

# AI for Earth Monitoring MOOC

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**Mark Higgins** - *Training manager*

*11 October 2021*







The banner features a central image of Earth with a digital grid overlay. To the right, four circular icons represent monitoring categories: Marine Monitoring (fish), Atmosphere Monitoring (globe), Land Monitoring (bar chart with leaf), and Climate Change (thermometer). The text 'AI FOR EARTH MONITORING' is prominently displayed in the center-left. The email address 'emob@ggew.de' is visible near the globe. Logos for Copernicus, WEKEO, and the European Union flag are at the bottom left. The 'IMPLEMENTED BY' section includes logos for EUMETSAT, Mercator Ocean International, ECMWF, and the European Environment Agency.

**Copernicus**  
Europe's eyes on Earth

## AI FOR EARTH MONITORING

[emob@ggew.de](mailto:emob@ggew.de)

Marine Monitoring

Atmosphere Monitoring

Land Monitoring

Climate Change

**WEKEO**  
BY COPERNICUS

**Copernicus**  
Europe's eyes on Earth

IMPLEMENTED BY

**EUMETSAT** **MERCATOR OCEAN**  
INTERNATIONAL **ECMWF** **European Environment Agency**



The story behind the experience

AI FOR EARTH MONITORING

operarius Europe's eyes on Earth

Climate Change  
Land Monitoring  
Atmosphere Monitoring  
Marine Monitoring

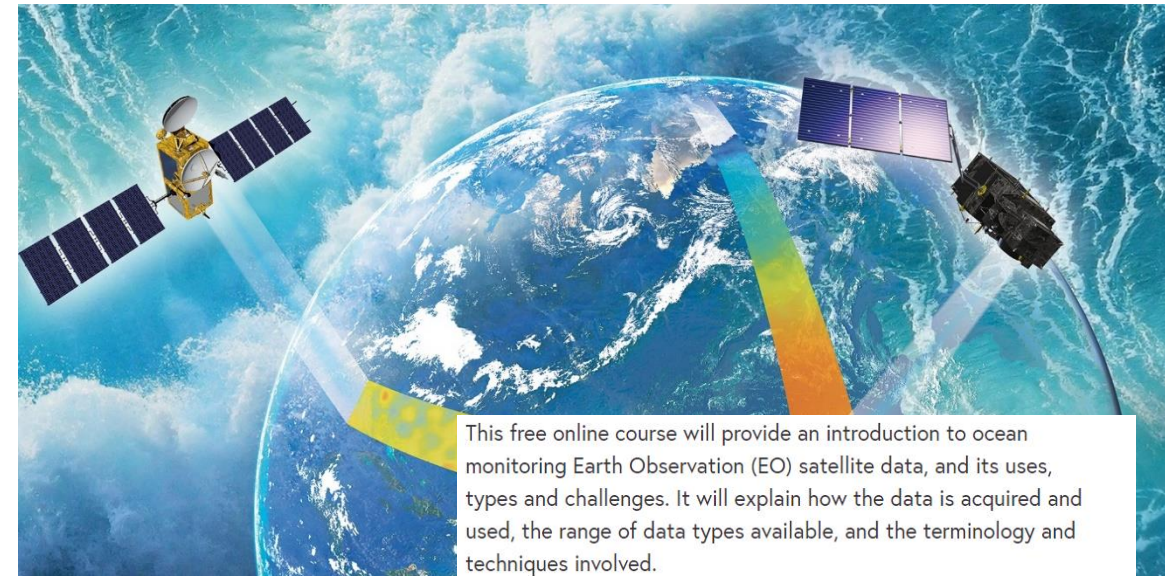
operarius  
EUROPEAN UNION  
WIKED

IMPLEMENTED BY

EUMETSAT  
INTERNATIONAL OCEAN MERCATOR  
ECMWF  
European Environment Agency

The graphic features a central globe with a blue and green color scheme, surrounded by icons for Climate Change, Land Monitoring, Atmosphere Monitoring, and Marine Monitoring. The text 'AI FOR EARTH MONITORING' is prominently displayed in white, with 'operarius Europe's eyes on Earth' above it. Logos for operarius, the European Union, and WIKED are shown in the middle. At the bottom, logos for EUMETSAT, International Ocean Mercator, ECMWF, and the European Environment Agency are listed under the heading 'IMPLEMENTED BY'. A central text box contains the phrase 'The story behind the experience'.

