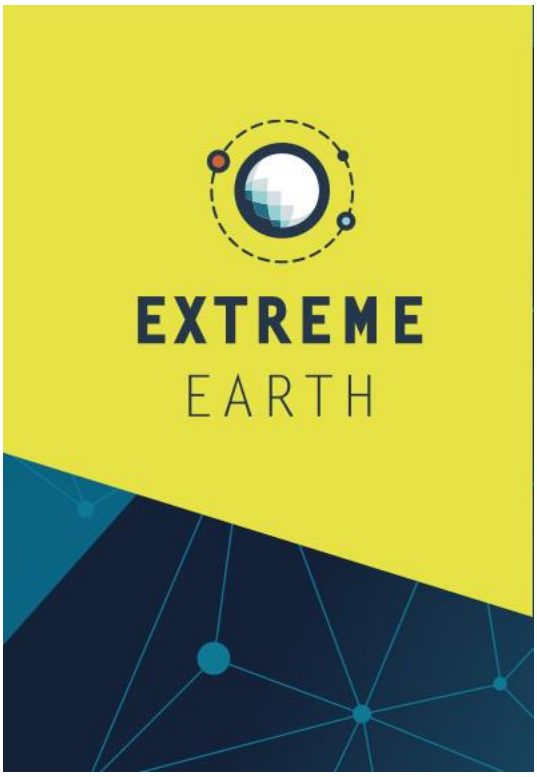

ExtremeEarth

H2020 - 825258

Deliverable

D6.4

Report on dissemination and communication activities – version II

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31 December 2021

Status: Final

Scheduled Delivery Date: **31/12/2021**

Executive Summary

This document reports on the dissemination and communication activities that have been done for the project ExtremeEarth.

The dissemination and communication channels include the project web site, social media, scientific publications, talks, workshops, press releases, the production of promotional material such as flyers and posters, the establishment of links with other projects and users.

Document Information

Contract Number	H2020 - 825258	**Acronym**	ExtremeEarth
Full title	From Copernicus Big Data to Extreme Earth Analytics		
Project URL	http://earthanalytics.eu/		
EU Project officer	Riku Leppänen		

Deliverable	**Number**	D6.4	**Name**	Report on dissemination and communication activities – version II			
Task	**Number**	T6.3	**Name**	Dissemination and communication plan and activities			
Work package	**Number**	WP6					
Date of delivery	**Contractual**		M36	**Actual**	M36		
Status	Draft ☐ final ☒						
Nature	Prototype ☐ Report ☒						
Distribution Type	Public ☒ Restricted ☐ Consortium ☐						
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Project Information

This document is part of a research project funded by the IST Programme of the Commission of the European Communities as project number H2020-825258. The beneficiaries in this project are the following:

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1. Introduction

This document reports on the dissemination and communication activities of the project ExtremeEarth for the 36 months of execution. The document reports on all activities that have been carried out to promote the outcomes of the project, based on the dissemination plan that was presented in D6.2.

The research and development work performed in ExtremeEarth aims to close the gaps in research and innovation in the Copernicus context with significant impact for the European industry. ExtremeEarth concentrates on developing techniques and software that will enable the extraction of information and knowledge from big Copernicus data using deep learning techniques and linked geospatial analysis, and the development of two use cases based on this information and knowledge and other relevant non-EO data sets.

ExtremeEarth is based on state-of-the-art technologies from the research areas of Remote Sensing, Deep Learning, Big Data, Distributed Systems, Semantic Web and Linked Geospatial Data. Existing implementations of these technologies by project partners will be re-engineered so that they scale to the big data, information, knowledge and extreme earth analytics of the Copernicus setting. A major role in going beyond the current state of the art in all these areas, especially when addressing data volume and scale-out deep learning, will be played by the Hops Data Platform. Hops is a platform for managing data, compute and GPUs in a data centre setting. Hops can scale to store an order of magnitude more data than existing Hadoop clusters and works in harmony with other open source big data and deep learning systems.

The main dissemination channel is the Web site of the project and social media accounts. In addition, other channels include scientific publications, talks, workshops, press releases, the production of promotional material and the establishment of links with other projects and users. In Section 2 we present the overall dissemination plan. In Section 3 we present all the dissemination and communication activities that were performed by the consortium members. Finally, in Section 4 we summarize the results.

2. Overall Dissemination Plan

The activities of dissemination and exploitation are carried out by WP6. The main partner responsible for dissemination is UoA, while VISTA, Logical Clocks and PolarView are the main partners responsible for industrial exploitation.

In ExtremeEarth, we undertake versatile dissemination activities both at consortium level and at individual partner level. To this end, the following channels were selected in the dissemination and communication plan, as presented in D6.3.

Web Site. The project Web site (http://earthanalytics.eu/) was set up in the first month of the project. It contains all public project deliverables, management reports, demos, presentation materials and datasets along with information about the project's rationale, objectives, expected results and partners.

Social Media. A major goal for our consortium is to ensure high visibility for ExtremeEarth through a strong presence in social media. Within the first month of the project, the following actions were carried out by UoA:

- We have setup a group in LinkedIn[1] and accounts in Instagram[2] and SlideShare.
- For short dissemination messages, we use Twitter[3]. Apart from the partner's accounts, a new account was created for the project itself.
- We have established a mailing list with stakeholders from the EO community that are interested in the project's outcome and will update it on a regular basis. We will also identify relevant existing mailing lists of Copernicus, OGC and W3C.

Throughout the project, all these channels will be enriched with new, interesting content on a frequent basis, according to the following plan:

- Partners publish blog posts about their activity within ExtremeEarth or major contributions of ExtremeEarth to the EO community.
- Partners **tweet** about recent developments relevant to ExtremeEarth, annotating their tweets with the user @ExtremeEarth_EU.
- The project releases 1 newsletter every 12 months, disseminating it through the stakeholder's list. In every newsletter, there will be at least 1 article by every partner, describing the relevant activities, events or achievements in the context of ExtremeEarth.
- The LinkedIn group and the Instagram accounts will be updated after every event that is organized or attended by at least one project partner.
- In the SlideShare account of ExtremeEarth, we publish all non-commercial presentation materials under a Creative Commons license or another appropriate license.

Publications. Being a Research and Innovation Action, one of the main dissemination means of ExtremeEarth is the presentation of the project's research results in top-rated scientific journals, conferences and workshops. Relevant conferences such as "Big Data from Space", which is organized by ESA, will also be considered to disseminate the outcomes of ExtremeEarth to the Earth Observation community. Publications will be made available on the project Web site using open access policies. In cases where the gold model of open access is not supported by the publisher (i.e., the paper is not immediately available freely), the project Web site will be used to disseminate a pre-final version of each paper (i.e., green open access by default).

Demos. In a similar way, a major target of our consortium is to demonstrate the individual components of ExtremeEarth, its use cases and its infrastructure as a whole in top venues of the EO community. This includes not only related conferences and workshops, but also events that reach a wider audience and involve relevant application domains.

User Community Workshops. We are organizing three User Community workshops in M2, M17 and M35 that will bring together the communities of the two TEPs so that their requirements concerning the two use cases are captured and feedback for our designs and implementations is collected. The workshop organization will be undertaken by partners

[1] https://www.linkedin.com/groups/13697732/
[2] https://www.instagram.com/extremeearthanalytics/
[3] https://twitter.com/ExtremeEarth_EU

VISTA and PolarView. Partners VISTA and PolarView have budgeted 25,000 Euros each for covering the expenses of users (including international ones) that are not consortium partners for coming to these workshops.

Thematic Workshops. We are organizing joint workshops with other H2020 projects working on big EO data. The workshop will possibly be collocated with the "Big Data from Space" conference or the ESA Phi-Week. In M36, we will also have an open workshop in Brussels or Luxembourg to present the results of the project to the European Commission, Copernicus stakeholders, and the EO and Big Data research communities.

Traditional Mass Media. We are promoting all important milestones and events of ExtremeEarth through press releases. There will be press releases by every partner in his own country and language (for countries which are represented by more than one partner, every press release will be co-edited by both partners). These press releases will target the local or national press of the partner entrusted with this task. They will describe the goals of the project in simple, jargon-free language, highlighting the benefits to the region/country and the importance of the local partner being part of the ExtremeEarth consortium.

Promotional material. In ExtremeEarth, we are also exploiting traditional dissemination means that will be distributed in every event involving any of its partners. These are the following:

- By M1, we had a project logo of professional quality designed and will use it consistently on the project Web site and all communication activities.
- By M2, we produced a flyer with the main information about the project, distributing it in all events attended by consortium partners.

Proprietary dissemination channels. To increase the visibility of ExtremeEarth, every partner is committed to exploiting its own dissemination channels. In more detail, the research partners, i.e. UoA, UNITN, KTH and UiT will use their graduate courses on Big Data, Deep Learning, Semantic Web, Linked Data, Remote Sensing and related areas to disseminate the project results. VISTA, PolarView, METNO and Logical Clocks will use their Web sites and social media accounts (Twitter, Facebook, LinkedIn, etc.) to distribute information about the ExtremeEarth progress. These channels can also be used to get an interaction with users started.

2.1. Main Research Results for Dissemination

In this section we present the main results to be disseminated, organized by work package.

WP1: The ExtremeEarth Platform Operations and Support

- The HOPS data platform.
- Semantic catalogue for EO data.
- EO data pipelines.

WP2: Scalable Deep Learning and Extreme Earth Analytics for Big Copernicus Data

- Large training databases for the Food Security and Polar use cases.
- Deep Learning architectures for Copernicus data.

WP3: Querying, Federation and Extreme Analytics for Big Linked Geospatial Data

- Software for transformation, interlinking and querying big linked geospatial data.
- Software for federations over big linked geospatial data.

- Benchmarking of big linked geospatial data processing engines.

WP4: The Food Security Use Case

- Integration of different EO information and modelling using big data for water availability, watershed monitoring and irrigation recommendation of agricultural crops in drought-volatile areas.
- Integration with the Food Security TEP.

WP5: The Polar Use Case

- Integration of different EO information and modelling using big data for sea ice concentration and type maps, with lead and ridge density measurements.
- Integration with the Polar TEP.

3. Dissemination and Communication

In this Section we present the dissemination and communication activities of the project ExtremeEarth for the 36 months of execution. The main channels remain the same as presented in D6.3, but we updated the information where needed to show our new activities and results for the second half of the project.

3.1. ExtremeEarth Visual Identity

The project logo of professional quality design is used consistently on the project Web site and all dissemination and communication activities, where applicable.

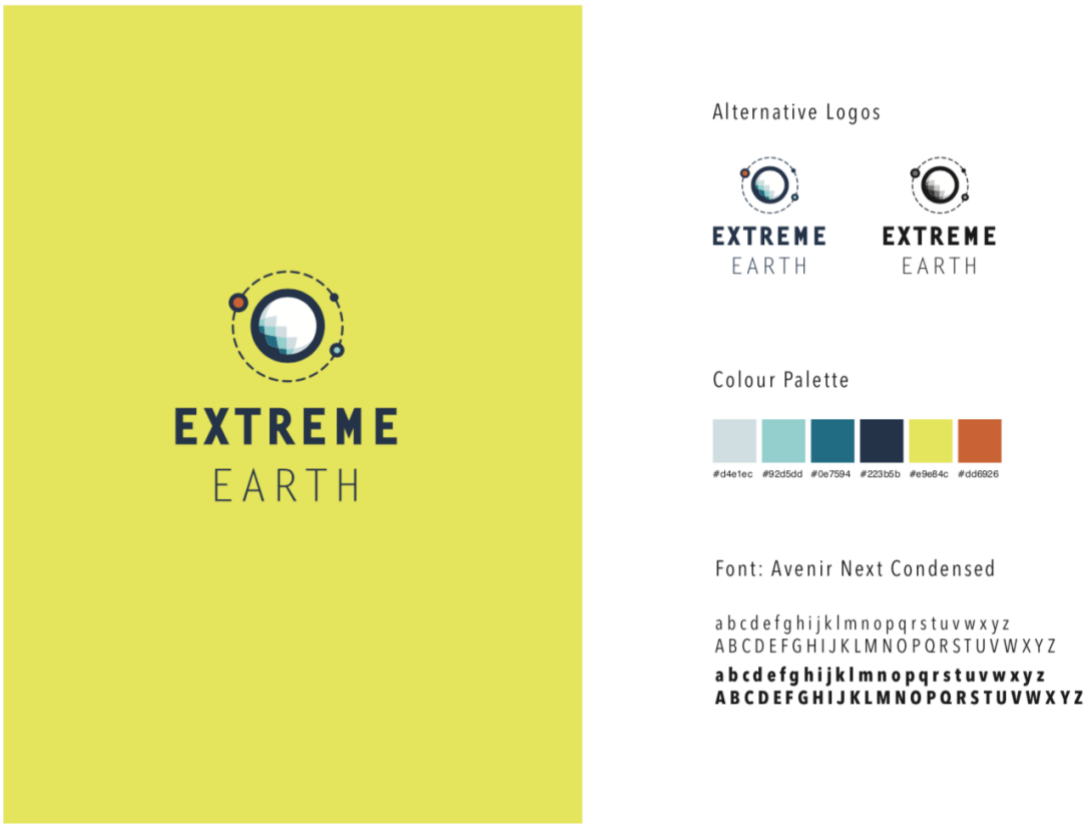

Figure 1: The ExtremeEarth Logo

3.2. ExtremeEarth templates

3.2.1. Presentation template

The ExtremeEarth project is presented in several events, conferences, meetings, as well as other means of dissemination of the project developments and results, enhancing the overall dissemination effort. A presentation template has been designed in line with the ExtremeEarth visual identity in order to promote the recognition of ExtremeEarth.

