nereus
network of european regions using space technologies

EDUCATION AND TRAINING IN THE SPACE SECTOR XVII: POPULAR/NEW STUDIES IN THE SPACE SECTOR AND TRAINING PROGRAMMES IN EUROPE (2)

XVII SESSION 15 MAY 2025 11.00-12:30 CET

NEW EUROPEAN CURRICULA FOR THE SPACE SECTOR

Valerio Tramutoli
University of Basilicata

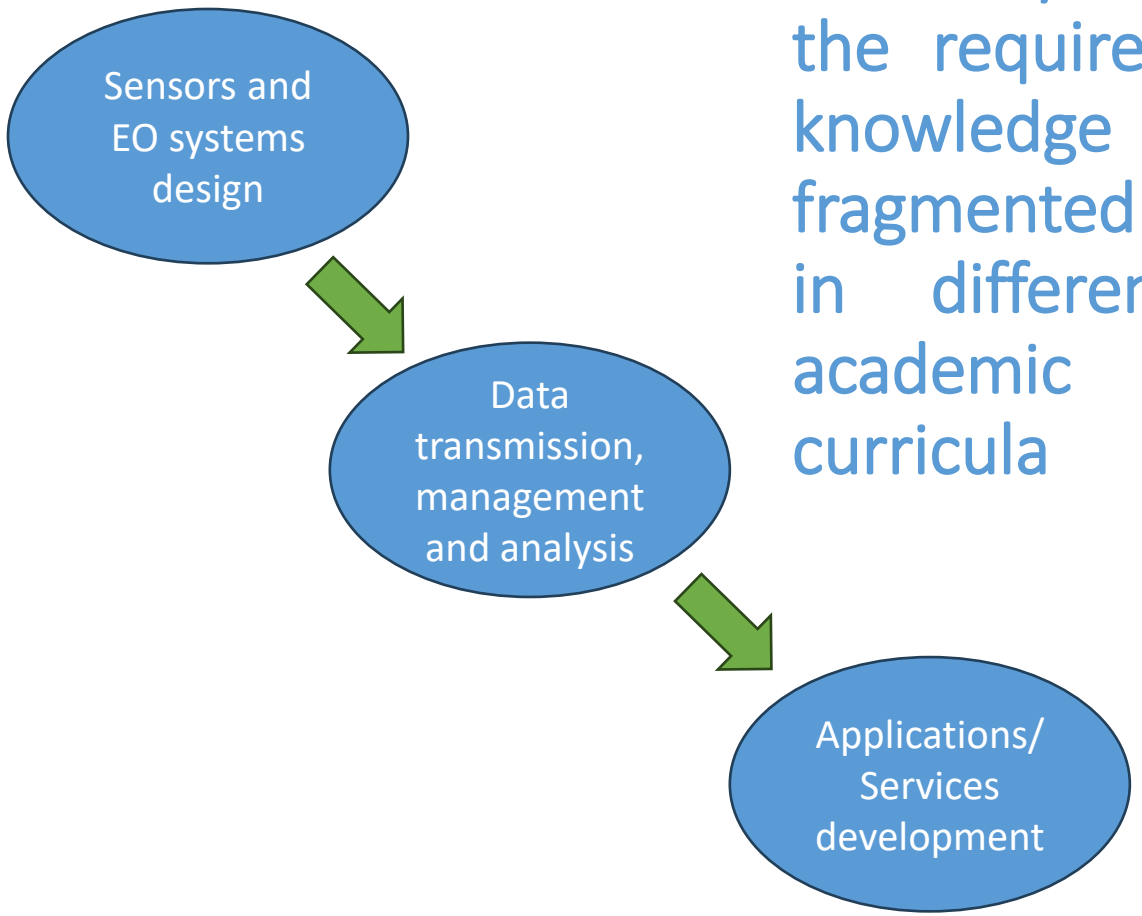
Facts 1

In the catalog of the almost 3000 qualifications recognized at European level by **ESCO, the reference to experts on the development of applications/services based on EO technologies is still absent**

(they instead exist with reference to GIS, aeronautics, ITC, etc.)