- **Copernicus Oceans MOOC (2017)**
- 5 week course - 2 runs FutureLearn – total 9k participants
- Strong support from users
- Weekly feedback- YouTube - community answer Qs
- <http://www.oceansfromspace.org>



This free online course will provide an introduction to ocean monitoring Earth Observation (EO) satellite data, and its uses, types and challenges. It will explain how the data is acquired and used, the range of data types available, and the terminology and techniques involved.

The course is presented by physicist, oceanographer and broadcaster Dr Helen Czerski from University College London,

[Read more](#)



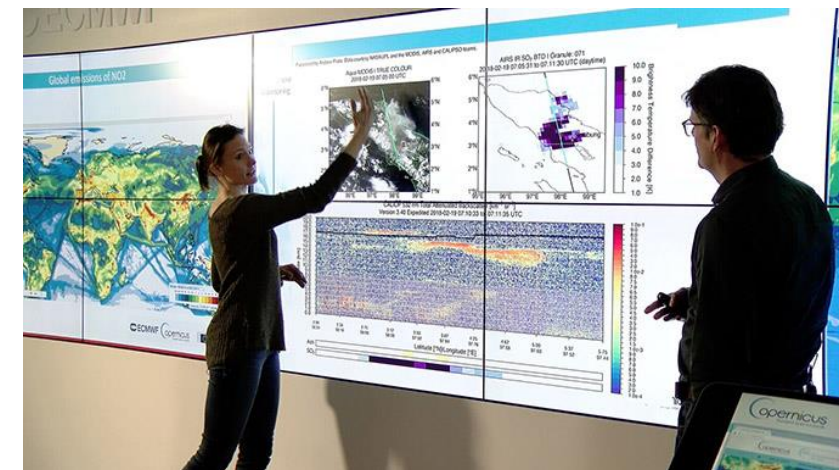
[View transcript](#)

Download video: [standard](#) or [HD](#)





- **Copernicus Atmosphere MOOC – jointly with CAMS (2019)**
- Single run on FutureLearn (3.5k people) then onto standalone site
- Live weekly feedback- on Facebook
- Linked to a Copernicus hackathon in Finland (#AtmosHack)
- [www.atmospheremooc.org](http://www.atmospheremooc.org)





## Copernicus Massive Open Online Course (2021)

Topic - Artificial intelligence techniques & Earth monitoring with Copernicus data (via WEKEO)

