
# BEYOND Centre - National Observatory of Athens: Ensuring National and European Autonomy for Sustainable Development and Security in Earth and Space

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**Keywords:** Disaster Risk Reduction (DRR), Emergency Management, Risk Assessment, Humanitarian Aid, Space Security, Space Surveillance and Tracking (SST), Hazard Modelling, Copernicus Emergency Management Service (CEMS), Earth Observation, AgriHUB, Ecosystems Monitoring, Biodiversity, Soil Monitoring, Solar Energy Nowcasting, SolarHUB, Epidemic Surveillance, Health Risk Assessment, Capacity Building, Erasmus+, Geospatial Intelligence, Remote Sensing, Sustainable Resource Management, Research and Innovation, Gender Balance, Science Communication, Media Outreach.

**Abstract:**

The BEYOND Centre for Earth Observation Research and Satellite Remote Sensing plays a crucial role in supporting both national and European autonomy through the provision of cutting-edge services in

Earth Observation and Space Security. An overview of BEYOND Centre activity is highlighted herein, together with its active involvement in both the Copernicus Emergency Management Service (CEMS) and the European Space Surveillance and Tracking (SST) Partnership. Moreover, the Centre supports informed decision-making for disaster resilience with its specialized tools like FireHUB for wildfire management, FloodHUB for comprehensive flood risk assessment, GeoHUB for geophysical disaster monitoring and response, and DustHUB for advanced dust forecasting.

Beyond crisis management, BEYOND applies Earth Observation in key areas such as agriculture, ecosystems, soil monitoring, and health. AgriHUB enhances precision agriculture, while satellite-based tools support biodiversity and environmental monitoring. The Centre also advances solar energy forecasting (SolarHUB) and epidemic surveillance, aiding sustainable energy integration and public health response.

BEYOND actively promotes capacity building through FPCUP, Erasmus+, and research initiatives, fostering expertise in Earth Observation. It maintains a strong commitment to diversity and gender balance, while strategic outreach and media visibility strengthen its role in global scientific and policy discussions.

By integrating advanced geospatial technologies, BEYOND enhances crisis response, environmental sustainability, and European autonomy in Earth Observation.

**Introduction**


BEYOND Centre of Excellence for Earth Observation Research and Satellite Remote Sensing is an Operational Unit of the Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS) of the National Observatory of Athens (NOA). Poised to deliver significant services for the ultimate benefit of all European citizens, BEYOND plays a pivotal role in developing cutting-edge research and providing innovative services in crucial thematic areas of security and crisis management and social growth relating to national and EU independence such as: Space Safety and Security, Disasters and Crisis Management, Citizen Safety, Humanitarian Aid, Food and Energy Security and Societal Wellbeing and Health. BEYOND Centre addresses stakeholders needs across Europe, and the neighboring Regions including Balkans, Middle East, and Africa. Leveraging large scale satellite acquisitions established at NOA's facilities, actionable information is provided on time for enhanced decision and policy making in the aforementioned areas of expertise.

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BEYOND, in the delivery of its tasks, collaborates with leading organizations, including, but not limited to, the World Meteorological Organization (WMO), the European Centre for Medium-Range Weather Forecasts (ECMWF), the Barcelona Supercomputing Center (BSC) and the European Organization for the Exploitation

of Meteorological Satellites (EUMETSAT). As key partners these institutions consistently drive together with BEYOND Centre advancements in meteorology, climate modeling, extreme weather, and man-made related hazards reduction. Furthermore, BEYOND Centre has the role of **UN-SPIDER Regional Support Office** to advance Capacity Building and services for DRR worldwide and is an active member of the CEOS Working Group on Disasters, GEO/LEO/SAR Flood Pilot "Understanding Flood Risk from Space" for the Balkan flood pilot (Evros river basin), and the **GEO Disaster Risk Reduction Working Group**. The Centre coordinates the GEO-CRADLE enabling a mechanism that is leveraging the GEO and EuroGEO innovation in Balkans, Black Sea, Middle East, Africa and Pacific Asia areas for addressing security and DRR priorities of national civil protection and civil safety authorities.

### The Persuasive Strength of a Storytelling
### BEYOND Centre's Role in 2021 Wildfire Crisis: Utilizing Copernicus Data for Emergency Response

In August 11th, 2021 the whole Europe went through one of the hottest summers since records began. At this same time, the scientists of BEYOND Centre monitored and informed in real time on wildfires caused by the extreme drought and unprecedented high temperatures all over Greece and Europe. We have had about 10 days of unrelenting action to analyse Sentinel-1/-2/-3/5P downloaded from the Hellenic Mirror Site (CollGS) and the Copernicus Open Access Hub, both operated by BEYOND Centre to provide warnings and situational pictures of the disaster to fire controllers, authorities, and inform citizens and health authorities about the atmospheric burden due to the transfer of black carbon over the whole Mediterranean. In Greece alone, about one hundred thousand hectares of land were on fire and many communities and local economies had been seriously hit in the last ten days. And the damages in Greece was just a small portion of the enormous disasters recorded in the same period on the Sentinel images in Europe, the western coast of the US, in Siberia, South America, Central and South Africa, the Middle East. The global need for quick reliable information to support the emergency response was reflected by the systematic use of Sentinel-1/-2/-3/5P data delivered through the Hellenic Mirror Site that was installed back in 2014 at BEYOND Centre, the first Collaborative Ground Segment ever put in routine operation at European level. Since then, BEYOND's operations have grown in line with the growth in demand for Copernicus Sentinel data worldwide and a number of additional Copernicus Data Hubs which are also based at BEYOND Centre offering petabytes of satellite data in the support of European and international critical services and authorities. For example, the host of the Sentinel-5P Data Hub, which went into operation on 11 July 2018, has been publishing on average around 54,000 images per month. This is due in large part to the global interest in both the circulation of NO2 and CO resulting from the large bushfires. In BEYOND Centre we are excited to be one of the three international nodes of the Copernicus Data Access Ecosystem that supports the uninterrupted massive publication of more than 15 million Copernicus Sentinel data on a yearly basis serving more than half a million of users over the globe.

## BEYOND Data & IT Ecosystem: Infrastructure, Hubs, Tools

BEYOND Centre Big Data infrastructure supports acquisition, processing, storing and disseminating of EO data at scale. Data engineering best practices enable efficient ingestion and analysis of big data for any type of application herein after, ranging from disaster response to climate monitoring and scientific production[1]. The ecosystem encompasses high-performance computing (CUDA), container-based workflows (Docker, Kubernetes), scalable geospatial databases, STAC cataloguing and EO-specific data cubes, ensuring interoperability with European and international standards[2,3].

This proprietary infrastructure provides a reliable and secure foundation for EO data utilization, and ensures national and European autonomy in space-based services.

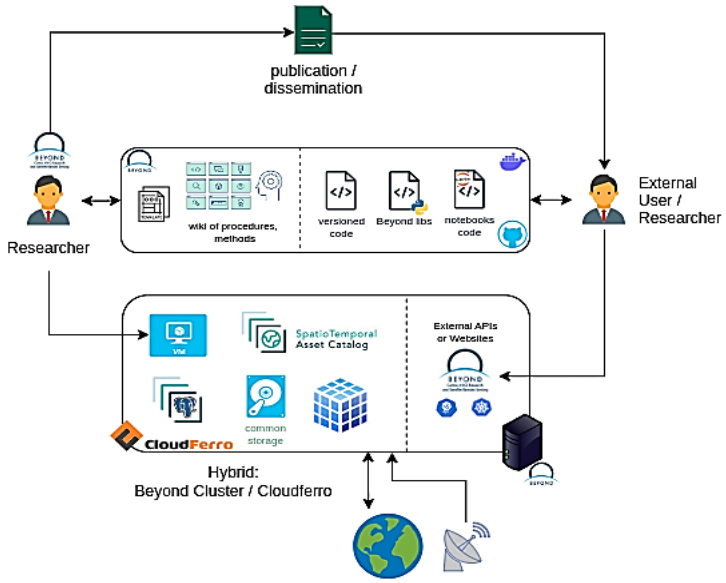



**Figure 1:** Infrastructure model of BEYOND, illustrating the integration of containers, data cubes, versioned code, libraries and notebooks with cloud-based infrastructure (e.g. Cloudferro). The system utilizes a SpatioTemporal Asset Catalog (STAC) and PostgreSQL for data management, enabling researchers and external collaborators to access and contribute via APIs and external data sources.

Links for more information on BEYOND Centre Infrastructure:
http://beyond-eocenter.eu/index.php/infrastructure
http://beyond-eocenter.eu/index.php/web-services/sentinels-greekhub
http://beyond-eocenter.eu/index.php/web-services/satellite-access-polar-orbit
https://github.com/noa-beyond/eoProcessors
https://github.com/noa-beyond/ADC
https://sentinels.space.noa.gr/
http://beyond-eocenter.eu/index.php/web-services/hellenic-mirror-site

It guarantees seamless access to Sentinel and other satellite data, enabling decision-makers, public authorities and researchers to base their decisions on EO data analysis for dynamic landscape and surface monitoring, emergency response and security. BEYOND's infrastructure enables EU Space Strategy, EU Space Surveillance and Tracking, the European Green Deal, and the Digital Europe Programme to foster technological sovereignty in EO-based services. The infrastructure (a) Supports European & National Autonomy by reducing reliance on third-party EO infrastructure, (b) Improves Decision-Making through fast, AI-driven EO data processing pipelines[4], and (c) Enhances Security from Space with elastic infrastructure for monitoring and security related events. The key end users of the Data and IT Ecosystem are Governmental institutions & Civil Protection Authorities activating BEYOND Centre through Copernicus CEMS, the European Union SST, Security stakeholders employing EO analytics for situational awareness, Scientific and commercial EO analytics providers accessing large-scale, structured data[1]. The applied Research and Technology means include (a) Scalable Processing of Data: Cloud and on-premises hosted data pipelines to process vast quantities of EO imagery, (b) Docker & Kubernetes: Containerized deployment of processing workflows to enable scalable data workflows and automation, (c) Data Cubes: Multi-source EO data model for standardize time-series analysis and AI-powered analytics, (d) APIs & Databases: RESTful APIs and spatiotemporal databases (PostGIS, Open Data Cube) for efficient and structured retrieval of EO data, (e) High-Performance Computing (HPC-CUDA): Parallelized image processing pipelines for accelerated feature extraction and model inference. The Infrastructure effectively performs (a) Scalability: Addressing the increasing requirement for high-resolution EO data storage and processing, (b)

Interoperability: Seamlessly integrating Copernicus, DIAS platforms, and European Data Spaces, (c) Algorithms and practices: Maintain state of the art practices and provide cutting edge scientific insights for EO data processing pipelines, (d) Real-time Processing: Facilitating near-real-time ingestion and dissemination of EO data for emergency response, (e) Cybersecurity & Data Protection: Implementing secure access control and attack resilience for EO-based infrastructures. The infrastructure sector of BEYOND Centre is used by key European and national authorities, research organizations, and industry players including the Copernicus Services (CDSE, Emergency Management Service, Climate Change, Security), the National Meteorological & Civil Protection Authorities, the EU Cloud providers such as: Cloudferro, European Open Science Cloud (EOSC) & EuroHPC initiatives and Universities.

