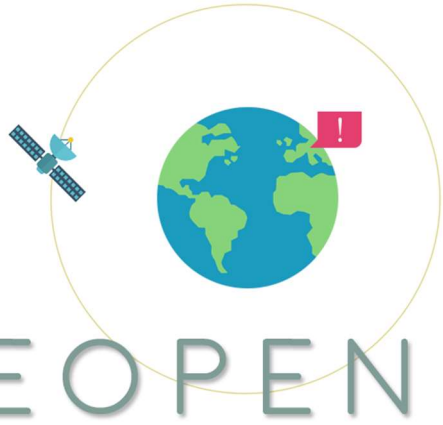

EOPEN

opEn interOperable Platform for unified access and analysis of Earth observatioN data
H2020-776019

D7.3
User Training Framework

Dissemination level:	Public
Contractual date of delivery:	Month 35, 30-09-2020
Actual date of delivery:	Month 35, 25-09-2020
Workpackage:	WP7 Evaluation and pilot implementation
Task:	T7.3 User training
Type:	Report
Approval Status:	Approved
Version:	1
Number of pages:	91
Filename:	D7.3 User Training Framework

Abstract

This deliverable contains the description of EOPEN training offer and it will include several types of materials and manuals such as on-line application (e.g. videos, user guide), accessible through the web site of the project, in order to provide the partners and the targeted users/stakeholders with different degrees of information according to their needs.

co-funded by the European Union

History

Version	Date	Reason	Revised by	Approved By
1	20-09-20	Initial Draft		
2	21-09-2020		Serco Silvia Scifoni	
3	22-09-2020		Serco Gabriella Scarpino	
4	25-09-2020			Serco Gabriella Scarpino

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Executive Summary

The deliverable D7.3, User Training Framework, contains the description of the generated products and the logics used to produce the training material. It is composed of EOPEN's training offer; it includes several types of materials and manuals generated for stakeholders and general users such as on-line application (i.e. videos, simple user guide), accessible by the web site of the project, and specific training slides in order to provide to the partners and the targeted users/stakeholders with different degrees of knowledge, all the information to use EOPEN platform according to their needs.

Abbreviations and Acronyms

AOI	Area Of Interest
API	Application Programming Interface
ARI	Adjusted Rand Index
COM	Current Operating Model
DCNN	Deep Convolutional Neural Network
DEM	Digital Elevation Model
DSM	Digital Surface Model
DSM	Digital Surface Model
GA	Grant Agreement
HPC	High Performance Computing
HPDA	High Performance Data Analytics
IoU	Intersection over Union
KPI	Key Performance Indicator
LDA	Latent Dirichlet Allocation
MNDWI	Modified Normalized Difference Water Index
NER	Name Entity Recognition
NMI	Normalized Mutual Information
OA	Overall Accuracy
OWL-DL	Ontology Web Language Description Language
PA	Producer's Accuracy
PUC	Pilot Use Case
PWM	
RDF	Resource Description Framework
RF	Random Forests
RNN	Recurrent Neural Networks
SAR	Synthetic Aperture Radar
SWIR	Short-Wave InfraRed
TOM	Target Operating Model
UA	User's Accuracy
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service

Table of Contents

1 INTRODUCTION

The EOPEN platform is designed to be used by expert EO users and non-expert EO users, one of the main goals achieved by the platform is the possibility to derive important information from satellite images without the need of a powerful ICT infrastructure and a specific background thanks to the presence of predefined processes and workflows.
To use the platform and to guarantee to all users the best user experience EOPEN consortium provides training materials, which will give end-users, and interested third parties, the possibility to use all the functions developed for the EOPEN platform.
Training materials provided for end users and stakeholders are:

- The EOPEN User Manual
- Introductive video for the EOPEN platform and DEMOs
- The EOPEN training slides

More precisely, through the material/manuals additional engagement activities will be promoted as well as the training activities, seeking a significant widen use of EOPEN platform and services, contributing to the most important objective of Copernicus on the uptake of EO data from the community. The material will also be supplied to EOPEN's various capacity building activities and will certainly bring about effects which will outlast the project timeframe, contributing to the sustainability of EOPEN approach and system.
This deliverable is composed of EOPEN's training offer and it includes several types of materials and manuals such as on-line application (i.e. videos, simple user guide), accessible through the web site of the project, in order to provide the partners and the targeted users/stakeholders with different degrees of information according to their needs.

2 GENERAL DESCRIPTION OF TRAINING MATERIAL

The training material provided for EOPEN can be divided in two categories, the training material for stakeholders that participate to EOPEN project and the training material for the general end users.
The training material for stakeholders is also made to ensure the autonomous usage of EOPEN platform during for example the field exercise of PUC1 better described in chapter 4 and was basically developed between technical partners and PUC leaders.
This material was developed starting from the stakeholders, their expertise and their needs, analysed and reported in the following chapters for each PUC.
The material for general public (end users) was developed mainly by technical partners and is more oriented to the potentials of the technologies developed in EOPEN with a deep focus on specific components. This material shows the complete usage of the platform and is useful for expert users.
This material is available here: https://eopen.spaceapplications.com/docs/user/index.html
Demo Videos and the EOPEN video introduction are also oriented to a general audience and are useful to introduce the platform, explain in general the potentials of EOPEN and the usage.
Those videos are available in the dedicated section of EOPEN website:
https://eopen-project.eu/introductory-tour/

2.1 Training material developed for EOPEN PUCs

To ensure the usage of EOPEN platform and to provide all information for the field exercise each PUC provides to stakeholders a specific training. The training material for this training are a series of slides with a common part and a specific part for each use case. The objective of this material is to provide to non EO expert stakeholders the minimum background needed for the usage of the platform and to provide to EO expert users all the information about the platform. Inside the slide pack there is also a part that describes the interface and the command to run/visualize or interact with the platform. Each PUC provide also a specific description of the usage of the platform in each use case with some useful examples and results obtained.

2.2 Training material developed for general public

The training material for general public is included in the dissemination material generated for EOPEN; in fact to present the platform during events as the EO Big Data Hackathon it was needed also a training part for users to allow the usage of EOPEN also during those events.
EOPEN consortium produced also two short videos providing a general description of the EOPEN platform have been produced for dissemination purposes. These videos synthesize the potential of EOPEN through guided examples of the platform usage. Moreover, webinars were organized for events like the EO Big Data Hackathon and project meetings like that given to the External Advisory Board - they are available in the EOPEN website.
Inside EOPEN website there is also a manual of the platform useful for developers and expert users.

3 PUC DESCRIPTION AND LEARNING NEEDS

In this paragraph there are the general descriptions of each PUC that represent the baselines for the development of training material. Based on the use case descriptions are derived also the learning needs for each PUC. In the chapter there is also the list of stakeholders involved, who will receive training and training material developed.

3.1 PUC 1 Description and learning needs

The test scenario of PUC1 was built based on the flood event of 2010 in Vicenza; the storyboard provided in Deliverable 2.1 underlines the most important figures involved in the emergency management and their role in the “Command Chain”. EOPEN provides a unique platform for all actors involved in the emergency management; the use of satellite images and ground truth information in a scalable environment is the added value that the PUC1 wants to test.
During emergencies all actors work together with a common target that is the emergency support and safety for citizens; the main problem is the fragmentation of information due to the number of actors involved. During emergencies it is very difficult to share information in traditional ways (papers, emails, fax and so on) and it requires a lot of time, so the decision maker can’t have a precise and timely view of the emergency. Another issue is that at the end of an emergency the lack of a unique database results in losing acquired information from the event.

The lack of powerful computer infrastructure is mainly a limit for the use of satellite images that require Earth Observation knowledge and an appropriate ICT infrastructure. What works is mostly the command chain that is known by all, during emergencies every actor works separately with its team, information and decisions are shared at the manager/director level that are physically inside each organization (from COC to DICOMAC).
Flood events during history were frequent and catastrophic. In the last centuries, there were the flood of 1882 (failure of ponte Angeli bridge, a medieval bridge modified during renaissance by Andrea Palladio), 1966 (most important event for damage and failures) and the most recent floods in 2010 and 2012.
Flood events cost millions of euros (direct and indirect damages) and people need years to rebuild what was lost. The flood risk management is also the scope of the 2007/60 EU Directive.
In particular, the scenario we are considering was built based on what happened in 2010 in Vicenza; the storyboard underlines the most important figures involved in the emergency management and their role in the "Command Chain".
The scope of this "play" is to highlight the command chain, the important role of the Civil Protection structure (planning includes) that is the framework during the emergency.
In fact, AAWA is an administration that supports decision makers during emergencies and during ordinary time providing knowledge about flood risk management (as previously mentioned about the 2007/60 EU Directive).
Under the condition previously exposed the field exercise will simulate a flood event as the 2010 flood in Vicenza using images of the flood events happened in the Eastern Alps River Basin District during the years of the project.

Description of stakeholders

ARPAV: This administration is the environmental agency of Veneto Region; inside this office there is also the Copernicus contact person for Veneto Region.
Regione Veneto Difesa Suolo: This Administration is the office of Veneto Region Administration responsible for land use, water, environmental planning, and waste management. This office is also responsible for cartography.
Regione Veneto Protezione Civile: This Administration is the office of Veneto Region Administration responsible of Civil Protection Volunteer (at regional scale, so about formation, guidelines etc.), for Bulletins (Alert bulletins).
Genio Civile di Vicenza: This Administration is the operative office of Veneto Region Administration in water management (river maintenance, river project, dikes etc.).
Corpo Nazionale dei Vigili del Fuoco di Vicenza: The firefighters of Vicenza.
Comune di Vicenza: Municipality of Vicenza, during floods the mayor is responsible for the coordination of civil protection volunteers at local scale; the municipality is also responsible for the safety of people at local scale.
Consorzio APV: This Administration is a Land reclamation authority responsible for ''Alta Pianura Veneta'' basin.
Consorzio Brenta: This Administration is a Land reclamation authority responsible for ''Brenta'' basin.
AAWA (Autorità di Bacino dei fiumi Isonzo Livenza Piave Brenta-Bacchiglione): This Administration is the major water authority in Veneto, Trentino-Alto-Adige and Friuli region; it is also responsible for some international basins like Timavo Basin (Slovenia). It is an office directly dependent from the Italian Environmental Ministry.

Description of their expectation and needs

ARPAV already uses EO data for certain applications, during floods they are part of the civil protection system providing measurements from ground sensors and weather forecasts, they need to be trained specifically on the platform usage.

Regione Veneto Difesa Suolo, Regione Veneto Protezione Civile and Genio Civile di Vicenza are part of the Veneto Region Administration, they have already experience in EO data and they can also provide expertise in EO. During the emergency they are responsible at regional scale and with ARPAV they provide civil protection bulletins. They need to be trained on the use of the platform; EOPEN can be useful to exchange datasets and to acquire a common picture of the emergency.

Corpo Nazionale dei Vigili del Fuoco di Vicenza: The firefighters of Vicenza, they have experience in emergency management and images acquired by UAV and aerial, they need specific training for the usage of the platform and we can also provide information on EO images and the potential of EOPEN platform for emergency management (flood scenarios as in the exercise).

Comune di Vicenza: Municipality of Vicenza, during floods the mayor is responsible for the coordination of civil protection volunteers at local scale; the municipality is also responsible for the safety of people at local scale. They have a little experience in EO data and we have to provide the training to explain some background information needed and the usage of the platform. The municipality of Vicenza will be one of the most important users since they will use all the information inside the Platform, from social media to water presence maps and weather forecast.

Consorzio APV and Consorzio Brenta: They have a small experience in EO data use and we have to provide the training to explain some background information needed and the usage of the platform. During emergencies they are responsible for the minor rivers in the upper part of the Bacchiglione river basin.

AAWA (Autorità di Bacino dei fiumi Isonzo Livenza Piave Brenta-Bacchiglione): They already use satellite data and during the EOPEN project have acquired specific knowledge on this topic, the training will be useful to enlarge the number of technicians that can manage those types of information.

3.2 PUC 2 Description and learning needs

The PUC2 scenario focuses on the timely and large-scale food security monitoring in South Korea. The storyboard and key stakeholders of PUC2 have been thoroughly described in D2.1. To recap the key food security issues in South Korea, it is a country that has experienced rapid population growth due to urbanization and the commercialization of the food chain. South Korea suffers from low food self-sufficiency that is decreasing in the long term, due to the market opening and due to being dependent on the import of most major grains. The PUC2 scenario focuses exclusively on rice, which is systematically overproduced, resulting in large storage costs, difficulties in exporting and undermines the cultivation of alternative crops. Therefore, having a detailed picture of the extent of cultivated rice in the entire country, but also monitoring its growth, health and indicating the expected biomass and yield at national scale is of foremost importance in food security related decision making.

Let us now further understand the information flow and the chain of events that have led to such food security issues in South Korea. Statistics Korea is the assigned partner to announce

the results of Korea's annual rice production forecasts in October each year. According to the Ministry of Agriculture, Food and Rural Affairs (MAFRA)'s key statistics on agriculture, forestry and food, in 2014, Korea's food self-sufficiency rate was 49.8% and grain self-sufficiency rate was 24%. Major grains, except for rice, depend more than 90% on imports. Since 2000, rice supply has been constantly oversupplied, and it is estimated that the annual supply of rice is over 280,000 tons. Therefore, the government's market intervention is inevitable. One of the main reasons for the overproduction of rice is the government's agricultural policy and active market intervention. The government would isolate the market if the price falls below the target price and compensate 85% of the price decreased. Apart from the central government, local governments also have a lot of support policies for rice farmers. Producers prefer rice farming because of the relatively lower labour input due to high mechanization and stable income compared to other crops. Relevant stakeholders and actors are the Prime minister, the Ministry of Agriculture Food and Rural Affairs (MAFRA), the Korea Rural Economic Institute (KREI), the National Institute of Agricultural Science, Local Governments, Producers (farmers), SMEs, Food Importers and Consumers.

Description of stakeholders

(1) Suk Kyu Kim from CJ Cheil Jedang

Mr. Suk Kyu Kim is a general manager of Strategy & Business Planning Team at CJ Cheil Jedang, the largest general food manufacturer in South Korea. He is in charge of BIO & Grain Trading Business management, carrying out bio business and manufacture of food, medicine, and feedstuffs and other ingredients. Keeping up with market trends, CJ further analyses social and environmental impacts.

(2) Dr. Jong In Kim from KREI (Korea Rural Economic Institute)

Dr. Jong In Kim works at a national agricultural policy research institute focused on the development of agriculture, rural areas and through the food industry. The institute is responsible for agricultural monitoring, Free Trade Agreements, world agriculture information, agricultural policies.

(3) Prof. Chang Gil Kim from the Dept of Agri Economics and Rural Development at Seoul National University

Prof. Chang-Gil Kim was an ex-president of KREI now works for Invited Professor. He focuses on research and teaching in the areas of agriculture, rural communities, natural resources and environment, as well as regional development in the department of Agricultural Economics and Rural Development.

(4) Yoon Ji Kim from KU Lab of Environmental Ecological Planning and Policy Studies (EEPPS Lab, Korea University)

Ms. Yoon Ji Kim works at the laboratory of environmental ecological planning and policy studies under the supervision of Prof. Seong Woo Jeon. The laboratory is focused on environmental ecological planning, adaptation for climate change and environmental policies.

(5) Dr. Sang Il Na from NASS (National Institute of Agricultural Science)

Dr. Sang Il Na works at the research institute under the Rural Development Administration, which is in charge of testing and research to develop agriculture info sustainable and competitive biological industry. The role of NASS is generating new income by exploration of the values of agricultural resources and maintaining a healthy agricultural ecosystem, crop protection and etc.

Description of their expectation and needs

(1) CJ Cheil Jedang

CJ Cheil Jedang expects us to compare the accuracy of the manual survey. As Korea will probably conduct a preliminary crop survey and forecast production of rice in the near future, CJ expects us and recommends us to compare the accuracy with this data.

CJ further considers that if there is a significant result in this part, this can replace the government's complete enumeration.

Currently CJ is conducting their own GLAM project. The data are used to predict corn/soybean production in the United States and Argentina with the simple Excel function.

This is also being compared to the crop condition announced by the USDA or Argentina itself. The results were shown that two months before the harvest, the corn had an estimated 95 percent yield. And soybeans are estimated to be 92% of the crop a month before harvest.

However, some numbers do not seem to be correct though.

Thus, to supplement this, CJ uses the data provided by KU as NDVI represents meaningful numbers in each phase of the crop. The result of this part would help CJ to predict in advance whether the harvest has been delayed, whether the crop is good or bad and used for pricing.

(2) KREI (Korea Rural Economic Institute)

KREI expects that the result can be meaningfully and widely used in the areas of the development of agriculture, rural areas and furthermore, to the food industry. They need the data with a high accuracy, more than 95% for agricultural monitoring and planning out Korea’s agricultural policies as Korean ministry is interested in early prediction of rice yield and rice paddy detection.

(3) Dept of Agri Economics and Rural Development at Seoul National University

SNU expects that the result can be used to further strengthen the research in the areas of agriculture, rural communities, natural resources and environment, as well as regional development in the department of Agricultural Economics and Rural Development. They expect to collaborate with KREI to participate in a meaningful project where the result of our platform can be widely used.

(4) KU Lab of Environmental Ecological Planning and Policy Studies (EEPPS Lab, Korea University)

KU EEPPS Lab expects that the result can be used to further strengthen their research and that the platform can be accessible to the public. They further expect to engage in the continued research with cooperation of the current stakeholders.

(5) NASS (National Institute of Agricultural Science)

NASS expects and recommends to us that due to the nature of the rice crop system, it is deemed important to maintain the accuracy of monitoring results. If monitoring is possible through maintaining a certain level of accuracy every year, the result will be very useful for the agencies in relation to supply and demand.

NASS expects us to have a clear distinction or definition of Yield indicator and biomass indicator. As generally, biomass divided by unit area is expressed as yield thus this may cause confusion to some users.

They expect that if the platform is disclosed to the public, it will be necessary to review related regulations such as personal information leakage. In particular, farmers usually want only themselves to know how much their arable land will yield crops as it is considered as a property thus are very reluctant to be exposed to the external parties.

3.3 PUC 3 Description and learning needs

In the present and future climate change environment, the average temperature in Finland is rising / will rise more (2°C by 2040), and precipitation will increase faster (5–10% by 2040) than the global average. The changes are affecting winters more than summers with the largest changes in the northern part of the country: Finnish Lapland.

