSG:4258
Input Data/Sources	FMI Open Data
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	Daily
Source Format	XML
Naming convention/Acronym	Weather observation time-series/AWS_OBS_FIN
Archiving and preservation	FMI Open Data Service
Data sharing	Open data
Standards and metadata	
License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Attribution	Finnish Meteorological Institute

Table 21: EOPEN FMI Weather Observations time series

(*) As part of FMI Open Data products they are available beyond project duration.

Dataset ID	PUC1_DA13, PUC3_DC9
Dataset Name	HIRLAM Weather Forecast (HIRLAM_NWP) (*)
Purpose	Provide short-term weather forecasts to support end used decision making

Description (Content Specification)	Output from numerical weather prediction model HIRLAM (High Resolution Limited Area Model). Output is unedited model output (i.e. a meteorologist has not post-processed the data by hand)
Output Layers	Surface layer
Measurement Unit	Pressure: Pa Hourly precipitation accumulation (**): mm Total precipitation accumulation: mm Temperature (**): K Land-sea mask: 1 (unitless) Relative humidity: % Geopotential height: m Wind speed (**): m/s Wind direction: degrees Radiation fluxes (**): J/m2 Cloud cover (**): 1 (unitless)
Temporal/spatial applicable domains	Model covers Europe, Northern Atlantic Ocean and Arctic Regions (partially). Output values are forecast hourly values.
Temporal coverage	Next 54 hours from the model run start.
Spatial Coverage / Area	NA
Spatial Resolution / Scale (Data Grid)	Horizontal: approx. 7500 m (0.068 degrees)
Geographic projection / Reference system	EPSG:4326
Input Data / Sources	FMI Open Data, HIRLAM NWP model, Amazon AWS S3
Input Data Archiving and rolling policies	FMI Open Data Service offers up to three latest model runs
Frequency of update (refresh rate)	Every 6 hours
Source Format	NetCDF or GRIB2 (User selectable)
Naming convention/Acronym	HIRLAM Weather Forecast/HIRLAM_NWP
Archiving and preservation	Amazon AWS (maintained by FMI) (see https://registry.opendata.aws/hirlam/ and https://en.ilmatieteenlaitos.fi/open-data-on-aws-s3)
Data sharing	Open data
Standards and metadata	

License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Attribution	Finnish Meteorological Institute

Table 22: EOPEN (FMI) HIRLAM Weather Forecast

(*) HIRLAM will be available as long as such service is maintained.

(**) Some clarifications about HIRLAM datafiles are found in [RD4].

6.2.2 Korean Meteorological Administration Climatological and Meteorological Products

Dataset ID	PUC2_DB2_a
Dataset Name	Meteorological observations from AWS
Purpose	Provision of air temperature, wind speed & direction, precipitation recorded at the stations (Automatic Weather System, AWS).
Description (Content Specification)	Daily mean, max, min value of recorded meteorological data monthly averaged and AWS number, observation period, Latitude & longitude, height, Station name
Output Layers	
Measurement Unit	°C, m/s & deg, mm, m
Temporal/spatial applicable domains	Monthly, South Korea
Temporal coverage	1997 - 2019
Spatial Coverage / Area	South Korea
Spatial Resolution / Scale (Data Grid)	
Geographic projection / Reference system	EPSG:5186 (Korea Central Belt 2010)
Input Data/Sources	KMA Open API
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	Monthly
Source Format	XML
Naming convention	
Archiving and preservation	
Data sharing	
Standards and metadata	
License	Creative Commons Attribution 2.0 Korea (CC BY 2.0)
Attribution	Korea Meteorological Administration

Table 23: KMA meteorological station data from Automatic Weather System

6.2.3 Copernicus Land Service Products

In the table below are provided the links to the Product User Guide of the Copernicus Land Service Products as from its website; some of these layers are already available on the platform; such products should be available as long as the related service is continued; in addition to them,

it is worth mentioning that service products from the Open Geo Hub can be added to the platform in a straightforward way https://geoserver.opengeohub.org/landgisgeoserver/wms - they can be searched through the browser at https://openlandmap.org.