Partners: ECMWF, EEA, Mercator Ocean Int

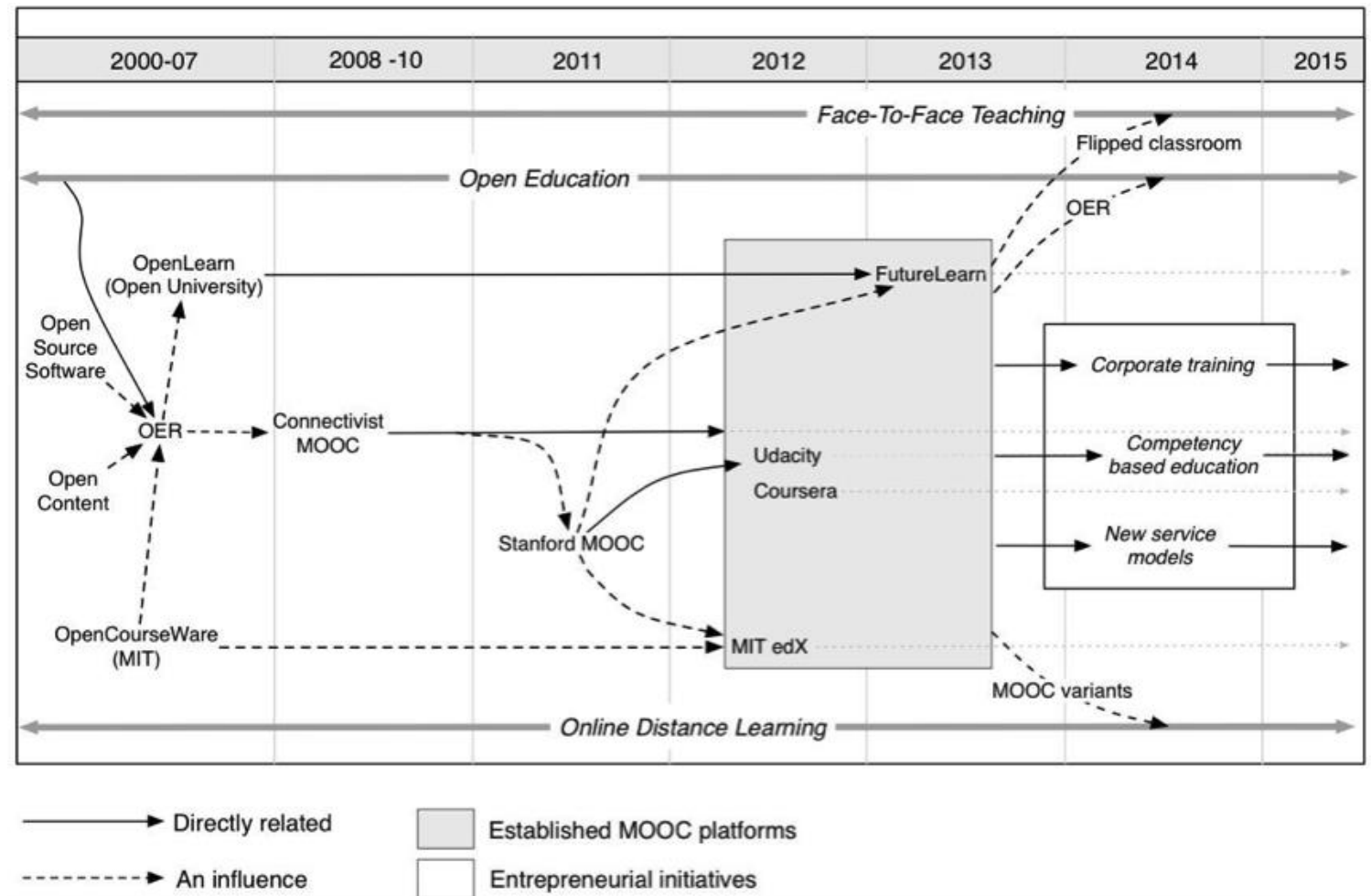
Free to access – upgrade for certificate





# There are many ways to MOOC

- MASSIVE – many people
- OPEN – open to many with / without connectionist approach
- ONLINE – may or may not be in a site (#)
- COURSE – or learning experience



- Connectionism: build connections between existing and new knowledge, practice the new knowledge in context with students who are ready for the experience
- Merrill – principles of instruction:
  - Learning is **problem-centred** and learners are engaged in solving real-world.
  - Existing knowledge is **activated** as a foundation for new knowledge.
  - New knowledge is **demonstrated** to the learner.
  - New knowledge is **applied** by the learner.
  - New knowledge is **integrated** into the learner's world.
- Many MOOCs become “engaging information sharing” – maybe with a quiz for to test recall. Trying out the new knowledge, using it is a challenge.