Since the early 2000s, Finland has taken a proactive role in managing the Climate Change situation nationally, with mitigation and adaptation plans. The activities of the transportation sector run deeply through the sectors: sustainable industry, land use planning and construction, tourism and recreation as summers become warmer, wetter and longer and snow packed regions shift northward. Our use case begins with historical snow and

temperature data, supplemented by EO data, which support Finnish Transportation Infrastructure Agency (FTIA)'s current and future road maintenance for the Finnish drivers and riders. Our Use Case continues with temperature and snow data support for the Finnish Lapland communities who are, and will be, experiencing the greatest climate change consequences. The reindeer herders are the frontline people experiencing Climate Change.

This use case is focused on the mitigation of the consequences due to climate change by providing services (data, tools etc.) that are relevant for the stakeholders. To this end, the main objective has been to gather feedback about their needs and expectations through personal interviews over phone, questionnaires, email exchanges, and meetings.

Description of stakeholders

Reindeer herders

Herding is small-scale livelihood in Northern Finland with about 5000 herders. Directly exposed to changes in land use and climate and have an intuitive, high fidelity knowledge of climate conditions to support reindeer care. Reindeer activities drive tourism in Northern Finland as 90% of tourists are from foreign countries.

Reindeer researchers

Due to reindeer herding's large Finnish social, cultural and economic importance, there are multiple research institutes that provide financial support to studies. The Reindeer Researchers study herding's economic development and sustainability, the herders' adaptation to mitigation of Climate Change, and the herders' effects on land use and environment.

The Finnish Transportation and Infrastructure Agency (FTIA)

FTIA is the Finnish national agency responsible for transportation and road maintenance in Finland. Finland has a total of 78 000 km of public roads, many in sparsely populated regions. Transportation in general accounts for 20% of all greenhouse gas emissions in Finland, out of which road transport in particular accounts for 90%. Climate change is expected to impact all facets of the transport system: the infrastructure, modes of transport and operations and, especially, the maintenance. The FTIA must make decisions based on yearly trends in weather and climate.

Description of their expectation and needs

Reindeer herders

Most of the herders are already familiar with online resources for the weather forecasts, road conditions, and the amount of snow in the reindeer herding areas. However, this information is fragmented and does not always offer clear solutions to the everyday problems reindeers and their herders face such as the trends for the snow depth and surface temperature in their region or the condition of the ground under the snow pack, which are important for planning grazing and feeding of the reindeer. They need user-friendly and better tools for this information.

Reindeer researchers

Reindeer researchers are experienced in using weather and climate data in their research and are generally more interested in long-term adaptation strategies for the herders during the

climate change. They need long-period historical data of temperature and snow conditions as well as climate projections to estimate the effect in the future. All this information needs to be centralized in an easily accessible fashion.

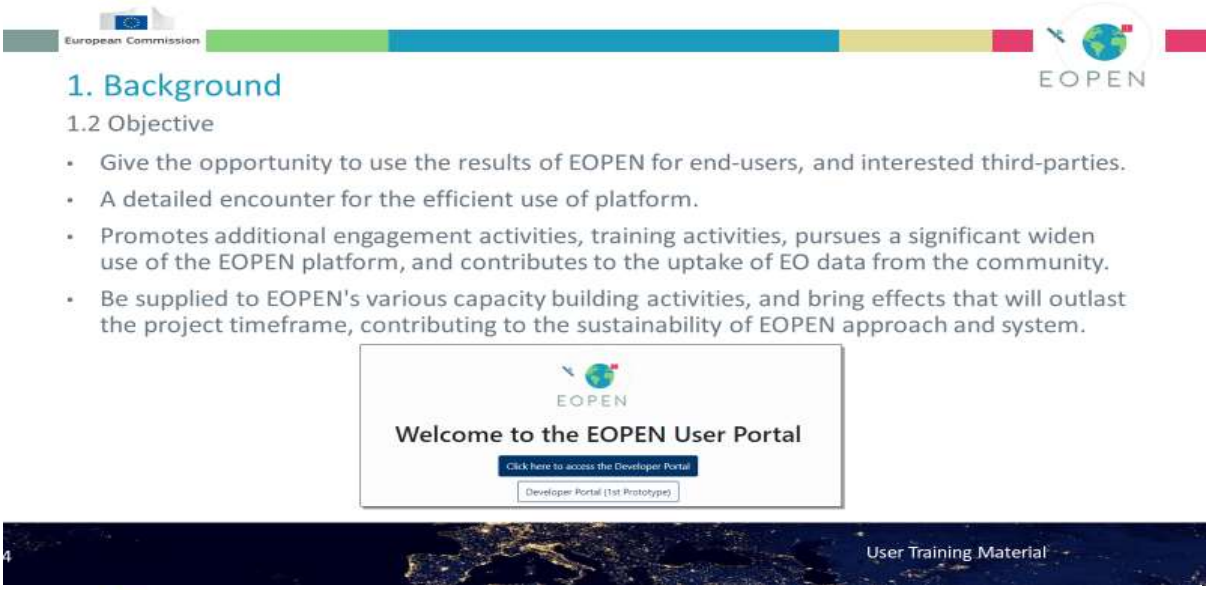
The Finnish Transportation and Infrastructure Agency (FTIA)
Since FTIA is the national authority for road maintenance, their main concerns are weather forecasts of rainfall/snowfall and temperature, the current road conditions, and yearly statistics of snow depth and temperature of roads. This information is used to plan their budget for the next years, and to keep track of the changes in order to update the thresholds for road maintenance tasks such as road sanding and clearing the snow. They also need this information to be centralized and easy-to-use.

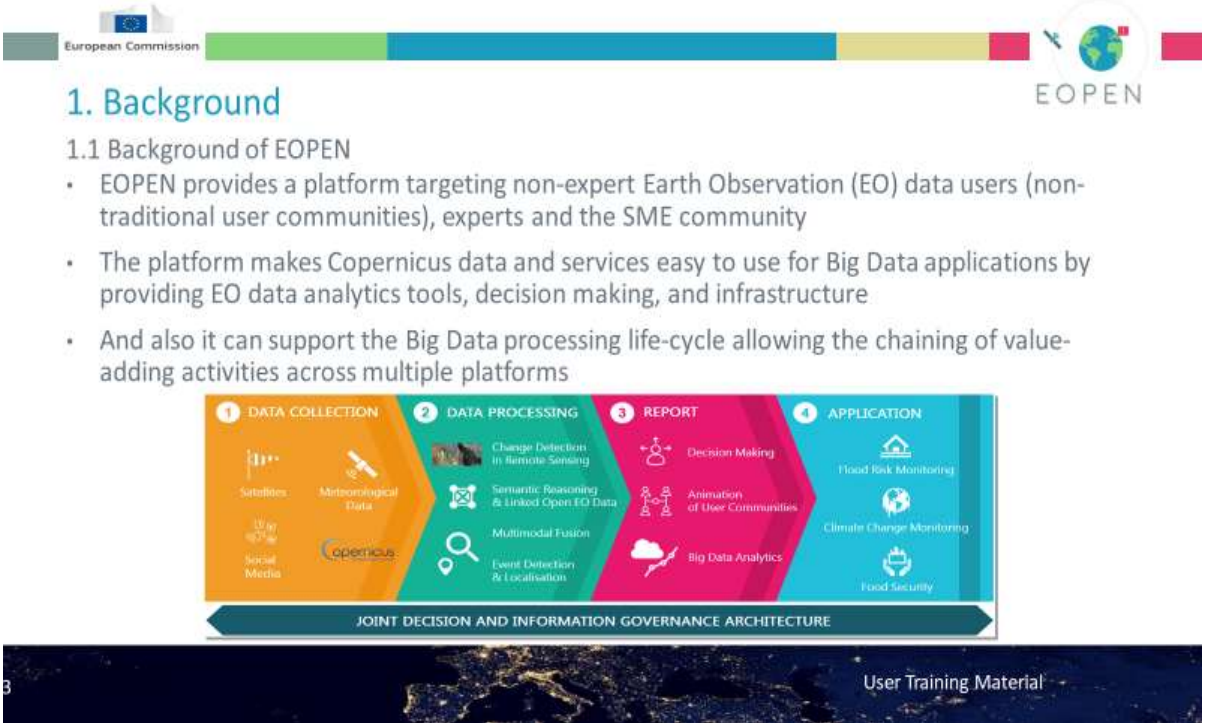
4 TRAINING MATERIAL ON PUCS AND FOR EOPEN RELATED EXERCISES

Training material generated in the project consists mainly in a series of slides developed for each use case to provide to different stakeholders all information for each demonstration/exercise. Inside the project the Consortium produced also some videos for specific events, useful to demonstrate the platform to stakeholders in some meetings/events (for example the Info-day organized by AAWA in 2019). Those videos were appreciated by users because of their capacity to synthesize the potential of EOPEN in a few minutes and because of the guided examples (tutorials) for the platform usage. Eventually an EOPEN User Guide, including a comprehensive description of the is available at https://eopen.spaceapplications.com/docs/
This section contains the training material made for users for each use case; as mentioned before each use case has different learning needs linked with the background of each group of users.
All material provided has been partly translated in the original language of each use case.
Each PUC slide set follows the same structure:

- A background part that provides all the information about satellite images, EO products and the theory behind all processes developed in the platform (flood detection, rice paddy detection etc.)
- The EOPEN platform inside each use case; this part provides information about the specific usage of EOPEN platform for each use case with examples to explain the actual usage of EOPEN to support use cases
- The practical training part where there is information about how to generate any specific product
- The visualization part that is a manual about the interface and how to visualize products; in this part there is the explanation of the different EOPEN tools (GIS viewer online, WMS service etc.)

4.1 PUC 1 specific material

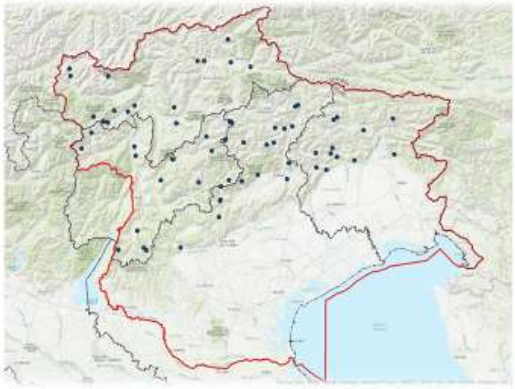




1. Background

1.3 The Eastern Alps river basin district

- The competence of the Authority (AAWA) covers the Autonomous Provinces of Trento and Bolzano, the Regions of Veneto, Friuli Venezia Giulia, and parts of basins falling within the borders of Switzerland, Austria and Slovenia.
- Overall, the District covers an area of over 37,000 km2.



User Training Material

1. Background

1.4 Floods in Italy

- The average annual precipitation is highly variable with increasing trend in the South-North direction at least up to the first orographic obstacle constituted by the pre-Alpine belt.
- The average annual values vary from just under 700 mm found in the southernmost part of the Veneto Region (province of Rovigo) to over 3,000 mm found in the Musi area of Lusevera and Uccea located near the border with Slovenia.

User Training Material

1. Background

1.4 Floods in Italy

- Six major rivers flows inside the district: the Isonzo, the Tagliamento, the Livenza, the Piave, the Brenta-Bacchiglione and the Adige, all streams with high slopes and fluvial-torrent character, with average flows annual substantially between 80 and 100 m3 / sec and full flow between 2,500 and 5,000 m3 / sec

1. Background

1.5 The importance of ground truth

- In Remote Sensing, Ground truth is the information or data collected on site so that the input data (image) can be related to the actual features and is considered to be much correct and appropriate than the input features. This process compares the pixel on a satellite image to what is there in reality (at the present time) in order to verify the contents of the pixel on the image

1. Background

1.6 The Copernicus Program and Satellite

- Copernicus is the European Union's Earth Observation Programme, looking at our planet and its environment for the ultimate benefit of all European citizens. It offers information services based on satellite Earth Observation and in situ (non-space) data.
- The Programme is coordinated and managed by the European Commission. It is implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océan.

1. Background

1.6 The Copernicus Program and Satellite

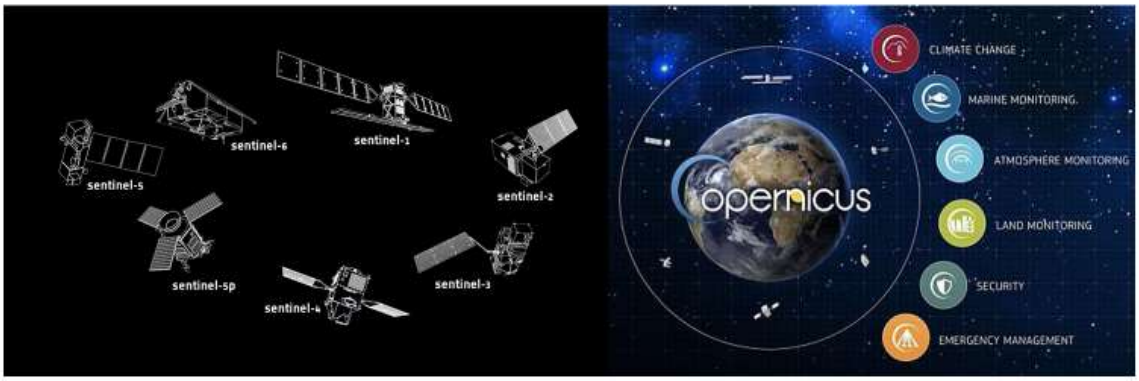
- Vast amounts of global data from satellites and from ground-based, airborne and seaborne measurement systems are being used to provide information to help service providers, public authorities and other international organisations improve the quality of life for the citizens of Europe. The information services provided are freely and openly accessible to its users.

European Commission

EOPEN

1. Background

1.6 The Copernicus Program and Satellite



11 User Training Material

European Commission

EOPEN

2. The EOPEN Platform for flood reduction

2.1 New methodology to derive flooded areas

- The EOPEN platform provides the opportunity to develop the concept of flooded area delineation. With EOPEN users can merge the information provided by classic hydraulic models with satellite imagine and data from social media inside a unique platform without the needs of a specific ICT infrastructure.

PRECURSORS:

Hydraulic models and simulations

Satellite imagine and maps

CONFIRMATION:

Ground truth (tweets)

12 User Training Material

2. The EOPEN Platform for flood reduction

2.2 The hydrological and Hydraulic model to predict floods

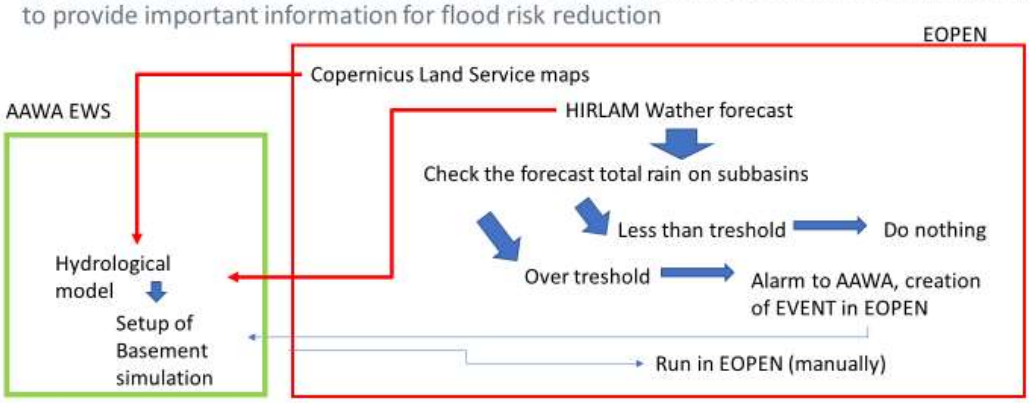
- The Flood Maps; those maps comes as results of the hydraulic model; the model geometry is generated offline by technician; boundary conditions comes from the last hydrological run of AAWA model. The user will be able to upload the geometry and boundary files into EOPEN, run the algorithm and download results. Once accepted the user will upload Flood maps for any user.

13 User Training Material

2. The EOPEN Platform for flood reduction

2.2 The hydrological and Hydraulic model to predict floods

- The schema below show the interaction between several datasets and several infrastructure to provide important information for flood risk reduction



14 User Training Material

2. The EOPEN Platform for flood reduction

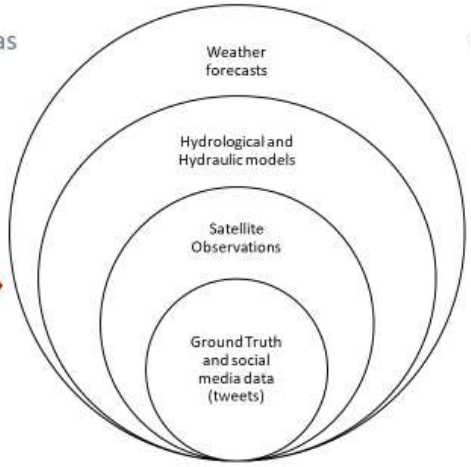
2.3 New methodology to derive flooded areas

- Advantages of EOPEN

From:
Weather forecasts
Hydraulic models
Surveys

Costs
Time

To:



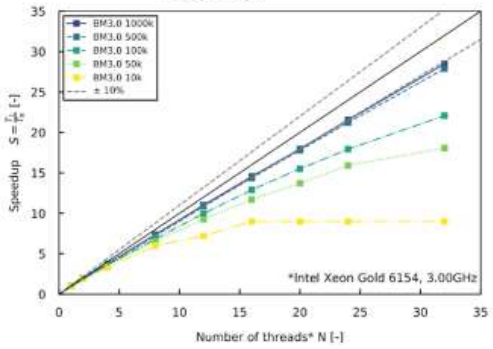
Time
Costs

15 User Training Material

2. The EOPEN Platform for flood reduction

2.4 EOPEN capabilities for flood management

Speedup



Secure Storage

16 User Training Material

2. The EOPEN Platform for flood reduction

2.4 EOPEN capabilities for flood management

- One important advantage of EOPEN is that once a user generate a product can also decide to public the content on the platform for other users, this part permit to save time and money.