Dataset ID.	Product Name/acronym	Web Location (**)
PUC1_DA2.1	SWE_CGLS (**)	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS2_PUM_SWE-NH-5km-V1_I1.02.pdf
PUC1_DA2.2	SCE_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS2_PUM_SCE500-CEURO-500m_V1_I1.02.pdf
PUC1_DA3	SME_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS1_PUM_SSM1km-V1_I1.30.pdf
PUC1_DA11.1	LAI_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/GIOGL1_PUM_LAI300m-V1_I1.60.pdf
PUC1_DA11.2	FCOVER_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/GIOGL1_PUM_FCOVER300m-V1_I1.60.pdf
PUC1_DA11.3	NDVI_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/GIOGL1_PUM_NDVI300m-V1_I1.11.pdf
PUC1_DA11.4	VCI_CGLS	https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/GIOGL1_PUM_VCI-VPI_I2.00.pdf
PUC3_DC2.2	Sentinel-3 SLSTR Level-2 LST	https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-3-slstr/product-types/level-2-lst

Table 24: Copernicus Land Service Products available & foreseen in EOPEN

(**) CGLS => Copernicus Land Service

6.2.4 Tweets Product

Dataset ID.	PUC1_DA14; PUC2_DB8; PUC3_DC6
Dataset Name	Tweet Collections (TC)

Purpose	Relevancy estimation, event detection, community detection, clustering, concept extraction, location estimation and projection on a map
Description (Content Specification):	Public Twitter posts (tweets) that are published by preselected accounts or contain certain keywords
Output Layers:	JSON file (there is also the possibility to export as a GIS layer)
Measurement Unit:	NA
Temporal/spatial applicable domains:	The selected areas of interest per use case scenario
Temporal coverage	1 second
Spatial Coverage / Area:	PUC1: North-Eastern Italy, incl. Vicenza; PUC2: South Korea; PUC3: Finland
Spatial Resolution / Scale (Data Grid):	up to 1 m
Geographic projection / Reference system:	WGS84
Input Data/Sources:	PUC-specific keywords and accounts (complete list is omitted here - please refer to D3.3) PUC1 BB: SW= Long 10.2, Lat 45 NE = Long 14.1, Lat 47.3 PUC2 BB: SW = Long 125.33, Lat 33.85 NE = Long 130.0, Lat 38.6 PUC3 BB: SW = Long 19.08321, Lat 59.454159 NE = Long 31.586706, Lat 70.092293
Input Data Archiving and rolling policies	Developer Agreement and Policy[4]
Frequency of update (refresh rate):	Every second
Format:	JSON
Naming convention:	<Use Case collection>_<Unique post ID provided by Twitter> where <Use Case collection> can be IF (ItalianFloods), EF (EnglishFloods), GF (GreekFloods), FS (FinnishSnow), ES

[4] https://developer.twitter.com/en/developer-terms/agreement-and-policy.html

	(EnglishSnow), GS (GreekSnow), KFS (KoreanFoodSecurity), EFS (EnglishFoodSecurity) e.g. IF_875639410665992196
Archiving and preservation	MongoDB, regular backups
Data sharing:	Database ingestion is possible
Standards and metadata:	Twitter JSON format

Table 25: EOPEN Tweet product

6.2.5 AAWA (AMICO) Product

Dataset ID.	PUC1_DA4
Dataset Name/Acronym	EOPEN AAWA Early Warning System Flood Forecast (AA_EWS_FF)
Purpose	Providing a Flood forecast, based on AAWA Early Warning System model (EWS,) upgraded to a two-dimensional model, exploiting products generated (or available) in EOPEN, derived (or obtained) from Copernicus satellite data and services, levering on EOPEN resources.
Description (Content Specification):	Currently AAWA provides flood forecast based on weather forecast bases on a complex geoclimatic model and a hydraulic model that converts weather forecast into discharge and into water levels at a certain number of Bacchiglione river sections; the implementation devised for the EOPEN project foresees the generation of water levels over a selected area.
Output Layers:	Water level height over Vicenza area (*)
Measurement Unit:	m [height above the ground]
Temporal/spatial applicable domains:	Flood event/Vicenza area
Temporal coverage	Whole flood event
Spatial Coverage / Area:	Water district selected area
Spatial Resolution / Scale (Data Grid):	~10 cm; ground surface spatial resolution: 10 m x 10 m or less depending on the satellite input data used.
Geographic projection / Reference system:	Monte Mario Italy 1 (EPGS 3003) or WGS 84
Input Data/Sources:	Copernicus Land Service products (ref. par. 6.2.3); Weather forecast (HIRLAM) (ref. par. 6.2.1); Shapefile of the selected area.
Input Data Archiving and rolling policies	EOPEN Platform (Archiving of EO satellite open data not foreseen); AAWA server.
Frequency of update (refresh rate):	On request/continual update over a given period; following a given event whenever a weather forecast