- Many (1,000+) participants take the course at the same time
- Participants are global and diverse.
- If we allow for / enable connection people can help each other, much faster than teachers 😊
- The role of teacher changes – instructor *presence* still matters
- What does it mean for the participants to be a community ( we come back to this later)



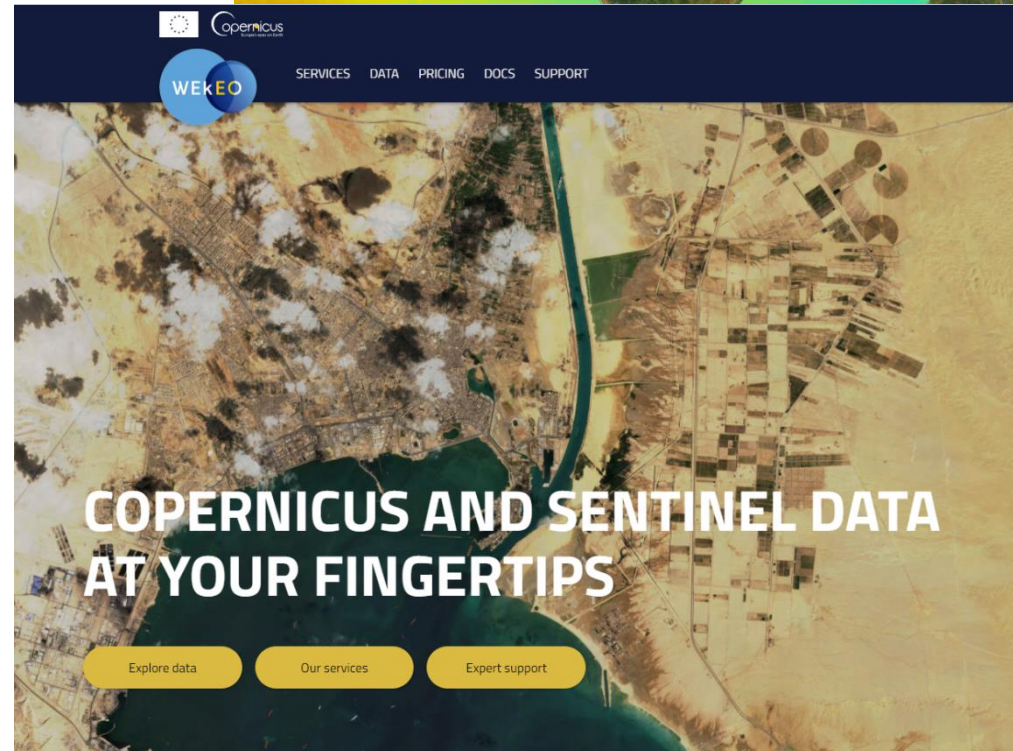
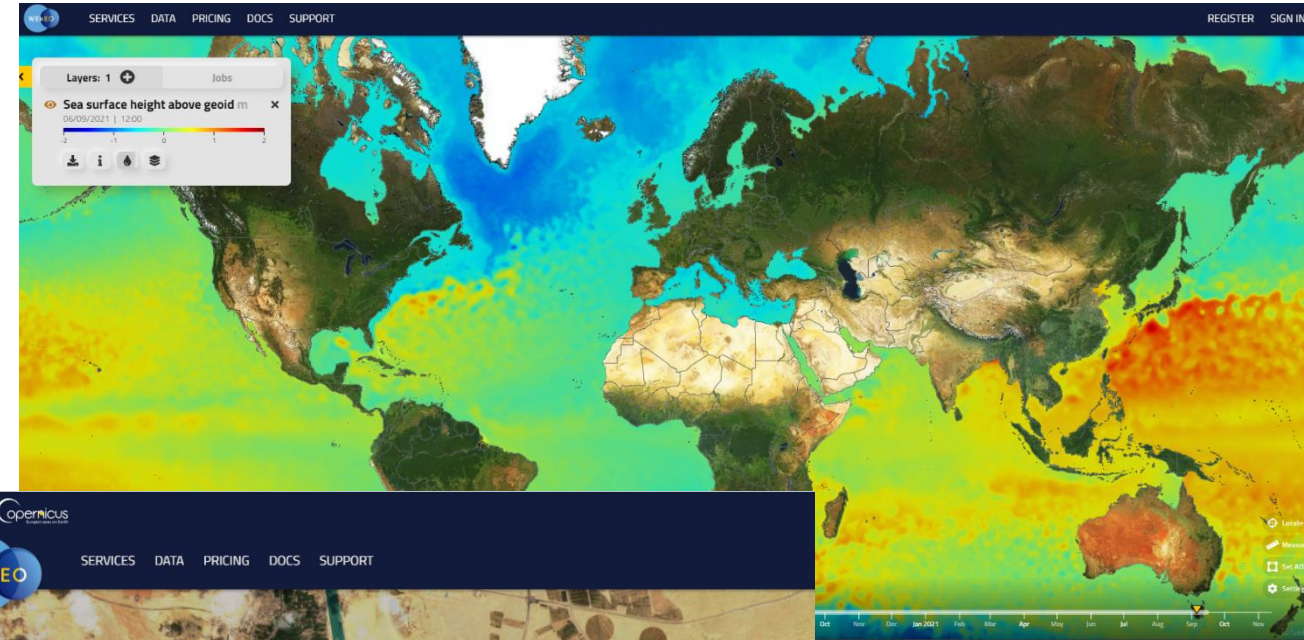
- What do I do ?
  - It is easier to create a passive, “information consumption” MOOC
  - Integration of learning requires doing stuff – creating “artefacts” and ideally getting feedback on the artefacts.
  - But ... doing stuff can lead to chaos – we want the “right” amount of chaos.
- Do I belong ?
  - The massive nature of the community means lots of discussion, with people having various levels of knowledge. It is really important to help people feel welcome and able to speak – creating a positive emotional space
  - People may identify that they need more skill to take part – this is ok – even better if they feel supported and validated