Figure 2: The ExtremeEarth presentation template

Additionally, as required per Article 29.4[4] of the Grant Agreement, all material used for dissemination and communication purposes of ExtremeEarth, will demonstrate the EU emblem along with along with the statement that the project has received funding from the H2020 Research and Innovation programme:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 825258.

Furthermore, poster templates have been produced to be used for presentations at project's own events, as well as external conferences and workshops.

[4] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

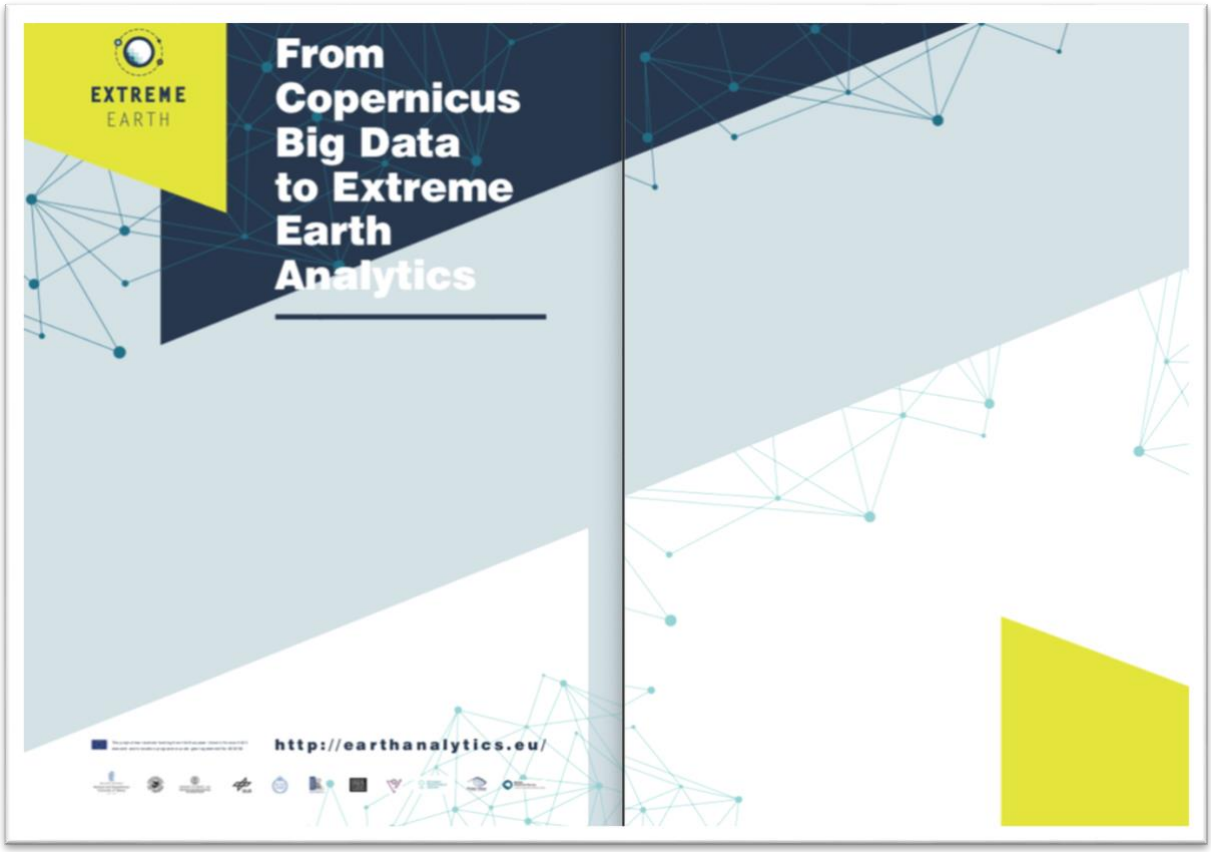

Figure 3: The ExtremeEarth poster template

3.2.2. Deliverable templates

The ExtremeEarth deliverable template was produced in line with the overall dissemination and communication material visual identity and is used by the consortium partners for the development of all project deliverables. The deliverable template has a cover page that displays the project's logo in a prominent position, its acronym, deliverable information (number, full title, the work package number and title) as well as the authors' information.

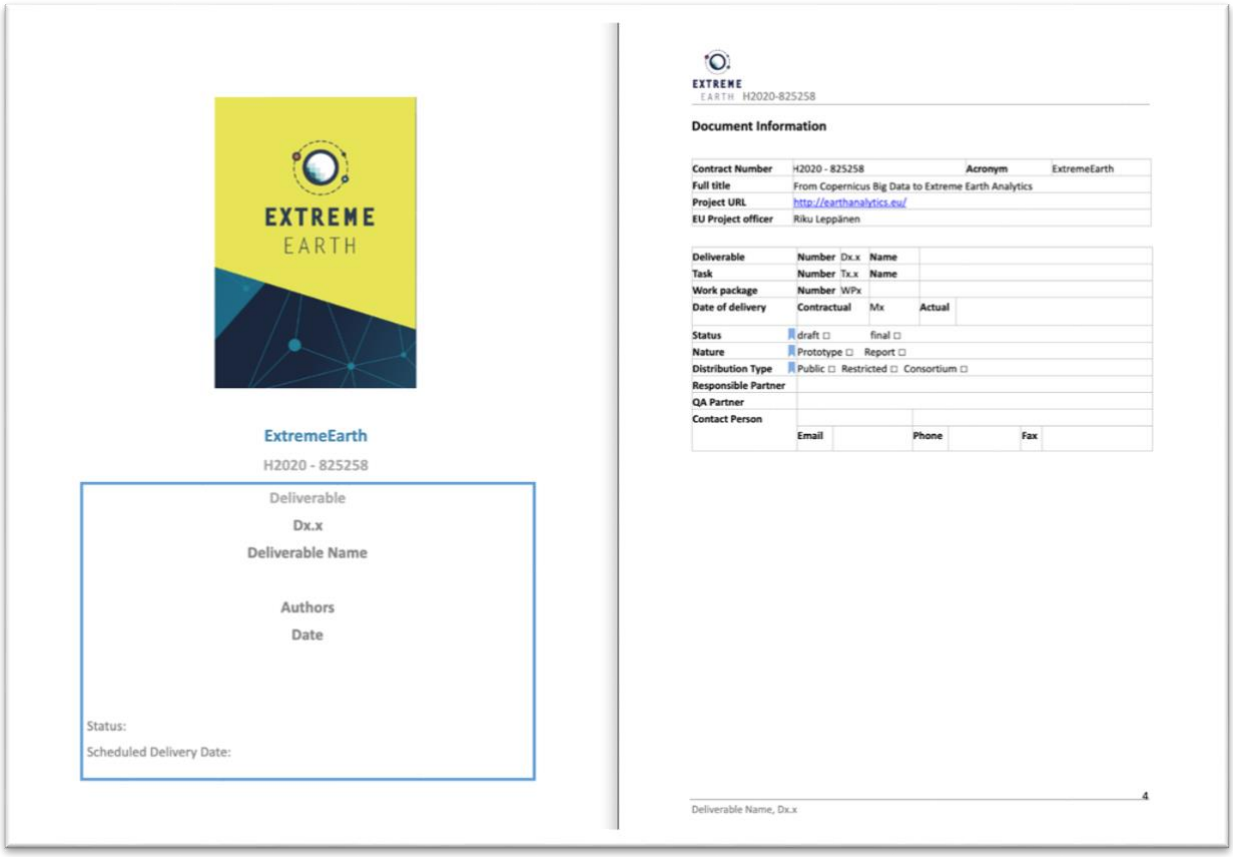

Figure 4: The ExtremeEarth deliverable template

3.3. Promotional material

ExtremeEarth exploits traditional dissemination means that are distributed in every event involving any of its partners. We present a poster, flyers and brochures with the main information about the project, distributing them in all events attended by consortium partners. The brochure is an A4 sized document that is folded in a three-page setup and presents the main information of the project. In the first page we present the title of the project with the main goal. The second page consists of an introduction to the project along with the main technological information and the link to the project web site. Then we introduce the main objectives, some background information and the two use cases. Finally, in the last page we present the contact information for the project coordinator along with the consortium and the details for the project funding.

Figure 5: The ExtremeEarth Flyer

In the following figures we present the first posters for the project that contain the main information about the project and were designed to complement the brochure. The posters

contain information for the main technologies that are being implemented and used in the project, along with an introduction to the use cases. In the lower part we have the logos of the consortium along with details for the funding of the project, as required for all dissemination material.