**BEYOND Centre in the support of National and European Space Surveillance & Tracking: Enhancing Safety, Sustainability, and Risks in Space Operations**

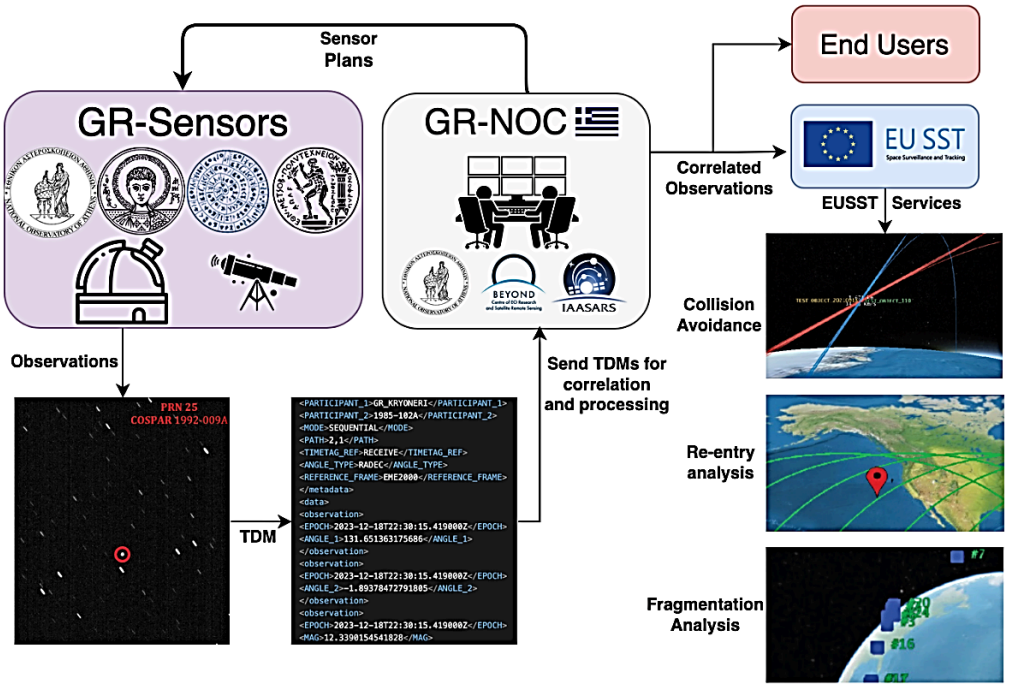



**Figure 2:** High-level overview of the Greek SST activities. The Greek National Operations Center for SST (GR-NOC SST), hosted by the BEYOND Centre, is responsible for the coordination of the SST activities. These include, but are not limited to, the generation of sensor plans for the Greek telescopes, the correlation of observations against space object catalogs, and the contributions to EUSST and its services.

BEYOND Centre leads the Space Surveillance and Tracking (SST) operations in Greece in the support of the European SST Partnership. It involves detecting, tracking, cataloging, and characterizing artificial objects orbiting Earth, including active satellites, defunct spacecraft, rocket bodies, and space debris. By leveraging ground-based and space-based sensors alongside advanced data processing techniques, BEYOND as the Greek National Operations Center (GR-SST NOC) for SST enables real-time monitoring of the orbital environment, supporting informed decision-making for satellite operators, policymakers, and defense entities. The role of BEYOND and its societal and national impact in terms of security is high, considering that the number of Resident Space Objects (RSOs) orbiting Earth is continuously

increasing due to the surge in satellite deployments and the accumulation of space debris[5].

This growing congestion increases the risk of collisions, posing a challenge to the sustainability of space operations and the continuity of space services provision, reinforcing the need for effective space surveillance and situational awareness. BEYOND as GR-NOC SST, supports the operations of the Greek observing telescopes offered by NOA, AUTH, FORTH, and NTUA. The Centre is responsible for the relevant activities at the national level, and at the EUSST level, and represents the Greek SST program in broader international collaborations, including with the United States Space Command. GR-NOC SST oversees activities that involve, but are not limited to (a) Coordinating Greek sensors for conducting space surveillance observations, (b) Processing observational data in accordance with EUSST specifications, (c) Correlating observations with known objects in space catalogs and (d) Contributing correlated results (in the form of Tracking Data Messages - TDM) to the EUSST database. As part of the Greek participation in the EUSST Partnership, GR SST-NOC actively supports the main EUSST services[6] in collaboration with the operational centers of other EU member states that include the: Collision Avoidance (CA) — Re-entry analysis (RE) — Fragmentation Analysis (FG).

Moreover, the Center GR-NOC SST runs comprehensive analysis of state-of-the-art AI methodologies for advancing SST services[7,8] and security of missions in Space. Practically, BEYOND as GR SST-NOC lays the foundation for space operations toward the autonomy in both National and EU-level, while significant benefits arise for the country as a whole, including (a) Enhancing the security of Greek satellite missions and, consequently, national security, by protecting from threats originating from or passing through space, (b) Monitoring and predicting the re-entry of space debris and other objects (e.g., spent rocket stages, ballistic missiles) of known or unknown origin, (c) Advancing space surveillance technologies (detection and tracking) by leveraging Greece's existing scientific expertise and infrastructure, (d) Integrating into emerging space markets that invest in space-related services, (e) Developing technological capabilities, specialized training and expertise, fostering a skilled workforce and advancing research in space surveillance, (f) Establishing collaborations between the Greek space industry and European and international organizations, contributing to economic growth and (g) Supporting European policies on space traffic management, security, and defense, while safeguarding the interests of the EU and its Member States. The Strategic Partners & End users of BEYOND consist of entities such as NOA, AUTH, NTUA, FORTH, HELLENIC SPACE CENTER, Hellenic Ministry of Defense, Hellenic Ministry of Digital Governance, Hellenic Ministry of Development, EUSPA, GMV, HELLAS SAT, Libre Space Foundation, USSPACECOM, NKUA, etc.

## BEYOND Centre in the support of the Global Copernicus Emergency Management Service for Risk and Recovery


The Copernicus Emergency Management Service (CEMS) provides validated assessments primarily based on satellite imagery for before, during or aftermath crisis, as well as early warning services for disasters. The BEYOND Centre

supports through CEMS the crisis managers, Civil Protection authorities and humanitarian aid actors dealing with natural disasters, man made emergency situations, and humanitarian crises, as well as those involved in recovery, disaster risk reduction and preparedness activities at global level with a high impact in as far as the national and European security and safety are concerned.

Links for more information on CEMS Activations of BEYOND Centre:
https://mapping.emergency.copernicus.eu/
https://mapping.emergency.copernicus.eu/activations/EMSN197/
https://mapping.emergency.copernicus.eu/activations/EMSN200/
https://mapping.emergency.copernicus.eu/activations/EMSN205/
https://mapping.emergency.copernicus.eu/activations/EMSN206/

The infrastructure and excellence developed in the BEYOND Centre are actively used in Risk & Recovery Mapping, nationally and worldwide, and on a routine basis towards the effective preparedness, prevention and recovery. The research and services developed are exploiting Earth Observation and geospatial data, when and where needed, for enhanced modelling of hazards and climate related disasters, mitigation and impact assessment for an effective and timely humanitarian aid. BEYOND has been activated in the framework of the CEMS 18 times since 2024 and has successfully been undertaken to support 12 activations worldwide from which 5 in the domain of wildfires, 2 in floods, 1 volcanic unrest, 1 in drought and water management, 1 in forest degradation, 1 in illegal waste dumping, 1 in multi-hazard analysis. To address the challenging task of hazard and disaster management worldwide, BEYOND has developed and validated a number of methodologies which exploit big EO data, expert/domain knowledge and AI techniques to model Seismic Hazards and Seismic Risks, Fire Risk Forecast, Fire Early Detection, Burn Severity Grading, Biodiversity and Food Losses, Fire Spread dynamics in time and space, Population & Assets Impact, Tsunami and Extreme Weather Disasters Forecasting, Soil Erosion and Landslides, Volcanic Eruption and Lava Flow, Ground Deformation Dynamics; Flood Delineation, Flood Depth and Flood Damage Assessment, Disruption of Transportation and Businesses. The BEYOND strategic partners in this application area are among others: The Joint Research Center of EC, the DG DEFIS, Crisis managers and Civil Protection authorities across the globe, the Humanitarian aid actors dealing with natural disasters, man made emergency situations, and humanitarian crises.

### FireHUB: A Comprehensive Wildfire Management System

FireHUB is an advanced wildfire management system that leverages free and open and big satellite data to predict, detect, monitor, and assess wildfire impacts across Greece, Southern Europe, North Africa, Balkans, Black Sea and the Middle East. A multitude of satellite systems acquired at the acquisition facilities of BEYOND Centre with varying spatial resolutions (low, medium, high) and revisit times, balancing detection speed and detail are used for the delivery of the service that in turn allows the provision to first responders of situational awareness pictures and fire hazard assessments at national level every 5 minutes. In practice, FireHUB integrates state-of-the-art models and scientific research to deliver to civil protection agencies, defense units and the public detailed fire ignition forecasts before crisis, as well as real-time warnings and fire monitoring during crisis, and last yet importantly post-fire assessments to allow informed decision-making at every stage of disaster management. Artificial Intelligence based fire risk forecasting is of utmost importance as it utilizes cutting edge Machine Learning models to handle the task of next day detailed fire prediction for the

whole Greek territory in a 500mx500m wide area. Moreover, FireHUB creates a comprehensive forest fire inventory by obtaining and fusing data from multiple data sources, including the FireHUB system of BEYOND, the NASA FIRMS, and the European Forest Fire Information System (EFFIS). A complete Machine Learning (ML) workflow trains classification models on this large historical dataset, for which labels (occurrence or absence of fire) are derived and the trained classifiers are then able to provide binary predictions (fire or no-fire) along with the best use of firefighting resources in every area at risk [9,10,11,12].