Sharing contents between users

17 User Training Material

2. The EOPEN Platform for flood reduction

2.5 Satellite imagine and water presence maps

▷ Products available and tools for flood risk reduction

- The Water Presence Maps (WPM): maps of the areas covered by water (flooded and non flooded areas)

18 User Training Material

2. The EOPEN Platform for flood reduction

2.5 Satellite imagine and water presence maps

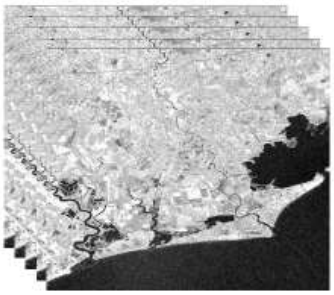
- ▷ Products available and tools for flood risk reduction
- The Water Presence Maps (WPM): those maps are the output of the water detection algorithm; this algorithm daily search into the catalogue if there is any new S1 or S2 imagine available and from them derive the maps that indicates the presence of water. The output are corrected applying masks to delete waterbodies and other permanent pool from the maps.

19 User Training Material

2. The EOPEN Platform for flood reduction

2.5 Satellite imagine flood map – outlier detection

X: Current image



TS: Timeseries of 30 previous images

Outlier (flood) detection on a target image X compared against a timeseries of 30 previous images that represent the "normal-state" of the area

$$\frac{X - TS_{mean}}{TS_{std}} > alpha$$

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2. The EOPEN Platform for flood reduction

2.5 Satellite imagine and flood maps

(a) (b)

▷ Comparison between non flooded and flooded dates:

Flood map of Lemene river region on 15/11/2019, at a dry state (a) and on 17/11/2019, during a flood event (b). Flooded areas appear in red colour.

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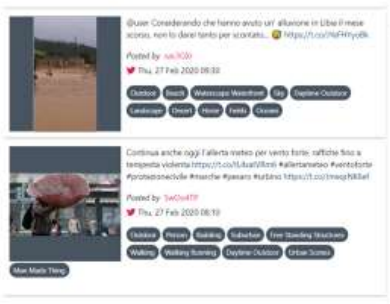
2. The EOPEN Platform for flood reduction

2.6 Social media data

- The ground truth are the feedback from the territory. EOPEN platform can every day scan the web to derive data from social media, in this case tweets, to provide more information about the situation.



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User Training Material

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2. The EOPEN Platform for flood reduction

2.7 Events on social media data

- Event detection is based on the fluctuation of collected tweets per day
- Outliers (peaks) can be associated to real-world events (flood incidents)
- Retrieving the most frequent words and the most detected locations can provide more insights on the event
- A detected event can trigger the acquisition of satellite images of the area and the production of water masks

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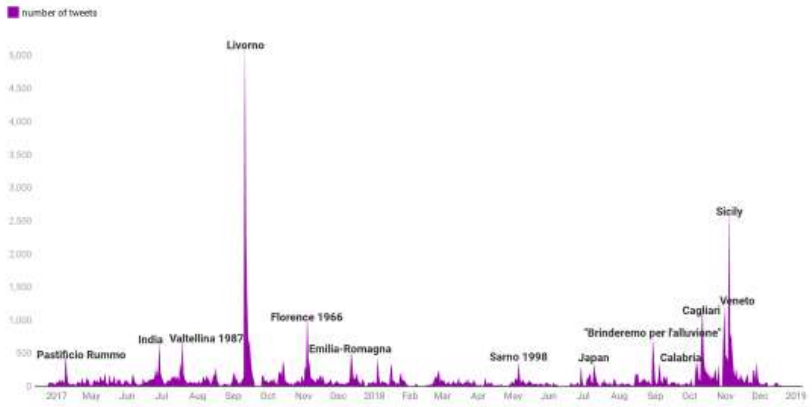
2. The EOPEN Platform for flood reduction

2.7 Events on social media data



Example of automatically detected flood events in Italy in years 2017 & 2018

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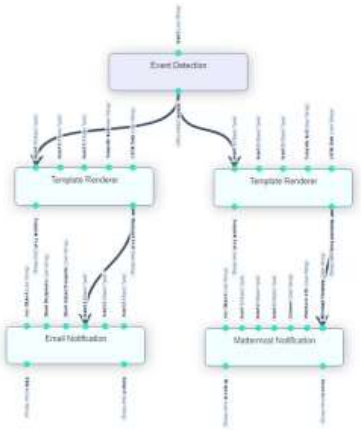
3. Practical Training

3.1 WORKFLOWS

- The platform most important feature is the ASB.
- The ASB is a framework enabling platform and application agnostic solution for implementing complex processing chains over globally distributed processing and data resources.
- ASB provides a “low coding” solution to develop a data processing facility based on orchestrated workflows.



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3. Practical Training

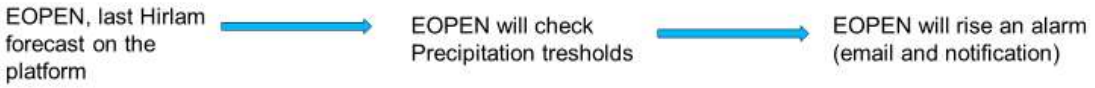
3.2 EOPEN workflow to derive a WPM

- Water presence maps comes from a predefined algorithm developed by CERTH based on Sentinel S1 and S2 observation with several corrections (permanent water bodies, elevation etc.). Following this method remains only the flooded areas.
- To run the algorithm users should only select the workflow (users can also modify the workflow) and run it inside the platform.
- The algorithm works also automatically and users will be able to visualize results directly in EOPEN.

3. Practical Training

3.3 EOPEN Event detection module

- Inside the platform exists many different workflows defined by users or created by the EOPEN team. One of this workflows already implemented inside EOPEN is the Event detection module; this module send a notification every time a rain threshold is exceed.



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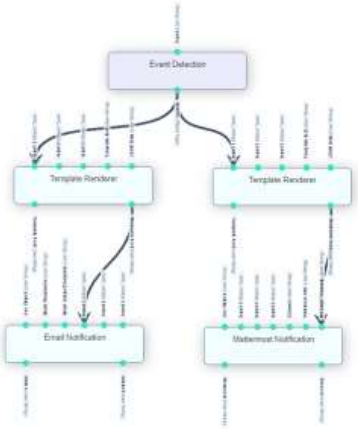
3. Practical Training

3.3 EOPEN Event detection module

▷ The event detection workflow

- The event detection module specifically check the Hirlam forecast every time HIRLAM consortium publish a new forecast. For each timestep the workflow check the threshold exceedance of a variable (es. Rain rate) and send eventually a notification to the user.
- Each box present input and output of the process



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3. Practical Training

3.3 EOPEN Event detection module

▷ The event detection workflow

- The result of event detection module is a map of the whole Eastern Alps River Basin District territory divided into municipalities where users can see the situation forecast.
- To provide a user friendly view there is also a colored scale for each threshold excedence

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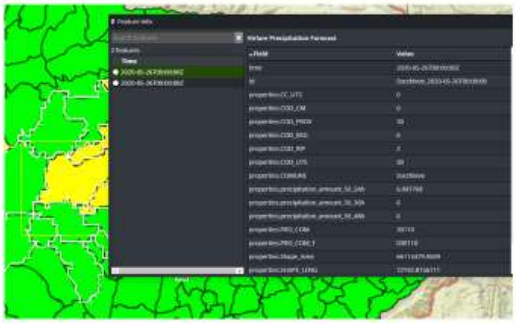
3. Practical Training

3.3 EOPEN Event detection module

▷ The event detection module

- Users can query the layer to know specific information about forecast; EOPEN platform provide also an archive of those layers so users can also see past forecasts.
- Thresholds are listed below:

PV= precipitation value (mm)	Duration			
Colours	1h	24h	36h	48h
green	0<PV<15	0<PV<50	0<PV<70	0<PV<100
yellow	16<PV<25	51<PV<70	71<PV<100	101<PV<200
orange	26<PV<39	71<PV<100	101<PV<200	201<PV<250
Red	Red: PV>40	PV>100	PV>200	PV>250



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3. Practical Training

3.3 Obtain a Flood Maps

- To obtain a flood map and to prepare the hydraulic model each user need some software and plugins (freeware) listed below:

Softwares:

BASEMENT

Plugins:

Crayfish

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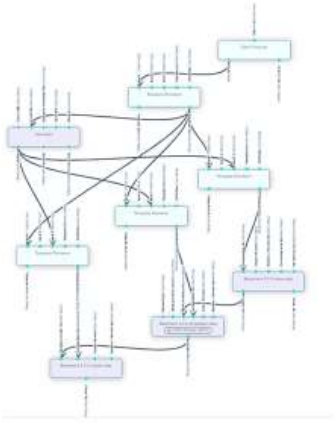
3. Practical Training

3.3 Obtain a Flood Maps

- To setup the simulation the user should:
  - Compile basement input file offline
  - Copy iside AAWA FTP the simulation files
  - Run the Basement workflow
- Once the simulation finished:
  - Download results files
  - Run the process for public geotiff



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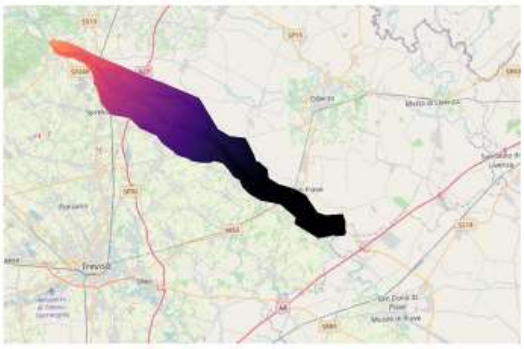
3. Practical Training

3.3 Obtain a Flood Maps



Practical example:

The Flood Maps are produced offline after the hydraulic model run on EOPEN, a domain with:

Edges: 2593042

Vertex: 1299807

83h of simulation (duration of the flood event),

normally runs in 2-3 days on a single PC, in EOPEN it runs in 2 hours.

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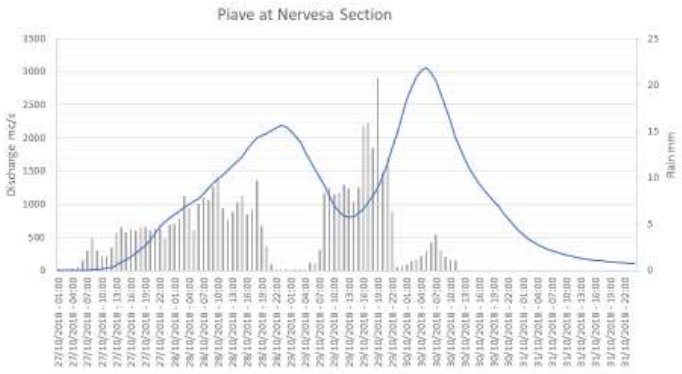
3. Practical Training

3.3 Obtain a Flood Maps



Practical example:

Inputs:

- Geometry file
- Discharge
- Configuration file

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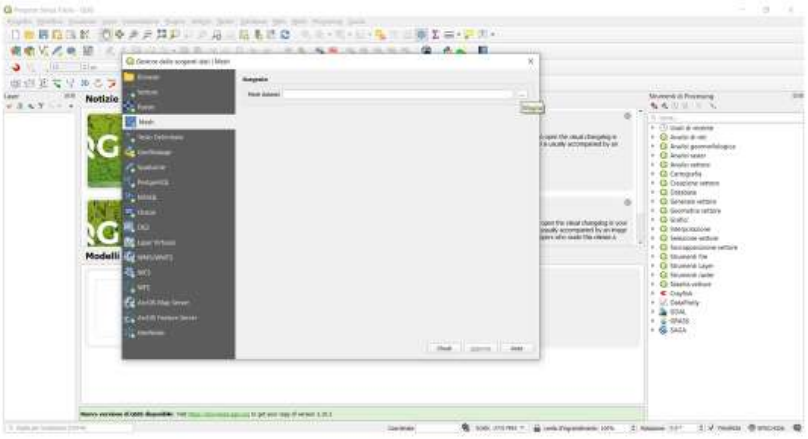
3. Practical Training

3.3 Obtain a Flood Maps

- Open the geometry from the 2dm file, it represent the initial geometry



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User Training Material

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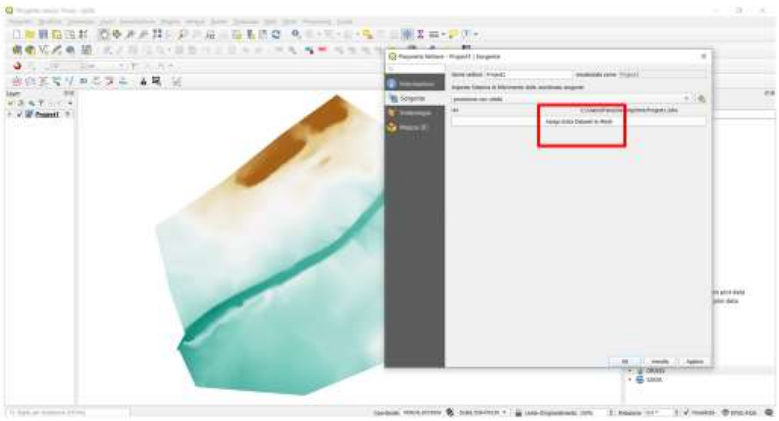
3. Practical Training

3.3 Obtain a Flood Maps

- Add results datasets (xdmf) obtained from EOPEN platform



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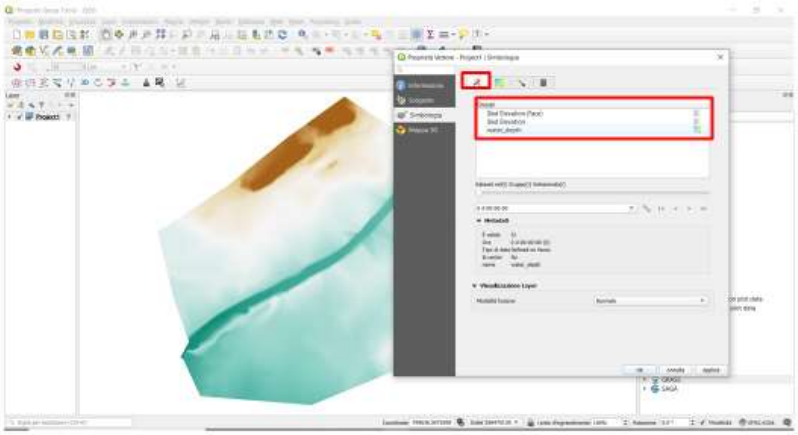
3. Practical Training

3.3 Obtain a Flood Maps

- Select the corresponding variables (es. Water depth or velocity)



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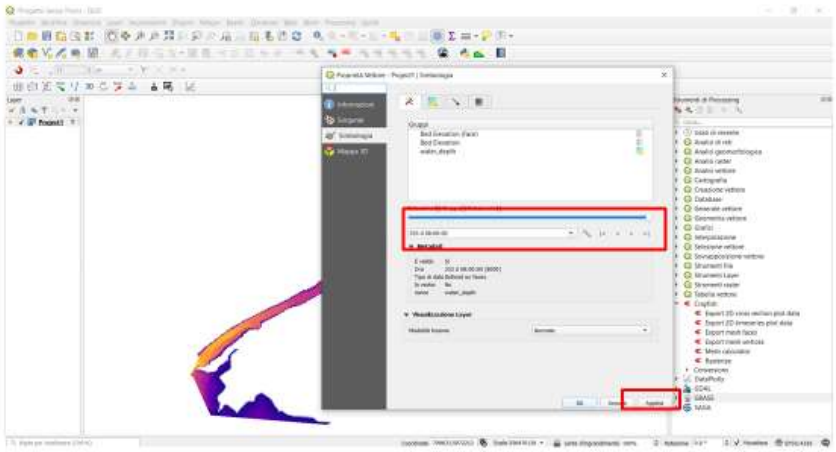
3. Practical Training

Obtain a Flood Maps

- Select the time step of the simulation



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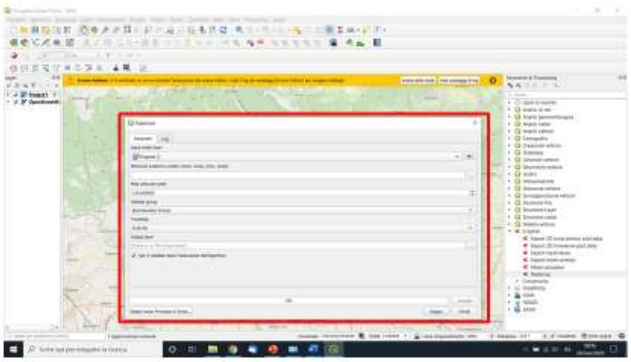
3. Practical Training

3.3 Obtain a Flood Maps

- Export geotiff with crayfish plugin:
- NAME CONVENTION:

AA_EWS_FF_DDMMYYstart_DDMMYYend

- And upload if necessary on EOPEN



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3. Practical Training

3.3 Obtain a Flood Maps

▷ Other Examples of flood maps

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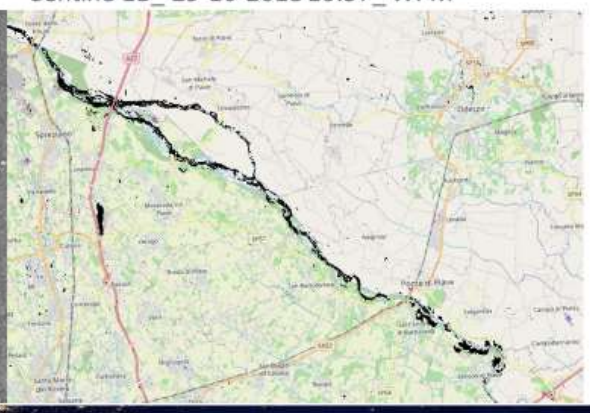
3. Practical Training

3.3 Obtain a Flood Maps

The Flood Maps; the VAIA Storm results, Sentine 1B _ 29-10-2018 16:57

The Flood Maps; the VAIA Storm results, Sentine 1B_ 29-10-2018 16:57_ WPM



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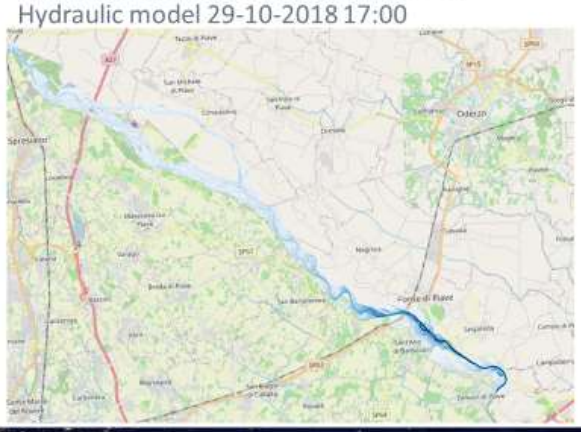
3. Practical Training