Figure 6: The ExtremeEarth poster No1

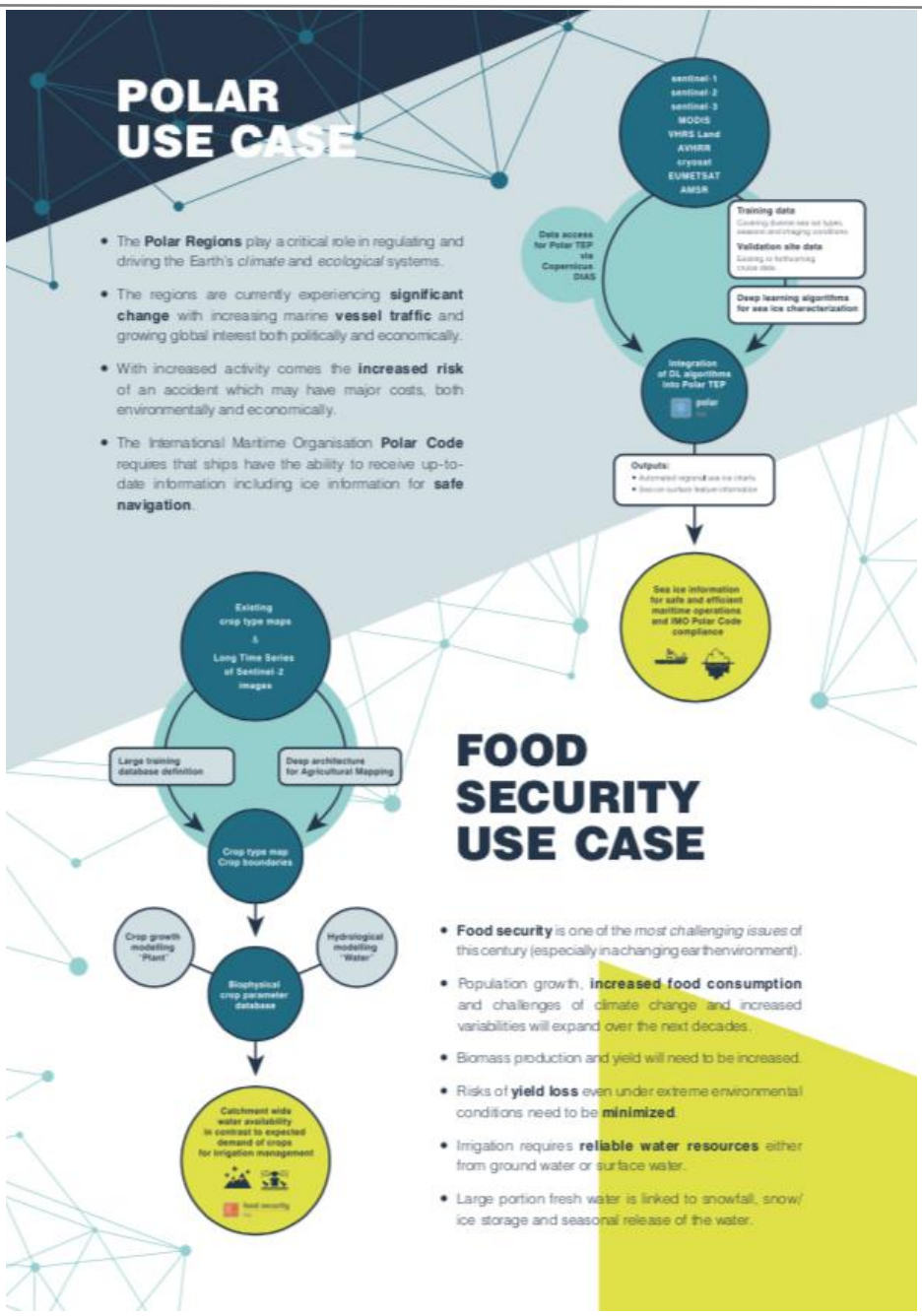

Figure 7: The ExtremeEarth poster No2

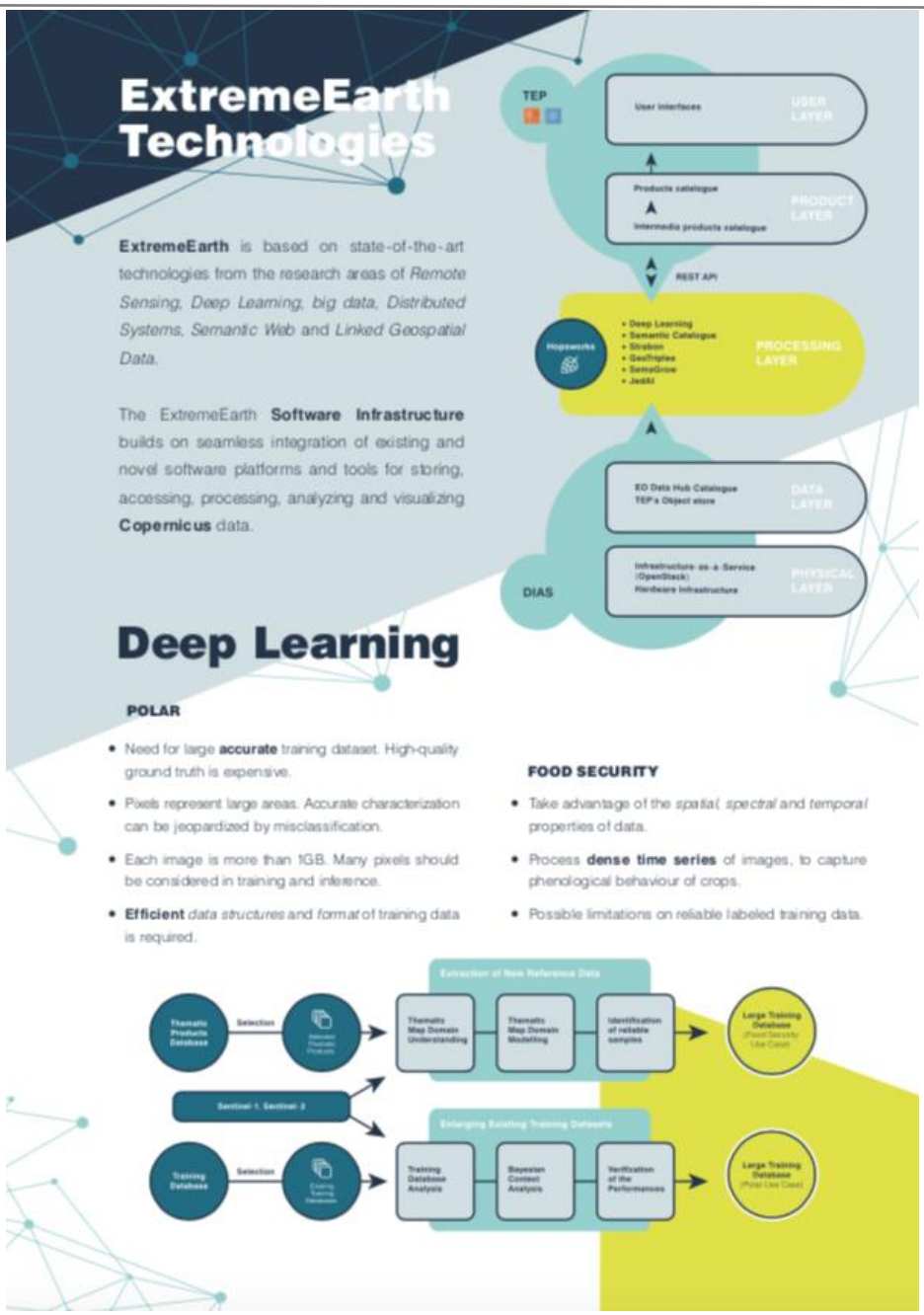

Figure 8: The ExtremeEarth poster No3

3.4. Web Site

The project Web site (http://earthanalytics.eu/) was set up in the first month of the project. It contains all public project deliverables, management reports, demos, presentation materials and datasets along with information about the project's rationale, objectives, expected results and partners. The Web site has a prominent position for the news section, featuring its latest developments. Another core part is the research section, that is regularly updated with blog

posts regarding the project's technology advancements and use case progress. We have uploaded 12 blogs on various topics of the project in this section.

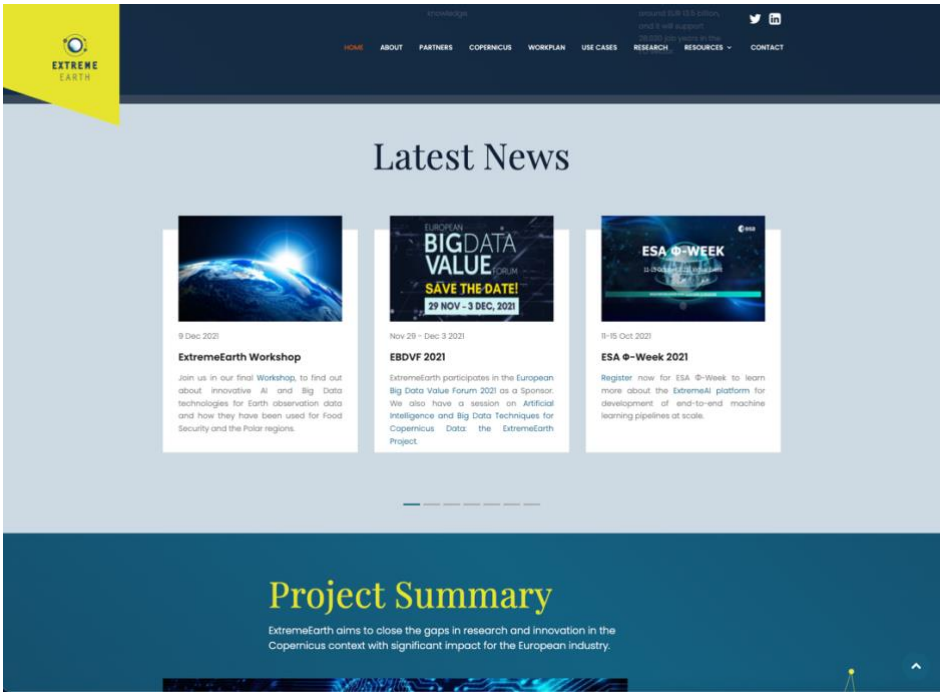

Figure 9: The ExtremeEarth website homepage

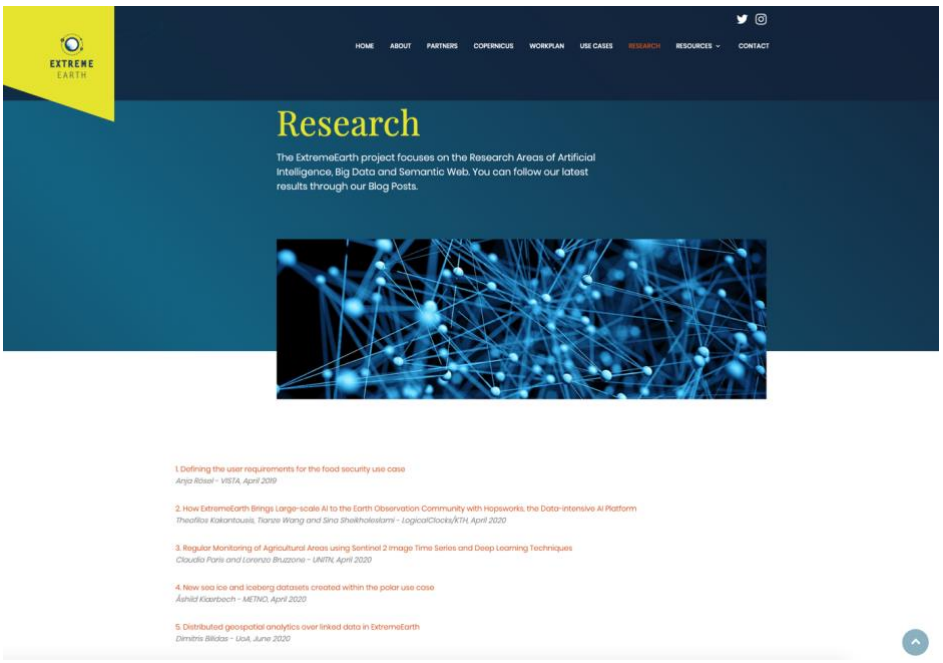

Figure 10: The ExtremeEarth website blogposts

Another valuable dissemination channel is the project's publications. We have created a dedicated section under the Resources tab, in order to allow visitors to have access to all publications related to the project from a single source.

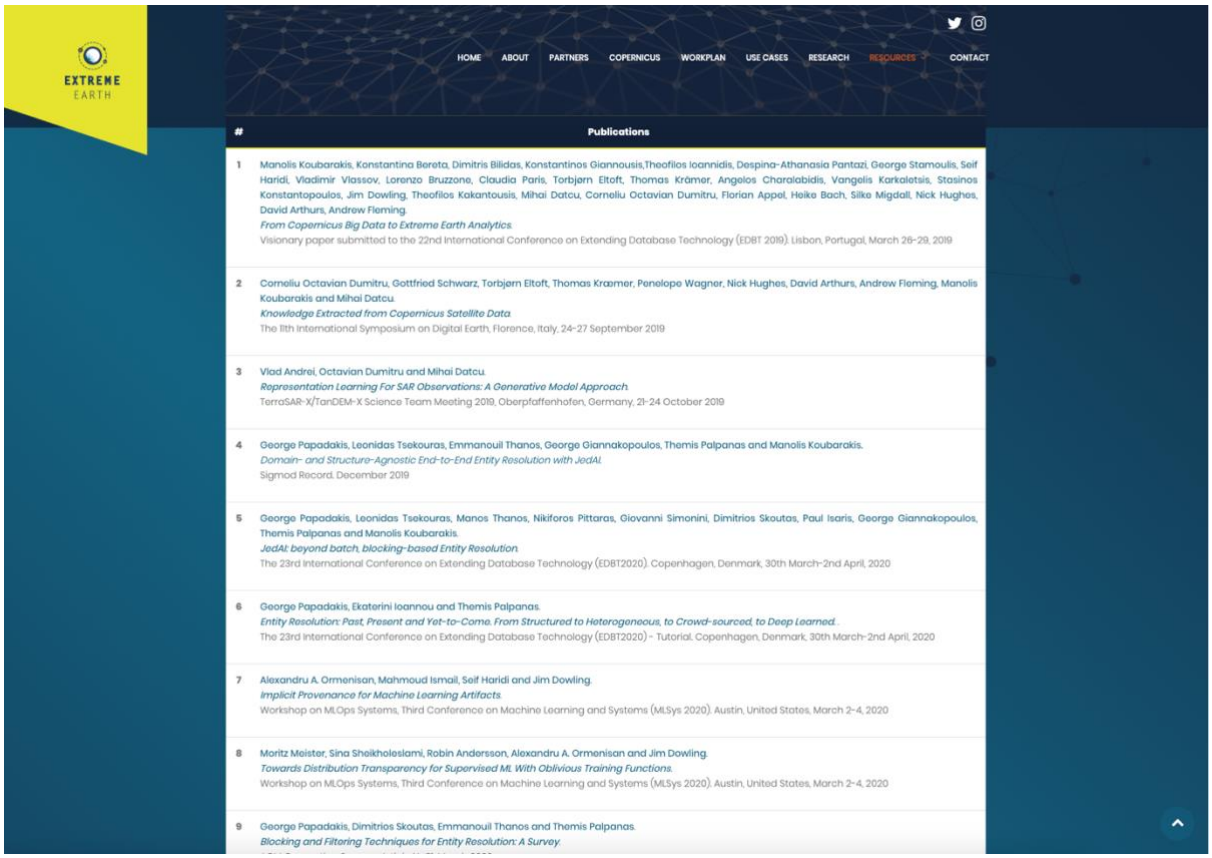

Figure 11: The ExtremeEarth website publications

In order to maximize our dissemination channels, we have added our social media links and a form to subscribe in our newsletter mailing list through the main menu and footer of the Web site of the project. The first newsletter[5] was communicated through the project's mailing lists, BDV newsletter, and the Food Security and Polar TEP lists, reaching out to more than 1900 people on the latest results until April 2020. The second newsletter[6] was communicated in the same channels during December 2021 and contains the latest news and achievements of the project. Both newsletters were also promoted in the website and social media channels (Twitter and LinkedIn) to maximize the target audience.

3.5. Social Media

The use of social media can be a powerful means of knowledge dissemination and communication. In ExtremeEarth we target three core social media channels and have a strong presence, in order to enhance our reach-out to target audiences and the broad public and ensure an active interaction with them. To ensure maximum usability and exploitation of the partners' already developed networks in social media, we also use all pre-existing accounts that the ExtremeEarth partners have been using regularly and successfully to communicate and interact with their audiences.

[5] http://earthanalytics.eu/newsletter.html
[6] http://earthanalytics.eu/newsletter2.html

3.5.1. Twitter

The ExtremeEarth main Twitter profile[7] is used in combination with all partners' existing accounts to maximize dissemination and communication of the project achievements, news and events and allows us to interact with the community. In the following figure of the recent status of the main ExtremeEarth profile, we have reached 194 followers and have posted more than 150 tweets.