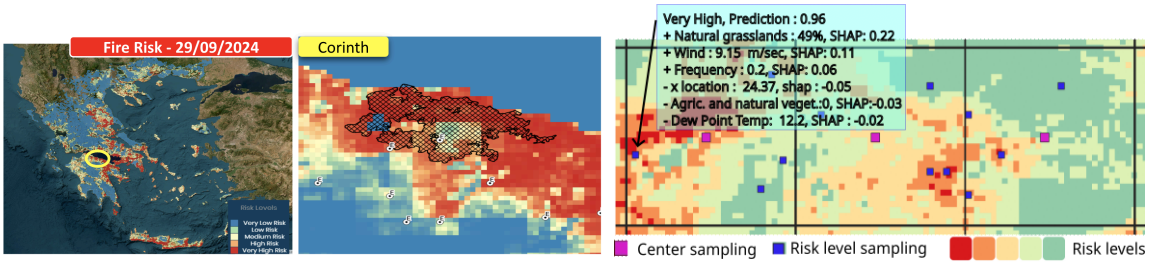



**Figure 3 (left):** Fire risk map generated on September 28, 2024 for the next day. Right – Actual wildfire perimeter in the Corinth area

**Figure 4 (right):** Model prediction explained in a very high-risk area. Key fire drivers include vegetation type

The BEYOND Centre advanced a 24/7 real-time fire monitoring service that leverages cutting-edge technology to provide continuous, high-resolution fire detection and monitoring. Satellite METEOSAT MSG SEVIRI data are ideal to early and timely detect and monitor the fast evolving fires. Every 5 minutes, the FireHUB system detects active fires into 500 m × 500 m wide cell. The system runs prototype image processing and data classification algorithms, which have been developed with the active participation of fire brigades for incorporating their expert knowledge in the delivery of a useful fire disaster operational picture [13,14]. Another fundamental part of FIREHUB that is developed by BEYOND is known as the Forest Fire Information System (FFIS). It provides rapid, satellite-based fire detection and burned area mapping in real-time across Europe, Balkans, North Africa, the Black Sea, and the Middle East. The system ingests and processes medium-resolution data multiple times per day from polar-orbiting satellites (EOS/Terra, EOS/Aqua, Suomi NPP, and NOAA-20), acquired in real time through the BEYOND/NOA Ground Reception Station enabling near real-time active fire detection and continuous wildfire tracking. For high-resolution burned area mapping, Sentinel-2 imagery acquired at Node 3 of Copernicus operated by BEYOND as part of the Hellenic Collaborative Ground Segment of Copernicus offers detailed assessments of fire-affected regions. In addition, the smoke dispersion service provides high-precision calculations of smoke transport resulting from wildfires, industrial accidents, and other large-scale fires on an hourly basis at national level. Elevated smoke concentrations pose serious health risks, impacting air quality and public safety across vast regions. Last yet worth noted, the Diachronic Burnt Scar Maps (BSM) service is a fully automatic but off-line multi-sensor processing chain that takes as input satellite images of any available spatial and spectral resolution and produces precise diachronic burnt area and damage assessment products over the Greek territory for the last 42 years. It has been based on using archived USGS Landsat TM, SPOT XS, IKONOS, FORMOSAT and Sentinel-2/3 imagery over the entire

The FireHUB relevant link:
http://beyond-eocenter.eu/index.php/web-services/firehub

Greece. The BSM is offered online and is publicly open, providing an invaluable dataset for public authorities, civil protection and scientific community. The FireHUB system is connected to the Emergency Operations Center of the Hellenic Fire Service. Additionally, FireHUB serves multiple critical stakeholders, including the Hellenic Army for the safe planning of outdoor activities, the EC LUCAS for ensuring the safety of surveyors in the field, as well as the civil protection authorities and the general public. FireHUB is instrumental in Disaster Management operations, covering not only the entire Greek region but also the Balkans, North Africa, the Black Sea, and the Middle East.

### FloodHUB: A Flood Risk Management and Resilience Service through Innovative Monitoring and Mapping based on Earth Observation

Floods are the most frequent disasters, affecting the largest number of people. In 2023, 164 floods were recorded worldwide, killing 7763 people, affecting 32.4 million people, and resulting in 20.4 billion USD losses[15]. The FloodHUB services of BEYOND Centre[16] increase flood resilience and support the flood risk management focused on early awareness, prevention, protection and preparedness to reduce the flood risk and safeguard human health [17,18]. In order to mitigate flood risk, decision-makers and civil protection authorities need reliable, timely and high-resolution information on flood risk assessment, covering all disaster management stages, particularly prevention, preparedness, response, and recovery. This need is even more crucial in highly dense urban river basins that are prone to flash floods. In this regard, the FloodHUB service supports the relevant authorities in adopting effective policies and practices for better flood risk management, prevention and mitigation in near-real-time. It supports the implementation of the EU Floods Directive 2007/60/EC at national level as well as the Sendai Framework for Disaster Risk Reduction, and the UN SDGs, and the UN Early Warnings for All initiatives at global level. The Near-Real-Time Floods Monitoring and Early Warning prototype service runs operationally and delivers a reliable operational awareness picture of the flood extent and depth every 5 minutes to all the relevant stakeholders across the river basin. It is built around a fully scalable and transferable modular architecture that allows the real-time ingestion and assimilation of a variety of data, depending on their availability, including, but not limited to, hydrometeorological parameters measured on the site by telemetric hydrometeorological stations, satellite data, crowdsourced information on the evolving flood, and pre-run simulations of a series of flood scenarios using validated tools as HEC-HMS & HEC-RAS in a multi-source data fusion concept. Moreover, the prototype Flood Diachronic Mapping Service is based on a fully automated system that searches, downloads and preprocesses Sentinel-1A/B SAR GRD data and then, using Machine Learning based models, automatically maps water surfaces across the river basin. It uses the Copernicus Dataspace Ecosystem as well as a set of technologies (Python scripts/libraries, ESA SNAP, OpenDataCube, GeoServer), and covers the time period since 2018. The service also includes the burnt scar mapping produced by the FireHUB Diachronic Mapping Service, in order to spatially correlate the burnt scar mapping and the flood mapping towards analyzing the impact of the wildfires on the floods.

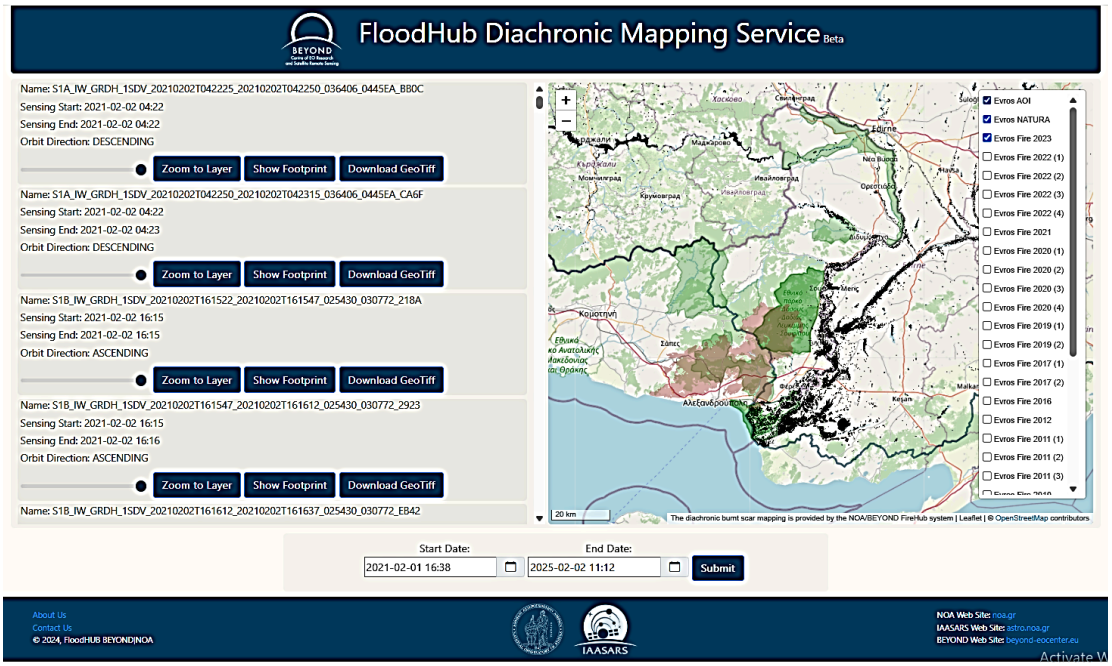



**Figure 5:** The Floods Diachronic Mapping Service for the Evros River Basin

The BEYOND FloodHUB Service is used by strategic partners worldwide as UN-SPIDER, the CEOS Working Group on Disasters, GEO/LEO/SAR Flood Pilot "Understanding Flood Risk from Space" for the Balkan flood pilot (Evros river basin), the Civil Protection Volunteer Associations which are used for the improvement of near-real-time flood monitoring, following dedicated training. Between the key stakeholders using the FloodHUB service are the Ministry of the Environment and Energy, Prefecture of Attica, Prefecture of Eastern Macedonia and Thrace, Fire Service, Civil Protection authorities at national, regional and municipal level, Civil Protection Volunteer Associations, international scientific community.

The FloodHUB relevant link:
http://beyond-eocenter.eu/index.php/web-services/floodhub

## GeoHUB: The Global Ground Deformation Monitoring Services for Timely Geophysical Disaster Assessment and Response

Timely monitoring and mapping of ground deformation worldwide, induced by major geological hazards, such as earthquakes, volcanic activity, landslides, etc. The GeoHUB's geoObservatory service [19](http://geobservatory.beyond-eocenter.eu/) provides emergency management authorities with timely assessments of ground deformation and establishes a global observatory of differential interferograms related to major catastrophic geological events. The service provides a deeper understanding of both the mechanisms driving their occurrence and the broader tectonic activity in affected regions. The produced interferograms enable the identification of the location, extent, and intensity of occurring geological hazards and related disasters. It also provides emergency management authorities with real-time information on ground deformation, facilitating informed decision-making and the implementation of appropriate disaster response measures. The so-called geObservatory system that supports GeoHUB, is developed by BEYOND Centre to promptly deliver to stakeholders constantly updated information on the evolution of the ground deformation in the

geological hazard affected area. This information is extremely useful for the local authorities responsible for decision making for evacuation, emergency response, relief and reconstruction planning, and taking measures to protect peoples' lives and their property. The service applies Differential SAR Interferometry (DInSAR) on Sentinel-1 SLC images, to produce pre- and co-seismic interferograms.