	(e.g. HIRLAM 4 times/day) and/or an updated water presence map.
Format:	.tif
Naming convention:	AA_EWS_FF_DDMMYYYYHHMM_DDMMYYYYHHMM - where the first and second day/time refer, respectively, to beginning and end of the forecast time interval.
Archiving and preservation	AAWA/ EOPEN Platform (Archiving of EO satellite open data not foreseen); AAWA server
Data sharing:	No sharing protocols (ftp, …), only query service
Standards and metadata:	Metadata stored in ORACLE DB

Table 26: EOPEN AAWA AMICO EWS Flood Forecast

(*) A prior version of this product, available from AAWA, was a TXT file accessible via web service with water level at given sections of the Bacchiglione river.

(possibly include a link to EOPEN website in which a downloadable sample is provided

6.2.6 NASA POWER product

Dataset ID	PUC2_DB2_a
Dataset Name	The Prediction of Worldwide Energy Resources project (POWER)
Purpose	Provides an alternative source for solar radiation data. This dataset was originally considered for PUC2. Even though it was not relevant for the Use Case, the dataset is still offered for future users.
Description (Content Specification)	A global dataset of solar and meteorological parameters, which are based on satellite observations and numerical modeling. Provides minimum, maximum, average, and range values aggregated over certain time periods. See full documentation for detailed listing.[5]
Output Layers	
Measurement Unit	Depends on parameter, see full documentation for detailed listing.

5 https://power.larc.nasa.gov/docs/ (Version: 1.0)

Temporal/spatial applicable domains	Daily / Interannual / Climatology
Temporal coverage	Starting from 1 Jan 1981 (meteorology) / 1 Jul 1983 (solar). See details in Input Data/Sources.
Spatial Coverage / Area	Global
Spatial Resolution / Scale (Data Grid)	0.5° x 0.5° global grid
Geographic projection / Reference system	Unprojected spherical coordinates (datum and ellipsoid not specified)
Input Data/Sources	Solar: GEWEX/SRB 3.0 (1 Jul 1983 – 31 Dec 2007) CERES FLASHFlux Version 2 (D,E,G,H) (1 Jan 2008 – 31 Dec 2012) CERES FLASHFlux Version 3 (A,B,C) (1 Jan 2013 – Near Real Time, Latency of 5-7 Days) Meteorological: GMAO MERRA-2 (1 Jan 1981 – Month Behind Real Time)[6] GEOS 5.12.4 FP-IT (End of MERRA2 – Near Real Time, Latency of 2 Days)
Input Data Archiving and rolling policies	Archived and made available through POWER's Services Suite
Frequency of update (refresh rate)	Solar: Daily Meteorological: Daily (GEOS), Every several months (MERRA-2)
Source Format	NetCDF, ASCII, JSON, and CSV (User selectable)
Naming convention	

6 The Modern-Era Retrospective Analysis for Research and Applications, Version 2 https://doi.org/10.1175/JCLI-D-16-0758.1

Archiving and preservation	POWER Services Suite
Data sharing	
Standards and metadata	
License	Unlicensed open data, see POWER's Terms of Use[7]
Attribution	These data were obtained from the NASA Langley Research Center (LaRC) POWER Project funded through the NASA Earth Science/Applied Science Program.

Table 27:

6.2.7 ERA5 reanalysis (ECMWF via Copernicus Climate Data Store)

Dataset ID	PUC3_DC1, PUC3_DC2, PUC3_DC3, PUC3_DC4
Dataset Name	ERA5 reanalysis (ERA5)
Purpose	Provides an alternative source for long time series of meteorological data.
Description (Content Specification)	Reanalysis is an estimate of historical atmosphere and ocean variables. It is constructed using past meteorological and oceanographic observations as an input to a state-of-the-art numerical weather/ocean model. Output consists of various atmosphere, ocean, and land parameters. See full documentation for details.[8]
Output Layers	
Measurement Unit	Various, depending on parameter. See full documentation for details.