3.3 Obtain a Flood Maps

The Flood Maps; the VAIA Storm results
Sentinel 1B 29-10-2018 16:57

The Flood Maps; the VAIA Storm results
Hydraulic model 29-10-2018 17:00



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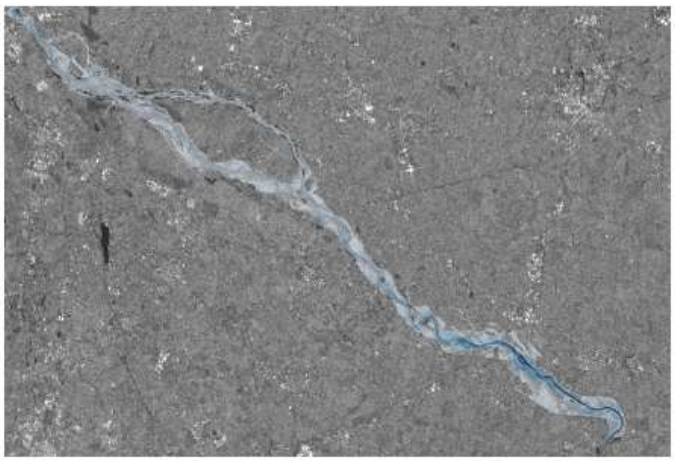
3. Practical Training

3.3 Obtain a Flood Maps

Comparison fo the Piave river flow path obtained with the hydraulic model and from satellite maps derived from S1



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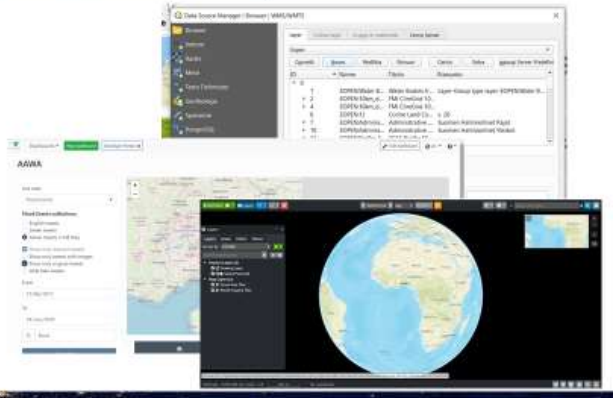
4. Visualization

Eopen provide to users different interfaces and tools to visualize results; the main tools are:

- ▷ Dashboards
- ▷ Opensphere (Gis viwer)
- ▷ The EOPEN Geoserver (WMS service)
- With this tools eachone can integrate the platform inside their workflows and offices.

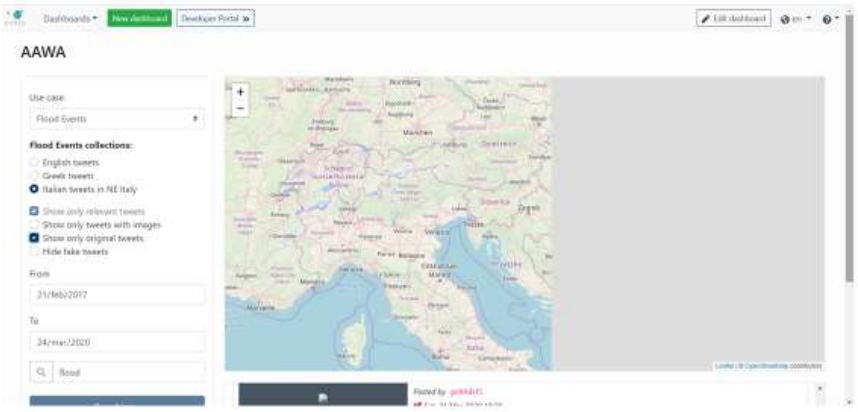


44 User Training Material

4. Visualization

4.1 Dashboards

- ▷ Dashboards



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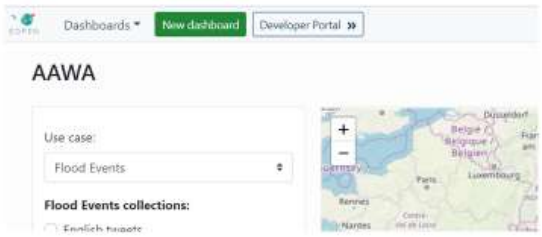
4. Visualization

4.1 Dashboards

▷ Create a Dashboard



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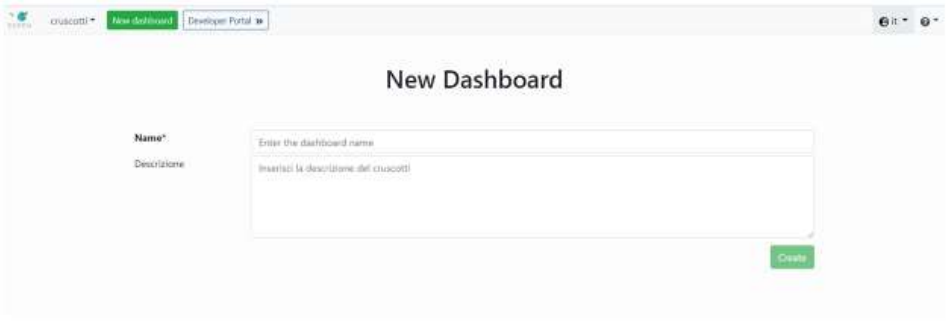
4. Visualization

4.1 Dashboards

▷ Create a Dashboard



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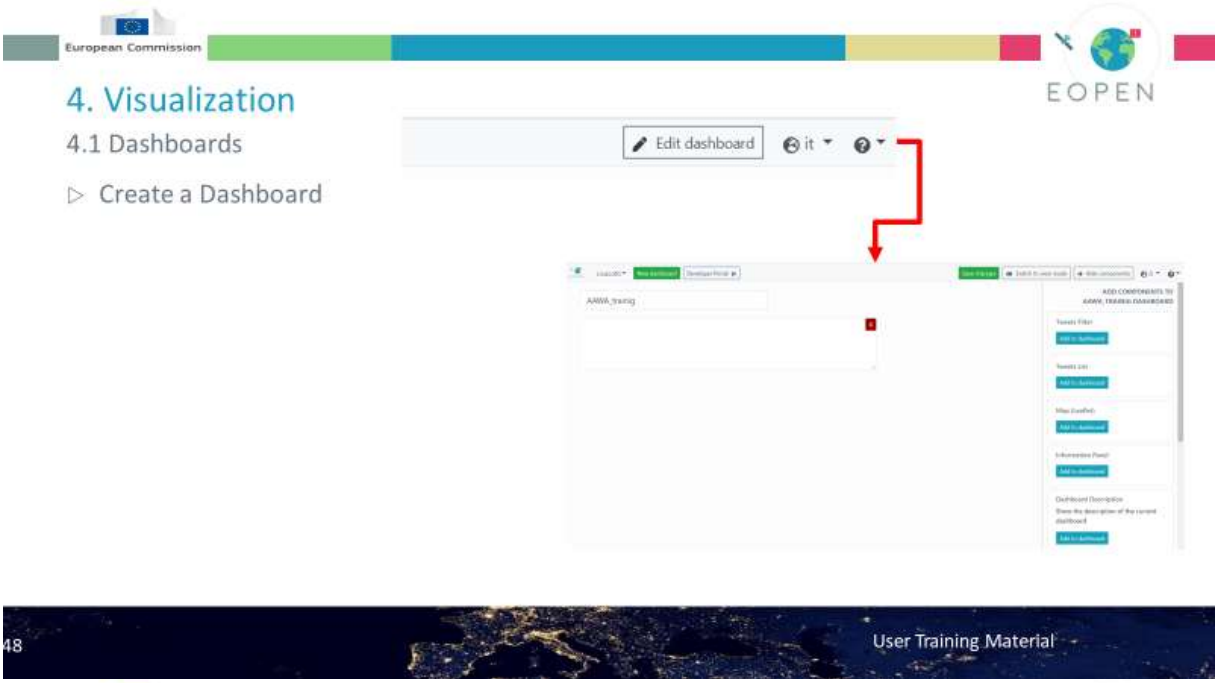
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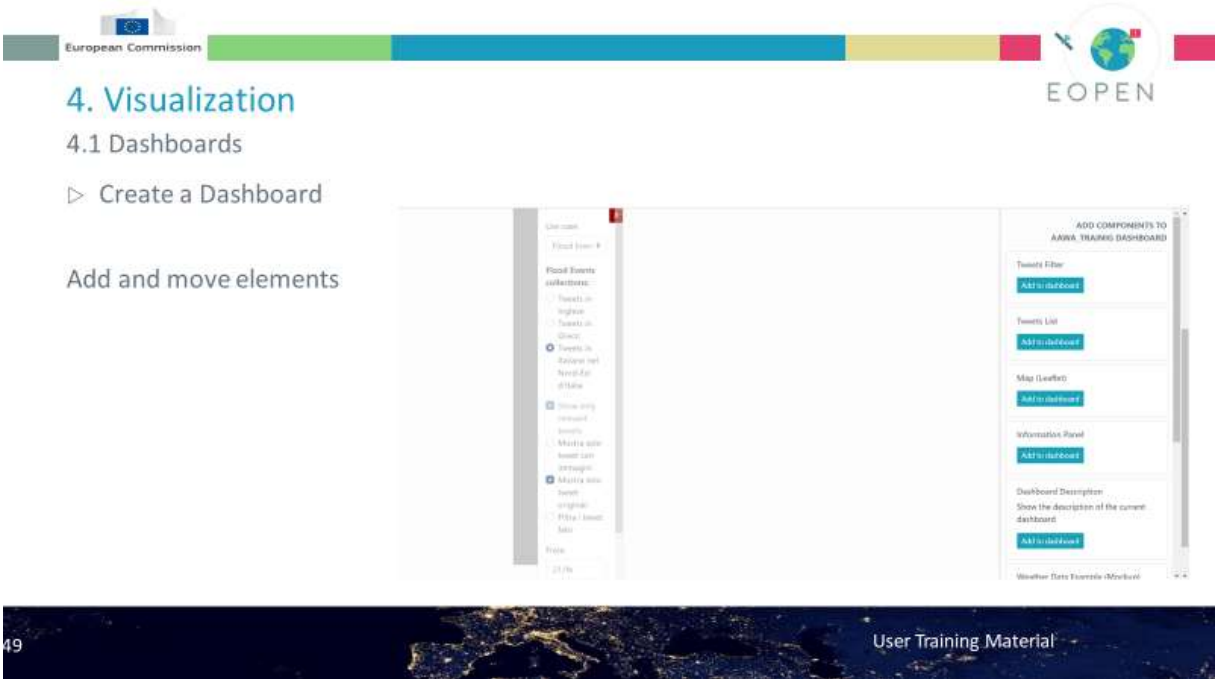
EOPEN
4. Visualization
4.1 Dashboards
▷ Create a Dashboard
Edit dashboard
it
48
User Training Material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4. Visualization
4.1 Dashboards
▷ Create a Dashboard
Add and move elements
ADD COMPONENTS TO AAWA_TRAINING DASHBOARD
49
User Training Material

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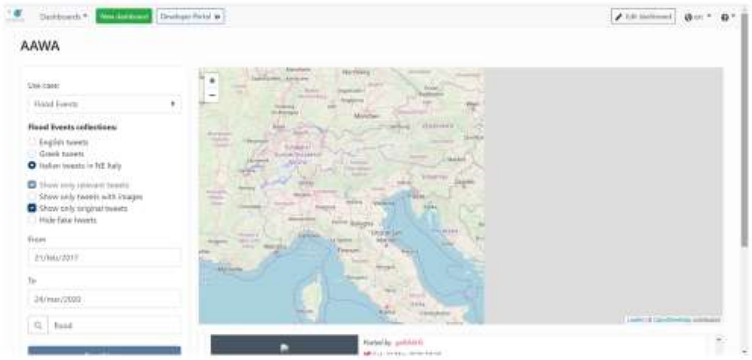
4. Visualization

4.2 Tweet visualization

▷ How to visualize tweets

Filters



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4. Visualization

4.2 Tweet visualization

▷ How to visualize tweets in the geoserver

1- select tweet layer
2- draw a box or an AOI
3- right click, query, load

Selected features
becomes white

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4. Visualization

4.2 Tweet visualization

▷ How to visualize tweets in the geoserver

Select the feature layer (eg. Italian tweets)
Double click on point and the map shows the selected tweet

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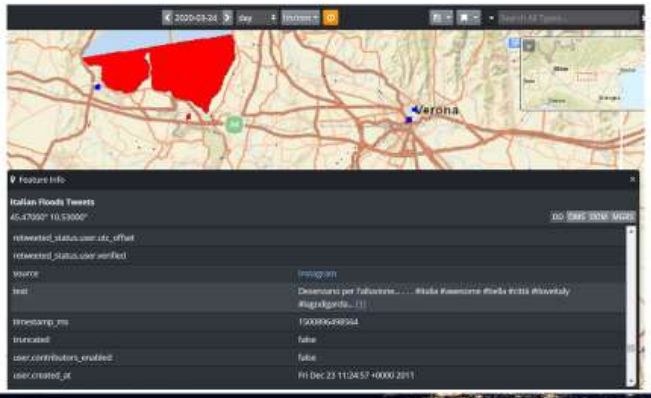
4. Visualization

4.2 Tweet visualization

▷ Ground truth inside EOPEN



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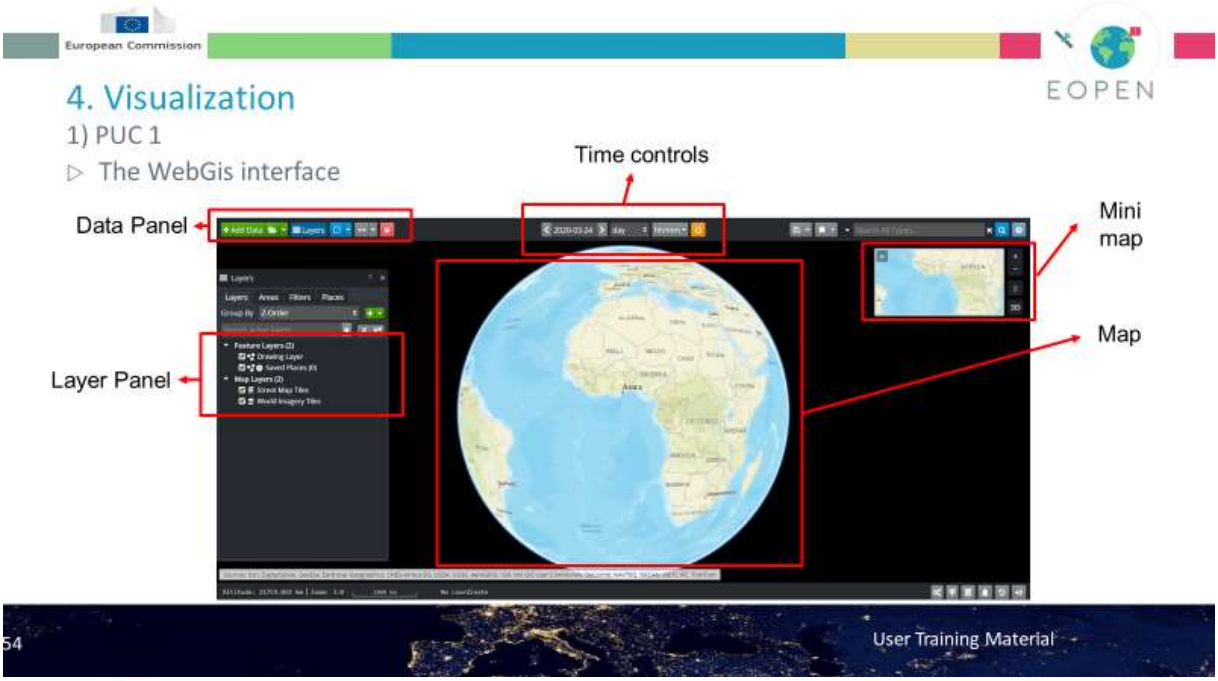
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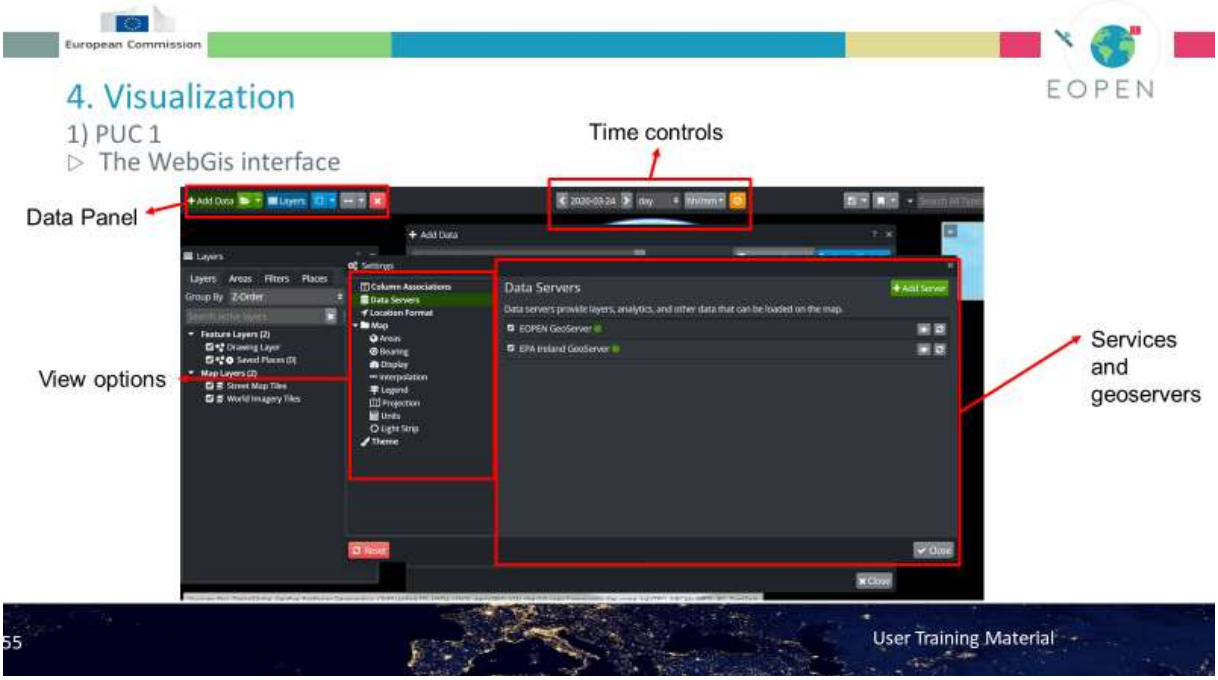
EOPEN
4. Visualization
1) PUC 1
▷ The WebGis interface
Time controls
Data Panel
Mini map
Map
Layer Panel
54
User Training Material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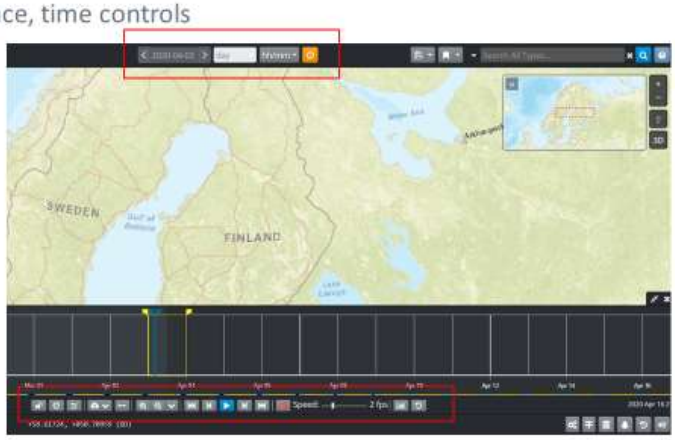
4. Visualization
1) PUC 1
▷ The WebGis interface
Time controls
Data Panel
Services and geoservers
View options
Data Servers
55
User Training Material