Facts 2

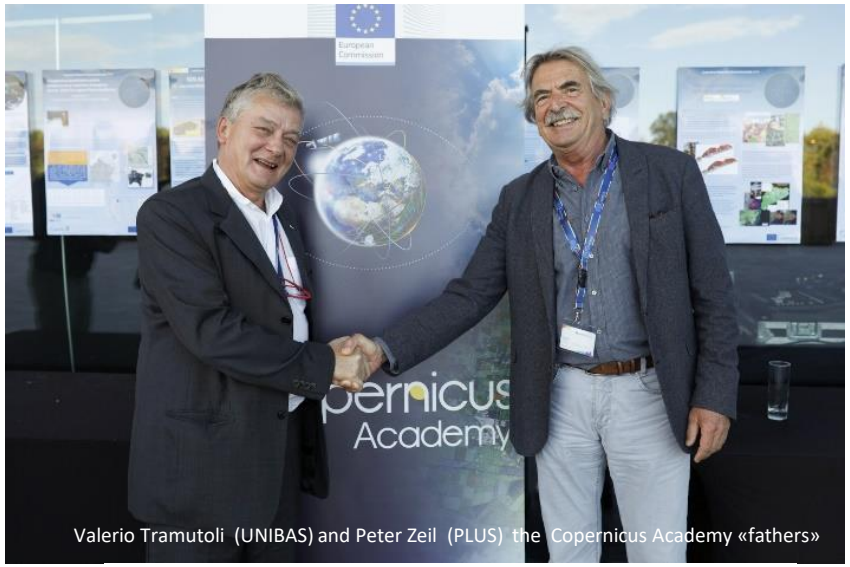
The lack (at European level) of **a unique academic curriculum**, offering the opportunity to researchers and professionals to acquire the **full chain of knowledge** required to move from the design of advanced EO systems and sensors up to the development of applications and services based on EO data, **has been**, since last decade, **recognized by the Commission as an important gap in the Copernicus User Uptake Strategy**.



Presently the required knowledge is fragmented in different academic curricula

Actions 1

2014. The establishment by the Commission, in the framework of the Copernicus User Uptake Strategy, of the **Networks of the Copernicus Academies**



Valerio Tramutoli (UNIBAS) and Peter Zeil (PLUS) the Copernicus Academy «fathers»

Geophysical Research Abstracts
Vol. 15, EGU2013-6292, 2013
EGU General Assembly 2013

The G4R GMES Academy – linking research, academia, service providers and local authorities.

Peter Zeil (1) and Valerio Tramutoli (2)
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The GMES Academy intends to enhance the role of the academic and R&D communities in the evolution of EO & GI services. The GMES4Regions G4R initiative, aiming to strengthen the link between GMES (Global Monitoring for Environment and Security) and European regions, inaugurated the GMES Academy at the University Mozarteum of Salzburg (Austria) on 13th - 14th September 2012. This academy has been created with the objective of fostering a dialogue among the private sector, Local and Regional Administration (LRA) and the academic and research community, in order to improve the development of Earth Observation (EO) and Geographic Information (GI) services.
On this occasion, Z_GIS, the Interfaculty Department of Geoinformatics of Salzburg University, hosted the round table "Fostering Downstream Services for the Regions - contributions from Research & Academia," during which the participants had the opportunity to discuss with representatives of the European Commission (EC) and the European Space Agency (ESA) the future role of the academic community in this domain.
Stakeholders from the academic and R&D world adopted the 'Salzburg Declaration on GMES related Research', calling for strengthening connections between research activities and educational programmes to improve GMES services. The Declaration calls mainly for:

- fostering education and training on GMES
- ensuring cooperation among the academic and research community through the GMES Academy
- maintaining a political commitment towards the implementation of such academic initiatives.

The GMES Academy is established as a platform with six components:
GATEWAY - the directory of Universities and Research Centres
BRIDGE - an inventory of research briefs documenting the latest offerings from research to effective applications
FACILITATOR - a portal to seek or propose internships or contract research across Europe

and addressing outreach and advocacy:

LINK - Access to the repository of on-going GMES related research projects in the EU
EDUCATION - a compendium of courses offered by universities in the field of GMES
LECTURES - G4R offers to arrange lectures on GMES at interested universities and institutions

The initiative by G4R invites collaboration to strengthen the role of research and education for the evolution of GMES services.

Actions 2

- 2016. The introduction of the **Blueprint for sectorial cooperation on skills** by the Skills Agenda for Europe 2016 (confirmed by the **European Skills Agenda 2020**) **to address sector skills** by creating new strategic approaches and cooperation.

