

φ-week 2020 Sessions' Summary

4

Diego Fernandez Prieto Phi-Week Team

THE EUROPEAN SPACE AGENCY

Summary – attendance and engagement



()

Total number of attendees: 2108 Total meeting communications: 5876 Chat messages: 4934 Meeting requests: 942 Meetings held during event: 541

Engagement score: 19.9*

*baseline score for successful events = 15



*

Engagement & New attendees

Summary – Social Media Reach
 YouTube



The Φ-week increased x3 times the traffic on the EO_Open_Science YouTube channel during September 2020:

		Channel analytics						
	eesa	(i)	got better. See when your audience is onl get data just minutes after you wrap up yo					cesa
	Your channel EO Open Science	Overview Reach Enga	igement Audience					Your channel
÷	Dashboard							EO Open Science
ş	Videos	Views are up! Yo	our channel got 16,1 last 28 days.	43 views in the			5	Dashboard
÷	Playlists		174 A.	121				Videos
1	Analytics	That's more t	than the 5,300–6,600 your channel usually gets.				Ξ,	Playlists
1	Comments	Views	Watch time (hours)	Subscribers			16	Analytics
E	Settings	16.1K 🕤	431.3 💿	+162 0			E	Comments
	Send feedback	9.5K more than usual	176.3 more than usual	100 more than usual			\$	Settings
=	YouTube ^{NC}	Search	٩	d III 🖉 🥌				Send feedback
ŧ								
Home	VIRTUAL	Cesa EVENT	ESA EO Φ-Week 2020 - Virtual event - Intro EO Open Science		~~~		2	
rending			20	2 videos	s upload	ded 4,30		
acriptio	28 September - 21	The second	89 EO Applications-1, Extreme Event Manage EO Open Science	gement	Pla	aylist wa	s live fr	om 01/
LD .8rary	ESA EO Φ-WEEK 2020 - 28 September - 2 October 31 Al4EO Methods, Algorithms-1,Intelligent Sampling for Retrieval of Crop					Top playlist , 60	ot . 600	/ ronki
	2020 202 videos · 4,367 views · Updated 2 days ago				10	Top playlist : 60% ranki		
	Public *	=	211 EO Platforms, Infrastructure-2, Peta-Pi Federation	xels United: the EarthServer				
	X A	WATCHED 5:37	EO Open Science				100	6-11

	cesa	(1)		ytics just got better. S ams, and get data jus		
	A Mail A	Overview	Reach	Engagement	Audience	
	Your channel EO Open Science	SEE MORE				
	eo open science	SEE MORE				
-	Dashboard					
	Videos	Top play Watch time	lists - Last 28 day:	s		
Ξ,	Playlists	F04 F0 + 1	FFV 0000 0	0.Cont		10.00
	Application	ESA EO Φ-V	VEEK 2020 - 2	8 Sept		60.6%
	Analytics	9th Advance	ed Training Co	ourse o	_	30.6%
1	Comments	EO and AI fo	or Health and	Urban		3.4%
2	Settings	Ф-week 201	9 (9-13 Septe	mber		3.1%
	Send feedback	EO OPEN S	CIENCE 2017	ESA-E	1	1.2%

÷

- 367 views between 28 Sept. 02 Oct. /09
 - king

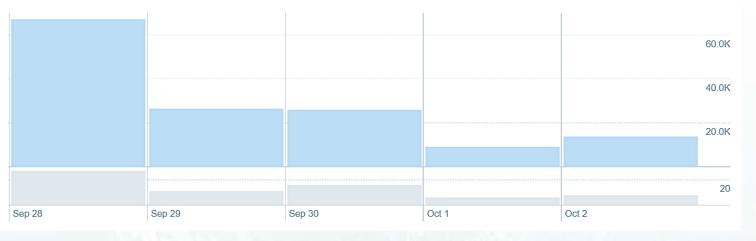
→ THE EUROPEAN SPACE AGENCY

Summary – Social Media Reach



Twitter Engagement during the Φ -week 28/09 to 02/10

Your Tweets earned 142.4K impressions over this 5 day period



Top Tweets (based on nr of impressions)