7 https://power.larc.nasa.gov/docs/terms-of-use/

8 https://confluence.ecmwf.int/display/CKB/ERA5%3A+data+documentation#ERA5:datadocumentation-Parameterlistings

Temporal/spatial applicable domains	
Temporal coverage	1979 – within 5 days of real time
Spatial Coverage / Area	Global
Spatial Resolution / Scale (Data Grid)	Native grid: Reduced Gaussian grid (N320), resolution of 0.28125° (31 km). Downloadable products: Reanalysis: 0.25°x0.25° (atmosphere), 0.5°x0.5° (ocean waves) Mean, spread and members: 0.5°x0.5° (atmosphere), 1°x1° (ocean waves)
Geographic projection / Reference system	Unprojected spherical coordinates
Input Data/Sources	ECMWF via Copernicus Climate Data Store
Input Data Archiving and rolling policies	
Frequency of update (refresh rate)	Preliminary updates: daily Quality-assured updates: monthly (within 3 months of real time)
Source Format	User-selectable, GRIB2 or NetCDF
Naming convention	
Archiving and preservation	Copernicus Climate Data Store
Data sharing	
Standards and metadata	

License	Copernicus C3S/CAMS License agreement[9]
Attribution	*Copernicus programme*[10]

Table 28:

6.3 Summary of EO data-products need vs Copernicus DWH DAP

The following tables provide an overview of the Quotas requested/obtained for the years 2018 – 2020 related to the Copernicus Contributing Missions (CCM); the requests submitted in 2018, 2019 were accepted and adjusted to meet PUC refined needs whereas for 2020 a reduced Quota was obtained and adjusted in particular to include a new dataset, namely, the Euro-Maps 3D DSM which was originally requested by PUC1 (PUC1_DA1), still was not available during the previous years; also, starting from 2019, some Quota of "rush datasets" [AD2] has being included in view of the "Field Demonstration" foreseen in the months 25-36 (Task 7.2) - such a service could have been tested starting from the first prototype, which became available at M19, anyway no hazardous events occurred during the second half of the project - this option will remain available until the last month of project to allow the "Real Time" testing of the platform in case of any flood event.

9 https://apps.ecmwf.int/datasets/licences/copernicus/

10 See Copernicus C3S/CAMS License agreement section 5 "Attribution" for details

Project	Dataset	Title Dataset ID	Assigned/used Quota (km2) 2018	PUC	Legend
EOPEN	Archive_standard_Optical_VHR1	D2_MG2b_EOPE_011a	0	500 passed to Archive_standard_SAR_HR1 - ref. line 8	PUC1
EOPEN	Archive_standard_SAR_HR1	D2_MG1_EOPE_013a	112500 + 41205 km2	PUC1+ PUC2	PUC2
EOPEN	Archive_standard_SAR_VHR1	D2_MG1_EOPE_015a	0	500 passed to Archive_standard_SAR_HR1 - ref. line 8	PUC1 & PUC2
EOPEN	Archive_standard_SAR_VHR2	D2_MG1_EOPE_015b	11,200	PUC1	
EOPEN	New acquisition standard (SAR_VHR1)	D2_MG1_EOPE_016a	418	PUC1	
EOPEN	New acquisition standard (Optical_VHR1)	D2_MG2b_EOPE_012a	500	PUC1	
EOPEN	New acquisition standard (SAR_HR1)	D2_MG1_EOPE_014a	12,500	7500 PUC2 + 5000 PUC1	

Table 29: EOPEN Quota 2018 [AD2]