## Aims

- Introduce big audience to Copernicus data and how to access it via WEkEO
- Provide examples to help people work with machine learning and Earth monitoring data
- Increase WEkEO users



- Credibility – many MOOCs available
- Important to get good team of educators
- Course developed by Imperative Space, Frontier Development Lab, Munich TU FutureLab (AI4EO.de) and Univ Rome, PML & NCEO

## Who will you learn with?



**Mark Higgins**

I am an educator, meteorologist and change agent working for EUMETSAT: Europe's weather and climate satellite organisation.



**Fabio Del Frate**

Professor of Remote Sensing at University of Rome "Tor Vergata"



**Xiaoxiang Zhu**

Professor for AI and Data Science in Earth Observation at the Technical University of Munich (TUM) & Department Head "EO Data Science", German Aerospace Center (DLR).



**Paolo Ruti**

Chief Scientist at EUMETSAT



**James Parr**

Director of the Frontier Development Lab



**Lauren Biermann**

Earth Observation Scientist at Plymouth Marine Laboratory



**Julia Wagemann**

Building up digital capacities and



**Ben Loveday**

Oceanographer & remote



**Hayley Evers-King**

Marine Application Expert



## Course structure...

6 week course (estimate 3-4 hours a week)

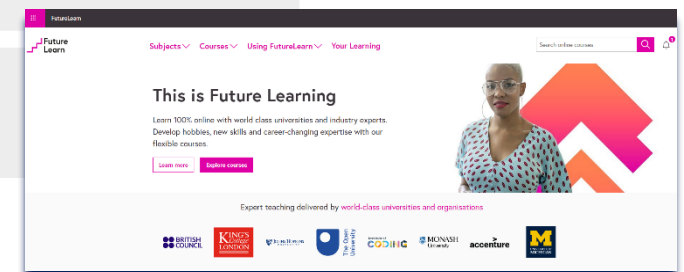
Overall topics - Copernicus, AI, land, oceans, atmosphere and climate

Over 40 individual contributors and >50 videos

Main course on FutureLearn (13 mil users) & practical examples on WEkEO

## Syllabus

- Week 1 Introduction to Copernicus  
[Show weekly breakdown](#)
- Week 2 AI and Machine Learning with Copernicus Data / Services  
[Show weekly breakdown](#)
- Week 3 Monitoring the Land  
[Show weekly breakdown](#)
- Week 4 Monitoring the Oceans  
[Show weekly breakdown](#)
- Week 5 Monitoring the Atmosphere  
[Show weekly breakdown](#)
- Week 6 Climate Monitoring  
[Show weekly breakdown](#)



## Week 4: Monitoring the Oceans

### Introduction to Week 4

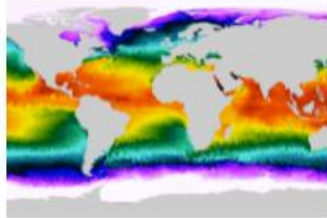
An introduction to Week 4!



