

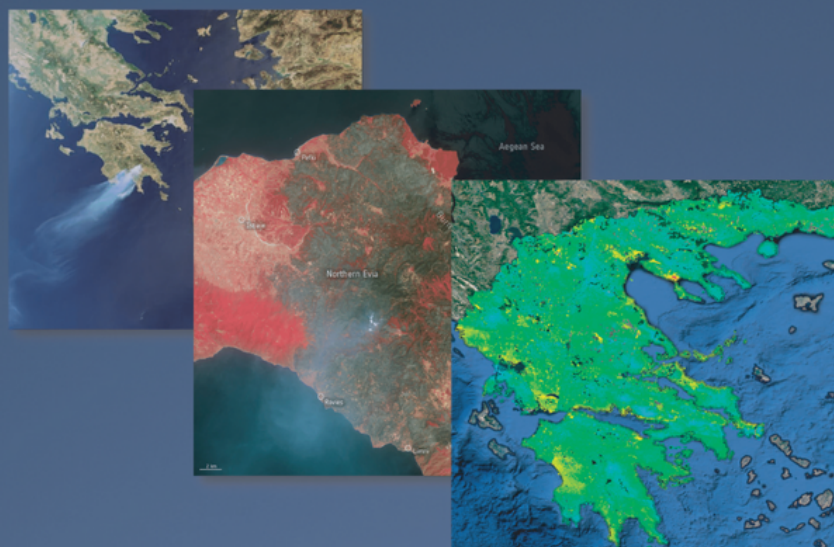
Satellite-based Services for Disaster Risk Management

25 May 2022

10:00 - 15:00 EEST

Ministry for Climate Crisis and Civil Protection

Athens



SATELLITE-BASED SERVICES FOR DISASTER RISK MANAGEMENT

TABLE OF CONTENTS

Introduction	2
The workshop	3
The policy framework	4
The service providers' perspective	11
The end-users' experience	13
The survey results	17
Conclusions	25

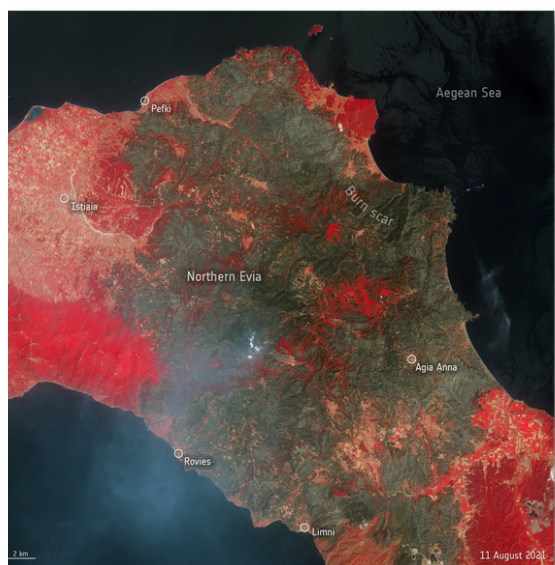
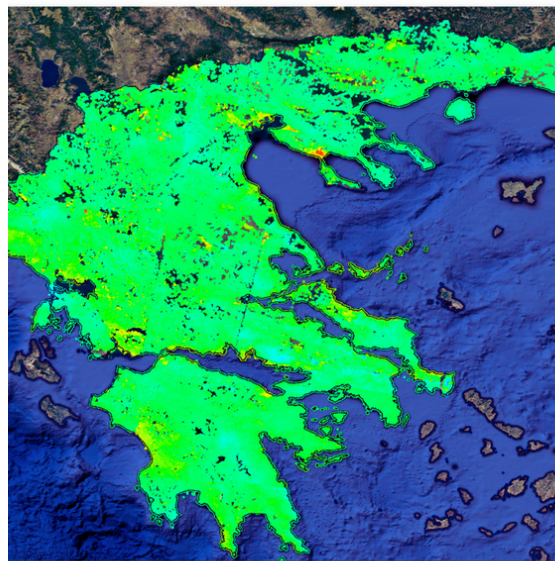
INTRODUCTION

Many efforts have already been made to make society more resilient and to decrease its exposure to the consequences of both natural and man-made disasters. This led not only to an increased understanding of disasters, but also to better preparedness, and post-disaster response and recovery.

The number of weather-related disasters is poised to increase in the future driven by climate change and other factors like industrialisation and increased urbanisation. **According to the World Meteorological Organization (WMO) Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019), more than 11 000 disasters were reported between 1970 and 2019 attributed to weather, climate and water-related hazards, with over 2 million deaths and more than 3 trillion euro in economic losses. The number of disasters has increased by a factor of 5 over this 50-year period. A recent study performed by Christian Aid showed that in 2021 alone, 10 extreme events influenced by climate change caused each 1.3 billion Euro damage or more.**

Europe is not exempt. **According to the European Civil Protection and Humanitarian Aid Operations (ECHO) in the EU, from 1980 to 2020, natural hazards affected nearly 50 million people and cost Member States an average of 12 billion euros per year.**

The rapid growth in the use of satellite applications over recent decades, has the potential to help mitigate the impact of climate change and related hazards. Earth observations, Global Navigation Satellite Systems, and satellite communications all support crucial phases of Disaster Risk Management, from prevention and preparation to response and recovery.



THE WORKSHOP "SATELLITE-BASED SERVICES FOR DISASTER RISK MANAGEMENT"



The workshop "**Satellite-based Services for Disaster Risk Management**" held on May 25th in Athens, aimed at creating a common understanding among Greek and European stakeholders of what satellite-based services can bring during the disaster management cycle and of how to facilitate the access and use of such solutions at national and regional levels.