Requested Datasets	EO Missions	DAP Additional Datasets	Product	Area	2018 (see last column)	2019	2020 (requested)	2020 (obtained/reshuffled)	Quota 2018 (km2)
PUC1_DA1	TerraSAR-X/TanDEM	SAR_VHR1 (ADD_015a/ADD_16a)		~ 3000 Km2		1500 km2 ADD_16a - New Acquisition SAR_VHR1; 1500 km2 ADD_15a - Archive SAR_VHR1 (total 3000)	Not needed	Not needed	2018 500 km2
	Airbus -Pleiades	Optical_VHR1 (ADD_011a and ADD_012a)		~ 3000 Km2		1500 km2 ADD_12a - New Acquisition Optical_VHR1; 1500 km2 ADD_11a - Archive Optical_VHR1 (total 3000)	3000 km2 ADD_11a - Archive Optical_VHR1	Cut due to reduced obtained 2020 Quota	2018 500 km2
PUC1_DA4	S1, S2, CSK, etc.	SAR_VHR2 (ADD_015b/16b)	Stripmap	~ 3000 Km2		15000 ADD_15b/16b; 5000 ADD_007b/ADD_008b (tbd) (*) (Total 20000)	3000 ADD_15b/16b; 3000 ADD_007b/ADD_008b	Confirmed	D2_MG1_EOPE_015b ~ 11200/11200 km2
PUC1_DA1	IRS-P5 Cartosat-1	Optical_VHR1 IRS-P5 Cartosat-1 PAN-A and PAN-F (ADD_009c)						(new product) 5000 km2	
PUC2_DB1	TerraSAR-X or COSMO-SkyMed, Sentinel-1,2	SAR_HR1 (ADD_13a)	Stripmap	~ 112500 km2 (tbc)		75000 Archive_standard_SAR_HR1 (ADD_13a)	Not needed	Not needed	2018 112,500
PUC2_DB6	TerraSAR-X or COSMO-SkyMed, Sentinel-1,2	SAR_HR1 (ADD_14a)	Stripmap	~7500 km2		5000 New acquisition_standard_SAR_HR1 (ADD_14a)	Not needed	Not needed	2018 12,500 km2
PUC2_DB1	IKONOS, WORLDVIEW	Archive Optical_VHR1 (ADD_011a)		~10,000 km2			Not needed	Not needed	2018 12,500 km2

(*) 007/008b refer to rush datasets (included for emergency purposes)

Table 30: EOPEN Quota for 2019-2020

APPENDIX A – ESA USER LICENCE

An ESA-User license has to be signed for the use of Copernicus Contributing Missions data (Data Warehouse, phase 2: 2014-2020), available at:

https://spacedata.copernicus.eu/documents/12833/14545/CSCDA_ESA_User_Licence

Below are some extracts

"[…]

NOW THEREFORE THE PARTIES AGREE AS FOLLOWS:

[…]

3.5 DOWNLOAD Service.

With the DOWNLOAD Service, the User is granted by the Agency a free of charge, nonexclusive, non-transferable right to use Primary Products and:

…

3.5.1.6 to publish or display Primary Products, Altered Products and Value Added Products in printed or digital media and internet websites, also as part of web-mapping, for the purpose of advertising, research reporting or any other kind of public non-commercial information or services, with the display of the following credit: "includes material "© CCME (year of acquisition), provided under COPERNICUS by the European Union and ESA, all rights reserved". Digital publications of Primary or Altered Products shall not allow the download or reconstruction of datasets in whole or in part;

…

3.5.1.9 to re-distribute to other parties involved in the project who have accepted the present Terms and Conditions by any technical means (internet, web mapping, media, etc.) as long as the recipients are restricted to the ones that have accepted these Terms and Conditions. Excluded is redistribution to entities that are not eligible for access to the DAP.

…

3.5.5. The User undertakes that the Primary Products provided by CSC-DA and the Altered Products derived by the User shall not be copied, transferred, re-distributed or otherwise made available to any entity other than the entities identified under article 3.5.1 bullet 9."

In particular, in the case of some data from CCM missions used in the EOPEN project credit will be as follows:

(https://spacedata.copernicus.eu/documents/12833/14545/CSCDA_ESA_User_Licence_Annex_26_March_2015.pdf)

CSK CCME: e-GEOS

"As an amendment to Articles 3.5.1.4, 3.5.1.6, 4.2.3, the credit formulation to be displayed shall read as follows: "…. © ASI (year of acquisition), distributed by e-GEOS S.p.A., provided under COPERNICUS by the European Union and ESA, all rights reserved."

Pleiades-1A & 1B

CCME: Airbus DS GEO SA

"As an amendment to Articles 3.5.1, 3.5.1.6, 4.2.3, the credit formulation to be displayed shall read as follows: "… © CNES (year of acquisition), distributed by Airbus DS, provided under COPERNICUS by the European Union and ESA, all rights reserved.