EO OPEN SCIENCE @EO_OPEN_SCIENCE	Impressions	5,968	Artificial Intelligence is the new ingredient': announces @AschbacherJosef @ESA_EO Director. "The #digitaltwin earth aims at combining observations, modols, observations & #Al to	Impressions	11,525	Phisal-1 - a satellite with #Al on-board porforming doud mask in Space! This experiment announced two years ago at #phiweek was an important experiment to understand & start exploring the potential of	Impressions	9,496
IDo not miss the @ESA_EO #phiweek poster session at 16:30 book your meeting to interact connect and network with	Total engagements	42		Total engagements	232		Total engagements	399
scientists, educators, developers, students, start-ups, global industries and institutions in the field of space! your video	Likes	11		Media engagements	65		Media engagements	178
available // https://inkd.in/dwfVdW3	Detail expands	10		Likes	51		Detail expands	84
	Link clicks	9	allow us to predict or simulate elements of our planet 🔴 🕥	Detail expands	50	#AI, deep learning and processing in Space. http://phiweek.esa.int	Likes	48
Reach a bigger audience	Profile clicks	6	Follow live http://phiweek.esa.int	Link clicks	25	pic.twitter.com/hIK7G1MBT1	Retweets	30
Get more engagements by promoting this Tweet	Retweets	5	pic.twitter.com/kdzGySTpQN	Retweets	22		Link clicks	26
COLUMN THE OWNER	Hashtag clicks	1		Profile clicks	18	Reach a bigger audience	Profile clicks	26
Get started	i too nog snorte		Reach a bigger audience	Replies	16 7	Get more engagements by promoting this Tweet!	Hashtag clicks	7

÷

Main announcements

Φ-sat-1 launch and commissioning

On 3 September, the worldwide first artificial intelligence technology carried onboard a European Earth observation mission, ϕ -sat-1, was launched from Europe's spaceport in French.

ESA, along with Cosine remote sensing, are happy to reveal the first ever hardware-accelerated AI inference of Earth observation images on an inorbit satellite - performed by a Deep Convolutional Neural Network, developed by the University of Pisa.

Quantum computing

Josef Aschbacher made a special announcement regarding an exciting new ESA initiative, the "EOP AI-enhanced Quantum Initiative for EO -QC4EO" in collaboration with the European Organization for Nuclear Research (CERN).

The initiative will be developed at the Φ -lab at ESRIN and involves creating a quantum capability which will have the ability to solve demanding Earth observation problems by using artificial intelligence to support programmes such as Digital Twin Earth and Copernicus.



•

Intel Powers First Satellite with AI on Board

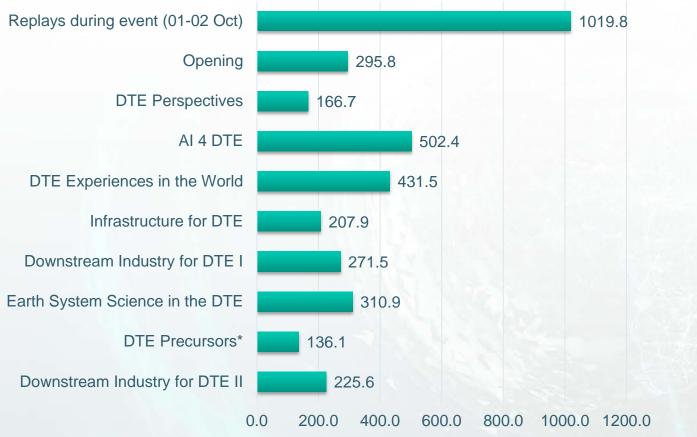




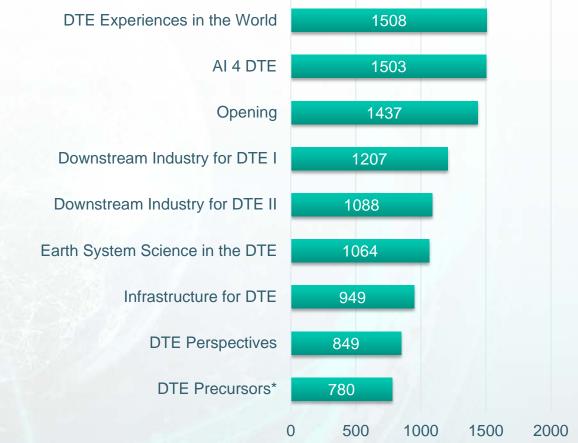
Summary – Audience Distribution per session



Cumulated audience time (in hours)



Number of live views



*

→ THE EUROPEAN SPACE AGENCY



	MONDAY		TUESDAY		WEDNESDAY
09:30 - 11:00	OPENING SESSION break	09:30 - 11:00	Infrastructure for DTE break	09:30 - 11:00	Downstream Industry for DTE - II break
11:10 - 12:10	DTE Perspectives break	11:30 - 13:30	Downstream Industry for DTE - I break		
12:20 - 13:50	AI for DTE break	14:30 - 16:00	Earth System Science in the DTE break		
14:30 - 16:00	DTE Experiences in the World break	16:30 - 17:30	DTE Precursors break		
16:30 - 18:00	POSTERS	17:30 - 18:30	POSTERS		