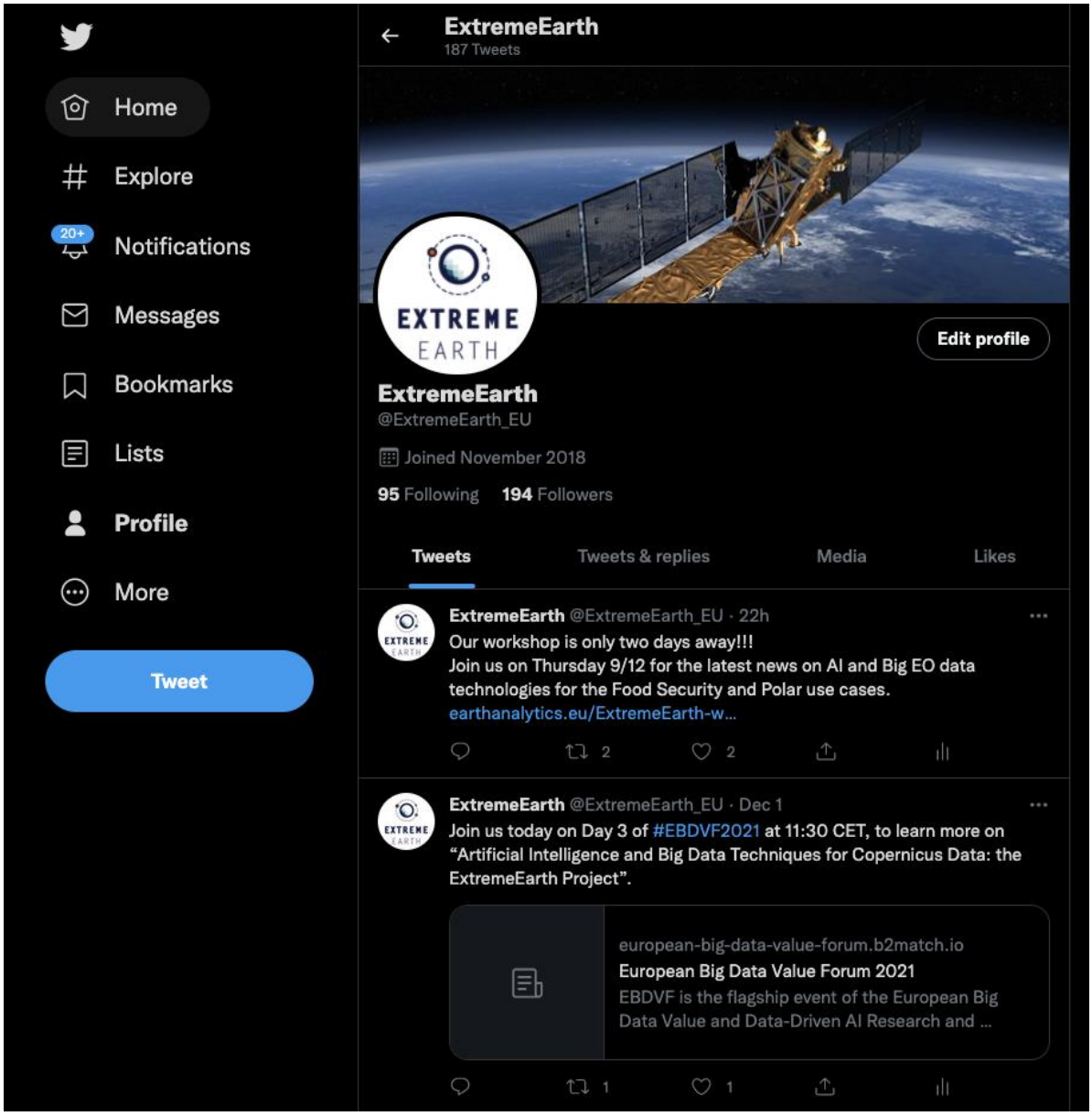

Figure 12: The ExtremeEarth Twitter profile

[7] https://twitter.com/ExtremeEarth_EU

3.5.2. LinkedIn

An ExtremeEarth Linkedin group[8] has been set up and is populated with project results and news. The group currently consists of 47 people and targets professionals and researchers working in the wider area of interest related to the project. This group interlinks materials shared through Twitter and Slideshare platforms allowing the access to a different target group and a different modality of social interaction and propagation.

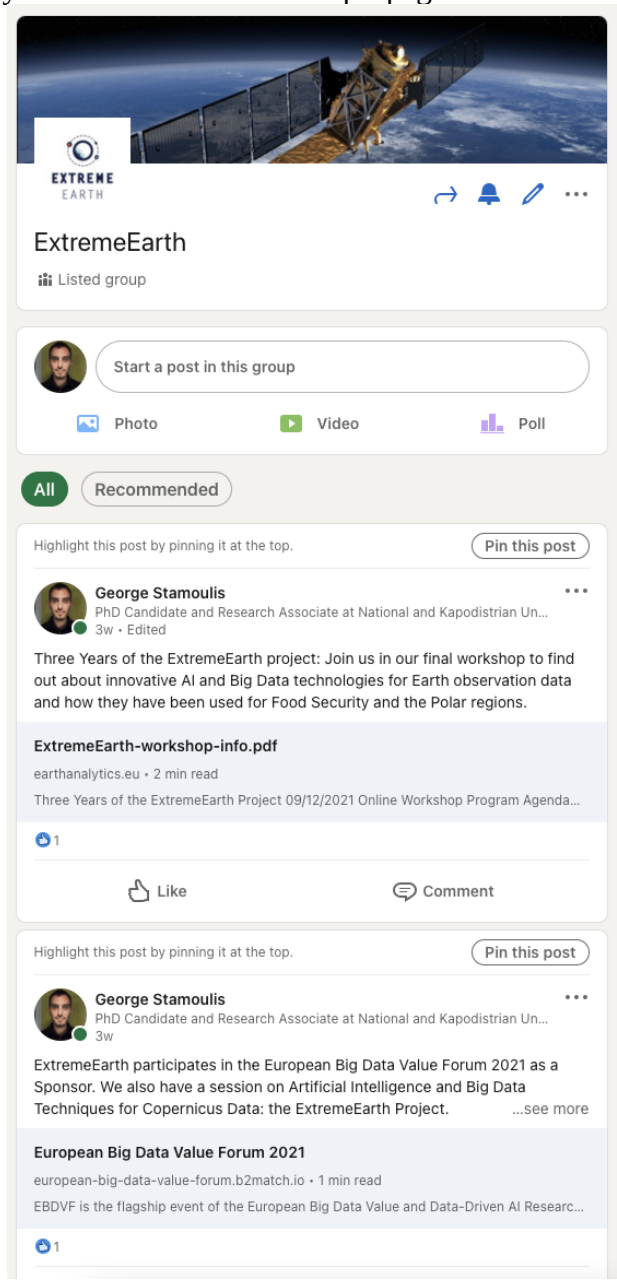

Figure 13: The ExtremeEarth LinkedIn group

[8] https://www.linkedin.com/groups/13697732/

3.5.3. SlideShare

In the SlideShare account of ExtremeEarth, we publish all non-commercial presentation materials under a Creative Commons license or another appropriate license. All presentations are available under the ExtremeEarth tag. So far, we have made available 26 presentations from various events.

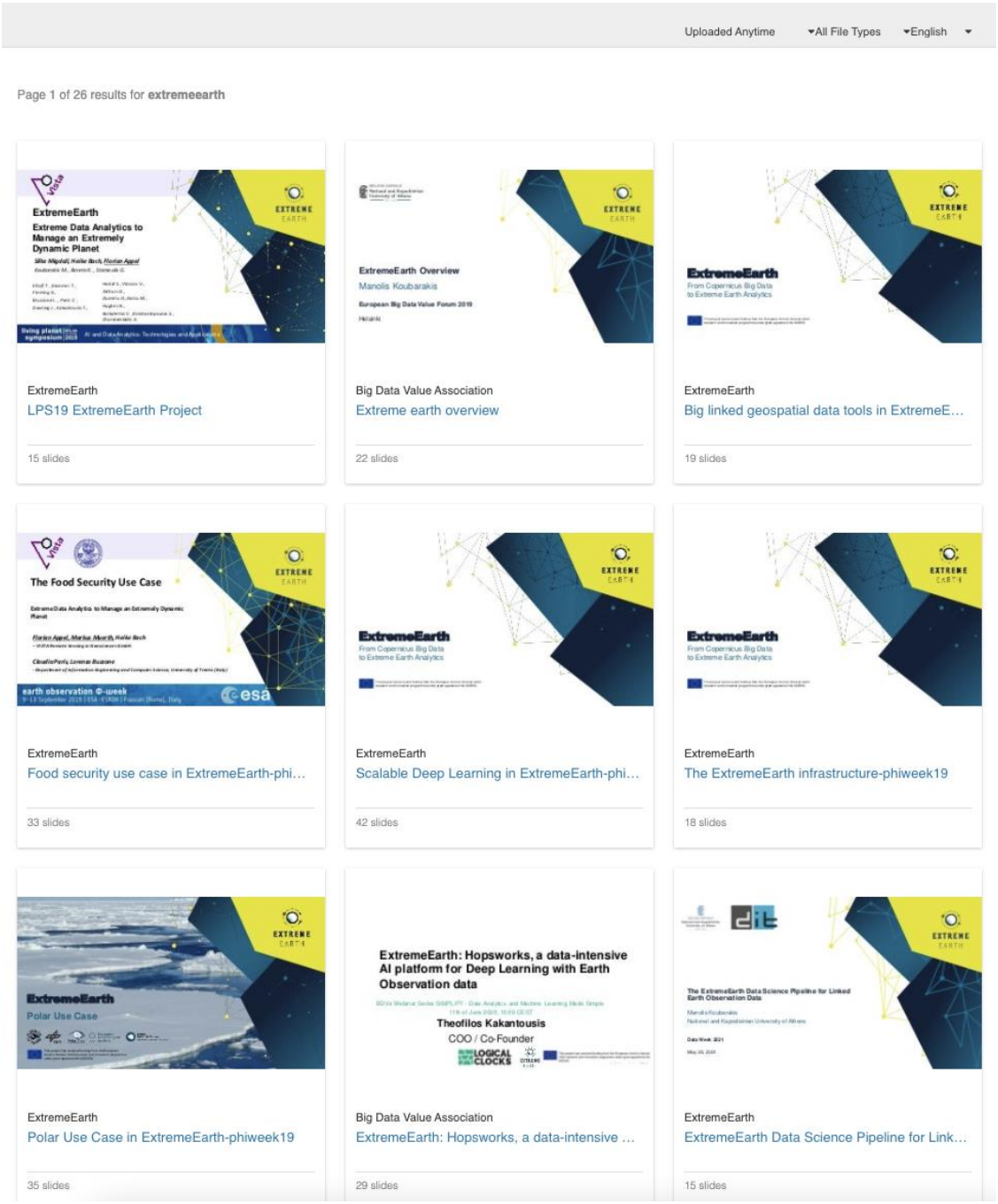

Figure 14: Search for keyword ExtremeEarth in SlideShare

3.6. User Community Workshops

In ExtremeEarth we planned to organize three User Community workshops in M2, M17 and M35 that will bring together the communities of the two TEPs so that their requirements

concerning the two use cases are captured and feedback for our designs and implementations is collected.

1st User Community Workshop. Building on top of the already available information about user needs and requirements for both use cases, the first dedicated workshop for the ExtremeEarth project was planned and conducted in 13-14 March 2019 (M3). It brought together both the Polar and the Food Security communities in one meeting with specialized sessions. The event location for the workshop was the "Tagungszentrum im Kolpinghaus München-Zentral GmbH[9]", Adolf-Kolping-Straße 1, 80336 München.

For the Food Security use case, seventy-one official invitations to stakeholders and potential demo users were sent out. Fifteen stakeholders reacted to the invitation and five of them accepted it. Seven users showed interest but could not attend the workshop because of conflicts in schedule or because they saw the invitation too late.

For the Polar use case, twelve official invitations were sent to stakeholders and potential demo users of the Polar use case and six stakeholders reacted and accepted the invitation. To assure good user involvement, all of the stakeholders were asked whether they wanted to present their own areas of interest and potential demos in relation to the use cases. Additionally, enough room for discussion was planned into the program and a questionnaire was compiled to get an overview of the data needs of the individual participants. Even though there were only relatively few users attending due to the short notice of the invitation, all users who participated did indeed present their own thematic areas and the participation in the discussions was very promising.

2nd User Community Workshop. Dedicated workshops for both use cases were planned for M15, but due to the COVID-19 pandemic we had to postpone the events and organize alternative virtual meetings where possible.

Food Security Use Case: The second Food Security Use Case dedicated workshop originally planned for M15 was skipped due to the unclear situation regarding the COVID-19 pandemic. Initially targeted as an event in Romania, which is in the center of most of the targeted users within the Danube catchment (one of the demo regions). The 2nd User Workshop with the title "Food Security Use Case Applications Workshop Danube" took place on September 15th 2021. The event was held online on the "RunTheWorld" platform. The workshop had 31 confirmed registrations whereby the participants joined from the following countries: Germany, Greece, Italy, Romania, Austria, Egypt, Estonia, Spain and Sweden.

The workshop focused on the use case Food Security with the regional focus on the Danube river basin. Within the last two years, the project team established and demonstrated several techniques on EO big data handling, extreme analytics, linked open data procedures and land surface modelling, including the workflows to provide water availability, crop growth and water demand information. Therefore the workshop was used to inform the participants on the ExtremeEarth project background and scopes and to show the achievements of generating information services for water management and agricultural irrigation applications. Due to the expert panel session on the technological innovations in AI methods and linked data

[9] https://www.tagungen-muenchen.de/kontakt/

applications the attendees received a deep insight into the latest developments in these fields of research.

Polar Use Case: The objective of the second polar use case workshop is to improve automation in iceberg and sea ice charting by bringing together domain experts within the sea ice and the AI communities to collaborate in the application of machine learning techniques. The collaboration will include:

- Use of common iceberg and sea ice datasets for training and testing of AI/DL models
- Comparison of machine learning and AI approaches for improving automation of sea ice charting from EO data
- Comparison of machine learning tools and platforms

Common training datasets are being made available that will serve as a foundation for discussions, comparison of approaches, and future development within the community. Further, machine learning resources (data, tools, and compute) and a collaboration forum are being made available to the community on Polar TEP to enable continued research and communications.