- 2021-2027. Continuing under the new Erasmus+ programme with the **Alliances for Innovation** (Lot 2: Alliances for sectoral cooperation on skills)

➡ Among the 28 projects funded …

EO4GEO Project

eo4geo

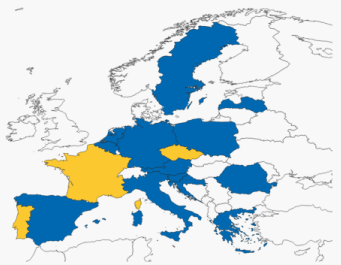
Co-funded by the Erasmus+ Programme of the European Union

Towards an innovative strategy for skills development and capacity building in the space geo-information sector supporting Copernicus User Uptake

Duration: 4 years from January the 1st, 2018

Partnership: 26 organisations + 22 (initially) Associated Partners (from 16 EU Countries), from Academia, Companies and networks, many of them Members of the Copernicus Academy Network

Addressed Copernicus Areas: Integrated Applications, Smart Cities, Climate Change



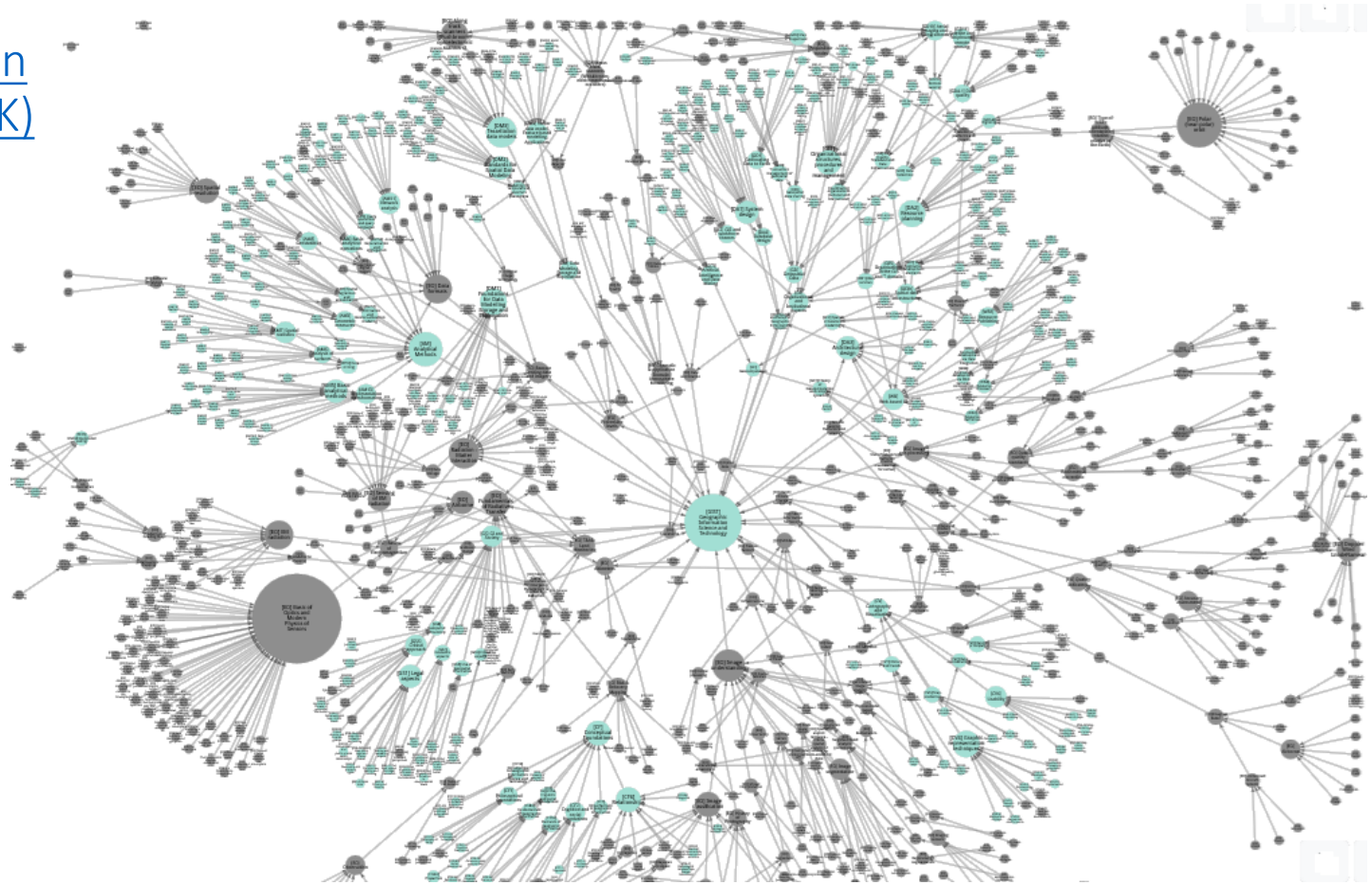
Some achievement 1
the EO-GIS body of knowledge (EO4GEO)