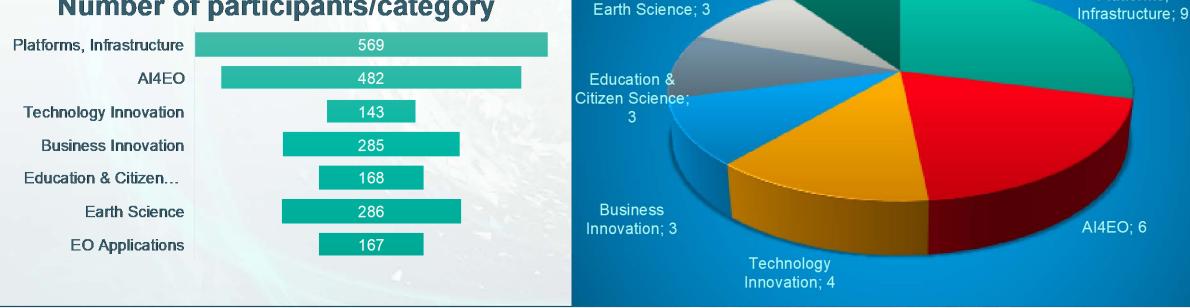
- || = 🔚 🚍 || || || = = 🔚 🛏 🔯 || = = = = 🖬 🛨 💥 🖕 |||

Side Events - Statistics



- 28 Side Events were organised as parallel sessions.
- Recordings will be made available on the Brella platform by 30 October 2020
- Most popular Side Events:
 - Earth Observation: Innovation & Entrepreneurship (146)
 - Al for understanding processes in intertwined Earth System Dynamics (145)
 - AIREO: AI-Ready EO Training Datasets (128)

Number of participants/category



EO Applications;

*

Platforms.

Al for Digital Twin Earth



- Al is a powerful tool that becomes critical to make sense of big EO data, it has also limitations (e.g. training data, explainability)- Europe has a unique opportunity now to catch up with developments in China and USA in particular on downstream science and applications with AI, it is important not to miss the AI train
- AI@edge is becoming mainstream for IoT, sensors are becoming increasingly connected and smarter, it is also happening at the ultimate edge - in space - with first demonstration with Φ-sat1. Again Europe can take the lead in developing the new generation of "AI-powered sat" that can open new avenues for IoT and distributed computing in space.
- Integrating of physics and statistics is critical for making the most of AI and EO, and pave the way towards physics-aware DTE
- More research is needed to show the power and limitations of AI, in particular to increase trust to accelerate uptake by increasing the explainability of the algorithms. AI4EO will focus on some of this priorities.

-



- Session replay: <u>https://youtu.be/Bw31IS4-Y1E</u>
- Need to conduct a suite of Research and Innovative activities aiming to accelerate the evolution of technical capabilities of European AI4EO research and industry.
- Ongoing development of a suite of Al4EO challenges, addressing data scientists and innovators, e.g. ESA-funded "Al4EO challenges" project (https://ai4eo.eu/). A new Al4EO dedicated platform for challenges will be built. A set of minimum 3 challenges will be organised in 2021, and the first one will address the downscaling of air quality products to deliver surface concentration maps of PM2.5 and NO2 of a higher resolution than SentineI-5P satellite data and the CAMS products. The need was highlighted by ECMWF and UNEP via its Global Environment Monitoring System for Air (GEMS Air) program. Thanks to the support of sponsors (among other Airbus, Wekeo or NVIDIA), the winner of each challenge can earn up to 30.000€ in prize (cloud, GPU, VHR imagery...)
- Two pitches were presented: one about the Pi School project and one by the Frontier Development Lab highlighting various AI4EO case studies (cloud classification, aerosol modelling, on-board flood segmentation, flood and time-to-inundation prediction, hydrology mapping, ...)