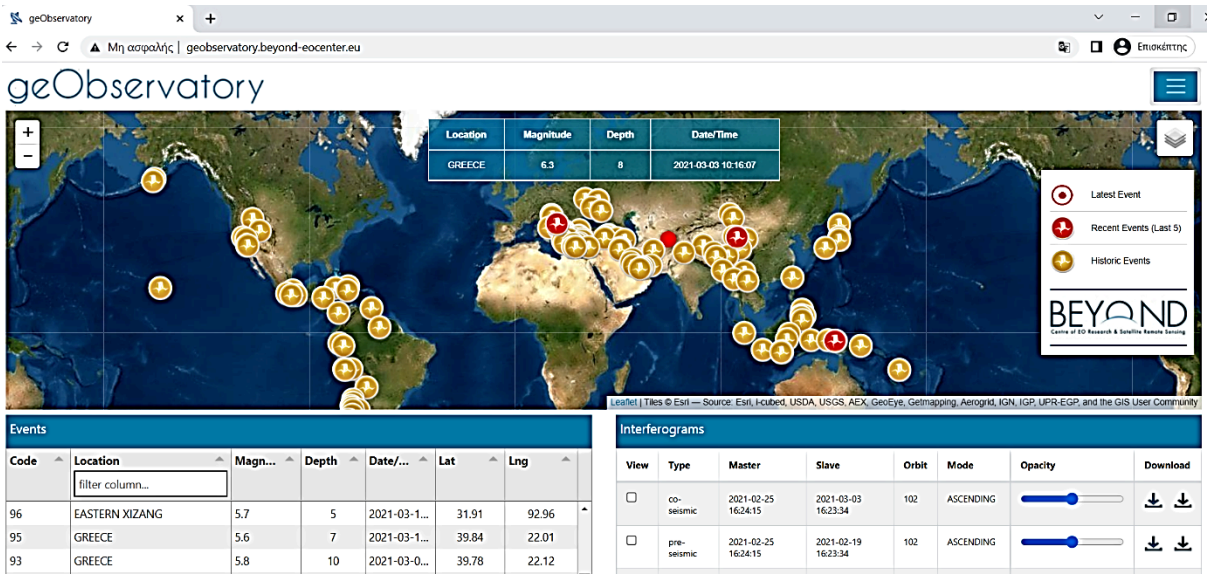



**Figure 6**: The geObservatory service

The GeoHUB relevant link:
http://geobservatory.beyond-eocenter.eu/

The GeoHUB provides timeliness and consistency in detecting and monitoring ground deformation on a global scale.

## DustHUB: Advanced Dust Forecasting Services for Environmental, Health, and Climate Impact Management

The DustHUB service in BEYOND provides timely forecasts of dust outbreaks along with their spatiotemporal and quantitative properties to local authorities and the public. The forecasting service is provided daily with a forecasting horizon of 3 days ahead. DustHUB products include the aerosol optical depth of dust, concentrations of dust at the surface as well as dry and wet depositions which make important information for a sustainable health system and solar energy ecosystem.

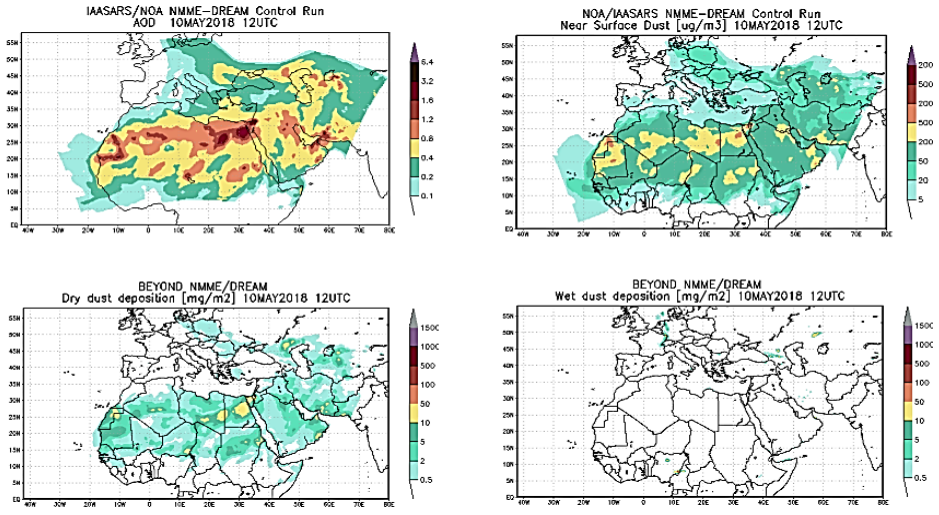



**Figure 7.**: Aerosol Optical Depth, Near Surface Dust Concentration (μgr/m3), Dry and Wet Deposition of Dust (mg/m2), as forecasted by DustHUB

The DustHUB relevant link:
http://dusthub.beyond-eocenter.eu/

The impact of the service is high. Mineral dust affects radiation and alters liquid and ice cloud properties, modifying significantly the precipitation processes. The dust particles when deposited have diverse impact. The smaller PM2.5 particles are easily inhaled and deposited on the lungs and are related to human health disorders, both respiratory as well as cardiovascular. On the other end, they provide micro nutrients to the ocean and/or land ecosystems, thus affecting fishery and agriculture and food security. Desert dust is always present in North Africa, Middle East and the Mediterranean with adverse effects in various scientific and societal sectors including climate change, weather conditions, health, aviation, energy and tourism. Thus, continuous monitoring and forecasting of dust transfer as provided by BEYOND Centre through the DustHUB service assists policy makers for natural hazards and climate change mitigation activities. In the running operational version of DustHUB the forecasts are provided by using DREAM-NMM numerical model. The meteorological core is the NCEP Nonhydrostatic Mesoscale Model on E-grid (NCEP/NMME). Surface properties are defined using the USGS global 1-km land cover data and the USDA global 1-km soil. The model is configured at 0.2°×0.2° resolution and includes 8 dust size bins with effective radii of 0.15, 0.25 0.45, 0.78, 1.3, 2.2, 3.8 and 7.1 μm respectively. The service offers (a) Prediction of dust outbreaks over the Mediterranean region, (b) Estimations of expected dry and wet dust deposition, to mitigate against impacts on energy (PV panel cleaning, etc). A future challenge is to separate the mineralogical composition of dust, through which we can identify specific attributes that induce specific impacts on radiative transfer, cloud formation, ocean fertilization and human health.

**AgriHub: Data Science for sustainable agriculture and food Security**

Agriculture is at a crossroads. According to the European Environment Agency, agriculture is not only one of the largest contributors to climate and environmental change, but also the industry most vulnerable to its effects. On the one hand, agriculture leads in helping go beyond core Planetary Boundaries, including land degradation and biosphere integrity, land-system change, freshwater use, and nitrogen flows. Crucially, circa 50% global food production depends on planetary boundary transgressions. On the other hand, climate change threatens farmland productivity, crop diversity, and input requirements. Therefore, the big challenge is finding ways and tools to help achieve future food security without compromising Earth system resilience.

BEYOND Center's AgriHub responds to this challenge by advancing research in artificial intelligence and big data analytics for Earth observation to understand agro-ecosystems and develop applications that support agricultural and food system sustainability. By integrating satellite data with advanced modeling, we propose solutions for multi-temporal monitoring of agricultural practices, crop health, soil conditions, and environmental impacts, helping stakeholders, from farmers to policy makers, make informed decisions, while keeping an eye on evolving climate challenges. AgriHub aims to develop operational products and pipelines for resource-efficient, climate-resilient farming by providing accessible, interoperable data for policy development and deployment. We utilize space-borne Earth observation, Copernicus Data Access Ecosystem, Cloud & ICT technologies, and AI to evaluate the

impact of farming practices interventions on agro-ecosystems under different climatic futures (Figure 8) and equip policymakers - and farmers - with actionable insights.

To achieve these goals, AgriHub develops and applies advanced analytical tools for monitoring and optimizing agricultural systems. Combining Machine Learning with Earth Observation data enables crop classification, change detection tasks, and the assessment of key indicators such as soil moisture, organic carbon, and crop phenology [20,21]. Predictive models help forecast yields and pest dynamics, while explainable AI enhances transparency in decision-making[22,23]. Additionally, causal inference, causal Machine Learning and counterfactual reasoning provide insights regarding the effectiveness of agricultural practices and recommendations that lead to the optimization of resource usage and productivity improvement [24,25]. Finally, through data fusion techniques that combine satellite, drone, and ground-based observations, AgriHub ensures accurate, scalable, and actionable insights to support sustainable and climate-resilient farming [26].

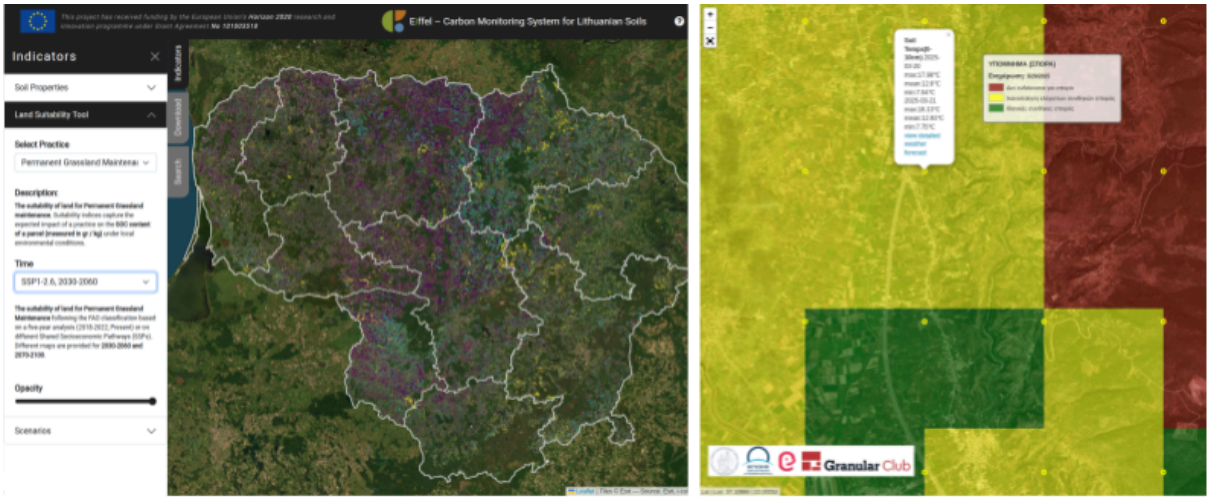



**Figure 8: Left**, a platform[1], where we applied causal Machine Learning to provide the Lithuanian Paying Agency with spatiotemporal insights into the effectiveness of various nature-based agricultural practices (e.g., crop rotation, permanent grassland maintenance) on key outcomes such as Soil Organic Carbon (SOC). SOC estimation[2] and the detection of agricultural practices have been enhanced in newer versions using Deep Learning methods that leverage Earth Observation data. **Right**, a daily knowledge-based recommendation system for optimal cotton sowing, which we evaluated using observational causal inference [AGR6]. Results revealed that fields sown according to our recommendations achieved a statistically significant yield increase of 12% to 17%. This key insight led Corteva Agriscience to adopt the system for four consecutive years (2022-2025) across the entire mainland of Greece for three crops (cotton, corn, sunflower) for which optimal sowing conditions are critical.

AgriHub serves various stakeholders and end users, including farmers, agronomists, policymakers, agricultural companies and researchers. By providing actionable insights, it helps farmers improve productivity, optimize resources, and promote sustainability. For policymakers, AgriHub supports the development of policies aligned with the Common Agricultural Policy (CAP), focusing on climate resilience and resource efficiency. Highlights include collaborations with international companies like Corteva Agriscience—a major American agricultural chemical and seed company; Selected Textiles S.A.—one of Greece's largest textile companies and leader of a group of companies (Selected Energy SA, Selected Volt Single Member SA, Selected Biogas Single Member SA); the Lithuanian Paying Agency; and several farmers' cooperatives in Greece. These partnerships reflect AgriHub's commitment

[1] Developed by i-BEC
[2] SOC concentration model developed by i-BEC

to transforming research into impactful, sustainable agricultural solutions. Last but not least, one of Hub's main goals is the continuous contribution of research, through data science, to addressing climate-related challenges and fostering a collaborative approach to sustainable agriculture. Agrihub targets the most prestigious journals and venues in the interception of AI and agriculture. Recent research highlights were published in Computers and Electronics in Agriculture [21], the AAAI Conference on Artificial Intelligence [26], the Conference on Neural Information Processing Systems [25] and the IEEE/CVF Conference on Computer Vision and Pattern Recognition [26].