Following the previous Geographic Information Science & Technology Body of Knowledge (BoK) initiative (EC project)

A formal description of the EO-GIS knowledge domain made by:

- **thousands of Concepts** (theory, models, methods, technologies)
- **and relations** among concepts

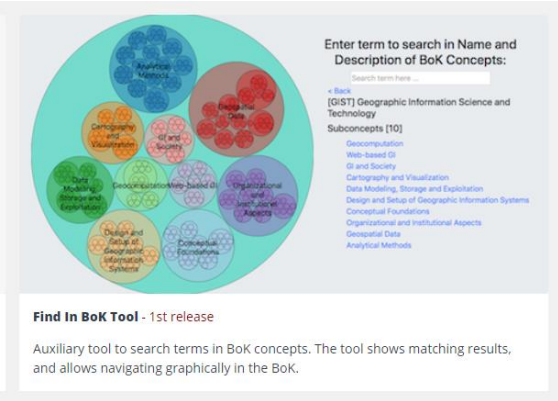
elaborated by the **joint effort of hundreds of worldwide experts**



Some achievement 2
the EO4GEO Tools

- **To match job offer and demand** on the base of specific and formalized elements of knowledge

- **To draw new** educational/training **curricula**



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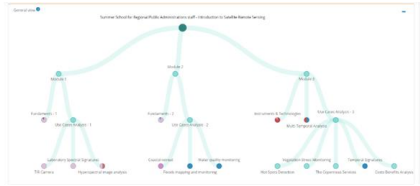
First implementations

- Practice on adults re-skilling
  (e.g. short course for Basilicata Regional Administration Workforce)