Digital Twin Experiences in the World



- DTE can enable shorter turnaround for science and accelerate rate at which science results are being fed into societal challenges
- DTE as enabler of science should support various IDEs and APIs, on-the-fly cloud based simulations for Earth Science, with HPC at core. DTE as an enabler of business should be an information system for business risk quantification and compliance with regulations.
- Synergy between simulations and data visualisations are key to improve the understanding of Earth System and complex processes in the DTE. Interpretability can be supported in the DTE by providing tools for model inspection and for comparisons between observation and prediction. DTE should enable model testing with NRT data feeding into the system. Training data should be part of the code. Good DevOps, CI/CD management is required to keep versioning of data, model and algorithm
- Biggest potential for innovation: looking at cause-effect relationships, AI to learn closed relationships and causality, including sensor data, EO data and physical models, with multi-scenario capability

Infrastructure for Digital Twin Earth



- There are public data and commercial data that have to contribute and that will never happen to be on a single infrastructure: data/algorithm owners have different preferences on where they are ready to share their assets
 - A federated opne approach is needed
 - A hybrid approach is needed (free contributions by public bodies, paid contributions by commercial actors)
- Analytics capabilities on top of infrastructure make the difference to get value out of data
- The most effective way to involve commercial infrastructure is to create a «pull»; public investment should focus on buying commercial services and use them; committed consumption is needed to keep the infrastructure alive and in particular to allow industry to set off the storage costs
- Research needs "free-at-point-of-use" access to commercial infrastructures
- Standards are needed, but will take time; this should not obstacle quick technological advance in providing new capabilities to the community

Earth System Science in the Digital Twin Earth



While significant efforts should be mobilised to achieve a quantum leap in infrastructures capabilities to realise the DTE vison, an equivalent parallel effort shall be dedicated to address the major scientific challenges. 4 main domains...

Advanced Earth system science and process understanding

68%

Enhanced representation of human activities as part of the Earth system including related feedback mechanisms at actionable time and space scales. This shall account for human impacts (e.g. emissions) and incorporate socio-economic data into the analytics

Advance EO data and data-driven process description

A sound integration of multiple heterogeneous data sources (satellite-based products, in-situ, citizen observations) into a coherent multi-variate and multi-temporal data structure, consistent across variables, accounting for spatio-temporal covariation

77 %

Advance modelling and data assimilation

Advance data assimilation methods to make sure that models can ingest novel information available from classical and new types of observations

52 %

57%

• Advanced AI as a tool for Earth system science

The development of hybrid approaches to combining AI and physical modelling balancing between deriving parameters from first principles and learning directly from the data Enhanced representation of the biological and ecosystems component as part of the Earth system including the related feedback mechanisms at actionable time and space scales between the physics and the biology

A new generation of multi-variate consistent and integrated EO datasets that comprehensively describe the Earth system, its natural and anthropogenic processes at spatial and temporal resolutions suitable for environmental management and policy making

Fostering an effective integration of advanced models, cutting edge AI methodologies and the latest EO observations capabilities to achieve high performance simulations at extreme scale

48 %

55 %

55 %

Harnessing the power of AI to reveal the latent structure of physical variables that may not be directly observable / measurable through current remote sensing and can be revealed through simulations and numerical models



- Session replay: <u>https://youtu.be/jlwoI9MKCqY</u>
- Equip ESS against naive applications of AI methods: machine learning models are weak in extrapolations and many recent high-impact papers. Identifying when machines operate in extrapolation regimes is important, but quantifying what's the extrapolation level (and how to address it) is a big challenge nowadays.
- Learn from AI what we don't know from first principles: Where physical knowledge is incomplete, latent variables in some Deep-Learning model may compensate. Ground-truth data-sparsity emerged as one caveat limiting the potential of such learning approaches. AI can be used to learn Ordinary Differential Equations (ODEs) underlying some complex system from observing its temporal dynamics. "Reverse Engineering" and "Automated Machine Scientists" are the keywords in this context.
- Towards causal inference from Earth observations: methods in the domain of causal inference have huge potential but are in their infancy and represent a clear frontier of science that needs to be pushed further
- Three key pathways to develop: hybrid modeling, explainable AI, causality, based on active interdisciplinary collaboration between computer scientists and domain experts



- Session replays: Morning https://youtu.be/7SfKtXHI9t4, Afternoon https://youtu.be/7SfKtXHI9t4, Afternoon https://youtu.be/7SfKtXHI9t4, Afternoon https://youtu.be/7SfKtXHI9t4, Afternoon https://youtu.be/7SfKtXHI9t4, Afternoon https://youtu.be/qj7bJJFFstg
- A comprehensive digital representation of the ocean, based on interoperable and trusted real-time and historical data from a wide range of sources, state of the art modelling (Physics, Sea Ice, Biogeochemistry, Ecosystems), coupling and data assimilation and visualisation tools
- A 5-dimensional DTO (Ocean5D): 1 temporal dimension, 3 spatial dimensions, 1 societal dimension
- **DTO for Ocean Health**: includes biodiversity and ecosystem function, allows streamlined sharing through open-access databases of biodiversity and ecosystem data, provides a virtual reality showing the impact of human interactions on Ocean health and allow for the testing of "what if scenarios".
- Building blocks: observations (smart sensors, Internet of Things, adopting Sensor Web Enablement (SWE) supporting FAIR, citizen science, crowd sourced data), existing projects and activities (e.g. Blue-Cloud), Copernicus Marine Service, HPC and cloud infrastructure, state of the art modelling, coupling and data assimilation, user interaction and user engagement