## Capacity Buiiding & Education Hub

Capacity Building & Education relevant link:
http://beyond-eocenter.eu/index.php/thematic-areas/capacity-building

Education plays an essential role in advancing the United Nations Sustainable Development Goals (SDGs) and responding to the climate crisis, as highlighted by the Intergovernmental Panel on Climate Change (IPCC). Aligned with these global priorities, the BEYOND Center focuses on education programs relating to Earth Observation (EO), space sciences, and geospatial technologies and fosters scientific literacy and digital competency among primary and secondary students and teachers. By emphasizing climate resilience and natural disaster preparedness, BEYOND Center designs tailored educational material that demonstrates the importance of satellite data for environmental monitoring while underscoring the interdisciplinary nature of space sciences.

To achieve these goals, we employ multiple educational formats, including presentations, hands-on workshops, and field visits that immerse students and teachers in real-world EO applications. The flagship program, BEYONDedu, introduces students to satellite remote sensing, the European Copernicus Programme, and various satellite-based methods for tracking environmental changes. During workshops, participants learn to visualize and process satellite data, performing tasks such as mapping wildfires or flooded areas. Field visits further enhance practical understanding by guiding students through local streams, where they assess flood risks and identify critical points within the watercourse. In parallel, teachers receive tutorials and teaching materials that facilitate the incorporation of EO concepts into their lesson plans.


**Figure 9:** Educational activities: Presentation on Earth Observation in collaboration with the Greek Embassy and the Consulates of Greece in Albania, delivered to Greek-speaking students of primary and secondary schools (top left) and field visits in an urban stream with the 7th Junior High School of Ilioupolis (top right). Capacity building activities in Albania (bottom left) and Tunisia (bottom right).

Despite these efforts, many schools still face obstacles such as limited digital infrastructure and insufficient training resources. To overcome these challenges, BEYOND Center develops online accessible lesson plans, interactive content, and workshop scenarios that boost teacher confidence and spark student enthusiasm. An example is the Erasmus+ project 'SpaceEDUnity', which focuses on creating student communities for disaster prevention through both in-situ data collection and satellite monitoring. Recognized by the European Union as a Good Practice, SpaceEDUnity reached over 1,100 students, 83 teachers, and 32 schools. Another recognized need is a cross-disciplinary approach to climate change adaptation, which the Erasmus+ STEMMOS project addresses by emphasizing advanced Earth Observation concepts and teacher training across multiple European countries. Within STEMMOS, BEYOND's role is to create teaching plans and train educators in remote sensing, enabling them to process satellite data and integrate EO activities into their curriculum.

Furthermore, BEYOND's work in training and technology transfer includes public institutions and decision-making authorities, as well as research institutions. In fact, within the framework of the "Caroline-Herschel-FPA (FPCUP)" program, and through various activations, BEYOND Center organizes and implements capacity building workshops and seminars in the field of natural disasters (floods, fire etc), health, agriculture. The University of Gjirokaster, the Subsidiary Sarande-University of Tirana, Institut National Agronomique de Tunisie (INAT), Tunisian Ministry of Agriculture, GRSS Student Chapter at INAT, WWF Hellas, where among the participants in these capacity building activities.

BEYOND's impact extends well beyond technological advance, directly contributing to knowledge dissemination and capacity building fostering interdisciplinary collaboration.These actions provide stakeholders involved in disaster response, healthcare, and agriculture with new tools and methods, enhancing resilience against floods, fires, and other natural disasters. Through bridging research theory and practice, BEYOND plays a key role in building institutional capacities and supporting data-driven decision-making to build resilience in both social and environmental spheres. Regarding education, the goal is the same: to translate complex scientific advances into accessible, engaging content for the classroom. By doing so, we equip students and teachers with the tools to understand, apply, and act on environmental knowledge in meaningful ways.

## A Hub for Ecosystems and Biodiversity

Biodiversity and natural resources are inextricably linked and their effective monitoring, protection and sustainable management lie at the heart of the objectives of the European Green Deal, the Sustainable Development Goals (SDGs), and the global post-2020 biodiversity framework towards healthy and resourceful ecosystems. In order to plan and monitor interventions for a sustainable and climate-resilient economic transition, public and private decision makers and stakeholders require integrated digital solutions and decision support systems that can simultaneously assess and predict the impacts of these interventions on biodiversity and ecosystem services. In support of these needs, the BEYOND Centre conducts fundamental and applied research to facilitate decision-making by policy makers in the area of biodiversity protection and sustainable use of natural resources. The products and solutions provided within the Ecosystems and Biodiversity Hub enable public and private sectors to comply with the requirements of national and international environmental treaties and agreements. They also contribute to the development of a national and Pan-European environmental protection framework by utilizing the wealth of European research infrastructure and global biodiversity databases.

The research conducted at the BEYOND Center in the specific Hub is transdisciplinary and aims at modelling and mapping the temporal and spatial distribution of all aspects of biodiversity, from microbial diversity, to habitats and ecosystems, as well as assessing the societal impact of alternative biodiversity protection strategies. It primarily utilizes Earth Observation data, high-throughput DNA sequencing and bioinformatics, large biodiversity databases and ecoinformatics, Artificial Intelligence/Computer Vision algorithms, and Climate Change models. Actual focal research areas include: i) Predicting soil microbial biodiversity and pathogen occurrence in agricultural, semi-natural and natural ecosystems[27]. Key findings indicate that soil microbiota can be adequately predicted by satellite imagery. ii) Quantifying the impacts of climate and land-use change in mountain biodiversity and the associated natural resources [28,29] . Published and ongoing research assesses the degradation of national, European and global mountain habitats due to rising temperatures and satellite-captured land transformation. It further assesses the impacts of this degradation to the genetic erosion of biological resources of social significance, and to the depletion of freshwater runoff stemming from mountain habitats. iii) Evaluating bioactive compounds stemming from biodiversity and their responses to human interventions [30]. The developed research framework integrates plant biochemistry, biodiversity, and environmental change research in a transdisciplinary framework for establishing the capacity, potential societal benefits, and the exposure of natural medicinal resources to global environmental change.

The research products stemming from the Ecosystems and Biodiversity Hub have significant implications for monitoring biodiversity and ecosystem states under anthropogenic climate change and land-use intensification, utilizing the full potential of Earth Observations. These products aim at informing key Users as the Core Services provided by Copernicus, i.e. Land Monitoring and Climate Change Service, the European Commission's Joint Research Centre[31], and biodiversity protection strategies developed by the European Environmental Agency. Important end-users also include the European network of national parks and protected areas, as well as local administrative authorities and decision makers in the areas of nature protection and sustainable development.

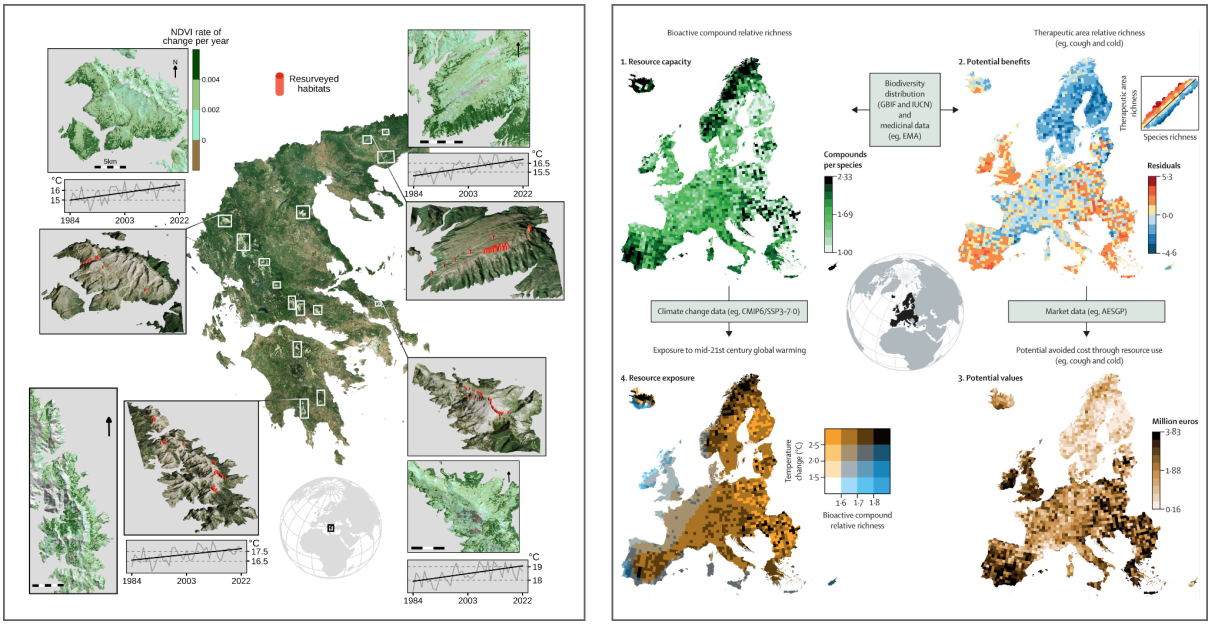



**Figure 10 Left:** Satellite-captured vegetation change and temperature rise in the Greek mountains over the last 40 years. **Right:** The distribution of natural medicinal resources in Europe and their exposure to mid-21st century climate and land-use change.

## HealthHub: The EYWA EWS for Mosquito-Borne Epidemics

According to WHO, Vector-borne diseases (VBDs) pose a significant challenge to global Public Health Systems, accounting for over 17% of all infectious diseases and causing more than 700,000 deaths annually. Amongst VBDs, Mosquito-Borne Diseases (MBDs) are particularly concerning, with diseases such as Malaria, Dengue, Zika, Chikungunya, and West Nile Virus (WNV) responsible for the majority of deaths, causing epidemics that put stress on the healthcare systems and economies. The spread of mosquitoes is closely connected to climate change and environmental factors like temperature, rainfall, and land-use changes, which affect their breeding areas and how diseases are transmitted [32]. In Europe, the emergence and re-emergence of mosquito-borne pathogens have intensified in recent decades. WNV, a flavivirus primarily transmitted by Culex mosquitoes and circulating in enzootic cycles between birds and mosquitoes, stands out as a growing threat. Notably, in 2010, Greece and Russia reported significant outbreaks of West Nile Virus, contributing to a total of 1,016 cases across Europe. In 2018, the EU reported 1,605 WNV infections, an eightfold increase compared to 2017 and the highest number at that time. Most cases were from Italy (39%), Greece (20%), and Romania (18%) and the virus spread to new areas, including Germany, which detected WNV in birds for the first time.