The ExtremeEarth project worked in cooperation with the ESA AI4Arctic project and the ESA Phi-lab to organize a joint workshop on "Machine Learning for Operational Sea Ice Charting" at the ESA Phi-lab in Esrin on May 5 and 6, 2020. The workshop was targeted at world experts on the use of machine learning for operational sea ice classification. The summary of the workshop context and objectives that was distributed to potential workshop participants is presented in the Appendix.

More than 25 people had registered for the workshop before it was canceled as a result of the Covid-19 pandemic. It is now expected that the workshop will be held in a virtual format as part of the ESA Phi-Week in September 2020.

In the meantime, efforts have been shifted to facilitating virtual collaboration within the community. To support this, the following resources have been put in place:

- **Discussion forum[10]:** This is a central location for discussions regarding training data, algorithms and approaches, platforms and tools, research results, and anything else of interest to the community.
- **Common training data sets:** The use of common training data will allow the community to better compare results. Three data sets have been made available so far. Links to the data are available in the forum under the "Training Data" topic. The community has been urged to contribute additional data sets.
    - *ExtremeEarth Polar Use Case Training Data*[11] – This is a set of sea ice, and iceberg, analysis data prepared for the ExtremeEarth project.

[10] https://polartep.io/forum/c/machine-learning-for-operational-sea-ice-charting/8
[11] https://zenodo.org/record/3695276#.Xl5SbnVKiV4

- *AI4Arctic Sea Ice Dataset*[12] – This contains 912 Sentinel-1 SAR scenes matched with sea ice charts produced by the Danish Meteorological Institute from 2014-2017. The ice charts have projected into the S1 geometry for use as labels in machine learning training processes. The dataset also includes co-located AMSR2 derived ice concentrations.
- *C-CORE Iceberg Data Set*[13] – This data was used initially as part of a Kaggle challenge to predict whether an image contains a ship or an iceberg. The labels were provided by human experts and geographic knowledge of the target.

- **Machine learning resources:** Polar TEP is in the process of implementing a number of machine learning tools and resources for use by the community. The first of these, Hopsworks, is now operational in the Polar TEP environment.

3rd User Community Workshop. Dedicated workshops for both use cases were planned for M35, but due to the COVID-19 pandemic we had to organize alternative virtual meetings where possible.

Food Security Use Case: The 3rd User Workshop was held as an online meeting on December 1st 2021 with in total 5 representatives from Cefetra Iberica (Digital Services for Agriculture and Logistics), and BayWa AG (Agricultural Business Expansion team) and VISTA GmbH.

This workshop took place to receive feedback from Spanish users on irrigation information from EO. Within the Food Security use case VISTA provided field wise irrigation recommendations for > 15 fields of different farmers in Spain, mainly within the Douro river basin. The irrigation recommendations are based on the simulation of crop water demand in mm with the crop growth and water balance model PROMET. For a period in summer (May to September), the irrigation recommendations were delivered on weekly basis via email. The discussion in the workshop showed that such recommendations were considered very favourable by the farmers. Knowing how much water is needed when on which field makes the agricultural daily life much easier and the management of irrigation systems more efficient. Due to the lack of validation data, it was not possible to proof that the given recommendations represented exactly the crop water demand. But based on presented methods of the scientific simulations, the information and irrigation recommendations had been considered as 'able to trust' by the users and experts.

Polar Use Case: "Machine Learning for Operational Sea Ice Charting II" was held as a virtual side event at the ESA Φ-Week 2021 on 15 October. The workshop was held in collaboration with the ESA AI4Arctic project (ESA) and the ESA Phi-Lab.

The subject of the event was the application of AI methodologies for downstream data processing for automated sea ice information retrieval with a focus on the advancements that had been made through the previous year since the second workshop. State-of-the-art developments in automatic operational sea ice charting were shared while bringing together domain experts from within the sea ice remote sensing and the AI communities to discuss future directions.

[12] https://data.dtu.dk/articles/ASIP_Sea_Ice_Dataset_-_version_1/11920416
[13] https://www.kaggle.com/c/statoil-iceberg-classifier-challenge/data

The themes covered included:

- Machine learning and AI techniques and architectures for improving automation of sea ice charting from EO data.
- Presentation of existing architectures and results of automation.
- Future developments and collaboration between AI and sea ice experts.
- Presentation of sea ice datasets for training and testing of AI models.
- Announcement of an ESA-sponsored machine learning for sea ice competition.

The following presentations were made:

Name	Affiliation	Topic
David Arthurs	Polar View (ExtremeEarth)	Introduction, competition
JørgenBuus-Hinkler	DMI	AI4Arctic / ASIP dataset v3
Andreas Stokholm / Tore Wulf	DTU/DMI (AI4Arctic)	AI4Arctic project developments of automating sea ice concentration charting at the Danish Meteorological Institute Ice Service with SAR and AMSR2
Anton Korosov	NERSC	Retrieval of sea ice type from Sentinel-1 SAR and assimilation into a sea ice model
Julien Brajard	NERSC	Super-resolution of sea ice thickness from satellite data
Alissa Kouraeva	NERSC	Improvements and uncertainty in convolutional neural networks sea ice type classification
Dmitrii Murashkin	DLR (ExtremeEarth)	Arctic Sea Ice Mapping with Sentinel-1 SAR scenes
Chandrabali Karmakar	DLR	Understanding the Changes in Polar Areas with Time Series Satellite Imagery
Ekaterina Kim / Nabil Panchi	NTNU	Supplementing Remote Sensing of Ice: Deep Learning-Based Image Segmentation System for Automatic Detection and Localization of Sea-ice Formations from Close-Range Optical Images
Torbjørn Eltoft	Uit (ExtremeEarth)	Development and Assessment of AI Techniques for Sea Ice and Iceberg Monitoring in ExtremeEarth
Jessica Cartwright	SPIRE	Taking advantage of machine learning for ice charting with reflected GPS Signals from Spire's Nanosatellite Constellation
Behzad Vahedi	University of Colorado Boulder	Sea Ice Type Classification Using Convolutional Neural Networks
Gordon Davidson	MDA	Sea Ice Monitoring Using RADARSAT-2 and Deep Learning

The workshop was attended by over 35 participants. A recording of the workshop is available on YouTube[14].

3.7. Open Workshop

As stated in the GA, in M36 we planned to have an open workshop in Brussels or Luxembourg to present the results of the project to the European Commission, Copernicus stakeholders, and the EO and Big Data research communities. Due to the COVID-19 situation though, we organized this workshop virtually. The event was disseminated though the website, Twitter, LinkedIn, BDVE and our mailing lists, and we managed to have 50 participants.

In this workshop we presented the innovative AI and Big Data technologies for Earth observation data and how they have been used for Food Security and the Polar regions. All partners participated with presentations and demos, to show how we have managed to combine EO data and AI in our two use cases. The presentations are also available in Slideshare.

3.8. Dissemination and Communication Activities Overview

In ExtremeEarth we undertake versatile dissemination activities both at consortium level and at individual partner level. We have participated in more than 60 conferences, events, workshops, where we have presented the latest achievements in our research and how it affects and assists our use cases for the Food Security and Polar TEPs. In the following table, we present the most important activities.

Name	Venue	Place	Partner
From Copernicus Big Data to Extreme Earth Analytics	EDBT 2019	Lisbon, Portugal	UoA
1st User Workshop	Kolping Haus Conference Center, Munich	Munich, Germany	Vista
ESA Living Planet Symposium 2019	MiCo Milan	Milan, Italy	Vista
DLR Symposium "Künstliche Intelligenz: Made in Germany"	Deutsche Telekom, Berlin, Germany	Berlin, Germany	Vista
Knowledge Extracted from Copernicus Satellite Data	11th International Symposium on Digital Earth	Florence, Italy	DLR
ESA Phi-week Side event	ESA ESRIN	Frascati, Italy	All
European Big Data Value Forum	EBDVF 2019	Helsinki, Finland	UoA
Presentation of Snow/Water/Irrigation within ExtremeEarth	SnowHydro Conference 2020	Bolzano, Italy	VISTA
Copernicus and Artificial Intelligence	Auditorium - Breydel Building	Brussels, Belgium	UoA
METNO internal talk	Norwegian Meteorological Institute	Tromsø/Oslo, Norway	METNO

[14] https://www.youtube.com/watch?v=DK5YLrzqDVQ&list=PLXCKUzR6YX-P2dHJPKaDLBs1bc1hcxvUw&index=6

Machine Learning for Sea Ice Monitoring from Satellites	The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences	Munich, Germany	DLR
Technical Meeting	DLR	Munich, Germany	DLR. UiT, METNO
Workshop on MLOps Systems	Third Conference on Machine Learning and Systems (MLSys 2020)	Austin, Texas, USA	LC
SIOS online conference on "Earth Observation (EO), Remote Sensing (RS) and Geoinformation (GI) applications in Svalbard"	SIOS, zoom	Svalbard	METNO
SIMPLIFY Webinar	BDVA Webinar	Virtual	LC
Space and Artificial Intelligence	ESA-CLAIRE AI Special Interest Group on Space	Virtual	UoA
ESA Phi-week Online Event 2020	ESA Phi-week 2020	Virtual	VISTA, UNITN, METNO
Parallel session on Big Data and Artificial Intelligence Techniques for EO (ExtremeEarth)	EBDVF 2020	Virtual	UoA, UNITN, UiT, LC
Parallel Ablation Studies for Machine Learning with Maggy on Apache Spark	Data+AI Summit Europe 2020	Virtual	KTH, LC
Semantic technologies for big Copernicus data	Workshop Artificial Intelligence for Big Satellite Data	Virtual	UoA
1st International Workshop on Data Analytics and Machine Learning Made Simple	SIMPLIFY 2021	Virtual	UoA
Earth and Space Science Informatics	European Geosciences Union (EGU) General Assembly 2021	Virtual	DLR
Machine Learning-Based Paradigm for Boosting the Semantic Annotation of EO Images	IGARSS 2021	Virtual	DLR
The ExtremeEarth project	BiDS 2021	Virtual	UoA, KTH, LC, VISTA
Artificial Intelligence and Big Data Technologies for Earth Observation	DataWeek 2021	Virtual	UoA
AI for earth observation	Artificial Intelligence in Remote Sensing Applications	Virtual	UoA

The ExtremeEarth Software Architecture for Copernicus Earth Observation Data	Phi-week 2021	Virtual	VISTA, PV, LC
Challenges in DL-based sea ice classification fram SAR - Lessens learnt from ExtremeEarth	Phi-week 2021: Side Event	Virtual	UiT
Artificial Intelligence and Big Data Techniques for Copernicus Data: the ExtremeEarth Project	EBDVF 2021	Virtual	UoA, VISTA, METNO
Extreme AI Platform	European Space Agency	Virtual	PV, LC
Final Open Workshop	Organized Workshop	Virtual	All

3.9. Publications

As a Research and Innovation Action, one of the main dissemination channels of ExtremeEarth is the presentation of the project's research results in top-rated scientific journals, conferences and workshops. We have published 49 papers/journals with our work. All publications are available on the project's website[15].

1) Manolis Koubarakis, Konstantina Bereta, Dimitris Bilidas, Konstantinos Giannousis,Theofilos Ioannidis, Despina-Athanasia Pantazi, George Stamoulis, Seif Haridi, Vladimir Vlassov, Lorenzo Bruzzone, Claudia Paris, Torbjørn Eltoft, Thomas Krämer, Angelos Charalabidis, Vangelis Karkaletsis, Stasinos Konstantopoulos, Jim Dowling, Theofilos Kakantousis, Mihai Datcu, Corneliu Octavian Dumitru, Florian Appel, Heike Bach, Silke Migdall, Nick Hughes, David Arthurs, Andrew Fleming.
From Copernicus Big Data to Extreme Earth Analytics.
Visionary paper submitted to the 22nd International Conference on Extending Database Technology (EDBT 2019). Lisbon, Portugal, March 26-29, 2019

2) Corneliu Octavian Dumitru, Gottfried Schwarz, Torbjørn Eltoft, Thomas Kræmer, Penelope Wagner, Nick Hughes, David Arthurs, Andrew Fleming, Manolis Koubarakis and Mihai Datcu.
Knowledge Extracted from Copernicus Satellite Data.
The 11th International Symposium on Digital Earth, Florence, Italy, 24-27 September 2019

3) Vlad Andrei, Octavian Dumitru and Mihai Datcu.
Representation Learning For SAR Observations: A Generative Model Approach.
TerraSAR-X/TanDEM-X Science Team Meeting 2019, Oberpfaffenhofen, Germany, 21-24 October 2019

4) George Papadakis, Leonidas Tsekouras, Emmanouil Thanos, George Giannakopoulos, Themis Palpanas and Manolis Koubarakis.
Domain- and Structure-Agnostic End-to-End Entity Resolution with JedAI.
Sigmod Record. December 2019

[15] http://earthanalytics.eu/publications.html

5) George Papadakis, Leonidas Tsekouras, Manos Thanos, Nikiforos Pittaras, Giovanni Simonini, Dimitrios Skoutas, Paul Isaris, George Giannakopoulos, Themis Palpanas and Manolis Koubarakis.
JedAI: beyond batch, blocking-based Entity Resolution.
The 23rd International Conference on Extending Database Technology (EDBT2020). Copenhagen, Denmark, 30th March-2nd April, 2020

6) George Papadakis, Ekaterini Ioannou and Themis Palpanas.
Entity Resolution: Past, Present and Yet-to-Come. From Structured to Heterogeneous, to Crowd-sourced, to Deep Learned. .
The 23rd International Conference on Extending Database Technology (EDBT2020) - Tutorial. Copenhagen, Denmark, 30th March-2nd April, 2020

7) Alexandru A. Ormenisan, Mahmoud Ismail, Seif Haridi and Jim Dowling.
Implicit Provenance for Machine Learning Artifacts.
Workshop on MLOps Systems, Third Conference on Machine Learning and Systems (MLSys 2020). Austin, United States, March 2-4, 2020

8) Moritz Meister, Sina Sheikholeslami, Robin Andersson, Alexandru A. Ormenisan and Jim Dowling.
Towards Distribution Transparency for Supervised ML With Oblivious Training Functions.
Workshop on MLOps Systems, Third Conference on Machine Learning and Systems (MLSys 2020). Austin, United States, March 2-4, 2020

9) George Papadakis, Dimitrios Skoutas, Emmanouil Thanos and Themis Palpanas.
Blocking and Filtering Techniques for Entity Resolution: A Survey.
ACM Computing Surveys. Article No31, March 2020.