Downstream Industry for the DTE



- Main opportunities that the Digital Twin Earth Development can bring to organisations and companies:
 - Scaling up from regional and continental applications and developments to global analyses
 - Global collaboration with partners and close involvement of end users, stronger collaboration linking capacities in algorithm development and solution building to integrate the current and upcoming science results into global solutions for society, PPPs to foster collaborations towards using data for commercial purposes as well as to serve societal needs e.g. for densely populated coastal areas
 - From the data providers perspective: opportunities for data fusion, analytics across different data, use
 cases for super-resolution; there is a huge gap in the data creation side, with currently limited systems that
 capture the 3D nature of the processes. Another substantial gap is in the validation and training data which
 are very costly to collect. Consolidation is needed focusing on data resolution and quality.
 - From the operational user perspective: Informational access to the latest developments and state-of-the-art solutions with potential to be adopted in the operational chain

Downstream Industry for the DTE EO Innovation and Entrepreneurship – InCubed side event



- Commercial EO is in the middle of a perfect storm where different worlds are colliding. New technologies, new approaches are entering the sector attracting new players and new investment
- The event focused on different perspectives: Institutional, innovative enablers, Industrial growth, the investors perspective, an industrial video pitch competition and an Investors roundtable discussion
- Speakers came from the φ-Lab, InCubed, ESA Business Applications, ESA Business Incubation, the European Commission (DG-DEFIS), Copernicus Masters, EU PARSEC Accelerator, Euroconsult, EARSC, Grenoble Institute of Technology and Eversis.
- The video pitch winners (chosen by the investors) were: SAT4Flood (InCubed) and Dipteron (PARSEC)
- Representatives from industry: Geoville, TechWorksMarine, Unibap, Cosine, Open Cosmos & Mbryonics and many others
- Representatives from Investor entities include Seraphim Capital, EBAN, LVenture & Fondazione Amaldi
- Key messages: Newspace reaches out beyond space, value chains are critical. Earth observation is a passive term and the Newspace sector is active so a change in language may be needed. To grow businesses transformational deals are needed. Identify the problem to be solved first before developing the solution. Commercial EO has customers not users. SDGs are a potential growth area in the coming years.
- Conclusions: The event attracted a lot of attention over 50 people participated online for the whole day. It
 generated a lot of interest in the InCubed programme and we aim to repeat this type of event on an
 annual basis. A number of companies expressed interest (international & European)

WE'RE LOOKING AT WHAT HAPPENS WHEN WORLDS COLLIDE.

QUOTEHD.COM

*

17

Quentin Williams

e-Posters



- 202 e-posters were presented at the Φ-week 2020.
- Poster presentations are available openly on the EO_Open_Science YouTube playlist
- Poster abstracts are available on the Brella platform The posters were addressing topics from the following
 - categories:
- Products, Projects, Initiatives
- Earth Science
- DTE Precursors
- AI4EO
- EO Applications
- Platforms & Infrastructure
- Technology Innovation
- Education & Citizen Science

97 - Procedure Outline for Desert Sand Dunes Displacement Detec EO Applications Part 1 Time-Series Analysis of Sentinel-2 Imagery Come meet us on Monday, 28 September 16.30 - 18.00! Website LinkedIn Twitter

eesa 97 EO Applications-1, Procedure Outline for Desert Sand Du... Vizioneaza — Trimite

- ✓ Conceive an experimental procedure to investigate desert sand dunes displacements through the exclusive use of multitemporal Sentnel-2 imagery
- ✓ Provide informational support to several construction engineering operations that require planning of mitigation measures to prevent undesired windblown sand interactions with infrastructures in the desert environment
- ✓ Outline benefits deriving from the systematic use of cutting-edge GIS technologies and data by leveraging Free MAI MULTE VIDEOCLIPURE of tware

► ► YouTube []

Company Details

Authors: Daniele, Oxoli, Politecnico di Milano; Maria Antonia, Brovelli, Politecnico di Milano; Diego, Frizzi, Saipem S.p.A.; Stefano, Martinati, Saipem S.p.A.

Abstract:

###