The HealthHub of the BEYOND Center has coordinated the development of the EYWA system, which is a state-of-the-art Early Warning System for mosquito abundance and mosquito borne epidemics. EYWA employs big Earth Observation data from multiple satellites and Socioeconomic data to develop two interconnected models, one for estimating the mosquito abundance [33] and another for predicting the transmission risk of mosquito-borne diseases [34] . Both models operate at extremely fine spatiotemporal resolution of 2x2 $km^2$ per month producing mosquito abundance maps and MBD transmission risk maps shown in Figure 1(a) and Figure 1(b) that are crucial for proactive disease control and outbreak prevention.

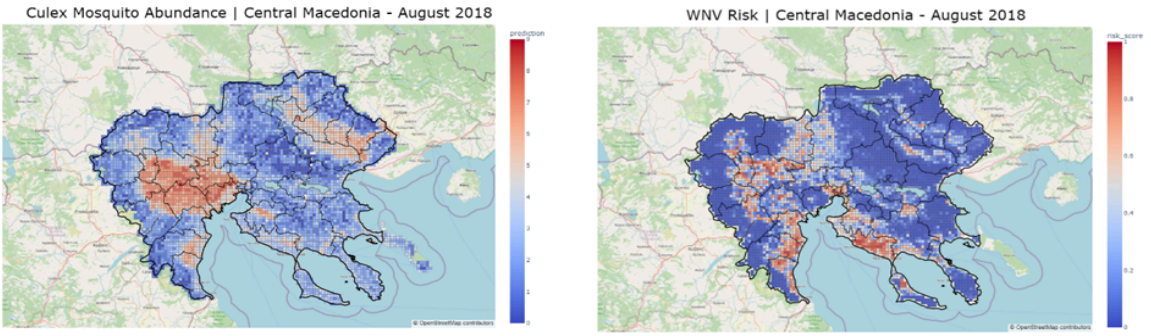



**Figure 11 (left):** Mosquito abundance map for the Culex mosquito. The map shows the predicted mosquito abundance using 9 mosquito classes for the region of Central Macedonia Greece, for August of 2018. **Right:** Transmission risk map for West Nile Virus. The map shows the predicted WNV transmission risk for the region of Central Macedonia Greece, for August of 2018.

EYWA's models allow Health Authorities to identify high-risk areas one month in advance, enabling the timely deployment of targeted interventions, such as vector control measures, public awareness campaigns, and appropriate resource allocation. The HealthHub developed models for the EYWA EWS, known as MAMOTH models, that utilize advanced Machine Learning algorithms to handle the task of predicting the mosquito abundance and the MBD transmission risk for the upcoming month. Advanced Explainable AI methods are employed that uncover the key drivers that influence mosquito populations, as well as the spread of MBDs, and Local Interpretation results reveal how shifts in feature values affect the outcome of both models. Both models are agnostic to the species of mosquito or the mosquito borne disease. The reliance on Earth Observation data makes the models easily transferable to other places on earth. The biggest challenge when attempting to transfer the models are the availability of historical mosquito abundance data or historical MBD case data. However, pretrained models from a specific area can be used for other areas with similar Climatic and Environmental characteristics.

The HealthHUB relevant link:
http://epidemics.space.noa.gr:8081/

EYWA's models are operational since 2022 supporting the Health Authorities in five countries in Europe, specifically 4 regions in Greece, 2 regions in Italy, 3 regions in France, 1 region in Serbia and 1 in Germany, 2 countries in Africa, Ivory Coast and Ghana and is expected to be transferred in Argentina and Camerron in 2025. The official Health Authorities of the supported regions get monthly reports during the transmission period from May to October.

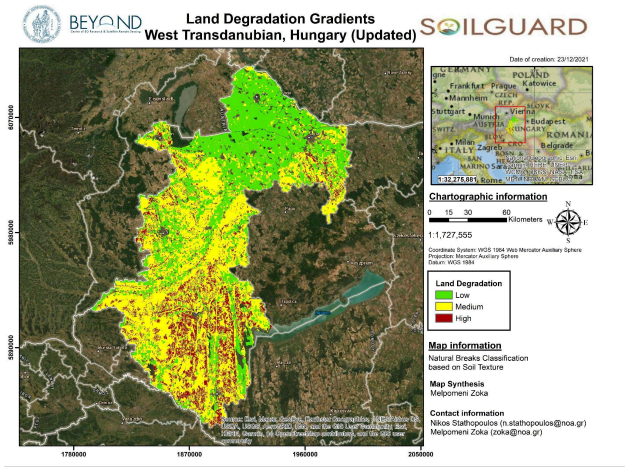
## SoilHub

The SoilHub of the BEYOND Center emphasizes the protection of health in soils, that is the ability of soil to function as a living ecosystem, supporting microbes, plants, animals, and humans. Its physical, chemical, and biological properties determine its capacity to deliver essential ecosystem services, including agriculture, biodiversity, water regulation, and climate resilience. Actually in the EU, soil degradation is a growing concern due to natural factors (e.g., geogenic pollution) and human activities like intensive farming, and urbanization. Land Degradation Neutrality (LDN) is central to the Land Restoration agenda and Sustainable Development Goal 15.3. Healthy soils are critical for implementing

the EU Green Deal, the EU Soil Mission and Soil Law, the Farm to Fork, the Biodiversity and the Climate Adaptation Strategy, the Nature Restoration Law, and the Common Agricultural Policy (CAP).

In this context of needs, the BEYOND Center plays a dual role to support assessment and policy efforts. On the one hand, for the purposes of the SOILGUARD project, BEYOND Center exploited advanced geospatial analysis, Earth Observation indices, climate projections, and field data to derive new knowledge on how vegetation dynamics respond to drought, and affect key factors like soil organic content, sand content, pH, and small woody features. Additionally, BEYOND's expertise has directly supported the sampling design and ecosystem assessment to derive such parameters and highlight the role of soil in ecosystem services (these endeavors are currently under review). On the other hand, the BEYOND Center assumes roles in Coordination & Support Actions as envisaged by the HE project "Soils for Europe- SOLO". BEYOND's SoilHub leads the Land Degradation Think Tank & co-leads the Soil Erosion Think Tank, aligned with the objectives of the Soil Mission Implementation Plan. It has engaged more than 100 stakeholders across regional, national, and European levels and supports the co-design research and innovation roadmaps for the Soil Mission in regard to soil erosion and degradation. This work has led to two publications. [35, 36]

**Figure 12:** Insights from physical meetings and workshops aiming to support the development of a Research & Innovation Roadmap to reduce soil degradation and erosion.



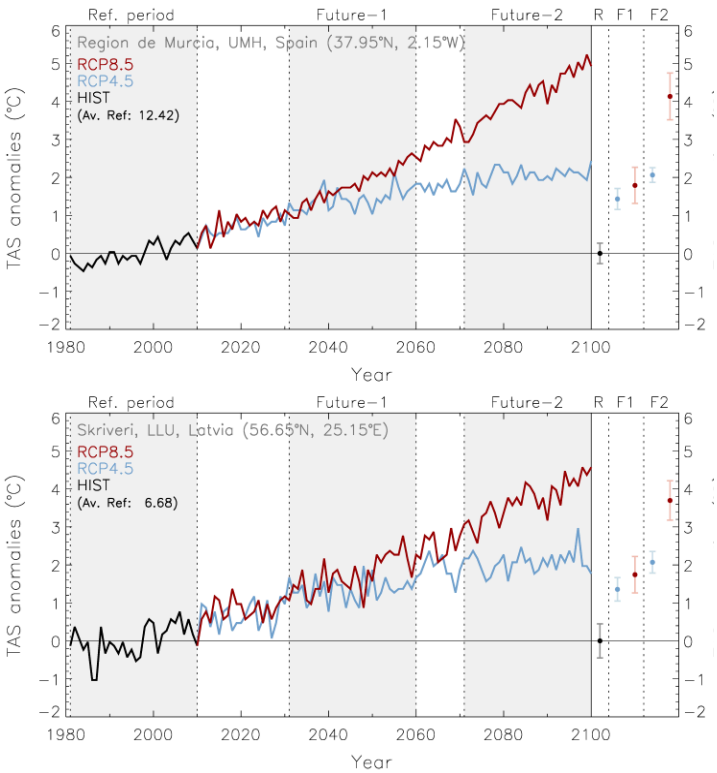




**Figure 13:** Indicative qualitative land degradation map within each soil texture class for the region of Western Transdanubia, Hungary (left) and example time series (right) depicting the differences in annual mean near-surface temperature (TAS - in

°C) compared to the reference period (1981-2010), based on the RCP4.5 and RCP8.5 scenarios from the IPCC AR5, for all locations.

## SolarHub: Advancing Solar Radiation and Renewable Energy Applications

The SolarHUb of BEYOND Center acts towards the transition to renewable energy that is critical in mitigating Climate Change and reducing dependency on fossil fuels. Among renewable sources, solar energy is one of the most abundant and promising, but its variability presents challenges for energy planning, grid management, and storage solutions. To address these issues, Earth Observation (EO) data and advanced solar forecasting methods play a crucial role in improving the efficiency and reliability of solar power systems. The SolarHub team of BEYOND Center collaborates with the PMOD/WRC (Physikalisch-Meteorologisches Observatorium Davos/World Radiation Center, Switzerland), leveraging EO technologies to provide cutting edge solar radiation monitoring and forecasting solutions. Through participation in major European initiatives such as GEO-CRADLE, EuroGEO applications powered by Europe, and Destination Renewable Energy/a DestinE use case, the group is contributing to the widespread adoption of solar energy solutions across Europe and beyond.

SolarHub facilitates the availability and accuracy of solar radiation data by modeling its temporal and spatial distribution in both UV and all-spectral shortwave radiation, thus providing support for better decision-making. The group seeks to improve solar energy forecasting, optimize the integration of produced power into electricity grids, and support policymakers and investors in making informed choices for renewable energy deployment. By developing high-resolution solar radiation maps, real-time short term and long-term forecasting models (e.g. NextSENSE2 service), and energy efficiency solutions, the group aims to bridge the gap between solar energy potential and practical implementation. The developed services are offered as a solution to support the energy management of distributed solar systems of private and national energy transmission and distribution operators in Europe, the Middle East and North Africa, as well as ministries, citizens and other stakeholders.

SolarHUbof BEYOND Center has made significant advancements. Through collaborations within European funded projects, it has contributed to the creation of solar energy atlases (e.g. Solar Atlas of Egypt)[37], providing detailed assessments of solar potential across different regions, including Europe, North Africa, and the Middle East and Cyprus through the Excelsior project [38,39] . The group has successfully implemented nowcasting and forecasting models that help predict solar energy output in real-time, benefiting grid operators and energy providers [40,41]. These models integrate data from satellite observations, ground-based measurement stations, and advanced atmospheric models (atmospheric composition forecasts by Copernicus Atmospheric Monitoring Service - CAMS), significantly improving the accuracy of solar energy predictions[42]. The models have been used and evaluated in various studies [43,44,45,46,47]. Furthermore, the group has played a key role in developing methodologies for assessing the impact of aerosols, clouds, and atmospheric conditions on solar power generation, enhancing the reliability of photovoltaic energy production models. Furthermore, it participates in knowledge transfer activities (e.g. Excelsior project).