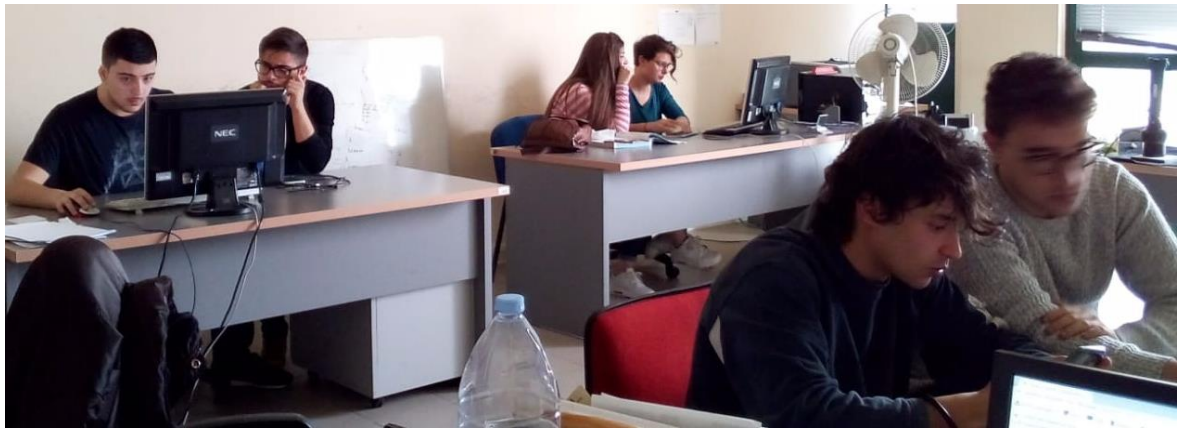


Module 1
- [IP3-1-2-3] Normalized Difference Vegetation Index (NDVI)
- [PP1] Basics of Optical Remote Sensing
- [PP1-1-1] Electromagnetic Waves and Photons
- [PP1-1-1-1] Earth's radiation (intensity, spectrum, etc.)
- [PP1-1-2] Electromagnetic spectrum
- [PP1-1-4] Planck law for the black body. Wien's displacement law
- [PP1-1-6] Stefan–Boltzmann law, Kirchoff law
- [PP1-1-7] Concepts of Spectral Emissivity and Brightness Temperature.
- [PP1-2-1.0] The Rayleigh roughness criterion
- [PP1-2-5] Concepts of Transmittance, Absorbance, Reflectance, Scattering,
- [PP1-2-8] EM rad. penetration in the matter; Attenuation Length
- [PP1-3-1] Radiometric quantities: radiance, irradiance, flux, brightness, exitance, luminosity, etc.
- [PP1-3-3] Spectral Signatures of the matter
- [PP1-4-5] Beer-Bouguer-Lambert law.
- [PP2-2-5-2] Attenuation lenght and penetration depth
- [PS1-2] Passive vs. active sensors

Module 2
- [IP1-7-1] Atmospheric correction
- [PP1-1-1] Earth's radiation (intensity, spectrum, etc.)
- [PP1-1-5] Rayleigh-Jeans approximation. Wien's approximation
- [PP1-6-1] Structure and chemical-physical composition of Earth's atmosphere
- [PP1-6-2] Absorption and scattering of solar radiation in the Atmosphere
- [PP1-6-3] Mie Scattering in the Earth's Atmosphere
- [PP1-6-4] Rayleigh Scattering in the Earth's Atmosphere
- [PP1-6-6] Light scattering by atmospheric particulates
- [PP1-6-7] Earth's (standard) Atmosphere Transmittance
- [PP2-2-2] Scattering and emission

Module 3
- [GD11-2] Platforms and sensors
- [PP1-8-4] Satellite orbits parametrization and choice
- [PS1] Types of remote sensing sensors
- [PS1-2-1-1-1] Along track scanners
- [PS1-2-2] Radiometers
- [PS1-4] Imaging vs. nonimaging sensors
- [PS1-5-1-2] Across track scanners
- [PS2-2-3-2] Types of satellite orbits
- [PS2-2-3-4] Swath
- [PS3-4-1] Spectral resolution
- [PS3-4-2] Spatial resolution
- [PS3-4-3] Radiometric resolution
- [PS3-4-4] Temporal resolution

- Practice with scholars
  (e.g. the School-Work Alternation at UNIBAS)



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Implementations

MASTER Copernicus Academy academic year 2024-2025
EOSAT
EARTH OBSERVATION FROM SPACE: ADVANCED TECHNOLOGIES AND APPLICATIONS

1st level Academic Master

«*Earth Observations from Space: Advanced Technologies and Applications*»

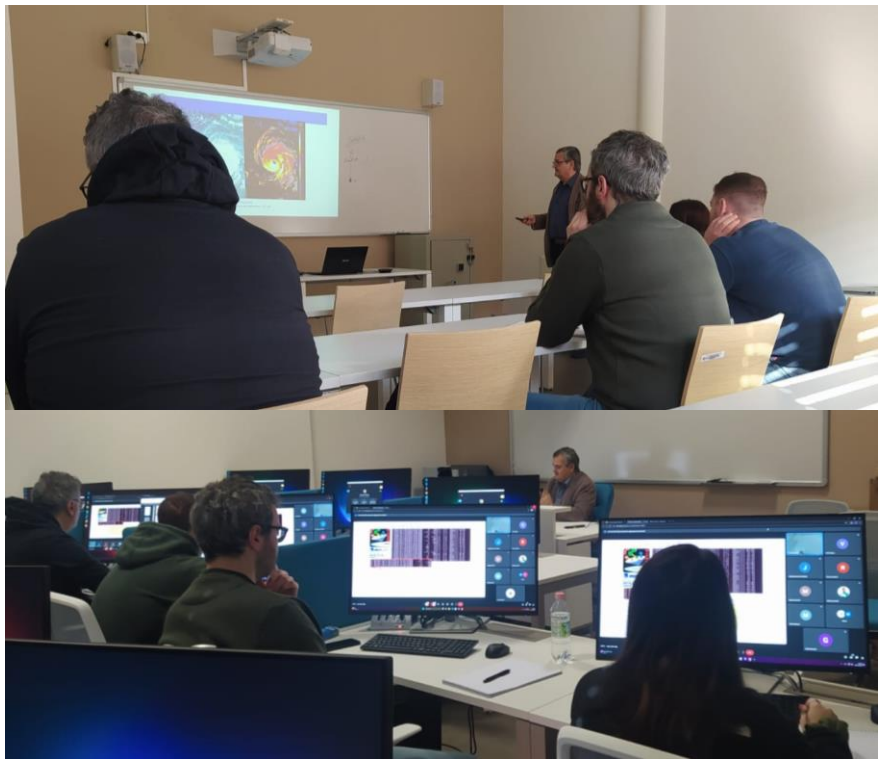
(selected and funded by MUR, in cooperation with TeRN supported by CLAS and ENCA)