4. Visualization

1) PUC 1

▷ The WebGis interface, time controls



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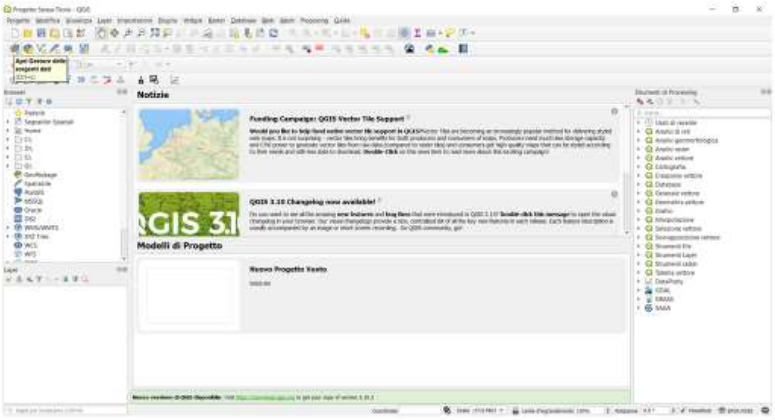
4. Visualization

1) PUC 1

▷ EOPEN as a Geoserver

1- Open Qgis



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4. Visualization

1) PUC 1

▷ How to visualize a WPM

1- change language

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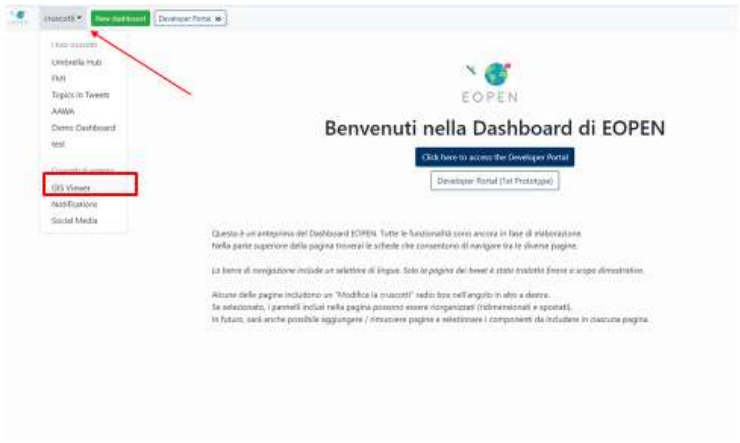
4. Visualization

1) PUC 1

▷ How to visualize a WPM

2- select Gis Viwer



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4. Visualization

1) PUC 1

▷ How to visualize a WPM

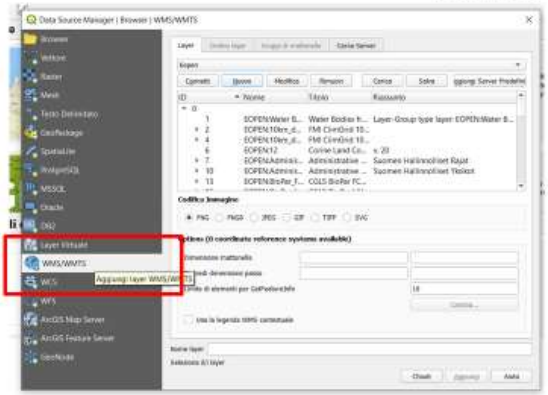
3- access to EOPEN geoserver

4. Visualization

1) PUC 1

▷ EOPEN as a Geoserver

2- Select add WMS layer



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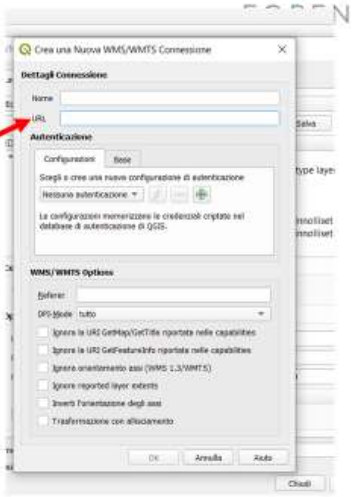
4. Visualization

1) PUC 1

▷ EOPEN as a Geoserver

3- Add

https://proto2.eopen.spaceapplications.com/geoserver/ows



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4. Visualization

1) PUC1

- How to merge different layers in a unique interface

Add

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4. Visualization

1) PUC1

- How to merge different layers in a unique interface

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4. Visualization

1) PUC1

- How to merge different layers in a unique interface

Add

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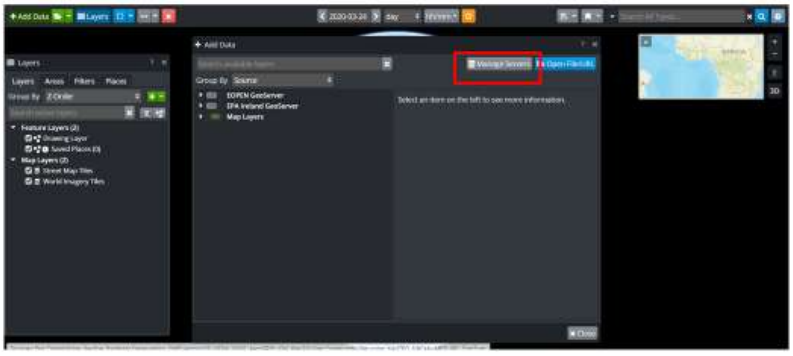
4. Visualization

1) PUC1

- How to merge different layers in a unique interface



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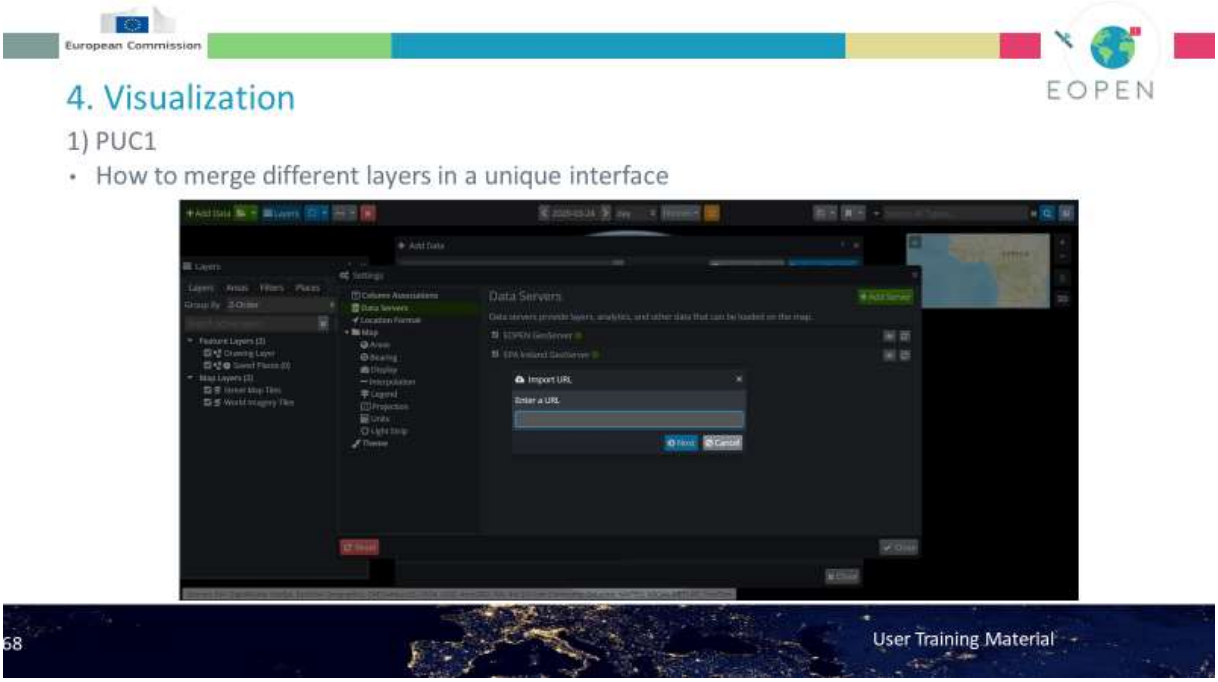
4. Visualization

1) PUC1

- How to merge different layers in a unique interface



4.2 **PUC 2 specific material**

1. Background

1) Background of EOPEN

- EOPEN provides a platform targeting non-expert Earth Observation (EO) data users (non-traditional user communities), experts and the SME community.
- The platform makes Copernicus data and services easy to use for Big Data applications by providing EO data analytics tools, decision making, and infrastructure.
- It includes three PUCs, namely, PUC 1 - flood risk assessment and prevention, PUC 2 - food security through EO datasets and PUC 3 - monitoring climate change through EO, EOPEN provides big data analytics and supports decision making mainly in monitoring agricultural areas.

3 User Training Material

1. Background

2) Objective of the Training Material

- Allowing the use of the results of EOPEN to end-users, and interested third-parties.
- Providing a detailed description of how the platform works for the efficient use of platform.
- Promoting additional engagement activities, training activities, pursuing a significant widen use of the EOPEN platform, contributing to the uptake of EO data from the community.
- Favoring EOPEN's various capacity building activities that will outlast the project time frame, contributing to the sustainability of EOPEN approach and system.

4 User Training Material

1. Background

3) Food Security

- "Food Security" is a denomination introduced by the Food and Agriculture Organization (FAO) of the United Nations.
- The problem is really complex and comprises several different components
  - Food access
  - Food distribution
  - Food supply stability,
  - Use of food

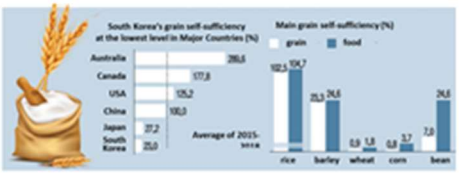
4 pillars of Food security, 2018, Food security Cluster

6 User Training Material

1. Background

4) Food Security in South Korea

- South Korea has low food self-sufficiency that is decreasing in the long term due to being dependent on the import of most major grains.
- South Korea is maintaining 50% of food self-sufficiency thanks to the influence of high self-sufficiency of rice, but grain self-sufficiency rate has decreased to 20% due to the increasing import of feed grain.
- Domestic rice production decreased from 4,103,135 tons in 2011 to 3,763,340 tons in 2018 and the future output of rice predicted by Korea Rural Economic Institute (KREI) is expected to decrease due to the effects of climate change.



MAFRA(left), KREI(right), 2016

7 User Training Material

1. Background

5) Rice Monitoring

- Satellite data have been applied on the occurrence of severe agriculture events since 1972.
- It is applied to agriculture in several ways such as a means of estimating crop yields.
- It can provide an accurate picture of the areas being cultivated, while also differentiating between crop types and determining their health and maturity.
- This information helps to inform the market, and provide early warning of crop failure or famine.
- Satellites are used as a management tool through the practice of precision agriculture, where satellite images are used to characterize a farmer's fields.
- Although early prediction of rice production using satellite images is carried out as the basis for the decision-making for improving rice supply and demand stability, low resolution satellites used in most previous studies have limitations in observing fragmented land in Asia and Europe.

8 User Training Material

1. Background

6) The Copernicus Program and Sentinels

- Copernicus program including Sentinel missions is the most ambitious Earth observation initiative and can have a great impact and contribution also in the field of food security
- It offers information services based on satellite Earth Observation and in situ (non-space) data aiming to help service providers, public authorities and other international organizations improve the quality of life for the citizens worldwide.
- The information services provided are freely and openly accessible to its users.

9 User Training Material

1. Background

6) The Copernicus Program and Sentinels

- The evolution of Earth Observation in terms of spectral, spatial and temporal resolution allows for the timely and effective monitoring of the land
- Sentinel missions – High Resolution optical and radar imagery
  - 5 day revisit time
  - 10 and 20 m spatial resolution

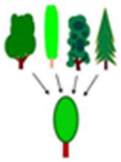
10 User Training Material

2. The EOPEN Platform for paddy rice monitoring

1) New methodologies for paddy rice monitoring

- This training material shows two different approaches for classification of rice based on Recurrent Neural Network (RNN) and Random Forest.
- Two different methods are produced to examine the relevant differences in processing complexity, accuracy, and generalization
- In addition, indicators related to rice status, biomass and yields are produced.

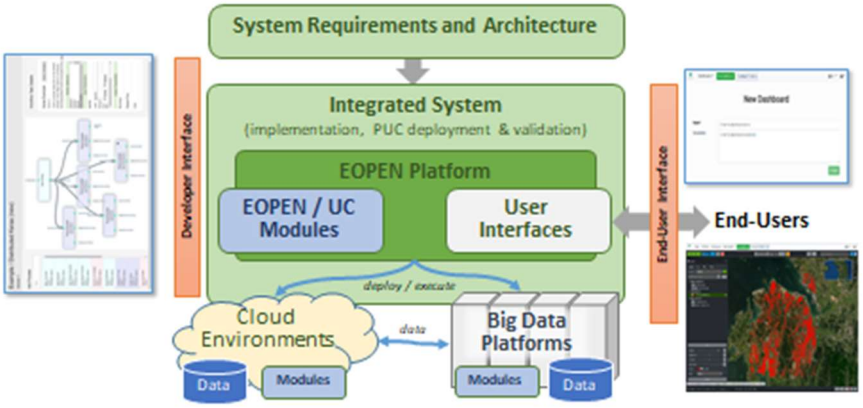




1 User Training Material

2. The EOPEN Platform for paddy rice monitoring

2) EOPEN Platform Interoperability – Developer & User Portal



2. The EOPEN Platform for paddy rice monitoring

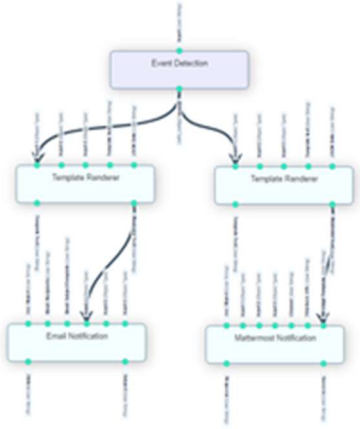
3) Advantages of EOPEN Platform

- Big Data Management (TBs of data)
  - Large-scale application – National and International scales
- Distributed processing
- Interactive GIS interfaces
- Public modules
  - Users can exploit modules generated from other users

3. Practical Training

▷ **The EOPEN Platform integrates the Automated Service Builder (ASB) Framework to provide:**

- A platform and application agnostic solution for implementing complex processing chains over globally distributed processing and data resources
- A "low coding" solution to develop a data processing facility based on orchestrated workflows.