10) George Papadakis, George Mandilaras, Luca Gagliardelli, Giovanni Simonini, Emmanouil Thanos, George Giannakopoulos, Sonia Bergamaschi, Themis Palpanas, Manolis Koubarakis.
Three-Dimensional Entity Resolution with JedAI.
Information Systems. Volume 93, November 2020

11) George Mandilaras, Despina-Athanasia Pantazi, Manolis Koubarakis, Nick Hughes, Alistair Everett and ̊Ashild Kiærbech.
Ice Monitoring With ExtremeEarth.
LASCAR 2nd Workshop on Large Scale RDF Analytics 2020. Online, May 31 - June 4, 2020

12) Claudia Paris, Giulio Weikmann and Lorenzo Bruzzone.
Monitoring of Agricultural Areas by using Sentinel 2 Image Time Series and Deep Learning Techniques.
SPIE Remote Sensing Conference, Edinburgh, United Kingdom, September 21 - 24, 2020

13) Charalampos Kostopoulos, Giannis Mouchakis, Nefeli Prokopaki-Kostopoulou, Antonis Troumpoukis, Angelos Charalambidis and Stasinos Konstantopoulos.
KOBE: Cloud-native Open Benchmarking Engine for Federated Query Processors.
Demo paper in the International Semantic Web Conference 2020, Virtual, November 1 - 6, 2020

14) Antonis Troumpoukis, Stasinos Konstantopoulos, Giannis Mouchakis, Nefeli Prokopaki-Kostopoulou, Claudia Paris, Lorenzo Bruzzone, Despina-Athanasia Pantazi and Manolis Koubarakis.
GeoFedBench: A Benchmark for Federated GeoSPARQL Query Processors.
Demo paper in the International Semantic Web Conference 2020, Virtual, November 1 - 6, 2020

15) Chandrabali Karmakar, Corneliu Octavian Dumitru, Gottfried Schwarz and Mihai Datcu.
Feature-free Explainable Data Mining in SAR Images Using Latent Dirichlet Allocation.
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, November 18, 2020

16) Corneliu Octavian Dumitru, Gottfried Schwarz, Mihai Datcu, Alistair Everett, Nick Hughes and Manolis Koubarakis.
Efficient Algorithms for Monitoring Polar Areas Using Satellite Images.
2020 EUROPEAN POLAR SCIENCE WEEK, Virtual, November 1 - 6, 2020

17) Moritz Meister, Sina Sheikholeslami, Amir H. Payberah, Vladimir Vlassov and Jim Dowling.
Maggy: Scalable Asynchronous Parallel Hyperparameter Search.
The 1st Workshop on Distributed Machine Learning (DistributedML'20), ACM, December 2020

18) Dumitru, C. O., Andrei, V., Schwarz, G., and Datcu, M..
Machine Learning for Sea Ice Monitoring from Satellites.
Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLII-2/W16, 83–89, https://doi.org/10.5194/isprs-archives-XLII-2-W16-83-2019, 2019

19) Corneliu Octavian Dumitru, Gottfried Schwarz, Gabriel Dax, Vlad Andrei, Dongyang Ao and Mihai Datcu.
Active and Machine Learning for Earth Observation Image Analysis with Traditional and Innovative Approaches.
Principles of Data Science, p.207-231, 2020

20) Dimitris Bilidas and Manolis Koubarakis.
In-memory parallelization of join queries over large ontological hierarchies.
Distributed and Parallel Databases, 2020

21) George Papadakis, Dimitrios Skoutas, Emmanouil Thanos, Themis Palpanas.
An Overview of End-to-End Entity Resolution for Big Data.

CoRR, abs/1905.06167. http://arxiv.org/abs/1905.06167

22) Theofilos Ioannidis, George Garbis, Kostis Kyzirakos, Konstantina Bereta, Manolis Koubarakis.
Evaluating Geospatial RDF stores Using the Benchmark Geographica 2.
Journal on Data Semantics, 2021

23) Salman Khaleghian, Thomas Kræmer, Alistair Everett, Åshild Kiærbech, Nick Hughes, Torbjørn Eltoft, Andrea Marinoni.
Synthetic aperture radar data analysis by deep learning for automatic sea ice classification.
The European Conference on Synthetic Aperture Radar 2020, March 29 - April 1, 2021

24) Thomas Kræmer, Salman Khaleghian, Torbjørn Eltoft and Andrea Marinoni.
Iceberg Detection in Sentinel-1 Extra Wide Swath Images: Deep Learning vs. Statistical Methods.
ESA Phi week 2019, Frascati, Itally, September 9 - 13, 2019

25) Salman Khaleghian, Thomas Kræmer, Alistair Everett, Åshild Kiærbech, Nick Hughes, Torbjørn Eltoft, Andrea Marinoni.
Deep learning for enhanced sea ice understanding.
Arctic Frontiers 2020, Tromsø, Norway, January 26 - 30, 2020

26) Andrea Marinoni, Gianni Christian Iannelli, Salman Khaleghian and Paolo Gamba.
On the optimal design of convolutional neural networks for Earth observation data analysis by maximization of information extraction.
IEEE International Geoscience and Remote Sensing symposium, Virtual, September 26 - October 2, 2020

27) Konstantina Bereta, George Papadakis and Manolis Koubarakis.
Ontop4theWeb: SPARQLing the Web On-the-fly.
The 15th IEEE International Conference on Semantic Computing (ICSC2021), 27-29 January, 2021. Short paper.

28) George Papadakis, Georgios Mandilaras, Nikos Mamoulis, Manolis Koubarakis.
Progressive, Holistic Geospatial Interlinking.
The Web Conference 2021, April 19 - 23, Ljubljana, Slovenia, 2021

29) Dimitris Bilidas and Manolis Koubarakis.
Handling redundant processing in OBDA query execution over relational sources.
Journal of Web Semantics. Volume 68, April 2021

30) Antonios Deligiannakis, Manolis Koubarakis and Dimitris Skoutas (editors).
Proceedings of the Workshops of the EDBT/ICDT 2021 Joint Conference.
The 24th International Conference on Extending Database Technology. Nicosia, Cyprus, March 23, 2021

31) Sina Sheikholeslami, Moritz Meister, Tianze Wang, Amir H. Payberah, Vladimir Vlassov, Jim Dowling.
AutoAblation: Automated Parallel Ablation Studies for Deep Learning.
The 1st Workshop on Machine Learning and Systems (EuroMLSys '21), April 2021

32) Desta Haileselassie Hagos, Theofilos Kakantousis, Vladimir Vlassov, Sina Sheikholeslami, Tianze Wang, Jim Dowling, Andrew Fleming, Andreas Cziferszky, Markus Muerth, Florian Appel, Despina-Athanasia Pantazi, Dimitris Bilidas, George Papadakis, George Mandilaras, George Stamoulis, Manolis Koubarakis, Antonis Troumpoukis, Stasinos Konstantopoulos.
The ExtremeEarth Software Architecture for Copernicus Earth Observation Data..
Conference on Big Data from Space (BiDS21) 2021. Virtual event, 18-20 May 2021

33) Manolis Koubarakis, George Stamoulis, Dimitris Bilidas, Theofilos Ioannidis, George Mandilaras, Despina-Athanasia Pantazi, George Papadakis, Vladimir Vlassov, Amir H. Payberah, Tianze Wang, Sina Sheikholeslami, Desta Haileselassie Hagos, Lorenzo Bruzzone, Claudia Paris, Giulio Weikmann, Daniele Marinelli, Torbjørn Eltoft, Andrea Marinoni, Thomas Kræmer, Salman Khaleghian, Habib Ullah, Antonis Troumpoukis, Nefeli Prokopaki Kostopoulou, Stasinos Konstantopoulos, Vangelis Karkaletsis, Jim Dowling, Theofilos Kakantousis, Mihai Datcu, Wei Yao, Corneliu Octavian Dumitru, Florian Appel, Silke Migdall, Markus Muerth, Heike Bach, Nick Hughes, Alistair Everett, Ashild Kiærbech, Joakim Lillehaug Pedersen, David Arthurs, Andrew Fleming, Andreas Cziferszky.
Artificial Intelligence and Big Data Technologies for Copernicus Data: The ExtremeEarth Project.
Conference on Big Data from Space (BiDS21) 2021. Virtual event, 18-20 May 2021

34) Silke Migdall, Sandra Dotzler, Christian Miesgang, Florian Appel, Markus Muerth, Heike Bach, Giulio Weikmann, Claudia Paris, Daniele Marinelli, Lorenzo Bruzzone.
Water Stress Assessment in Austria Based on Deep Learning and Crop Growth Modelling.
Conference on Big Data from Space (BiDS21) 2021. Virtual event, 18-20 May 2021

35) Giulio Weikmann, Claudia Paris and Lorenzo Bruzzone.
TimeSen2Crop: A Million Labeled Samples Dataset of Sentinel 2 Image Time Series for Crop-Type Classification.
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (Volume: 14), June 2021

36) Charalampos Kostopoulos, Giannis Mouchakis, Antonis Troumpoukis, Nefeli Prokopaki-Kostopoulou, Angelos Charalambidis and Stasinos~Konstantopoulos.
KOBE: Cloud-native Open Benchmarking Engine for Federated Query Processors.
Proceedings of the 18th European Semantic Web Conference (ESWC 2021), Virtual conference, 6-10 June 2021. Best paper award nominee.

37) George Mandilaras and Manolis Koubarakis.
Scalable Transformation of Big Geospatial Data into Linked Data.

The 20th International Semantic Web Conference, Virtual Conference, 24-28 October, 2021.

38) Desta Haileselassie Hagos, Theofilos Kakantousis, Vladimir Vlassov, Sina Sheikholeslami, Tianze Wang, Jim Dowling, Claudia Paris, Daniele Marinelli, Giulio Weikmann, Lorenzo Bruzzone, Salman Khaleghian, Thomas Kræmer, Torbjørn Eltoft, Andrea Marinoni, Despina-Athanasia Pantazi, George Stamoulis, Dimitris Bilidas, George Papadakis, George Mandilaras, Manolis Koubarakis, Antonis Troumpoukis, Stasinos Konstantopoulos, Markus Muerth, Florian Appel, Andrew Fleming, and Andreas Cziferszky.
ExtremeEarth Meets Satellite Data From Space.
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2021

39) Desta Haileselassie Hagos, Theofilos Kakantousis, Sina Sheikholeslami, Tianze Wang, Vladimir Vlassov, Moritz Meister and Jim Dowling.
Scalable Artificial Intelligence for Earth Observation Data Using Hopsworks.
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2021

40) Migdall S., Dotzler S., Gleisberg E., Appel F., Muerth M., Bach H., Weikmann G., Paris C., Marinelli D., Bruzzone L.
Crop Water Availability Mapping in the Danube Basin based on Deep Learning, Hydrological and Crop Growth Modelling.
European Federation for Information Technology in Agriculture, Food and the Environment (EFITA 21), 2021

41) Salman Khaleghian, Habib Ullah, Thomas Kræmer, Nick Hughes, Torbjørn Eltoft and Andrea Marinoni.
Sea Ice Classification of SAR Imagery Based on Convolution Neural Networks.
Remote Sensing, MDPI, 2021

42) Salman Khaleghian, Habib Ullah, Thomas Kræmer, Torbjørn Eltoft and Andrea Marinoni.
Deep Semi-Supervised Teacher-Student Model based on Label Propagation for Sea Ice Classification.
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2021

43) Habib Ullah, Salman Khaleghian, Thomas Kræmer, Nick Hughes, Torbjørn Eltoft and Andrea Marinoni.
A Noise-Aware Deep Learning Model for Sea Ice Classification Based on Sentinel-1 Sar Imagery.
IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2021

44) Salman Khaleghian, Thomas Kræmer, Alistair Everett, Ashild Kiærbech, Nick Hughes, Torbjørn Eltoft and Andrea Marinoni.
Synthetic aperture radar data analysis by deep learning for automatic sea ice

classification.
The 13th European Conference on Synthetic Aperture Radar (EUSAR 2021), 2021

45) Corneliu Octavian Dumitru and Mihai Datcu.
Semantic Analysis of Satellite Image Time Series.
Change Detection and Image Time Series Analysis 2: Supervised Methods, iSTE/WILEY, Chapter 3, December 2021

46) C.O. Dumitru, G. Schwarz, C. Karmakar and M. Datcu.
Machine Learning Techniques for Knowledge Extraction.
IEEE International Geoscience and Remote Sensing Symposium IGARSS, 202

47) Zhongling Huang, Corneliu Octavian Dumitru and Jun Ren.
Physics-Aware Feature Learning of Sar Images with Deep Neural Networks: A Case Study.
IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2021

48) Wei Yao, Octavian Dumitru and Mihai Datcu.
An Active Learning Tool for the Generation of Earth Observation Image Benchmarks.
IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2021

49) C.O. Dumitru, G. Schwarz, C. Karmakar and M. Datcu.
Machine Learning-Based Paradigm for Boosting the Semantic Annotation of EO Images.
IEEE International Geoscience and Remote Sensing Symposium IGARSS, 2021

3.10. European Big Data Value PPP

The Big Data Value Public-Private Partnership aims at creating a functional Data Market and Data Economy in Europe, in order to allow Europe to play a leading role in Big Data in the global market. The Big Data Value PPP is a partnership between the European Commission and the Big Data Value Association (BDVA). The ExtremeEarth project is part of the BDV community and provides Big Data and AI solutions for our use cases that could also benefit the PPP.