The group collaborates with grid operators, policymakers, and industry stakeholders to ensure that its research findings translate into real-world applications, improving energy market operations and supporting climate goals. Through its participation in GEO-CRADLE and EuroGEO, the team has

attracted interest in its services (SENSE2/NextSENSE2) from entities active in the solar energy production sector, both from the public and private sector, such as ADMIE (Independent Electricity Transmission Operator), the ministry of electricity and renewable Energy of Egypt (solar Atlas of Egypt) and Attica Group, as well as various academic institutions (research institutes and universities), and is also contributing to capacity building in developing regions, helping countries optimize their solar energy potential through EO-based solutions.

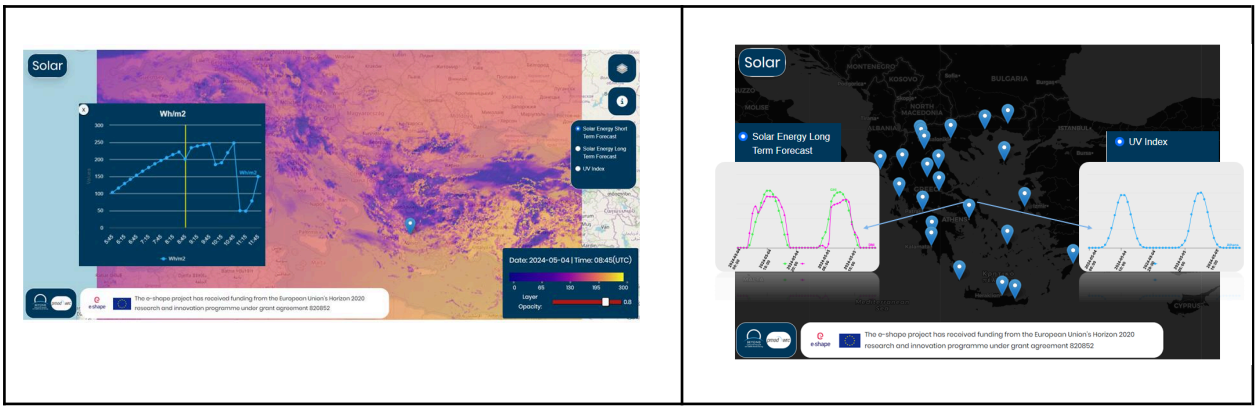



**Figure 14:** Examples of the services provided by the SolarHUB of the BEYOND center **(Left)** Real time satellite-based estimates of the available solar energy (colored map in Wh/m$^2$) on surface are provided by the NextSENSE2 service over a wide area covering Europe, North Africa and parts of Middle East at high spatial resolution (5km). Forecasts of the available solar energy are provided for 3 hours ahead in 15-minute increments for every pixel on the map (the pop up diagram for the selected pixel). **(Right):** Example of the 2 days ahead solar energy and UVI forecasting services.

The SolarHUB relevant link.

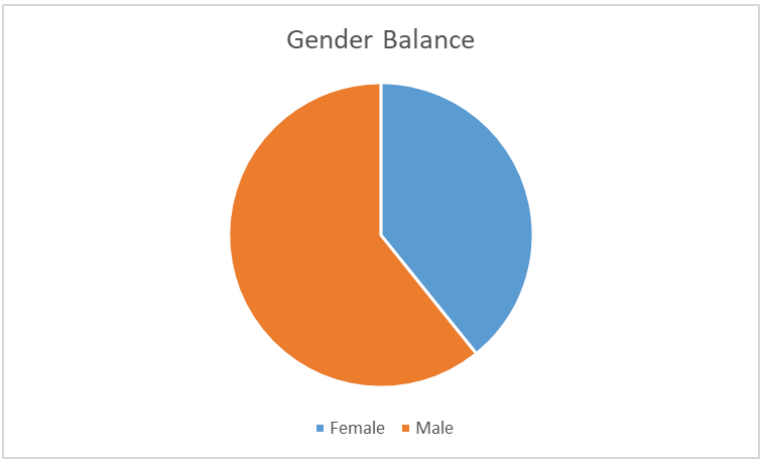
| SolarHUB Portal & Services | |
|---|---|
| SolarHUB Portal | http://beyond-eocenter.eu/index.php/web-services/solarhub |
| nextSENSE2: solar energy nowcasting & short-term forecasting system | https://solar.beyond-eocenter.eu/#solar_short |
| Solar Atlas Service | http://beyond-eocenter.eu/solarapp/ |
| Solar Energy long-term Forecasting | https://solar.beyond-eocenter.eu/#solar_long |
| UV index (UVI) long-term forecasting | https://solar.beyond-eocenter.eu/#uv |

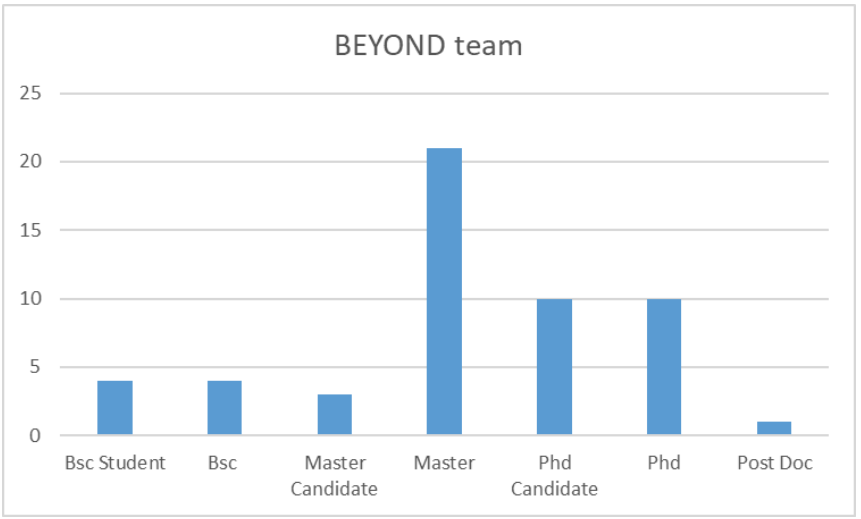
## BEYOND team statistics & gender balance

The BEYOND Center is an interdisciplinary team comprising researchers with international visibility and is supported by distinguished researchers from other Institutes of the National Observatory of Athens and renowned research Institutions worldwide. Actually, BEYOND is working together with over 170 recognized international partners within the area of Space Applications, from universities and research institutions to industries, international organizations, government agencies, and ministries. The members of the team are contributing heavily to scientific meetings and public discussion and are

involved in the dissemination of research results. The intersection of various fields of science enables our personnel to possess the capacity to create novel research projects and unique services, making use of a vast area of knowledge and skills, which has persistently enhanced our contributions to conferences and publications in peer-reviewed academic journals.

During 2024, the BEYOND Center hires 53 research associates with varied scientific experience. Among them, 40% belong to the doctoral-degree holders and postdoctoral level, whereas 46% hold a MSc degree. In addition, a significant number of BSc holders and students contribute to the research and administrative activities.




**BEYOND Outreach 2024**

BEYOND has been marked by its active involvement in several key international and European events for Earth Observation fostering global partnerships and collaborations. This increased outreach has solidified BEYOND's role as a catalyst for delivering space based solutions, amplifying its impact on global, European and regional initiatives while reinforcing its reputation as a trusted partner in Earth observation and environmental management. An indicative list of events that BEYOND participated only during 2024 is presented herein below:

- Kick off Meeting of the Project “Copernicus Emergency Management service (CEMS) Risk and Recovery Mapping (RRM) – Tailor-Made Products (FLEX)”, JRC premises in ISPRA, January 24, 2024
- BEYOND as a Regional Support Office of UN-SPIDER participated at the UN-SPIDER Bonn International Conference on Space-based Solutions for Disaster Management - "Early Warnings for All", 12-14 March, 2024 in Bonn, Germany
- BEYOND at the 10th International Conference on Remote Sensing and Geoinformation of Environment, 8-9 April, 2024, in Cyprus
- BEYOND’s standout participation in Firelogue Working Group Workshop, 9-11 April 2024 Nea Makri, Greece
- BEYOND at ESA – ECMWF Workshop on Machine Learning for Earth Observation and Prediction, 7-10/5/2024, Italy
- Earth Observation & Protection Presentation Series powered by the Operational Unit BEYOND of IAASARS/NOA presented “A Soil Deal for Europe: Showcasing the SOILGUARD and SOLO projects” , 11/6/2024
- IGARSS 2024 Announcement: Local Organizing Committee Appreciation Letter and sincere thanks to all the Participants in IGARSS 2024
- IGARSS 2024 record numbers!
- Photo and video highlights from IGARSS 2024
- Operational Unit BEYOND of IAASARS/NOA supports the 7th CASSINI Hackathon as a Partner, September 13-15, in Thessaloniki
- BEYOND’s key contribution takes center stage at the 2024 GEO Symposium, in Hangzhou, China, 24/9/2024
- BEYOND Leads Discussions on EUROGEO’s contribution to GEO in the support of OneHealth and sustainable Agriculture and Food and Fosters GRSS-GEO Collaboration at the GEO Symposium and ODOK Workshop, Hangzhou 2024
- BEYOND at Soil Health: Current Status and Future Needs Conference, 7-9/10/2024, Chania | Crete
- BEYOND/NOA's strategic contributions featured at the EuroGEO Workshop 2024 in Krakow, Poland, 8-10/10/2024
- BEYOND/NOA labelled participation in the 3rd Destination Earth (DestinE) User eXchange event, in Darmstadt, Germany,15-16/10/2024
- Data-Driven Pathways to Agroecosystem One Health: Ecosystem Services, Challenges and Opportunities" - A BEYOND/NOA labelled special session at the 5th ESP Europe Conference, Wageningen, The Netherlands, 21/11/2024

**BEYOND in media 2024**

**TV & RADIO publicity (Indicatively)**

- **ERT News, July 2024** | Space Technologies
- **REAL FM 97.8, July 2024** | Space Technologies
- **ERT News, FASMA, October 2024** | Kifisos river basin
- **SKAI TV News, October 2024** | Floods in Valencia
- **SKAI TV, LIVE YOU, November 2024** | Floods in Valencia
- **ANT1 News, November 2024** | Kifisos river basin
- **SKAI TV, LIVE YOU, December 2024** | Floods in Rhodes