Objectives: to offer the **full chain of knowledge required to move from the design of advanced EO systems and sensors up to the development of applications and services based on EO data**

Audience: students and professionals (STEM graduates)

2 editions: AA 2024-2025 and 2025-2026

Moving to a MoS AA 2026-2027



Tecnologie per le Osservazioni della Terra ed i Rischi Naturali

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Implementations

MASTER Copernicus Academy academic year 2024-2025
EO-SAT
EARTH OBSERVATION FROM SPACE: ADVANCED TECHNOLOGIES AND APPLICATIONS

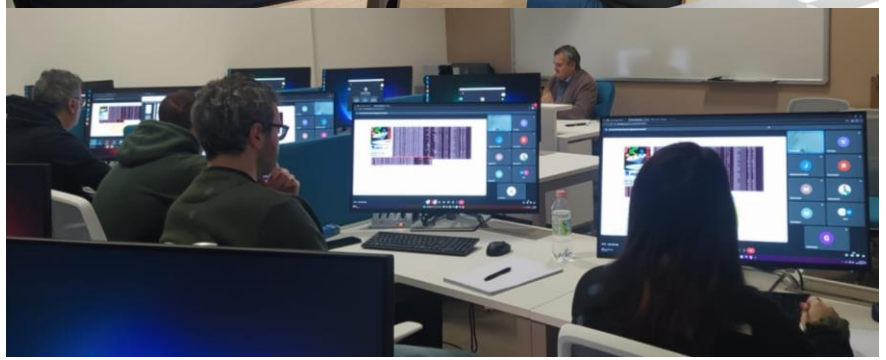
1st level Academic Master EO-SAT

«*Earth Observations from Space: Advanced Technologies and Applications*»

(selected and funded by MUR, in cooperation with TeRN supported by CLAS and ENCA)

Courses Contents

1. Sensors Modern Physics
2. Atmospheric Physics and Meteorology
3. Digital Cartography and GIS
4. Fundamentals of Remote Sensing in the Optical range
5. Fundamentals of Remote Sensing in the Microwaves
6. Inverse Problems Theory Applied to EO Remote Sensing
7. Spacecraft Systems Engineering for Earth Observations (Space Vehicle Dynamics & Systems Engineering, EO Techniques from RPAS)



+ Stages at space sector companies
+ 5 Summer/Winter Schools as complements on specific EO related topic:
  EO for monitoring : 1. Infrastructures, 2. Nat-Env Risks & Climate,
  3. Space Weather, 4. Water.
  5. AI for EO

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Toward the first European MoS on the Earth Observations from Space

MASTER Copernicus Academy academic year 2024-2025
EOSAT
EARTH OBSERVATION FROM SPACE: ADVANCED TECHNOLOGIES AND APPLICATIONS

MoS in *Earth Observations from Space*

(International, inter-universities, start planned AA 2026-2027)

I-II semester (first annuality)

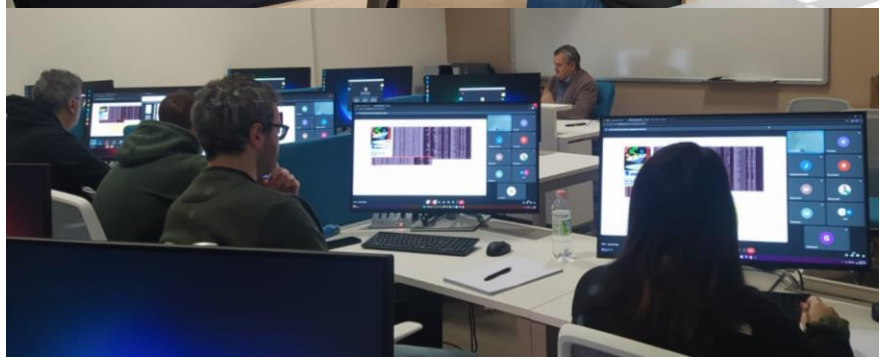
1. Sensors Modern Physics
2. Atmospheric Physics and Meteorology
3. Digital Cartography and GIS
4. GNSS (Global Navigation Satellite Systems)
5. Fundamentals of Remote Sensing in the Optical range
6. Fundamentals of Remote Sensing in the Microwaves
7. Inverse Problems Theory Applied to EO Remote Sensing