14 User Training Material

3. Practical Training

2) Method 1 (RNN) – Getting started

EOPEN Developer Panel

Select or Add processor to edit

15 User Training Material

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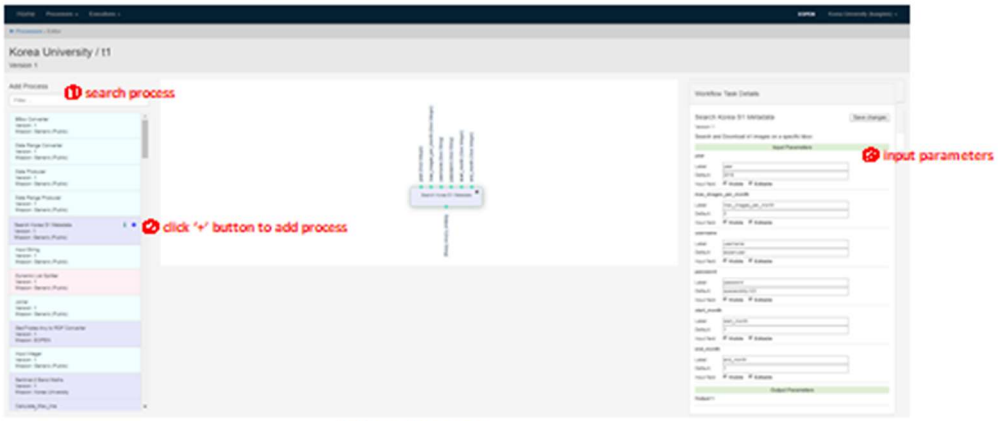
EOPEN

3. Practical Training

2) Method 1 (RNN) – Getting started



Editor of process

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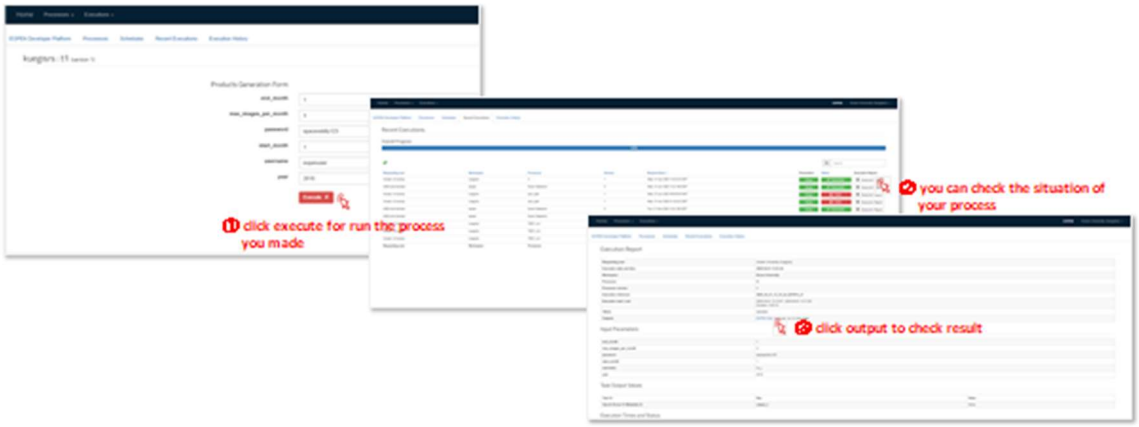
3. Practical Training

2) Method 1 (RNN) – Getting started

3. Practical Training

2) Method 1 (RNN) – Getting started



18 User Training Material

3. Practical Training

2) Method 1 (RNN) – Getting started

Structure Demonstrating overall structure of each workflows.
RNN method 1 consists of four workflows.
1. Download sentinel-1 products
2. Preprocess sentinel-1 products
3. Rice paddy detection
4. RNNs model training

Parameter Explaining parameters of each processes.

Explanation Providing further information about structures and parameters, such as baseline algorithm and way to accessing the output file.

19 User Training Material

3. Practical Training

2) Method 1 (RNN) – Getting started

- The Processor and Workflow concepts have been merged in favour of Workflow. This removes the ambiguity that existed between a resource type (Processor) and its definition (Workflow).
- A user who creates a Process or a Workflow is automatically registered as its owner. By default, Processes and Workflows are only visible and may only be managed by their owner.
- The Workspace and user Role concepts have been introduced to allow sharing resources, including Processes and Workflows. The fundamental rule is that a particular resource is only visible by the users who are given a role in one of the workspace the resource belongs to. To share a resource, a user who has the right to do so assigns that resource to one or more workspaces.

20 User Training Material

3. Practical Training

2) Method 1 (RNN) – 1. Basic processes

- Deep learning based rice paddy detection consists of the following workflow and processes

Download Sentinel-1 products…

- Search Korea S1 Metadata

Preprocess Sentinel-1 products…

- Sentinel 1 Preprocessing

21 User Training Material

3. Practical Training

2) Method 1 (RNN) – 1. Basic processes

- Deep learning based rice paddy detection consists of the following workflow and processes
  - Input String/Integer: Provide string/integer as an input

Rice paddy detection…

- Monthly_mosaic: Mosaic downloaded images to produce a Monthly S-1 mosaic
- rp_detection: Apply RNN model to the time-series array to detect rice paddies

RNNs model training…

- Time_series_list: Gather input image files with a provided regular expression
- import_x_y: Concatenate image files and labeled data into a time-series array
- Separate_Tr_Va: Divide the time-series array into training and validation data
- concatenate_set: Merge multiple time-series arrays into a single array
- RNN: Train RNNs model with the provided time-series arrays

22 User Training Material

3. Practical Training

2) Method 1 (RNN) – 2. Download Sentinel-1 Products

Structure
Parameter

▷ The workflow consists of a single process
: Search Korea S1 Metadata

- year: Target year for searching images
- max_imges_per_month: Maximum number of images in a month
- username/password: ID and password for https://scihub.copernicus.eu/dhus/#/home
- start_month/end_month: Set a searching period

The rice paddy detection algorithm requires images from March to November

The area of interest is Dangjin, South Korea

23 User Training Material

3. Practical Training

2) Method 1 (RNN) – 2. Download Sentinel-1 Products Explanation

▷ The images are downloaded at https://proto1.eopen.spaceapplications.com/public/noa_test/Download/

Index of /dev/public/noa_test/Download/

File Name ↓	File Size ↓	Date ↓
Parent directory/	-	-
S1B_IW_GRDH_1SDV_20190714T213152_20190714T213217_017135_0203C2_1BE0.SAFE/	-	2019-Oct-15 08:06
S1B_IW_GRDH_1SDV_20181128T213149_20181128T213214_013810_01998E_1CD7.SAFE/	-	2019-Oct-15 09:46
S1B_IW_GRDH_1SDV_20181128T213124_20181128T213149_013810_01998E_A05F.SAFE/	-	2019-Oct-15 01:49
S1B_IW_GRDH_1SDV_20181023T213125_20181023T213150_013285_0188FB_74A9.SAFE/	-	2019-Oct-15 09:44
S1B_IW_GRDH_1SDV_20181016T213946_20181016T214001_013183_0185CB_5F78.SAFE/	-	2019-Oct-15 10:06
S1B_IW_GRDH_1SDV_20181011T213150_20181011T213215_013110_018390_3D56.SAFE/	-	2019-Oct-15 08:29
S1B_IW_GRDH_1SDV_20180917T213124_20180917T213149_012760_0178E3_ADF3.SAFE/	-	2019-Oct-15 09:19
S1B_IW_GRDH_1SDV_20180905T213124_20180905T213149_012585_017386_A66E.SAFE/	-	2019-Oct-15 09:45
S1B_IW_GRDH_1SDV_20180829T213944_20180829T214000_012483_017058_FC01.SAFE/	-	2019-Oct-15 01:50
S1B_IW_GRDH_1SDV_20180719T213147_20180719T213212_011885_015E06_A8E7.SAFE/	-	2019-Oct-15 07:43
S1B_IW_GRDH_1SDV_20180625T213145_20180625T213210_011535_015332_5A48.SAFE/	-	2019-Oct-15 07:21
S1B_IW_GRDH_1SDV_20180613T213144_20180613T213209_011360_014DC6_E984.SAFE/	-	2019-Oct-15 06:59
S1B_IW_GRDH_1SDV_20180601T213143_20180601T213208_011185_014858_78E0.SAFE/	-	2019-Oct-15 06:34

3. Practical Training

2) Method 1 (RNN) – 3. Preprocess Sentinel-1 Products Structure Parameter

▷ The workflow consists of a single process: Sentinel 1 Preprocess

- Input 1: String "test" is required in the current version
- Input 2: String "test" is required in the current version

3. Practical Training

1) Method 1 (RNN) – 3. Preprocess Sentinel-1 Products

Explanation

▷ A list of preprocessing is applied to the downloaded images

- Apply orbit file
- Thermal noise removal
- Radiometric calibration
- Terrain correction

▷ The preprocessed products are saved at https://proto1.eopen.spaceapplications.com/public/noa_test/Download/<*Image Name*>/Results/

Index of /dev/public/noa_test/Download/S1B_IW_GRDH_1SDV_20190714T213152_20190714T213217_017135_0203C2_1BE0.SAFE/Results/

File Name ↓	File Size ↓	Date ↓
Parent directory/	-	-
Processed_VV.tif	572.2 MB	2019-Oct-15 08:23
Processed_VH.tif	572.2 MB	2019-Oct-15 08:12

26 User Training Material

3. Practical Training

2) Method 1 (RNN) – 4. Rice Paddy Detection

Structure

▷ The workflow consists of following processes: Monthly_mosaic, Time_series_list, rp_detection

- "Monthly_mosaic" mosaics the downloaded images to produce monthly mean composite images and delivers a temporary output path, which contains the monthly composite images, to the "Time_series_list"
- "Time_series_list" produces a list of input data with the provided path
- "rp_detection" produces binary raster files, which maps rice paddy, by processing the time-series Sentinel images in the provided list

27 User Training Material

3. Practical Training

2) Method 1 (RNN) – 4. Rice Paddy Detection

▷ Monthly_mosaic

- year: Target year of rice paddy detection (Preprocessed time series images are required)
- shape: Boundary of interested area where mean value composite for producing time series data will be processed (Put "test" for setting the boundary to Dangjin city)

Parameter

3. Practical Training

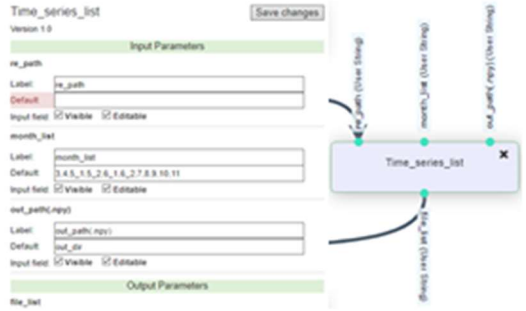
2) Method 1 (RNN) – 4. Rice Paddy Detection

▷ Time_series_list

- re_path: Regular Expression for producing a list of input data (Take input from "make _timeseries")
- Month_list: A list of months to be analyzed (From March to November are needed, while May and June need to be separated into 2 part as in the figure)
- Out_path: A path where the list of file name to be saved (Put "out_dir" for saving it as a temporary file")

*Example: re_path = './PUC_2/*_', Month_list = '4, 5_1'
Images to be searched = './PUC_2/*_4.tif' and

Parameter



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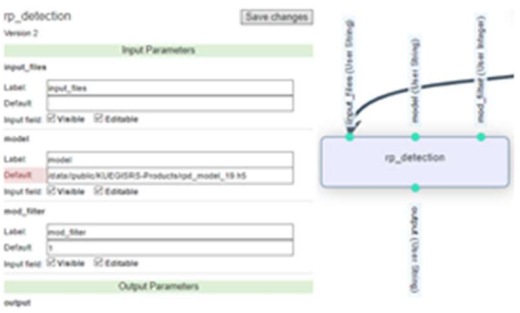
3. Practical Training

2) Method 1 (RNN) – 4. Rice Paddy Detection

▷ rp_detection

- input_files: A list of files to be analyzed (Take input form "Time_series_list")
- model: Trained RNNs model
- mod_filter: Number of applying majority filter, which will reduce salt and pepper noise

Parameter



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3. Practical Training

2) Method 1 (RNN) – 4. Rice Paddy Detection

Explanation

▷ Binary rice paddy detection result is produced (Execution Report -> EOPEN Datastore -> ./outputs)

Index of /processor-run-2020_03_10_09_42_56_647570z_test_ku/wps-run-kuegisrs-rp-detection-2-f58d78d1-661a-471d-bd31-fe0f697f41ff/outputs/

File Name ↓	File Size ↓	Date ↓
Parent directory/	-	-
rp_detection.tif	70.5 MiB	2020-Mar-10 10:01

3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

Structure

▷ The workflow consists of the following processes
: Time_series_list, import_x_y, separate_Tr_Va, RNN

- "Time_series_list" produces a list of input data with the provided regular expression
- "import_x_y" concatenate the listed image files and labeled data into a time-series array
- "Separate_Tr_Va" divide the time-series array into training and validation data
- "RNN" train RNNs model with the provided training and validation data

32 User Training Material

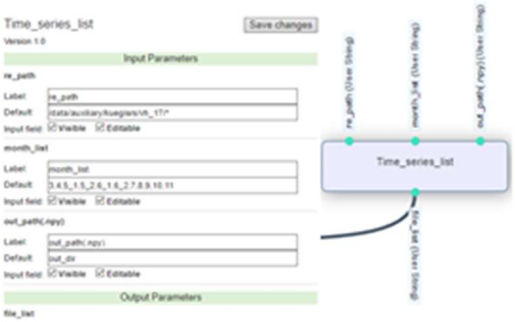
3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

Parameter

▷ Time_series_list

- re_path: Regular Expression for producing a list of input data
(The input data should be compatible with a labeling data, which will be provided at the next process)
- Month_list: A list of months to be analyzed
(From March to November are needed, while May and June need to be separated into 2 part as in the figure)
- out_path: A path where the list of file name to be saved
("out_dir" for saving it as a temporary file")



33 User Training Material

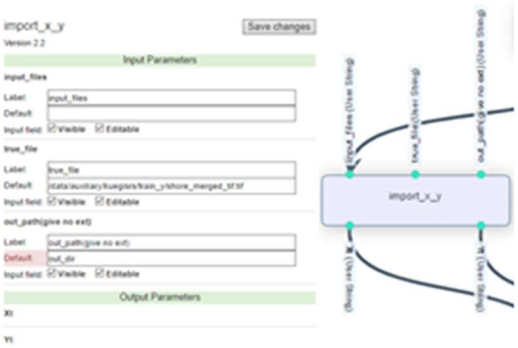
3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

▷ import_x_y

- input_files: A list of image files to be analyzed (Take input form "Calculate_Max_line")
- true_file: A rice paddy labeling data (0: Others, 1: Rice paddy, 2: Rice paddy-optional)
- out_path: A path where the image data(x) and labeling data(y) to be saved (No extension needed. The out put will be generated as "./~xt.npy" and "./~yt.npy")

Parameter



34 User Training Material

3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

▷ Separate_Tr_Va

- xt/yt: Array of image/labeling data which is provided by "import_x_y"
- train_ratio: Percentage of training data (The rest of data will be used as validation data)
- max_data_num: Limit the number of array(pixel) not to exceed memory capacity
- random_seed: Random seed for array separation
- out_path: A path where data to be saved, separated into training and validation data (No extension needed. The out put will be generated as "./~xt.npz" and "./~yt.npz")

Parameter

35 User Training Material

3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

▷ RNN

- xt_set/yt_set: Sets of x/y data which is provided by "Separate_Tr_Va" (training/validation zipped)
- batch_size: Batch size of training (hyper-parameter, default: 100000)
- max_epoch: Maximum number of training epoch. Training will stop if loss does not decrease (hyper-parameter, default: 100)
- learning_rate: Scale of parameter update per training (hyper-parameter, default, 0.0003)
- out_path: A path where trained RNN model to be saved ("out_dir" for saving it as a temporary file)

Parameter

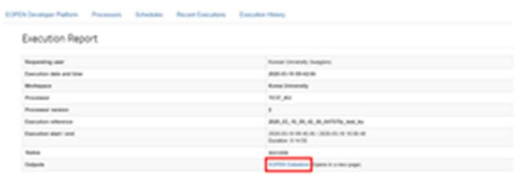
36 User Training Material

3. Practical Training

2) Method 1 (RNN) – 5. RNNs Model Training

Explanation

▷ Trained model is produced (Designated path or Execution Report ->EOPEN Datastore->./outputs)



Index of /processor-run-2020_03_10_11_31_06_564688z_test_ku/wps-run-kuegisrs-rnn-2-52-30f479bf-1959-4dbd-bc67-602250a156dd/outputs/

File Name ↓	File Size ↓	Date ↓
Parent directory/	-	-
rpd_model_14.h5	155.7 KiB	2020-Mar-10 12:11
rpd_model_13.h5	155.7 KiB	2020-Mar-10 12:11

37 User Training Material

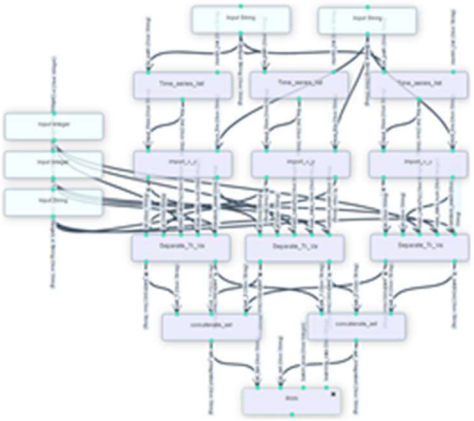
3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

Structure

▷ The processor consists of following processes : Input String, Time_series_list, import_x_y, Separate_Tr_Va, concatenate_set, RNN

- The structure is a modified version of the previous processor with Data Augmentation technique
- Three different training/validation sets are produced and concatenated before training RNNs model
- "Input String/Integer" efficiently provides same input to multiple processes
- "concatenate_set" merges diverse sets into a single set (maximum 3 sets)



38 User Training Material

3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

Parameter

▷ Input String -> Time_series_list

- Input String: Regular Expression for producing a list of input data, which will be commonly used in 3 different "Time_series_list"
- month_list: A list of time series to be analyzed (Feb-Oct, Mar-Nov, Apr-Dec)
- out_path: A path where the list of file name to be saved (Linked to input_files of "import_x_y")

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3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

Parameter

▷ Time_series_list & Input String -> import_x_y

- Input String: A rice paddy labeling data, which will be commonly used in 3 different "import_x_y" (0: Others, 1: Rice paddy, 2: Rice paddy-optional)
- input_files: A list of image files to be analyzed (Take input form "Time_series_list")
- out_path: A path where the image data(x) and labeling data(y) to be saved (Linked to xt/yt of "Separate_Tr_Va")

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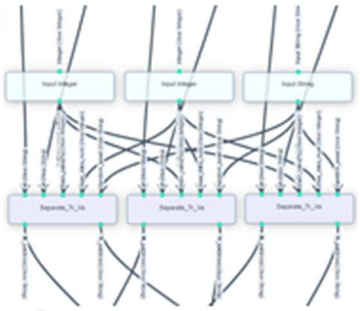
3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

Parameter

▷ import_x_y & Input Integer/String ->Separate_Tr_Va



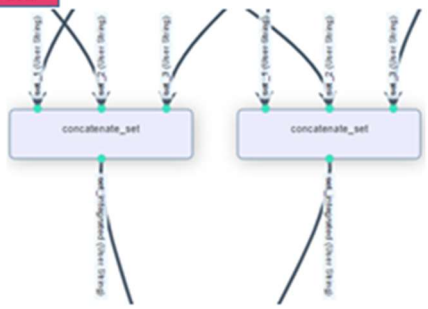
- xt/yt: Array of image/labeling data which is provided by "import_x_y"
- Input Integer: Provide common training percent to 3 "Separate_Tr_Va"
- Input Integer: Provide common max_data_num to 3 "Separate_Tr_Va"
- Input String: Provide common random_seed to 3 "Separate_Tr_Va"

3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

▷ Separate_Tr_Va -> concatenate_set

Parameter



- One "concatenate_set" takes all of xt from 3 "Separate_Tr_Va"
- The other "concatenate_set" takes all of yt from 3 "Separate_Tr_Va"

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3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

▷ concatenate_set -> RNN

- xt_set: Sets of training data which is provided by "concatenate_set" taking x data
- yt_set: Sets of validation data which is provided by "concatenate_set" taking y data
- max_epoch: Maximum number of training epoch. Training will stop if loss does not decrease (hyper-parameter, default: 100)
- learning_rate: Scale of parameter update per training (hyper-parameter, default, 0.0003)
- out_path: A path where trained RNN model to be saved ("out_dir" for saving it as a temporary file)

Parameter

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3. Practical Training

2) Method 1 (RNN) – 6. RNNs Model Training_DA

Explanation

▷ Data Augmentation

- Large volume of training data can be acquired by applying Data Augmentation, which transforms data to the extent that they do not impair the intrinsic attributes of the classification target. By using large volume of training data, which consists of original data and transformed data, general applicability of models can be enhanced (avoid over-fitting).
- In case of rice paddy detection in South Korea, the Data Augmentation was applied by shifting time series because one major key feature for rice paddy detection is planting season, which varies along the regions.
- The optimal rice planting season in South Korea varies from May 7 to June 21, and that of Dangjin is from late May to early June. Therefore, through moving the time series of Dangjin back and forth, the phenology of other regions can be simulated, which will increase applicability of the model in the end.