TerraSAR-X/TANDEM

Ref.

https://www.airbus.com/content/dam/corporate-topics/publications/suppliers/bootc-ai-de-law.pdf

APPENDIX B - FMI RESEARCH DATA POLICY

Data distributed by FMI are compliant with the FAIR paradigm

"o FMI strategic goal is to promote open science (FMI Strategy 2025).

o FMI promotes the FAIR (Findable, Accessible, Interoperable, Re-usable) principles3 for research data, in line with the requirements of several research funding organizations that call for open and systematic research data management.

o Research data produced with national public funding are considered open and FMI will make its research data available for others to use if there is no legal, ethical, contractual or other reason to restrict it."

APPENDIX C – DATA FROM SOCIAL MEDIA (TWEETS) VS FAIR DATA PARADIGM ASSESSMENT

a. Making data findable, including provisions for metadata

2. Are the data produced and/or used in the project discoverable with metadata, identifiable and locatable by means of a standard identification mechanism (e.g. persistent and unique identifiers such as Digital Object Identifiers)?

   Collected social media from Twitter come along with a unique numeric identifier (e.g. 875637434934939648) and can be re-discovered using this.

3. What naming conventions do you follow?

   The unique numeric identifier provided by Twitter serves as the name of each stored tweet.

4. Will search keywords be provided that optimize possibilities for re-use?

   Collected tweets are separated by language and use case, so predefined keywords (e.g. “English”, “Floods”) will be provided to search for relevant data more efficiently.

5. Do you provide clear version numbers?

   Tweets cannot have multiple versions.

6. What metadata will be created? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.

   Metadata refer to the outcomes of various analyses on the tweets (e.g. verification, estimated relevancy, localisation, etc.) and are included as additional fields in the original JSON format of the tweets. Specifically, for the localisation estimation process, extracted locations are stored as “Point” following the GeoJSON standard.

b. Making data openly accessible

7. Which data produced and/or used in the project will be made openly available as the default? If certain datasets cannot be shared (or need to be shared under restrictions), explain why, clearly separating legal and contractual reasons from voluntary restrictions.

   End users of the EOPEN Web platform will be able to view and filter all the collected Twitter posts. Displayed information of the tweets will include their text, image, and date of post. As far as it concerns the sharing of the dataset, it is clearly stated in Twitter’s Developer Agreement and Policy (https://developer.twitter.com/en/developer-terms/agreement-and-policy.html) that collected data should not be distributed to third parties. However, it is allowed to distribute a list of Twitter identifiers and their analysis outcomes or human annotation. The recipients of the dataset will then have to retrieve the tweets by themselves, if the posts are still online.

8. Note that in multi-beneficiary projects it is also possible for specific beneficiaries to keep their data closed if relevant provisions are made in the consortium agreement and are in line with the reasons for opting out.

   This is not the case regarding social media data in the EOPEN project.

9. How will the data be made accessible (e.g. by deposition in a repository)?

Collected tweets are stored in a MongoDB database, but open access to this database is prohibited by Twitter. Read-only access to some information of the tweets (text, image, date) is possible using the EOPEN Dashboard interface.

10. What methods or software tools are needed to access the data?
    In case that the dataset is released as a list of Twitter identifiers, Twitter API is needed to retrieve the actual tweets.
11. Is documentation about the software needed to access the data included?
    Simple instructions to access the data would be helpful, but not necessary.
12. Is it possible to include the relevant software (e.g. in open source code)?
    A code to retrieve tweets based on their id could accompany the dataset, but credentials to use Twitter API have to be created by each user personally.
13. Where will the data and associated metadata, documentation and code be deposited? Preference should be given to certified repositories which support open access where possible.
    Data (as a list of identifiers), associated metadata (analysis outcomes, annotation), documentation and assisting code will be deposited in a public GitHub repository.
14. Have you explored appropriate arrangements with the identified repository?
    GitHub has been preferred in many previous H2020 projects.
15. If there are restrictions on use, how will access be provided?
    Restrictions concern direct access to the stored Twitter data, so a list of Twitter identifiers can be provided instead of the complete dataset.
16. Is there a need for a data access committee?
    A data access committee is not necessary.
17. Are there well described conditions for access (i.e. a machine-readable license)?
    No special conditions are needed for access.
18. How will the identity of the person accessing the data be ascertained?
    Any person will be able to access the public dataset, but they will have to create their own Twitter API credentials.