III semester (second annuality)

8. Spacecraft Systems Engineering for Earth Observations
9. Space Weather
10. Introduction to Computer Science Techniques for AI
11. Geostatistics and AI Methods for Earth Observation

IV semester (second annuality)

+ Stages outside for thesis preparation (in any other Universities and/or Space Sector companies)



Tecnologie per le Osservazioni della Terra ed i Rischi Naturali

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The European collaboration among Academies

MoS in *Earth Observations from Space*
(International, inter-universities)

	I and II semesters	III semester	I V semester
What	**Theoretical fundamentals** (common for all Universities)	**Specialist insights**	**Stages and thesis preparation**
Where	**At students' home University**	**any European University**	**any European University and/or Space Sector company**
How	**Eventually with students/teachers mobility supported by the Erasmus Program**	**Students mobility supported by the Erasmus Program**	**Students mobility supported by the Erasmus Program**

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The European collaboration

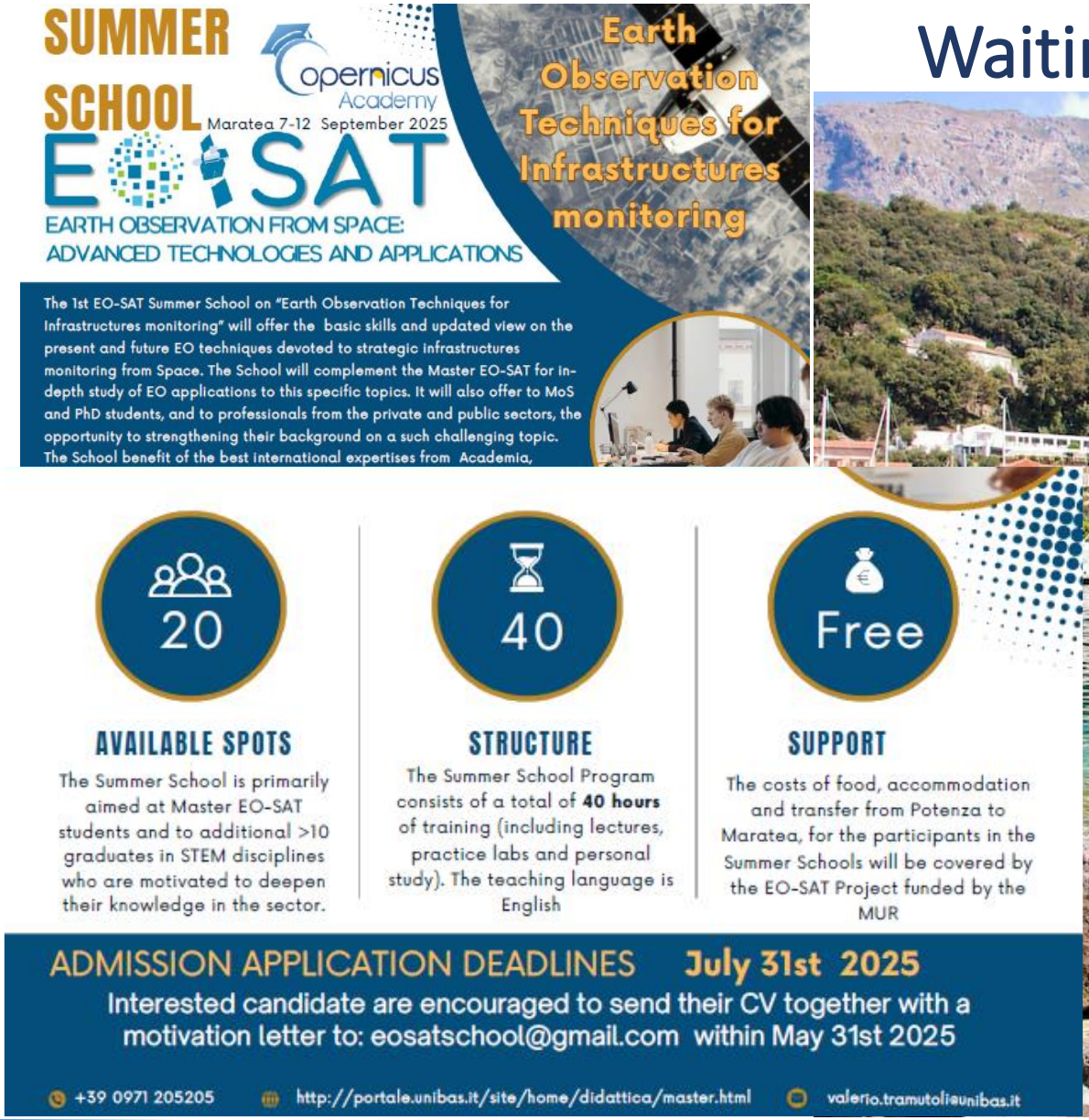
and the possible role of the Copernicus Academy, Pact for Skills (and NEREUS)