3.10.1. The Big Data Value eCosystem Project

The Big Data Value eCosystem Project (BDVe) provides coordination and support for the current and future H2020 projects within the Big Data Value Public-Private Partnership. BDVe directly interfaces with numerous stakeholders, both from inside and outside the PPP to foster a true vibrant community around Big Data in Europe and facilitating the common bodies to discover and exploit synergies at project management level and generate a complete Big Data Value Reference Model at technical level. ExtremeEarth is participating in BDVe as a H2020 project, to benefit from the dissemination channels and multiply the impact of the project into the different targets at communication level. BDVe also offers webinar series related to Big Data technologies and AI to show the results of EU projects. As ExtremeEarth we have

participated in the SIMPLIFY webinar[16] where we presented Hopsworks, a data-intensive AI platform for Deep Learning with Earth Observation data.

3.10.2. The European Big Data Value Forum

The European Big Data Value Forum (EBDVF) is the main event of the European Big Data and Data-Driven AI Research and Innovation community. EBDVF19 was organized by BDVA, in collaboration with the European Commission and VTT as the main local organizer. The European Big Data Value Forum 2019 continued the success of previous editions, where on average around 700 industry professionals, business developers, researchers, and policymakers coming from 40 different countries attended the event. The organiser committee of the event included, in addition to BDVA, the EC and VTT, multiple Finnish industrial, Innovation and Research players as well as international companies and other research institutions.

ExtremeEarth provided a Gold Sponsorship[17] to the event, to maximize our dissemination and communication activities. We had an exhibition booth with our logo, flyers and posters throughout the event to promote our progress and research results of the project. The sponsorship also allowed us to have our logo and description of the project in the visitor's brochure and visibility in announcements during the conference, which assisted in the promotion of ExtremeEarth in this flagship event of Big Data and AI in Europe.

The project was also represented by Prof. Manolis Koubarakis in his presentation *Artificial Intelligence and Big Data Techniques for Copernicus Data: the ExtremeEarth project*[18], which took place on the second day of the conference.

We have also participated in the virtual events of EBDVF 2020 and 2021, where we also provided a Project Sponsorship. In both events we organized a session to present the latest results and achievement of the project. In EBDVF 2020 we hosted a parallel session on Big Data and Artificial Intelligence Techniques for EO data, where we presented our work on Deep Learning over the Hopsworks platform. In EBDVF 2021 we held a session on Artificial Intelligence and Big Data Techniques for Copernicus data, where we presented the technologies we developed and their use in the two use cases.

3.11. Collaboration with other Projects

In order to maximize our dissemination and communication activities, we have established close links with other ongoing European projects in Big Data and EO that are participating in relevant activities of the H2020 framework.

We are collaborating with the projects INFORE[19] and SmartDataLake[20]. Both projects try to tackle the Big Data domain from different perspectives, so by collaborating with them we can join forces to provide different solutions to the community regarding Big Data technologies. So far we have co-organised a webinar hosted by BDVe (section 3.9.1) on Big Data analytics and Machine Learning, and we plan to organise more webinars in the future.

[16] https://www.big-data-value.eu/simplify-data-analytics-and-machine-learning-made-simple/
[17] https://www.european-big-data-value-forum.eu/sponsors/
[18] https://es.slideshare.net/BDVA/extreme-earth-overview
[19] https://www.infore-project.eu/
[20] https://smartdatalake.eu/

We have collaborated with the ReachOut[21] project that aims to connect research projects with beta testers and early users on the market. We have used their Beta Tester tools in order to receive feedback and also disseminate our technologies.
We have also collaborated with the CIRFA[22] centre. CIRFA is hosted by the Department of Physics and Technology at UiT the Arctic University of Norway. The overall ambition of CIRFA is that the centre will become a knowledge hub for research and development on Arctic surveillance technologies, with leading expertise in disciplines such as remote sensing, signal processing, radar technology, RPAS technology, numerical modelling and data assimilation.
In the past year, we also started new collaborations with the projects DeepCube[23] and AI4Copernicus[24] that try to combine AI and EO data and provide services to their end users.

3.12. Open Research Data Pilot

The Open Research Data Pilot of the European Commission enables open access and reuse of research data generated by Horizon 2020 projects. ExtremeEarth participates in the Open Research Data Pilot of the Horizon 2020 programme. Following Article 29.3 "Open access to research data" of our grant agreement, we will make available in the repository OpenAIRE[25] all of the research data produced in the project so that the scientific techniques we will develop become reproducible by other researchers. Our Data Management Plan is presented in detail in Deliverable 7.3 (M12). We have produced six datasets as shown in the table below.

Description	DOI or URL
"Synthetic-Aperture Radar (SAR) based Ice types/Ice edge dataset for deep learning analysis", Salman Khaleghian, 2019, DRAFT VERSION	https://doi.org/10.18710/QAYI4O
"Large Multitemporal Multispectral Sentinel 2 Training dataset for Deep Learning Architectures for Crop Type Mapping"	https://zenodo.org/record/4715631#.YI-xX7UzZaQ
"ExtremeEarth Polar Use Case Training Data (Version 1.0.0)", Nick Hughes, 2020	https://zenodo.org/record/3695276#.Xucu2M8za-Z
"ExtremeEarth Polar Use Case Training Data (Version 2.0.0)", Nick Hughes and Frank Amdal, 2021	https://zenodo.org/record/4683174#.YIF6g5MzZdA
Semantic Sea-Ice Classification for Belgica Bank in Greenland, Octavian Dumitru, ChandrabaliKarmakar, Mihai Datcu, 2021	https://zenodo.org/record/5075448#.YOR7FxMzZdA
Sea-Ice Data Content Representation Based on Latent Dirichlet Allocation for Belgica Bank in Greenland, Chandrabali Karmakar, Octavian Dumitru, Mihai Datcu, 2021	https://zenodo.org/record/5075861#.YOR7HxMzZdA

[21] https://www.reachout-project.eu/
[22] https://cirfa.uit.no/
[23] https://deepcube-h2020.eu/
[24] https://ai4copernicus-project.eu/
[25] https://www.openaire.eu/

Crop Type Maps (Danube Subsection) for the years 2018, 2019, 2020 based on Sentinel-2 and AI	https://foodsecurity-tep.net/app/#/explorer
Water Availability Maps (Douro + Danube) from EO and Modelling	https://foodsecurity-tep.net/app/#/explorer

Food Security Datasets. The main goal of the deep learning architectures for the Food Security Case is the production of crop type and crop boundaries maps. However, when using deep learning in operational remote sensing scenarios a crucial issue is the lack of enough large training dataset. Most of the benchmark dataset used in the past for the evaluation of classification algorithms cannot be used for testing deep learning approaches due to the small number of annotated images included in the archives. Hence, the low number of training samples is not enough to properly estimate the large network parameters of modern deep learning models, thus leading to poor generalization ability that prevents the accurate characterization of the semantic content provided by the remote sensing data. Moreover, most of the benchmark archives contain aerial images with only RGB image bands instead of considering satellite multispectral optical images such as Sentinel 2.

In order to generate a reliable and representative large training set for crop type mapping, we leverage on the long time series of Sentinel 2 images and publicly available thematic products. The definition of valuable training set to the Remote Sensing community requires reliable but informative labeled samples. Moreover, the identification of a proper classification scheme is necessary to ensure that the selected crop types can be discriminated using the spectral/spatial/temporal information provided by satellite multispectral optical data considered.

The considered classification scheme is made up of the following classes: Grassland, Maize, Forage, Legumes, Oat, Rapeseed, Potato, Rye, Beet, Spring barley, Spring wheat, Winter barley, Winter wheat, Soy, Sunflower, Permanent plantations and Flowering legumes. For each class, the most reliable samples have been selected according to a stratified random sampling strategy. This condition allows us to generate a training set that is statistically balanced since for each crop type we consider a number of samples proportional to the number of crops associated with that type in the considered study area. Please see Deliverable 2.1 (M12) for more details.

We have also made available two datasets through the Food Security TEP. The first one is the Crop Type map for the Danube area through the years 2018-2020. The second is the water availability maps for the Danube and Douro areas using the PROMET model.

Polar Datasets. Freely available training datasets supporting algorithm development for Polar applications are still almost non-existent. Sea ice classification algorithms have previously been developed based on satellite data (often commercial) with very restrictive licenses. Combined with the lack of corresponding validation data and in-situ measurements, the task of creating high quality training datasets for machine learning models has therefore been very challenging. With the open data policy and increased coverage of the Copernicus Sentinel missions this is starting to change. Existing open datasets created based on Sentinel-1 data

include the Statoil/C-CORE Kaggle iceberg/ship dataset[26] and the SAR classification dataset of Wang et al. (2019)[27], which provided 10 classes some of which were sea ice classes.

The Khalegian (2019) dataset, described in Deliverable 2.1 (M12), contains a total of 98754 image patches extracted from the 40 m x 40 m ground range detected medium resolution product (GRDM) with corresponding labels for a binary sea ice vs. water classification. Patches cover a range of square window sizes with side lengths of 10, 20, 32, 35, 46 pixels, hence covering multiple resolutions. The data is structured in a way that is easily ingested by modern deep learning frameworks such as Tensorflow.

The Hughes (2020) datasets (v1, v2) consist of Shapefiles with polygons labeled as sea ice, water or icebergs. The datasets provide an analysis of approximately monthly images covering the Danmarkshavn area on the east coast of Greenland. The area has a wide variety of sea ice and iceberg conditions and was continuously monitored by key European Sentinel satellites during 2018. The presence of extensive (land) fast ice in the area ensures that classifications on those areas can be applied to additional dates.

Both datasets try to capture some of the sea ice variability with season, using satellite images spread geographically and in time. The use of optical data as reference is easy in winter and mostly relevant in summer. However, summer is also the season which poses the largest challenges for sea ice classification as the wet snow cover introduces large ambiguities in the SAR signatures. Capturing these ambiguities are important for creating robust classification algorithms.

The Octavian (2021) dataset contains Semantic Sea-Ice classification for the Belgica Bank in Greenland. Each Sentinel-1 image is tiled into patches of 256x256 pixels. The size of the images is different and we reduced to the smallest one. In total for each image are 6,400 patches [1-2, 4]. The semantic classes are: Black border, Old ice, First-Year ice, Glaciers, Icebergs, Mountains, Young ice, Water group. The last class combines the Floating ice, Water body, Water ice current and melted snow because they have very similar physical properties.

The Chandrabali (2021) dataset contains Sea-Ice data content representation for the Belgica Bank in Greenland. Each file in the dataset is a numpy array of size (number of 256x256 patches, 4096) indexed by id of the patch (each scene contains 6,400 patches, each patch has 4,096 micropatches of size 4x4, assigned one topic per micropatch, resulting in 4,096 topics per patch). Each file has 4 months of observation. Array size is 25600 x 4096. We provide 6 files containing 24 months of observation (see the excel file for the Sentinel-1 ids).

3.13. Traditional Mass Media

We promote all important milestones and events of ExtremeEarth through press releases, which target the local or national press of the partner entrusted with this task. So far, we have published two press releases, one in Greece and one in Germany.

[26] https://www.seanoe.org/data/00456/56796/
[27] https://www.seanoe.org/data/00456/56796/

In Greece, the press release was published in the main website of the National and Kapodistrian University of Athens as a general announcement in the Greek language[28]. In Germany, the press release was published in the main website of the partner VISTA in the news section and was available in German[29] and English[30].

Finally, we have started preparing a short video with the contributions and achievements of ExtremeEarth, that will be publicly available on YouTube and shared in our website and social media.

4. Summary

In this document we presented the dissemination and communication activities for the project ExtremeEarth in the 36 months of execution, based on the dissemination plan that was presented in D6.2. The dissemination and communication channels include the project web site, social media, scientific publications, talks, workshops, press releases, the production of promotional material such as flyers and posters, the establishment of links with other projects and users.

[28] https://www.uoa.gr/anakoinoseis_kai_ekdiloseis/proboli_anakoinosis/to_ekpa_syntonistis_se_protoporo_ereynitiko_ergo_technitis_noimosynis_gia_ti_diacheirisi_doryforikon_d/
[29] https://www.vista-geo.de/extreme_earth/
[30] https://www.vista-geo.de/en/extreme_earth-2/

APPENDIX

The ExtremeEarht Open Workshop Announcement

Polar TEP Virtual Workshop Announcement

Machine Learning for Operational Sea Ice Charting

May 5-6, 2020 in ESRIN, Italy

A joint workshop between the AI4Arctic project (ESA), the ExtremeEarth project (H2020), the Danish ASIP project and the ESA Phi-lab.