c. Making data interoperable

19. Are the data produced in the project interoperable, that is allowing data exchange and re-use between researchers, institutions, organisations, countries, etc. (i.e. adhering to standards for formats, as much as possible compliant with available (open) software applications, and in particular facilitating re-combinations with different datasets from different origins)?
    Even though distribution of the collected Twitter data is not allowed, tweets and their additional metadata are all stored in JSON format, making them fully interoperable.
20. What data and metadata vocabularies, standards or methodologies will you follow to make your data interoperable?
    JSON and GeoJSON standards are followed.

21. Will you be using standard vocabularies for all data types present in your data set, to allow inter-disciplinary interoperability?

Analysis outcomes are stored as string, numeric and Boolean types, while extracted locations are “Point” types according to GeoJSON standard.

22. In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies?

The EOPEN ontology is OGC-compliant and the representation of the data in a semantic way follows the standard RDF triplestore format.

d. Increase data re-use (through clarifying licences)

23. How will the data be licensed to permit the widest re-use possible?

The dataset will have an Apache License 2.0 allowing users to distribute it and modify it.

24. When will the data be made available for re-use? If an embargo is sought to give time to publish or seek patents, specify why and how long this will apply, bearing in mind that research data should be made available as soon as possible.

At the end of the project, all valuable metadata of the collected social media data will become available.

25. Are the data produced and/or used in the project useable by third parties, in particular after the end of the project? If the re-use of some data is restricted, explain why.

Twitter’s Developer Agreement and Policy explicitly prohibits any distribution of the collected data to third parties at any time. Only Twitter identifiers can become available and their associated metadata which have been extracted.

26. How long is it intended that the data remains re-usable?

As long as posts are still online on the Twitter platform.

27. Are data quality assurance processes described?

Periodic checks on whether collected tweets are still online will be performed in order to remove deleted posts from the dataset and maintain the data quality.

APPENDIX D – DATASETS FROM COPERNICUS SERVICES

D.1 Datasets from Copernicus Services

Copernicus, previously known as GMES (Global Monitoring for Environment and Security), is the European programme, coordinated and managed by the European Commission, for the establishment of a European capacity for Earth Observation.

Copernicus consists of a complex set of systems, which collect data from multiple sources: Earth Observation satellites and in situ sensors such as ground stations, airborne and sea-borne sensors. It processes these data and provides End-Users with reliable and up-to-date information through a set of services related to environmental and security issues.

The main End-Users of Copernicus services are policymakers and public authorities. They need the information to develop environmental legislation and policies or to take critical decisions in the event of an emergency, such as a natural disaster or a humanitarian crisis. Based on the Copernicus services, on the data collected through the Sentinels and the contributing missions, many value-added services can be tailored to specific public or commercial needs, resulting in new business opportunities.

The Copernicus programme is coordinated and managed by the European Commission. The development of the observation infrastructure is performed under the aegis of the European Space Agency for the space component and of the European Environment Agency and the Member States for the *in situ* component.

The services provided by Copernicus are addressed in six thematic areas (**http://www.copernicus.eu/main/services**):

Figure 1: Copernicus Services list (obtained from: **http://copernicus.eu/main/services**).D1.1 Copernicus Emergency Management Service

Copernicus Emergency Management Service (Copernicus EMS) provides information for emergency response in relation to different types of disasters. The Copernicus EMS is composed of an on-demand mapping component including the provision of **rapid maps** for emergency response and **risk & recovery maps** for prevention and planning and of the **early warning** and **monitoring component** (such as floods, droughts, fires). Specifically:

- **Copernicus Emergency Management Service - Mapping**[11]: Provides two types of activation: 1) Rapid Mapping that is composed by on-demand and fast provision of geospatial information; &

[11] http://emergency.copernicus.eu/mapping/#zoom=2&lat=30.24804&lon=34.08006&layers=00B0T

2) Risk & Recovery Mapping that is consist of an on-demand provision of geospatial information in support of Emergency Management activities not related to immediate response. The Copernicus EMS –Mapping service can be activated **only** by Authorized & Associated Users[12]. The results of the activations are available to general public.