MoS in *Earth Observations from Space*
(International, inter-universities)

- **Promote agreement on common core content** (e.g. based on the EO4GEO BoK) **of the proposed MoS**

- **Lobbying for inter-ministerial reciprocal recognition of the MoS by the Member States (top-down).**

Waiting for that, preparing for that…



Waiting for that……

SUMMER SCHOOL

Copernicus Academy

Maratea 7-12 September 2025

EO-SAT

EARTH OBSERVATION FROM SPACE:
ADVANCED TECHNOLOGIES AND APPLICATIONS

Earth Observation Techniques for Infrastructures monitoring

The 1st EO-SAT Summer School on "Earth Observation Techniques for Infrastructures monitoring" will offer the basic skills and updated view on the present and future EO techniques devoted to strategic infrastructures monitoring from Space. The School will complement the Master EO-SAT for in-depth study of EO applications to this specific topics. It will also offer to MoS and PhD students, and to professionals from the private and public sectors, the opportunity to strengthening their background on a such challenging topic. The School benefit of the best international expertises from Academia,

20

AVAILABLE SPOTS

The Summer School is primarily aimed at Master EO-SAT students and to additional >10 graduates in STEM disciplines who are motivated to deepen their knowledge in the sector.

40

STRUCTURE

The Summer School Program consists of a total of **40 hours** of training (including lectures, practice labs and personal study). The teaching language is English

Free

SUPPORT

The costs of food, accommodation and transfer from Potenza to Maratea, for the participants in the Summer Schools will be covered by the EO-SAT Project funded by the MUR

ADMISSION APPLICATION DEADLINES **July 31st 2025**

Interested candidate are encouraged to send their CV together with a motivation letter to: eosatschool@gmail.com within May 31st 2025

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MASTER EO-SAT

Copernicus Academy

academic year 2025-2026

EARTH OBSERVATION FROM SPACE:
ADVANCED TECHNOLOGIES AND APPLICATIONS

The 1st level Master's Degree in "Earth Observations from Space: Advanced Technologies and Applications - EO-SAT) aims to train professionals in the field of Earth Observations from Space by offering all the basic and specialist skills needed to provide original contributions to the development of the entire EO supply chain, from the design and implementation of remote sensing platforms and sensors to the analysis and interpretation of remote sensing data for the development of advanced applications and services. The course, the first of its kind in Europe, will be supported by several Summer/Winter Schools for in-depth study of EO applications to specific topics.

The Master's program will leverage the specific expertise available at the University of Basilicata with the support of the European Copernicus Academy Network, highly qualified research centers and companies. The content of the Master program will be aimed at integrating knowledge

20

AVAILABLE SPOTS

The course is primarily aimed at graduates in STEM disciplines who are motivated to engage in professional activities in the aerospace sector.

1500

STRUCTURE

The Master's Program consists of a total of **1500 hours** of training (including lectures, internships, and personal study).
The teaching language is English

7000

SCHOLARSHIP

Enrollment financed in full by Ministry of University and Research
To support in-person attendance, twenty scholarships of **€ 7,000.00** each are available

ADMISSION APPLICATION DEADLINES **SEPTEMBER 2025**

Selection procedures for admission and the requirements can be consulted since August 2025 on the dedicated University page or by contacting the Coordinator of the Master Prof. Valerio TRAMUTOLI

+39 0971 205205 http://portale.unibas.it/site/home/didattica/master.html valerio.tramutoli@unibas.it

Thanks

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