4.1 Introduction to Week 4 VIDEO (01:21)

### Topic 4a - Introduction to Monitoring the Ocean

An introduction to monitoring the oceans.



4.2 Topic 4a - Introduction to Monitoring the Ocean VIDEO (07:35)

### Topic 4b - Tracking Ships

In this topic you will look at how AI and ML can help with ship tracking.



4.3 Topic 4b - Tracking Ships VIDEO (02:27)

4.4 Topic 4b: Jupyter Notebook Task - AI for Ship Classification VIDEO (24:05)

The screenshot shows a Jupyter Notebook interface with a file browser on the left and a code editor on the right. The code defines a function to display NDVI for a specific area of interest (AOI) in northern Corsica. It uses `rio.open` to load a masked NDVI dataset, `plt.subplots` to create a figure, and `az.imshow` to display the data with a 'BuGn' color map. The resulting plot shows a green and white map of the AOI with a color bar on the right ranging from 0.3 to 0.8.

All 18 Jupyter notebooks running on WEkEO - plus videos





## Marketing - main audiences for MOOC?

- General - introduce people to Copernicus and AI and how being used...
- Data scientists – aim to help people work with machine learning & Earth monitoring data...





## How did we contact audience?

Web/social media promotion on EUMETSAT/MOI/EEA/ECMWF channels

DG DEFIS – Copernicus networks

Existing networks – EUMETSAT, ECMWF, Mercator Ocean, EEA

Targeted promotion to data science Communities....







## Frankfurt Data Science/Qemie outreach

Global search for data science groups and influencers...