Objectives: *The workshop represents an initiative to improve automation in sea ice charting, bringing together domain experts within sea ice remote sensing and the AI community. The focus of the workshop is on the application of AI methodologies for downstream Sentinel-1 SAR data processing for automated sea ice information retrival. Two training datasets will be made available approximately two months before the workshop through the Polar-TEP website. These can serve as a common foundation for discussions, comparison of approaches, and future development within the community.*

Earth Observation has a unique role in monitoring the Polar Regions by providing consistent, repeatable, year-round and wide area coverage information. SAR sensors, such as Sentinel-1, have for many years proven useful in high resolution monitoring due to their capability of acquiring data independent of cloud cover and polar night. The physical principles of the SAR sensor, though, confront users with difficulties regarding proper interpretation and image processing of the SAR imagery. Within Polar remote sensing, the design of an automated method for retrieval of high-resolution sea ice information from SAR imagery is a problem that has been studied for many years. Challenges are the ambiguities that can occur in SAR imagery, e.g. similar backscatter from different ice conditions, varying backscatter from the ocean depending on wind speeds, and the presence of thermal and speckle noise in the SAR imagery. This means that ice charts are still produced manually by Ice Analysts that are skilled in interpreting the SAR (texture) signatures of ice and ocean.

Few applications in Polar Regions have yet taken advantage of deep learning (DL). DL techniques have proven their capabilities in the Computer Vision domain, and could prove to be very useful in interpreting the SAR image ambiguities and complex sea ice features. The use of AI techniques for data fusion of Sentinel-1 imagery with data from other satellite sensors that have complementary capabilities, such as microwave radiometers, provide additional and interesting possibilities.

Workshop Themes:

- Machine learning and AI techniques and architectures for improving automation of sea ice charting from EO data (SAR and microwave radiometer)
- Presentation and introduction of a sea ice datasets for training and testing of AI/D models
- Presentation of existing architectures and results of automation
- Preprocessing and denoising to make Sentinel-1 data analysis-ready
- Future developments and collaboration between AI and sea ice experts.

The workshop will be organized around keynote and contributed presentations with ample time for discussion. As the number of participants is limited, please provide a short abstract (or motivation for attending) in the registration form. As attendees are encouraged to make a contribution, please specify your preference for oral or poster presentation. Workshop participation is free, but participants should cover their own travel and accomodation expenses.

We appreciate your registration for the workshop not later than 2 March 2020 with a title and 5-10 line abstract for a proposed presentation/poster at https://nikal.eventsair.com/ai-for-sea-ice/registration. Participants will be contacted by 15 March 2020 regarding their proposed contribution. Registered participants will be given access to the workshop datasets in early March through the Polar-TEP platform for use there or to download to their own ML infrastructure.

The ExtremeEarth press releases in Greece and Germany

ΑΡΧΙΚΗ » ΑΝΑΚΟΙΝΩΣΕΙΣ ΚΑΙ ΕΚΔΗΛΩΣΕΙΣ »

ΓΕΝΙΚΕΣ ΑΝΑΚΟΙΝΩΣΕΙΣ

ΤΟ ΕΚΠΑ ΣΥΝΤΟΝΙΣΤΗΣ ΣΕ ΠΡΩΤΟΠΟΡΟ ΕΡΕΥΝΗΤΙΚΟ ΕΡΓΟ ΤΕΧΝΗΤΗΣ ΝΟΗΜΟΣΥΝΗΣ ΓΙΑ ΤΗ ΔΙΑΧΕΙΡΙΣΗ ΔΟΡΥΦΟΡΙΚΩΝ ΔΕΔΟΜΕΝΩΝ

15/04/2019

ΜΟΙΡΑΣΤΕΙΤΕ ΤΟ:

ΕΠΙΣΤΡΟΦΗ ΣΤΗ ΛΙΣΤΑ

Την εφαρμογή νέων μεθόδων της Τεχνητής Νοημοσύνης, για την επεξεργασία και διαχείριση δορυφορικών δεδομένων μεγάλης κλίμακας, φιλοδοξεί να αναπτύξει το ExtremeEarth, ένα καινοτόμο ερευνητικό έργο που χρηματοδοτείται με σχεδόν 6.000.000 ευρώ από το πρόγραμμα Horizon 2020 της Ευρωπαϊκής Ένωσης για την Έρευνα και την Καινοτομία. Το ExtremeEarth συντονίζεται από τον Καθηγητή Μανόλη Κουμπαράκη του Τμήματος Πληροφορικής και Τηλεπικοινωνιών του ΕΚΠΑ. Ο κύριος Κουμπαράκης είναι επίσης αντιπρόεδρος της Ελληνικής Εταιρείας Τεχνητής Νοημοσύνης.

Στο ExtremeEarth συμμετέχουν κορυφαία πανεπιστήμια και πρωτοπόρες εταιρείες με επιφανείς ερευνητές από τις περιοχές των Μεγάλων Δεδομένων, της Μηχανικής Μάθησης και της Δορυφορικής Τηλεπισκόπησης. Τα αποτελέσματα του έργου θα χρησιμοποιηθούν σε δύο κρίσιμες εφαρμογές: την Γεωργία Ακριβείας και την χαρτογράφηση περιοχών του Αρκτικού Κύκλου. Τα δορυφορικά δεδομένα που θα χρησιμοποιηθούν είναι από τους δορυφόρους Sentinels του Ευρωπαϊκού έργου δορυφορικής τηλεπισκόπησης Copernicus. Το έργο Copernicus παρέχει, μέσω των δορυφόρων του, ζωτικής σημασίας δορυφορικά δεδομένα έτσι ώστε να αναπτυχθούν εφαρμογές με μεγάλο οικονομικό αντίκτυπο στην Ευρωπαϊκή Ένωση, και να αντιμετωπιστούν κρίσιμα φαινόμενα για τον πλανήτη μας, όπως η κλιματική αλλαγή.

Ο συντονιστής του ExtremeEarth, Καθηγητής Μανόλης Κουμπαράκης, δήλωσε πρόσφατα: *«Με το έργο ExtremeEarth, αναπτύσσουμε τεχνολογίες Τεχνητής Νοημοσύνης που είναι κομβικής σημασίας για την Ευρώπη με δεδομένη την τεράστια επένδυση της Ένωσης στο έργο Copernicus. Περιμένουμε στο τέλος του έργου μας να έχουμε συστήματα που θα μπορούν να διαχειριστούν αποδοτικά petabytes δορυφορικών δεδομένων, κάτι που δεν είναι δυνατόν να γίνει σήμερα. Αυτά τα συστήματα θα είναι ικανά να εξάγουν αποδοτικά γνώση που είναι κρυμμένη στα δεδομένα και μπορεί να χρησιμοποιηθεί επιτυχώς σε πρωτοπόρες εφαρμογές».*

Ιστοσελίδα έργου ExtremeEarth: http://earthanalytics.eu/index.html
Twitter: @ExtremeEarth_EU

Καθηγητής Μανόλης Κουμπαράκης http://cgi.di.uoa.gr/~koubarak/
Ιστοσελίδα της ερευνητικής ομάδας του κ. Κουμπαράκη: http://kr.di.uoa.gr/

Δελτίο Τύπου

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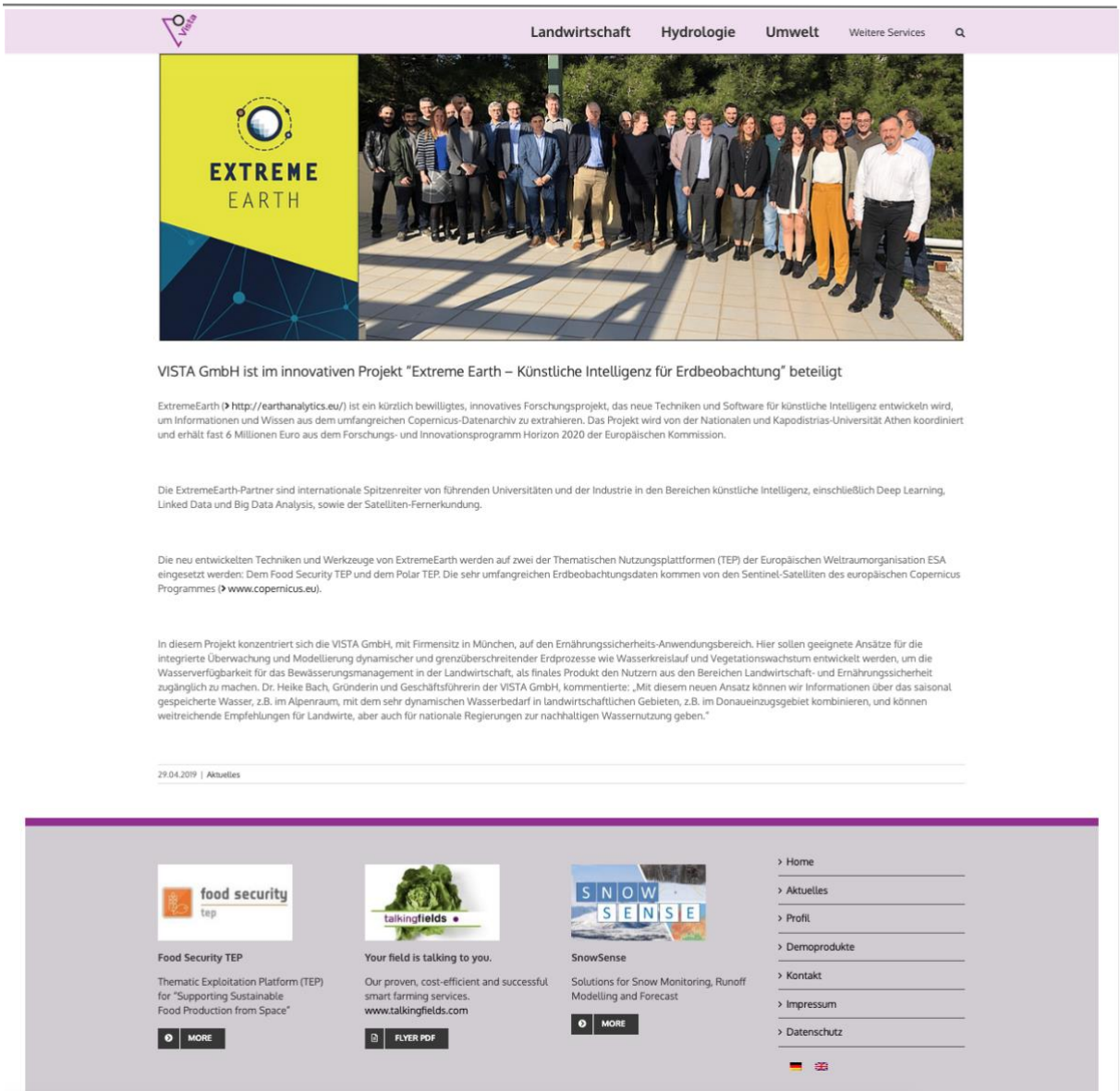

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EXTREME EARTH

VISTA GmbH ist im innovativen Projekt "Extreme Earth – Künstliche Intelligenz für Erdbeobachtung" beteiligt

ExtremeEarth (› http://earthanalytics.eu/) ist ein kürzlich bewilligtes, innovatives Forschungsprojekt, das neue Techniken und Software für künstliche Intelligenz entwickeln wird, um Informationen und Wissen aus dem umfangreichen Copernicus-Datenarchiv zu extrahieren. Das Projekt wird von der Nationalen und Kapodistrias-Universität Athen koordiniert und erhält fast 6 Millionen Euro aus dem Forschungs- und Innovationsprogramm Horizon 2020 der Europäischen Kommission.

Die ExtremeEarth-Partner sind internationale Spitzenreiter von führenden Universitäten und der Industrie in den Bereichen künstliche Intelligenz, einschließlich Deep Learning, Linked Data und Big Data Analysis, sowie der Satelliten-Fernerkundung.

Die neu entwickelten Techniken und Werkzeuge von ExtremeEarth werden auf zwei der Thematischen Nutzungsplattformen (TEP) der Europäischen Weltraumorganisation ESA eingesetzt werden: Dem Food Security TEP und dem Polar TEP. Die sehr umfangreichen Erdbeobachtungsdaten kommen von den Sentinel-Satelliten des europäischen Copernicus Programmes (› www.copernicus.eu).

In diesem Projekt konzentriert sich die VISTA GmbH, mit Firmensitz in München, auf den Ernährungssicherheits-Anwendungsbereich. Hier sollen geeignete Ansätze für die integrierte Überwachung und Modellierung dynamischer und grenzüberschreitender Erdprozesse wie Wasserkreislauf und Vegetationswachstum entwickelt werden, um die Wasserverfügbarkeit für das Bewässerungsmanagement in der Landwirtschaft, als finales Produkt den Nutzern aus den Bereichen Landwirtschaft- und Ernährungssicherheit zugänglich zu machen. Dr. Heike Bach, Gründerin und Geschäftsführerin der VISTA GmbH, kommentierte: „Mit diesem neuen Ansatz können wir Informationen über das saisonal gespeicherte Wasser, z.B. im Alpenraum, mit dem sehr dynamischen Wasserbedarf in landwirtschaftlichen Gebieten, z.B. im Donaueinzugsgebiet kombinieren, und können weitreichende Empfehlungen für Landwirte, aber auch für nationale Regierungen zur nachhaltigen Wassernutzung geben."

29.04.2019 | Aktuelles

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