- **European Flood Awareness System (EFAS)[13]**: The European Flood Awareness System (EFAS) is an operational system that monitors and forecasts flood events across Europe. It provides access to services such as the Global Flood Awareness System[14] & to EFAS Map viewer[15]
- **European Forest Fire Information System (EFFIS)[16]:** EFFIS is in charge of the protection of forests against fires. It provides access to both near-real time and archive information on forest fires. Two systems are currently supporting this service the Global Wildfire Information System (GWIS)[17] & the EFFIS[18]
- **Drought Observatory (DO)[19]:** The EMS Drought Observatory (DO) provides drought-relevant information and early-warnings for Europe (EDO) and the globe (GDO). Additional to that the service provides also short analytical reports.

D.2 Copernicus Land Service Products - Data Policy & Credits

In the following the data policy of the Copernicus Land Service products, is reported, as from the Product User Manuals.

SWE

Any use of the SWE-NH-5km product implies the obligation to include in any publication or communication using these products the following citation:

"The product was generated by the land service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs. The product is based on SWE-NH-5km data ((c) ESA and distributed by FMI)."

The user accepts to inform Copernicus about the outcome of the use of the above-mentioned products and to send a copy of any publications that use these products to the following address **kari.luojus@fmi.fi**

SCE

Any use of the SCE500-CEURO-500m product implies the obligation to include in any publication or communication using these products the following citation: "The product was generated by the land service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various

[12] http://emergency.copernicus.eu/mapping/ems/who-can-use-service
[13] https://www.efas.eu/
[14] http://www.globalfloods.eu/
[15] http://new-efas-test.ecmwf.int/efas_frontend/#/home
[16] http://effis.jrc.ec.europa.eu/
[17] http://gwis.jrc.ec.europa.eu/
[18] http://effis.jrc.ec.europa.eu/
[19] http://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000

European Commission Research and Technical Development programs. The product is based on SCE500-CEURO-500m data ((c) ESA and distributed by ENVEO).”

The user accepts to inform Copernicus about the outcome of the use of the above-mentioned products and to send a copy of any publications that use these products to the following address gabriele.schwaizer@enveo.at. 4

SME

“The product was generated by the Global component of the Land Service of Copernicus, the Earth Observation programme of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs. This product has been generated from Sentinel-1 data distributed by ESA.”

The user accepts to inform Copernicus about the outcome of the use of the above-mentioned products and to send a copy of any publications that use these products to the scientific & technical support contact specified in the next section. […] (ref. Prod. User Manual)

LAI/FCOVER

For complete acknowledgement and credits, the following statement can be used:

"The product was generated by the global component of the Land Service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs. The product is based on PROBA-V 333m data ((c) Belgian Science Policy and distributed by VITO NV).”

Publications or communications making references to the research (algorithm and validation) leading to the first version of these products should in addition include:

"The research leading to the current version of the product has received funding from FP7/ImagineS project under the Grant Agreement N°311766.”

The user accepts to inform the production and distribution centre of their publications through the following address: helpdeskticket@vgt.vito.be.

NDVI

Any use of the PROBA-V NDVI Collection 300m product implies the obligation to include in any publication or communication using these products the following citation:

"The product was generated by the land service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs. The product is based on PROBA-V 333m data ((c) ESA and distributed by VITO).”

The user accepts to inform Copernicus about the outcome of the use of the above-mentioned products and to send a copy of any publications that use these products to the following address helpdeskticket@vgt.vito.be.

VCI

Any use of the original VCI and VPI products implies the obligation to include in any publication or communication using these products the following citation for SPOT-VEGETATION products:

"The product was generated by the land service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs, more specifically the MARS program. The product is based on SPOT VEGETATION data ((c) CNES and distributed by VITO)."

or using the following citation for PROBA-V products:

"The product was generated by the land service of Copernicus, the Earth Observation program of the European Commission. The research leading to the current version of the product has received funding from various European Commission Research and Technical Development programs, more specifically the MARS program. The product is based on PROBA-V data ((c) ESA).

The user accepts to inform Copernicus about the outcome of the use of the above-mentioned products and to send a copy of any publications that use these products to the following address helpdeskticket@vgt.vito.be.