Then contacted as data science group

Thousands groups but difficult to break into – careful handling

Best results on Reddit

### Channel

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### Outreach

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Meetup.com

22 communities

Facebook

250 groups, 300 community pages, 1390 users

LinkedIn

435 groups, 100 users

Twitter

80 accounts

Reddit

110 subreddits

Instagram

330 accounts

Telegram

20 channels, 30 accounts

Slack

22 sub/channels

Discord

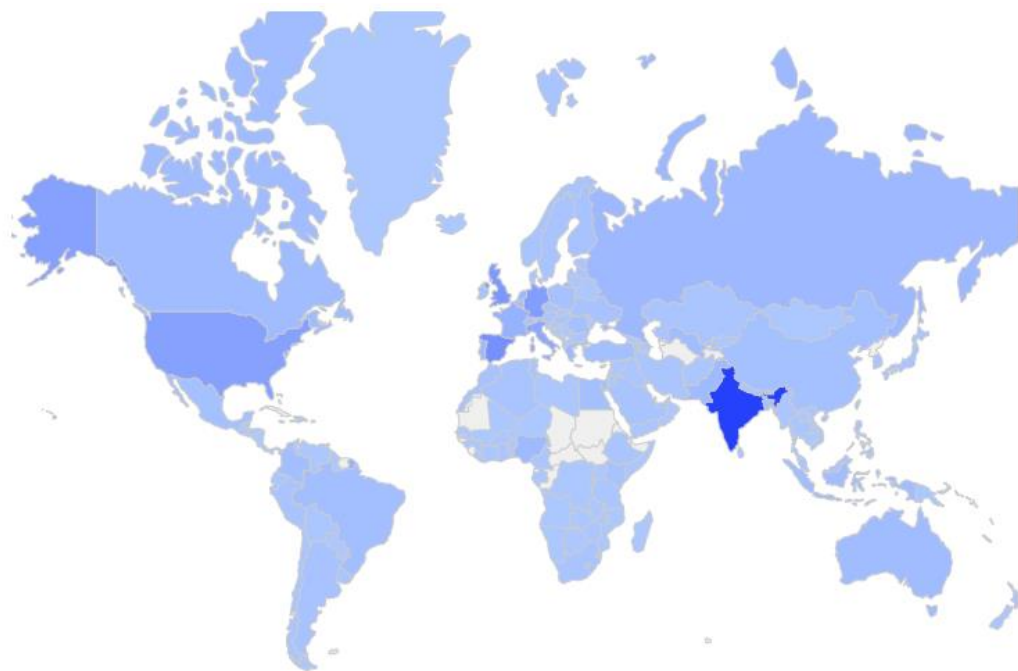
310 sub/channels

Frankfurt Data Science onsite event

45 participants onsite  
61 online via livestream

## To date - **>9800** registrations to date for the MOOC

Artificial Intelligence (AI) for Earth Monitoring - 18 Oct 2021

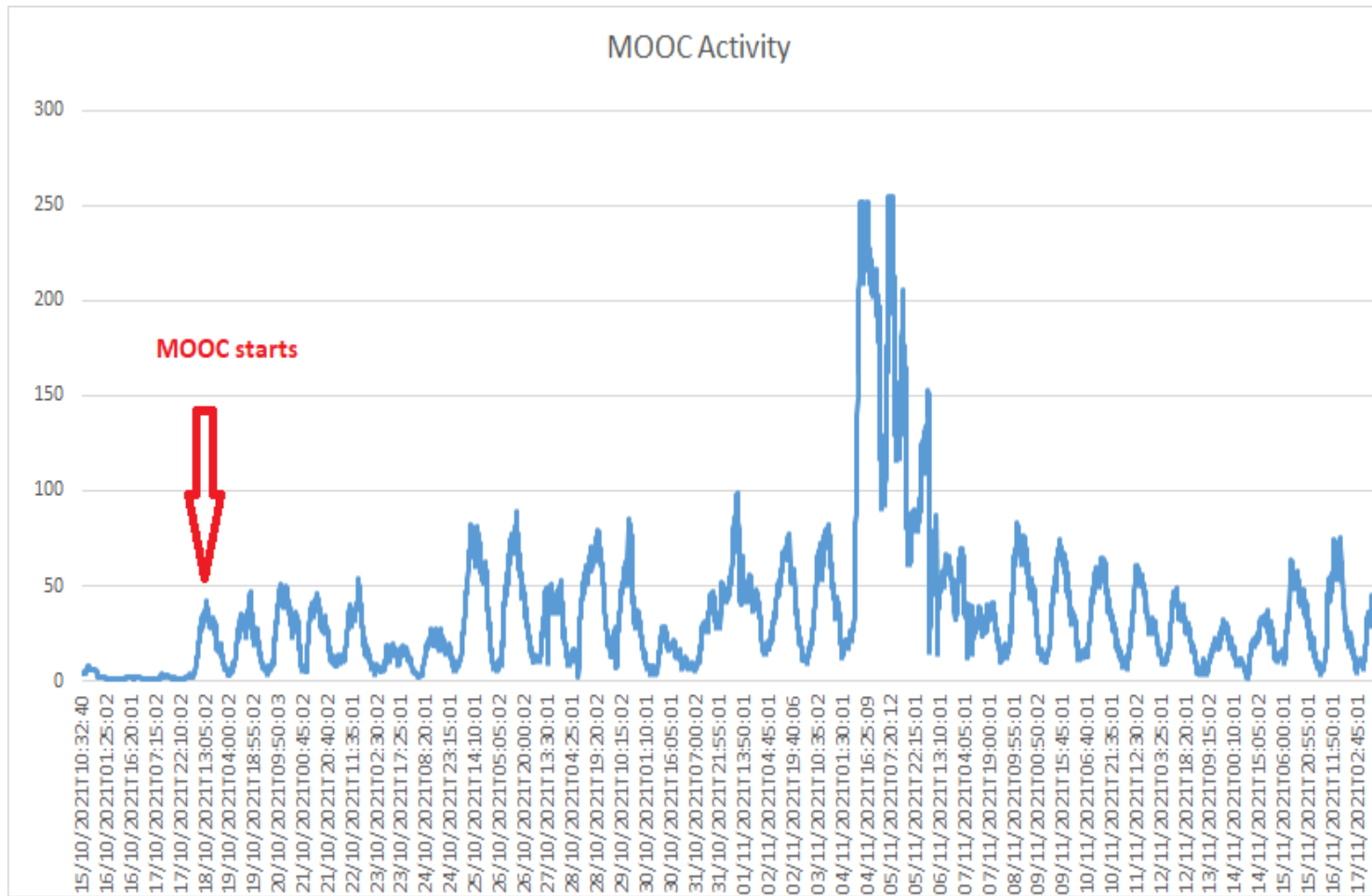


### Enrolments by age range

ⓘ Average

<18	2%	2%
18-25	19%	25%
26-35	23%	27%
36-45	12%	16%
46-55	12%	10%
56-65	8%	7%
>65	7%	5%
Unknown	17%	7%

>5000 new WEKEO users



Number of people using WEKEO at same time





# AI for Earth Monitoring MOOC

www.eumetsat.int

YouTube DE

Search



#AI4EarthMonitoring

AI for Earth Monitoring MOOC - Feedback Session with Mark Higgins

3,825 views • Streamed live on 26 Oct 2021

58 DISLIKE SHARE SAVE ...



EUMETSAT @eumetsat · Nov 12

We are ready! Are you?

Join us live now on YouTube - you can still ask us any questions with [#AI4EarthMonitoring](#) below



Ran 3 livestream Q&A **>4500 views on YouTube**



**WA** Wisdom Akpabio [Follow](#) 10 DEC

Wonderful course. I really enjoyed this.

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**TO** Tony O'Neill [Follow](#) 08 DEC

Well done to you and your team. Both theory and labs were excellent.

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**CR** Cristina R. [Follow](#) 07 DEC

Good material, good guests, interesting topics, and good answers from educators. Great course. Thankyou.

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**EW** Etienne Wey [Course team replied](#) [Follow](#) 24 NOV