Reference: Jo, H.W., Lee, S., Park, E., Lim, C.H., Song, C., Lee, H., Ko, Y., Cha, S., Yoon, H., & Lee, W.K. (2020). Deep Learning Applications on Multi-Temporal SAR (Sentinel-1) Image Classification Using Confined Labeled Data: The Case of Detecting Rice Paddy in South Korea. *IEEE Transactions on Geoscience and Remote Sensing*.

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3. Practical Training

2) Method 2 (DRF)

▷ Usage of a combined input dataset of both Sentinel-1 and Sentinel-2 imagery to train a distributed Random Forest classifier using

- an updated land cover map
- a generated training dataset .

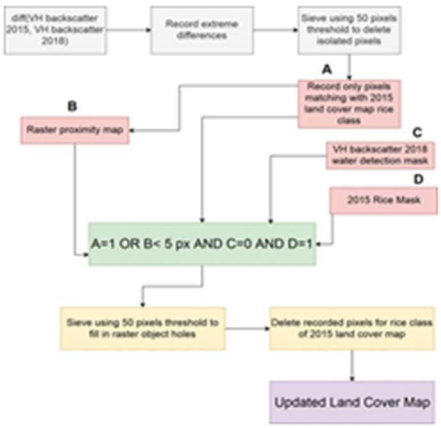
▷ Basic Processes on the EOPEN Platform side:

- Download Sentinel-1 products (described before)
- Change Detection
- HLRS Connection

3. Practical Training

2) Method 2 (DRF) –Land Cover Map Update

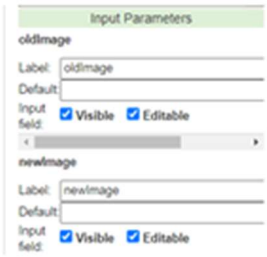
- Update existing land cover map by eliminating pixels considered to be outliers in a reference map.
- Usage of two properly selected Sentinel-1(VH) images, the first one related to the period of the reference map and the other related to the year of inspection.
- As a result, the updated land cover map does not contain the set of pixels identified as rice in the reference map that appear changed for the year of inspection

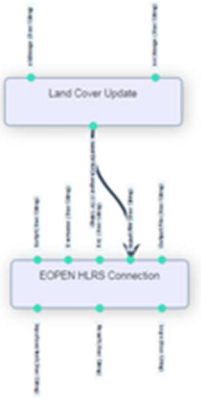


3. Practical Training

2) Method 2 (DRF) – Land Cover Update Process

- Land Cover Update Parameters
  - Input 1: Name of image related to the reference map
  - Input 2: Name of image in the year of inspection
  - Output 1: Full path of updated land cover map GeoTiff
- Part of Final Chain Workflow



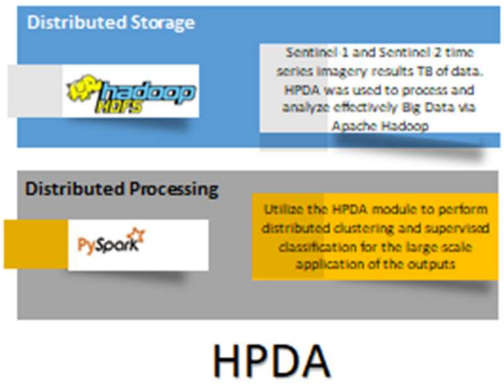


Parameter Structure

3. Practical Training

2) Method 2 (DRF) – Rice Classification

- Implementation on High Performance Data Analytics (HPDA) of High Performance Computing Center (HLRS).
  - Distributed classification algorithm demands specific Python libraries and frameworks for distributing storage (Apache Hadoop) and processing (PySpark).
  - However, integration of certain assistant modules in EOPEN platform are currently in-progress
- Two methods for training
  - Training using the updated land cover map generated from the Land Cover Update Process
  - Training using the generated training dataset that has been resulted by the distributed K-Means clustering algorithm



3. Practical Training

2) Method 2 (DRF) – EOPEN-HLRS Connection Process

- This process connects to the HPDA in order to copy the Update Land Cover Map and trigger the classification chain.
- Usage of SSH for connecting to HPDA
- A bash script contains all the appropriate commands to be executed on the remote server

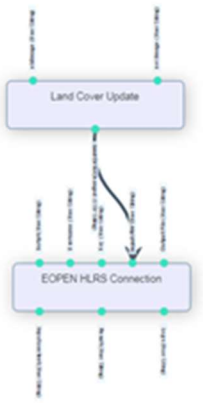
```
if [ "$mode" = "showresult" ]; then
    ssh -oBatchMode=yes -i $key $username@gilgamesch-login1.hlrs.de "cat /home/users/xeevasit/rf_obj_spark.py"
```

3. Practical Training

2) Method 2 (DRF) – EOPEN-HLRS Connection Process

- Land Cover Update Parameters
  - Input 1: Username on the remote server
  - Input 2: Generated Security Key for SSH connection
  - Input 3: Full path of bash script
  - Input 4: Full path of updated land cover map GeoTiff (output of land cover update process)
  - Input 5: name of the output file containing the classification results
- Part of Final Chain Workflow

Parameter



Structure

50 User Training Material

Process Version

- Search Korea S1 Metadata: 1
- Sentinel 1 Preprocess: 1
- Monthly_mosaic: 1
- Time_series_list: 1.0
- import_x_y: 2.2
- Separate_Tr_Va: 1.0
- concatenate_set: 2.2
- RNN: 2.52
- rp_detection: 2
- Land Cover Update: 1
- EOPEN – HLRS Connection: 1

51 User Training Material

Reference

- 2nd version of the EOPEN platform includes

(a) the current operating decision- making model

(b) the EOPEN ontology

(c) the 2nd iteration of the self-assessment plan

(d) report on EOPEN's clustering techniques

(e) meteorological and climatological data

(f) EOPEN's business model and exploitation plans and

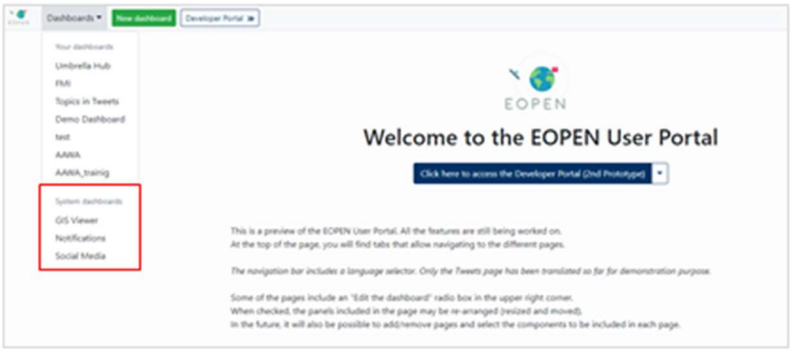
(g) the evaluation report of the 1st prototype

- A new instance of the EOPEN Platform (2nd prototype) has been deployed at https://proto2.eopen.spaceapplications.com

52 User Training Material

4. Visualization of Data

▷ Click Dashboards to enter into GIS Viewer, Notification, and Social Media



53 User Training Material

4. Visualization of Data

▷ The WebGis interface

54 User Training Material

4. Visualization of Data

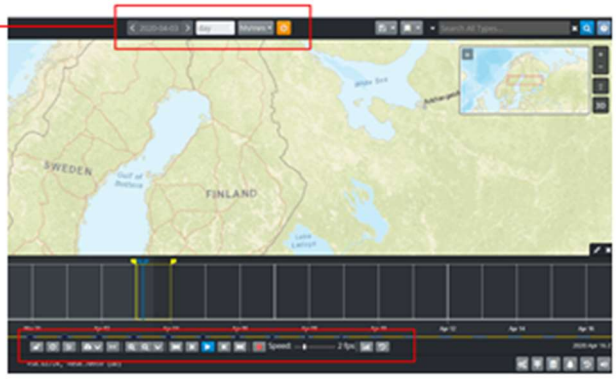
▷ The WebGis interface

55 User Training Material

4. Visualization of Data

▷ The WebGis interface

Time controls



56 User Training Material

4. Visualization of Data

▷ GIS Viewer

- Click Add data button → Click EOPEN GeoServer(You can group available layers by tag, type, source etc.) → Click "Rice paddy Field tiles" | "Rice paddy Field 2018 Timeseries" | "Rice paddy Field tiles" | "Biomass indicator" | "Yield indicator" | "Season start day indicator" | "Season end day indicator"

*Available Data : Water body, Rice paddy, Collected tweets, Weather etc.

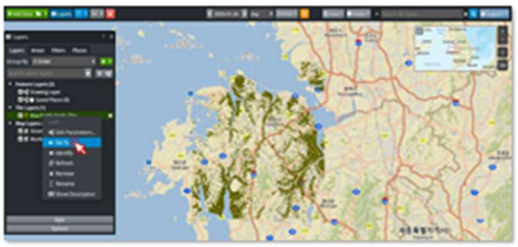
57 User Training Material

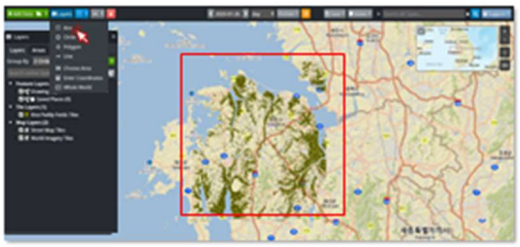
4. Visualization of Data

▷ GIS Viewer

- Click Go To (You can find your result.) → Select the appropriate layer

* You can change the style for your result; opacity, brightness, contrast, color etc.





58 User Training Material

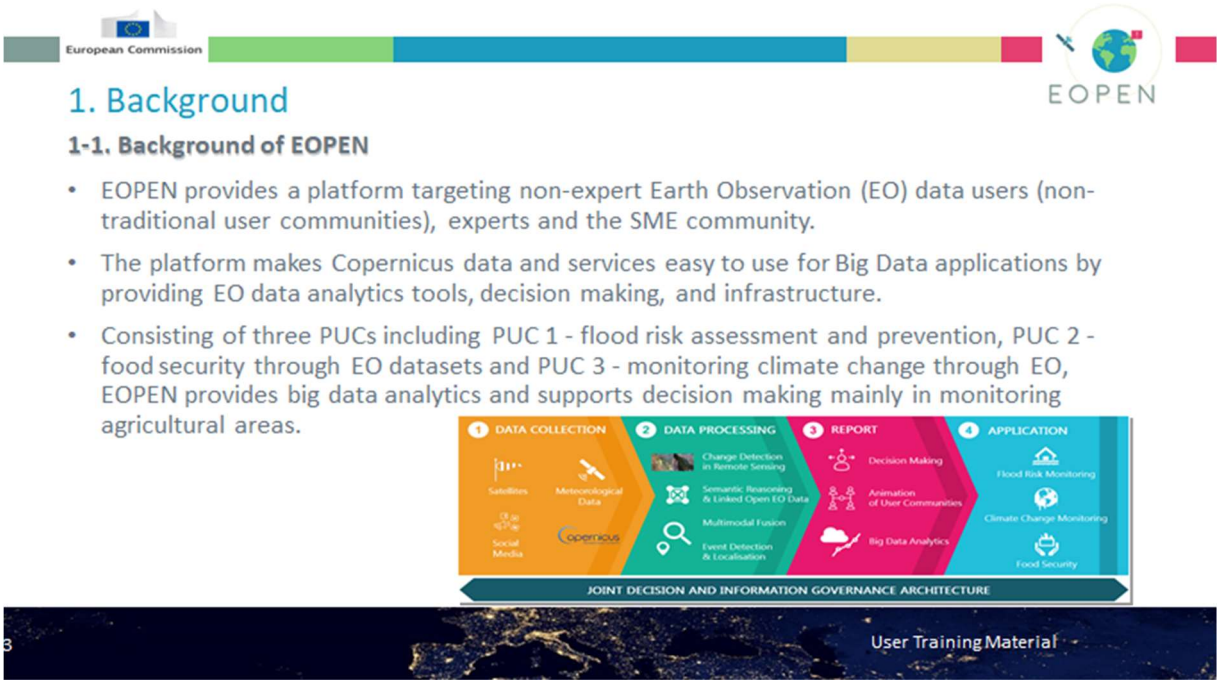
4. Visualization of Data

▷ Social Media and Notification

- Select the relevant issues and options (You can search the available tweets.)
- the notifications issued by the applications running in the EOPEN Platform

59 User Training Material

4.3 PUC 3 specific material



1. Background

1-2. Objective of the Training Material

- Give the opportunity to use the results of EOPEN for end-users, and interested third-parties.
- A detailed encounter for the efficient use of platform.
- Promotes additional engagement activities, training activities, pursues a significant widen use of the EOPEN platform, and contributes to the uptake of EO data from the community.
- Be supplied to EOPEN's various capacity building activities, and bring effects that will outlast the project timeframe, contributing to the sustainability of EOPEN approach and system.

4 User Training Material

2. Practical Training

2.1. Introduction

- Climate projections for Finland indicate 2° C increase in average temperatures and 5-10% increase in precipitation by 2040
- Largest changes occur for winters, especially in Lapland, Northern Finland
- Consequences affect large areas in national economy and infrastructure, and have an impact on social and cultural heritage, such as reindeer herding

5 User Training Material

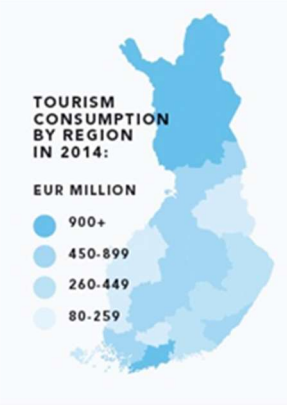
European Commission

EOPEN

2. Practical Training

2.1. Introduction

- Reindeer herding is a small-scale livelihood in Northern Finland with about 5000 herders
- It drives tourism in Northern Finland with 90% of tourists from foreign countries
- Herders are affected by climate change in both short-term and long-term time scales



6 User Training Material

European Commission

EOPEN

2. Practical Training

2.1. Introduction

- Climate change is expected to impact all facets of the transport system: the infrastructure, modes of transport and operations and the maintenance
- Finland has a total of 78000 km of public roads, many in sparsely populated regions
- The Finnish Transport Infrastructure Agency (FTIA), who is the national authority responsible for transportation and road maintenance in Finland, makes decisions based on both yearly trends in weather and climate and daily forecasts to adapt to the changes

7 User Training Material

2. Practical Training

2.1. Introduction

- Visualizing the impact of climate change in both short-term and long-term time intervals is important for the reindeer herders and FTIA
- EOPEN provides a unique platform for combining multiple data sets for snow depth, ground freezing condition, atmospheric properties, and climate scenarios that can be compared simultaneously and tools for estimating key parameters relevant for the users

2. Practical Training

2.2. FMI Open Data WFS and workflow

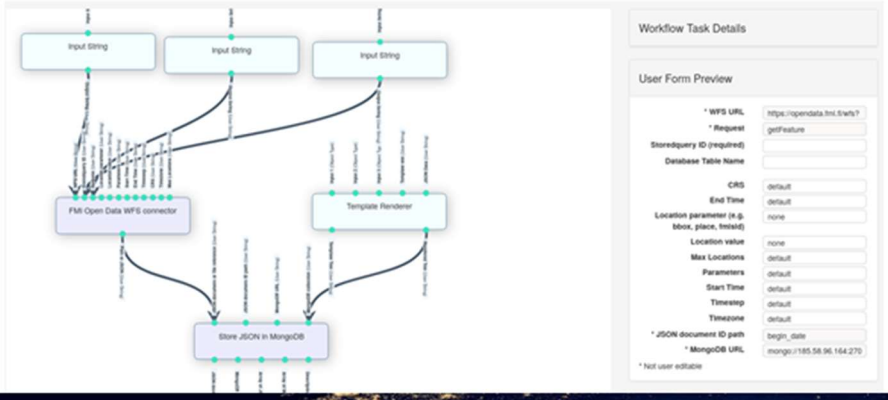
- Go to the Developer Portal and login
- Click 'Workflows' and locate 'FMI Open Data WFS' → Choose 'Edit workflow' → this shows the workflow and its processes in a visual graph
- Click 'Input String' to show the input parameters to the workflow

European Commission

EOPEN

2. Practical Training

2.2. FMI Open Data WFS and workflow



European Commission

EOPEN

2. Practical Training

2.2. FMI Open Data WFS and workflow

- Go back to the Workflow list, find 'FMI Open Data WFS' and Click 'Execute' → this will open the execution panel
- The user-defined input parameters can be given in text boxes
- The main parameters:

  - **Storedquery ID** is the identifier for the data that user wants to query (see https://www.ilmatieteenlaitos.fi/tallennetut-kyselyt)

  - **Database Table Name** allow the user to specify the name for the output data that is stored in EOPEN, 'FMI-Odata.' will be added as a prefix

  - **Location parameter** and **Location value** allow the user to specify the Area-of-Interest by a bounding box, location name, or an special id

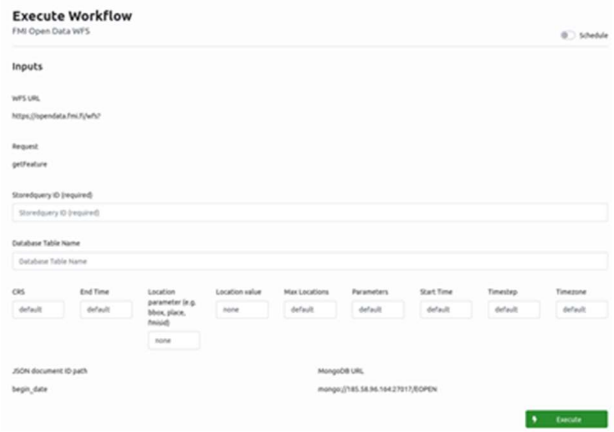
European Commission

EOPEN

2. Practical Training

2.2. FMI Open Data WFS and workflow

- Once user has given the inputs, the workflow can be executed by clicking the 'Execute' button
- Workflow fetches the data through the FMI Open Data WFS, converts the data to JSON format, and stores the data in the EOPEN MongoDB database



European Commission

EOPEN

3. Visualization of Data

3.1. FMI Dashboard and snow tweets

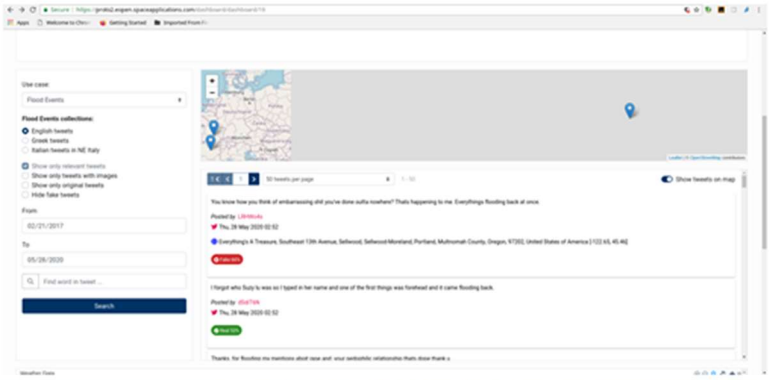
- Go to the EOPEN Dashboard → Select 'FMI' from the 'Dashboards' menu from the top bar
- The tweet window on the right shows the tweets for different use cases
- Select 'Snow Cover' from the menu on the left under 'Use Case'
- Select 'Finnish tweets' and time interval for the tweets
- Click 'Search' → Finnish snow-related tweets are shown on the right panel → Notice that the panel shows only 50 tweets at a time
- Click 'Show tweets on map' to display the locations for the tweets on a map on top
- The latest HIRLAM Forecasts for temperature, humidity, wind speed and hourly precipitation is shown in the graph at the bottom

European Commission

EOPEN

3. Visualization of Data

3.1. FMI Dashboard and snow tweets



European Commission

EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

- To setup this exercise, make sure to login to the Developer platform
- Select 'Workflows' in the top bar → Search the 'puc3-testing' workflow
- Select 'Edit Workflow' → This shows the workflow and its processors in the middle
- Click on the 'PUC3 Logic' Processor → This shows all the input parameters to the workflow
- Scroll to the bottom to the 'User Form Preview' and change the email address and the email subject accordingly → Do not change anything else

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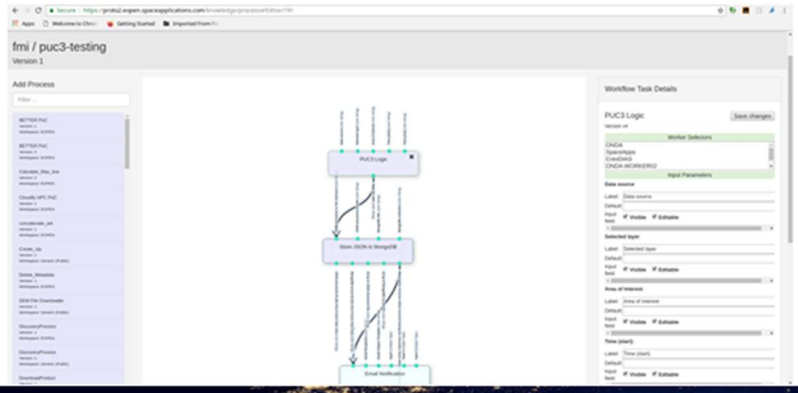
EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area



European Commission

EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

- Launch GIS Viewer from the 'Dashboards' menu
- Click 'Add Data' → Click 'EOpen GeoServer' → Switch ON 'FMI ClimGrid 10km Daily Mean Temperature Finland', 'FMI ClimGrid 10km Daily Snow Depth Finland', and 'Finland Reindeer Herding Districts (2019-05)'
- Navigate and zoom to Northern Finland
- Select Tile Layer 'FMI ClimGrid 10km Daily Snow Depth Finland' and Tile+Feature Layers 'Finland Reindeer Herding Districts (2019-05)' in the Layers window

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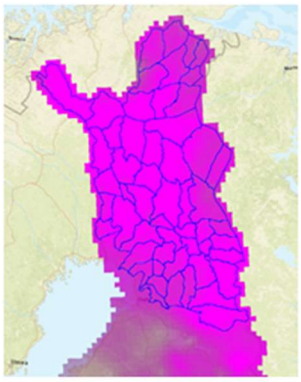
EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area



18 User Training Material

European Commission

EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

- Select a Box from the top bar and draw a large area → Select 'Load'
- Right-click the border and select 'Save Area' → Name the area → New area is created in 'Areas' → Ignore any warnings due to invalid topology
- Go to the 'Layers' window and right-click any Layer
- Select 'Statistics' from EOPEN tools → The statistics tool opens
- Select the 'FMI ClimGrid 10km Daily Snow Depth...' Layer
- Select the area you saved from the list
- Check that the date is before the end of 2018
- Click 'Execute' to run the statistics Workflow

19 User Training Material

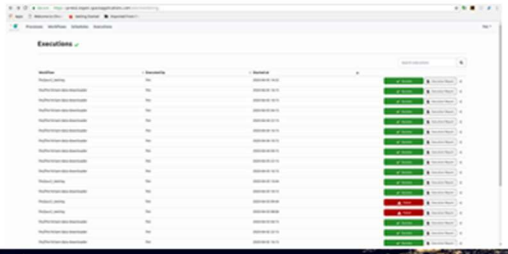
European Commission

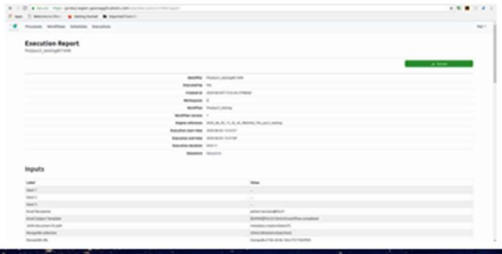
EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

- Go to the Developer Portal and select 'Executions' from the top bar → This shows the status of all the workflows and the history
- Wait for the workflow to finish and then click 'Execution Report' → This shows the details in the workflow execution





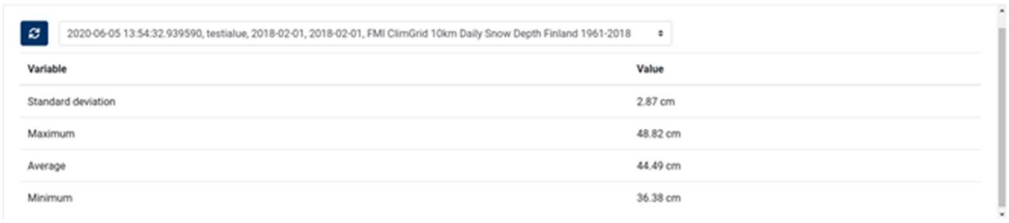
European Commission

EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

- To view the output snow depth statistics, go to the Dashboard and to the Statistics window
- Select the output including the area name from a drop down menu
- Statistics are shown below the menu



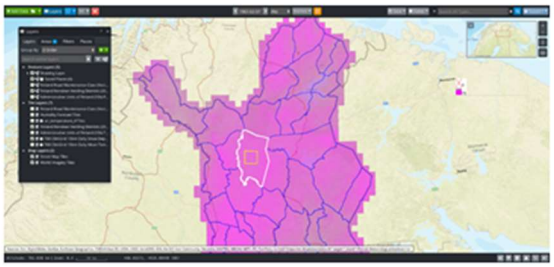
European Commission

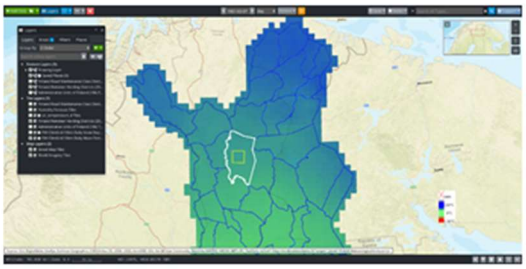
EOPEN

3. Visualization of Data

3.2. Snow depth and temperature statistics in a reindeer herding area

Do the same for 'FMI ClimGrid 10km Daily Mean Temperature Finland' by selecting the Tile Layer and de-selecting the current layer





22 User Training Material

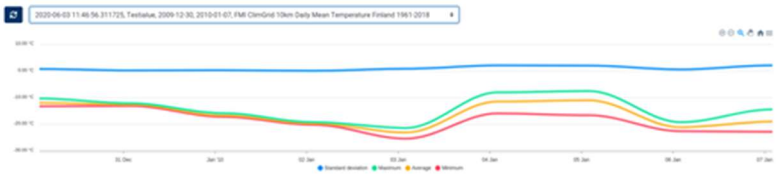
European Commission

EOPEN

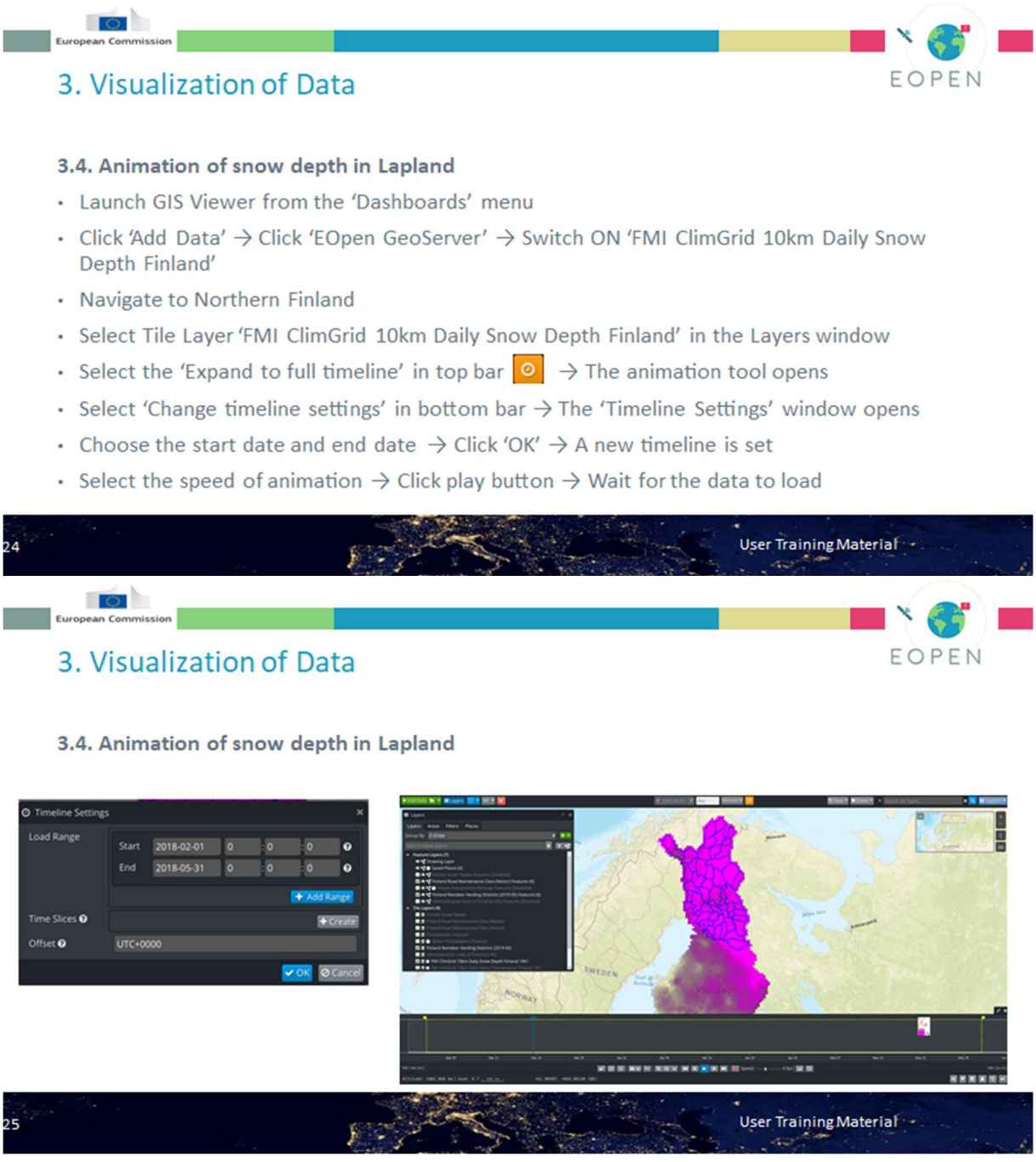
3. Visualization of Data

3.3. Temperature time series in a reindeer herding area

- To view time series of the over an area, go through the steps in statistics as shown before
- Select 'Time Series' from the EOPEN Tools and add the date range in the window → Click Execute
- Go to the Dashboard and to the Time series window → Select the output from the menu



23 User Training Material



5 TRAINING SESSIONS

This section reports about the training session developed by each PUC; the objectives of training sessions are to provide to stakeholders the information about EOPEN to ensure an autonomous usage of the platform and to provide all information to comprehend the potential of the platform and how the platform could be useful to overcome the COM and reach the TOM following the JDIG approach.

For PUC 1 are foreseen 2 training sessions with stakeholders and AAWA team before the field exercise; during each training session (remote sessions due to the Covid-2019 emergency) will be used the slides provided in chapter 4 and small videos sent to users with a step by step

explanation for each workflow available for them. The following table reports about the dates of the training and participants:

Session	Date	Participants
Infoday	September 2019	AAWA, Veneto Region Administration, Veneto Region Civil Protection Office, Municipality of Vicenza, Land reclamation authorities of Brenta river and Alta Pianura Veneta, Firefighters of Vicenza
AAWA training	17-09-2020	AAWA Team
Stakeholder training	22 and 23-09-2020	AAWA, Veneto Region Administration, Veneto Region Civil Protection Office, Municipality of Vicenza, Land reclamation authorities of Brenta river and Alta Pianura Veneta

Table 1 PUC1 Training\Demo session report table

PUC2 has held a webinar (22 June 2020) demonstrating the concept of EOPEN and the food security pertinent implementations to relevant stakeholders. Stakeholders from South Korea, such as participant from the Korea Rural Economic Institute, the food company CJ and the National Agriculture Science Institute (NASS), attended the webinar and got informed on how big earth observation data, when appropriately and efficiently managed can provide timely large-scale monitoring of food security. The content of the webinar used parts of the training material, showing how the EOPEN platform can enable food security monitoring for non-expert users. Nonetheless, the primary purpose of this event was to gather the stakeholders' evaluation and feedback and less on training the participants on how to use the platform and PUC2 modules.

After the webinar, a training was conducted, using the PUC2 training material, for the graduate students of Korea University who are majoring in Environmental Science and Ecological Engineering (non-expert users). Each student has utilized the PUC2 algorithms in the EOPEN developer platform by following the instructions of the training material. Also, they have explored the results of the PUC2 in the user portal and played around with the platform. Some of the students who currently analyse earth observation data on developing environmental policy were willing to utilize the platform after the training.

Session	Date	Participants
Demo Webinar	22-06-2020	PUC2 stakeholders (eg. Korea Rural Economic Institute, the food company CJ and the National Agriculture Science Institute (NASS))

Student Training	Summer 2020	graduate students of Korea University who are majoring in Environmental Science and Ecological Engineering (non-expert users)

Table 2 PUC2 Training\Demo session report table

For PUC3, a webinar was held on the 3rd of June 2020 among the representatives for the reindeer herders and researchers (2 out of 3 stakeholders). The purpose for this meeting was to share information regarding the EOPEN status and its implementations and to gather feedback from the stakeholders. The main goal for the feedback was to get specific knowledge on which data sets, tools and features were good, which were lacking in the platform, and which still needed improvement.

After the webinar, further feedback was collected through an online questionnaire and email. Overall, the stakeholders were generally positive about the visualizations and the data content on the platform. They also suggested additional data products that could indicate the snowpack quality and cloudiness/visibility. Some stakeholders also wanted to test the platform by themselves and were able to utilize the training material presented in this deliverable. Additional training and help were given through email exchanges.

Session	**Date**	**Participants**
Demo Webinar	03-06-2020	PUC3 stakeholders (reindeer herders and researchers)
Stakeholder training	Summer 2020	PUC3 stakeholders (reindeer researchers)

Table 3 PUC3 Training\Demo session report table

6 CONCLUSIONS

This deliverable reports about general framework used to generate the training material for use cases and stakeholders; it is very important to provide to users all information about the platform with appropriate material. The approach used to provide a sort of training or better, an explanation of the usage of the platform with videos and manuals for general public can better show the potentials of the platform.

Contrary the approach based on learning needs used for stakeholders permits to provide them all the information to guarantee an autonomous usage of the platform during the exercise.

The material for stakeholders can be also public; the structure of training session can demonstrate that the interface and in general the user experience follows the requirement of simple use since it can be learned after about 4 hours of explanation for non-expert users.