**ONLINE publicity (Indicatively)**

- **iefimerida.gr** – *What Would Happen in Attica if the Same Amount of Rainfall as in Valencia Fell* (January 2024)
- **newbomb.gr** – *Floods: What Would Happen in Attica if the Same Amount of Rainfall as in Valencia Fell – The Nightmare Scenario* (January 2024)
- **akous.gr** – *What Would Happen in Athens if the Same Rainfall as in Valencia Fell? The Terrifying Scenario (video)* (January 2024)
- **newsit.gr** – *What Would Happen in Athens if the Same Rainfall as in Valencia Fell? The Terrifying Scenario* (January 2024)
- **ethnos.gr** – *What Would Happen in Attica if the Same Amount of Rainfall as in Valencia Fell* (January 2024)
- **real.gr** – *Deadly Floods in Valencia: What Would Happen if the Same Amount of Rain Fell in Attica* (January 2024)
- **thetoc.gr** – *Deadly Floods in Spain: What Would Happen if the Same Amount of Rain Fell in Attica – The Two Most Vulnerable Areas* (January 2024)
- **gazzetta.gr** – *Greek Scientists Explain What Would Happen in Attica if the Same Amount of Rain Fell as in Valencia* (January 2024)
- **newsbeast.gr** – *What Would Happen if the Same Amount of Rain Fell in Attica – The Map from the National Observatory of Athens* (January 2024)
- **protothema.gr** – *Floods in Valencia: Which Areas of Attica Would Be Most at Risk if a Similar Phenomenon Struck* (January 2024)
- **parapolitika.gr** – *Attica: These Are the Areas Most at Risk of Becoming Like Valencia – The Warnings from Experts* (January 2024)
- **kontranews.gr** – *Deadly Floods in Valencia: What Would Happen if the Same Amount of Rain Fell in Attica? Expert Explains* (January 2024)
- **skai.gr** – *Valencia: What Would Happen in Attica if the Same Amount of Rain Fell – Map* (January 2024)
- **ieidiseis.gr** – *Which Areas in Attica Are at High Risk for Floods* (January 2024)
- **reporter.gr** – *What Would Happen if the Bad Weather Dana "Struck" Attica* (January 2024)
- **ieidiseis.gr** – *1.4% of Attica's Population Would Be at Risk if We Had the Floods of Valencia – The Red Zones* (January 2024)
- **iefimerida.gr** – *What Would Happen in Attica if the Same Amount of Rainfall as in Valencia Fell* (January 2024)
- **sdna.gr** – *What Would Happen in Attica if the Same Amount of Rain Fell as in Valencia* (January 2024)
- **tanea.gr** – *Could Athens Become Like Valencia?* (November 2024)
- **libre.gr** – *What Would Happen in Attica if the Same Amount of Rain Fell as in Valencia* (November 2024)
- **kathimerini.gr** – *Negative Record of Burned Areas in the Ionian* (June 2024)
- **kathimerini.gr** – *The 24-Hour Shift of Firefighting Drones* (June 2024)
- **insidestory.gr** – *Your Municipality Knows Which Houses Will Be Flooded in Your Area* (July 2024)
- **in.gr** – *Lack of Flood Warnings: The "Warning Bells" Ring for Scientists – 14 Municipalities in a State of Emergency* (July 2024)
- **naftemporiki.gr** - Hope for the Earth's rescue goes through Athens (July 2024)

**Indicative list of on-going Projects (European, national and international) in 2024**

| Project Title | Duration | Thematic area | Funding scheme |
|---|---|---|---|
| CLIMACA | 1/2/2024 – 31/12/2025 | Agriculture | GREECE 2.0 National Recovery & Resilience Plan<br><br>EUROPEAN UNION<br><br>HFRI |
| UNIVERSWATER | 1/6/2024 – 30/11/2027 | Agriculture | HORIZON EUROPE, EUROPEAN COMMISSION |
| E-SPFdigit | 1/10/2024 – 30/9/2027 | Agriculture | HORIZON EUROPE, EUROPEAN COMMISSION |
| FISHIMPACT | 1/9/2024 – 31/8/2027 | Agriculture | INTERREG EUROPEAN UNION IPA ADRION |
| Greco | 01/12/2024 - 31/05/2028 | Agriculture | EUROPEAN UNION |
| CARMINE | 1/2/2024 - 31/1/2028 | Fires/Disasters | HORIZON EUROPE, EUROPEAN COMMISSION |
| Axis 3 "Forest Monitoring Service" Sat4ΦorestΦ | 1/9/2024 - 30/06/2026 | Agriculture | EUROPEAN SPACE AGENCY |
| Axis 3 "Land Monitoring Service" Sat4GAIA | 1/9/2024 - 30/06/2026 | Geohazards | EUROPEAN SPACE AGENCY |
| ESA Asimov | 05/03/2024 - 01/04/2025 | AI | EUROPEAN SPACE AGENCY |
| ESA DRE | 10/11/2023 - 30/06/2025 | Energy | EUROPEAN SPACE AGENCY |
| UNICORN | 1/10/2024-31/3/2027 | Floods/Disasters | HORIZON EUROPE, EUROPEAN COMMISSION |
| STEMMOS | 01/12/2024 - 30/11/2027 | Education | ERASMUS+ |
| BEOPEN | 1/12/2023 - 30/06/2025 | Fires/Disasters | DIGITAL EUROPE, EUROPEAN COMMISSION |
| FIRELOGUE | 1/11/2021-30/10/2025 | Fires/Disasters | HORIZON EUROPE, EUROPEAN COMMISSION |
| EUROGEOSEC | 1/12/2023 - 30/11/2025 | Coordination and Support | HORIZON EUROPE, EUROPEAN COMMISSION |

| Project Title | Duration | Thematic area | Funding scheme |
|---|---|---|---|
| EXCELSIOR | 1/10/2019 - 31/12/2027 | Coordination and Support | HORIZON EUROPE, EUROPEAN COMMISSION |
| EMS | 1/1/2024 - 31/12/2026 | Disasters | EUROPEAN UNION |
| FPCUP | 02/09/2019 - 30/09/2025 | Capacity Building | EUROPEAN UNION |
| SOLO | 01/12/2022 - 30/11/2027 | Soil | HORIZON EUROPE, EUROPEAN COMMISSION |
| SOILGUARD | 01/06/2021 - 31/05/2025 | Soil | HORIZON EUROPE, EUROPEAN COMMISSION |
| SPACE SURVEILLANCE & TRACKING | 1/07/2023 - 30/06/2026 | Space | DG DEFIS & HADEA |
| DATA RELAY HUB FRAMEWORK-GREECE | 22/09/2022 - 11/2025 | Data & Infrastructures | EUROPEAN SPACE AGENCY |
| QATAR GEOLOGICAL MAPPING | 29/01/2024 - 01/01/2027 | Geohazards/Disasters | MINISTER OF MUNICIPALITY, QATAR |
| MEDEWSA | 1/11/2024 - 31/10/2027 | Fires/Disasters | HORIZON EUROPE, EUROPEAN COMMISSION |
| STARS EU | 15/07/2021 - 31/07/2025 | Space | HORIZON EUROPE, EUROPEAN COMMISSION |

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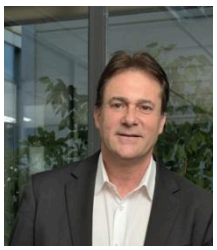
## Contributors' CVs



Kontoes Charalampos (Haris) holds the position of Research Director at the IAASARS/NOA and leads the Operational Unit BEYOND Center. He received his PhD in Earth Observation holding a grant from EC (JRC/ISPRA). He leads Space related projects funded by ESA, EC, and International Institutions (WB, EIB). He acts as National Delegate contributing to Space Policy and Program Committees of ESA, EC, COPERNICUS, SST/SSA. He is member of the Steering Committee of Geohazard Supersites and Natural Laboratories of Group of Earth Observations and the Committee of International Union of Geodesy and Geophysics, and is actively involved in the GEO Disaster Risk Reduction and Capacity Building Working Groups. He is the GRSS GEO principal and leader of the Disasters Resilience and Health Action Group of EuroGEO. He is responsible for Node 3 of Copernicus Data Access Service, the Hellenic Mirror Site, and the NOA's Ground Segment. He is the author of more than 200 publications (h-index 35). He speaks English, French and Italian.

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**Bormpoudakis Dimitrios** is an interdisciplinary environmental scientist. He combines research utilising data science for biodiversity and agro-ecosystems with social science studies on environmental governance and justice.

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**Choumos George** is a PhD candidate in AI applications for Space Surveillance and Tracking at the National and Kapodistrian University of Athens. With a background in Computer Science (BSc), Data Science (MSc), and Space Technologies (MSc), he has been specializing in software engineering, DevOps and infrastructure. At IAASARS/NOA, his research focuses on AI integration in Space Situational Awareness and SST, and he is actively involved in the activities of the Greek National Operations Center for SST.

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**Georgakis Angelos** holds a diploma (MEng) in Electrical & Computer Engineering from the National Technical University of Athens (NTUA), and is currently pursuing his Masters' degree in 'Space Technologies, Applications, and Services (STAR)' at the National Kapodistrian University of Athens (NKUA). He is specialized in solar energy modelling and forecasting applications while having a strong background in Machine and Deep Learning techniques, Computer Vision, EO, and Computer and Data science.

**Girtsou Stella** is a PhD candidate focusing on Forest Fire prediction systems, with a specialization in the application of artificial intelligence (AI) techniques. She is a Rural, Surveying and Geoinformatics Engineer, while during her Master's degree in Space Applications, she was trained on advanced Machine Learning methodologies, big data management and algorithms for data analysis and prediction systems.

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**Loukrezi Anastasia** is a communications and digital marketing professional with international experience in media, technology, and brand strategy. She studied Communication and Media at the University of Athens and earned a Master's in Digital Communication and Multimedia from Université Paris II Panthéon-Assas. After seven years in Paris working on digital marketing, branding, and strategic communications, she is now a Communicator at the BEYOND Centre.

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**Papakonstantinou Maria (Marietta)** graduated from the school of Philosophy at the University of Athens and holds an MA in Heritage Management with an expertise in Project Management. She has been working as project manager in European and national co-funded programs.

**Pissaridi Katerina** holds a diploma in Chemical Engineering and a PhD in the field of Biomaterials and Biospectroscopy. Her Postdoctoral studies were at the Laboratory of Food Chemistry and Biotechnology (Department of Chemistry, University of Patras). She has a strong background in fields such as food technology, food safety, nutrition and circular economy. She is Project Manager at the BEYOND Centre.

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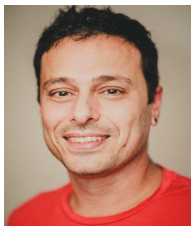

**Theodoridis Spyros** is a biodiversity researcher with an MSc in Biodiversity Conservation and a PhD in Plant Biogeography. His research focus is on integrating Earth Observations, in-situ DNA and ecological data, and computation modelling for mapping and predicting the responses of biodiversity under anthropogenic interventions and pressures, such as climate and land-use change.

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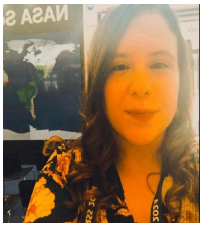

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