Very great course which gives a good multifaceted view on different ML uses on EO data. I found it useful to build some generic knowledge on ML techniques with the numerous Jupyter notebook examples and I can now understand better the technical stuff in the ML projects which I participate in at the science management level.

Thanks a lot for this huge work by all the presenters and tutors !

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**sn** **sabrina nappi** made a comment [Follow](#) 15 NOV

Topic 1e - Accessing Data and Using The WEkEO Platform

During the codeweek I showed the pupils how to get information from satellite images using the EO browser, which I studied without taking a course. The kids got excited and created custom images. The next study will lead us to analyze the territory, take data, analyze them and make future predictions. With this course I feel I can do it! Great course, all very...

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Copernicus EU  
@CopernicusEU



21 2021 #Copernicus achievements

#2 #AI4EarthMonitoring #MOOC

A six-week-long online course on AI & Earth monitoring was launched in October and attracted 7,900 participants!

Explore the wealth of Copernicus #OpenData & use #AI, #MachineLearning to extract information





- The hosted notebooks were a key innovation of this course.
- They provide:
  - Scaffolding – the learner does not start from a blank sheet – they see what is possible, and try something new – quickly
  - Pre-curated knowledge – the notebooks are not random – they provide information in a context and contain workflow and linked processes ( first this, then that, ...)
  - They provide a way for people to share their work with others
- Kudos to the note book team 😊

## Challenges?

Covid – filming difficult – home film/sound quality

Finding examples – Copernicus data and AI

Tech concerns - big audience, new notebooks, lots of risk ... company developing the notebooks wanted to use own infrastructure

*Audience as community – what about the future ?*





**Thank you!**  
Any questions?