The workshop was organised by the **EU Agency for the Space Programme (EUSPA)** and **Eurisy**, in cooperation with the **Greek Ministry for Climate Crisis and Civil Protection** and the **Ministry of Digital Governance**. The workshop gathered national stakeholders to present national capabilities, share experiences, exchange best practices and discuss the benefits of satellite-based services for disaster management and the challenges related to their operational use.

The workshop was hosted at the premises of the Greek Ministry for Climate Crisis and Civil Protection.



In cooperation with the Greek
Ministry for Climate Crisis and
Civil Protection and Ministry for
Digital Governance



THE POLICY FRAMEWORK

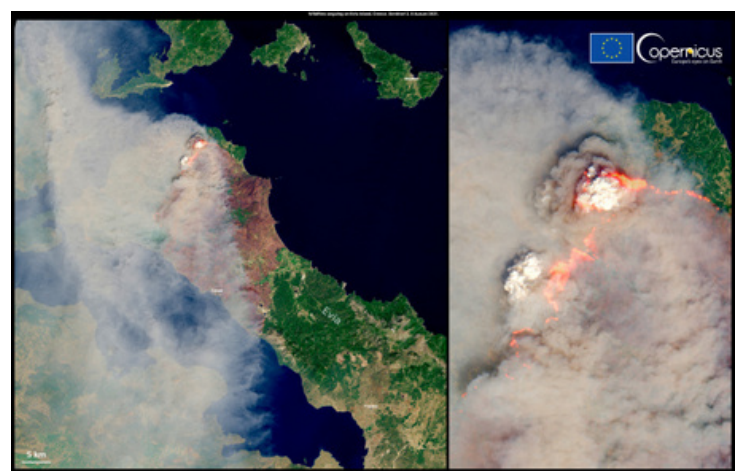
The Greek summer 2021 has been characterised by intense droughts and wildfires with severe consequences on the land and life of citizens. In these conditions, **“satellite technologies have proven to be invaluable in addressing emergencies with an enormous potential to further contribute to effective response and adequate recovery”**, as stated by Christos Stylianides, Minister for Climate Crisis and Civil Protection. Information retrieved from satellites are poised to become an integrated element of the modern disaster management cycle especially when it comes to climate change related events.

Considering climate change as a natural disaster is an approach meant to provide a holistic framework methodology incorporating cutting-edge innovation and technology, to better and more effectively tackle its hazardous effects. Remote sensing imagery has been successfully used in both disaster's prevention and preparedness phases. Satellite data has been exploited to generate systematic information to support long-term temporal series of climate phenomena, whilst improving early warning of extreme events and the accuracy of disaster's consequences forecasts.

When it comes to Greece, the country's need to bridge the existing technology gap between the traditional emergency management approach, and what technology can offer to public authorities to protect their citizens.



Christos Stylianides, Christos Stylianides, Greek Minister for Climate Crisis and Civil Protection



Evia wildfire in Greece, August 8th 2021. The image has been acquired by Copernicus Sentinel-2 satellites

Ensure safe communication to the emergency service, especially while or after a disaster occurred, is critical to support emergency operations.

"Greece is now one of the six countries in Europe with a national operational secure communication system. Also satellite communication plays in case a disaster occurs"

Athanasios Staveris-Polykalas,
Secretary General of
Telecommunications and Post, within
the Ministry of Digital Governance.

The digitalization of the emergency response to guarantee the safety of the Greek citizens is a priority of the government's action. **Greece is currently on the forefront of the satellite communication innovation, especially in the field of secured governmental communication. The launch of Hellas Sat-3 and -4 in 2019, allowed Greece to implement its national GOVSATCOM system connecting parliament, ministries, and civil protection authorities enabling secured communication especially in critical conditions.**

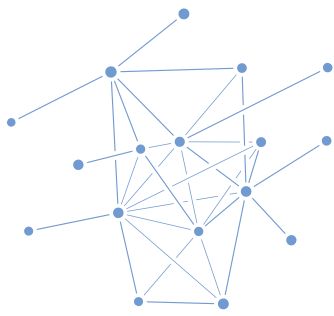


Hellas Sat 3 and 4. Credits Thales Alenia Space

"Hellas Sat 3 and 4 have been specifically designed, in cooperation with the Greek Government back in 2017, to facilitate through Greecom internal secure communications between national authorities and embassies, especially during emergencies"

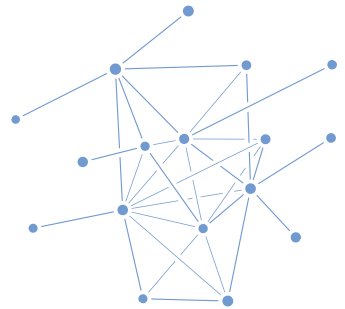
**Thomas Kalamaris - Technical
Director of Hellas Sat.**

disasters are not affected by borders: multi-stakeholder cooperation at any level, from international to local, is crucial to ensure the resilience of any country. **At a national level, the Greek Ministry of Digital Transformation and the National Civil Protection are jointly developing an early warning system providing life-saving information to the public through multiple communication pathways relying on several integrated technologies, as described by George M. Karagiannis-Deputy Secretary General for Civil Protection.**



"At the European level, the interoperability of the satellite navigation system Galileo and the Earth Observation programme Copernicus increase the safety of citizens around the globe"

Timo Pesonen, Director General for Defence, Industry and Space at the European Commission.



EU space activities under one umbrella. Credits: EUSPA

"Galileo data is today widely used for search and rescue (SAR) operations increasing the accuracy of the signalled location while reducing operators' time to respond in a situation of distress"

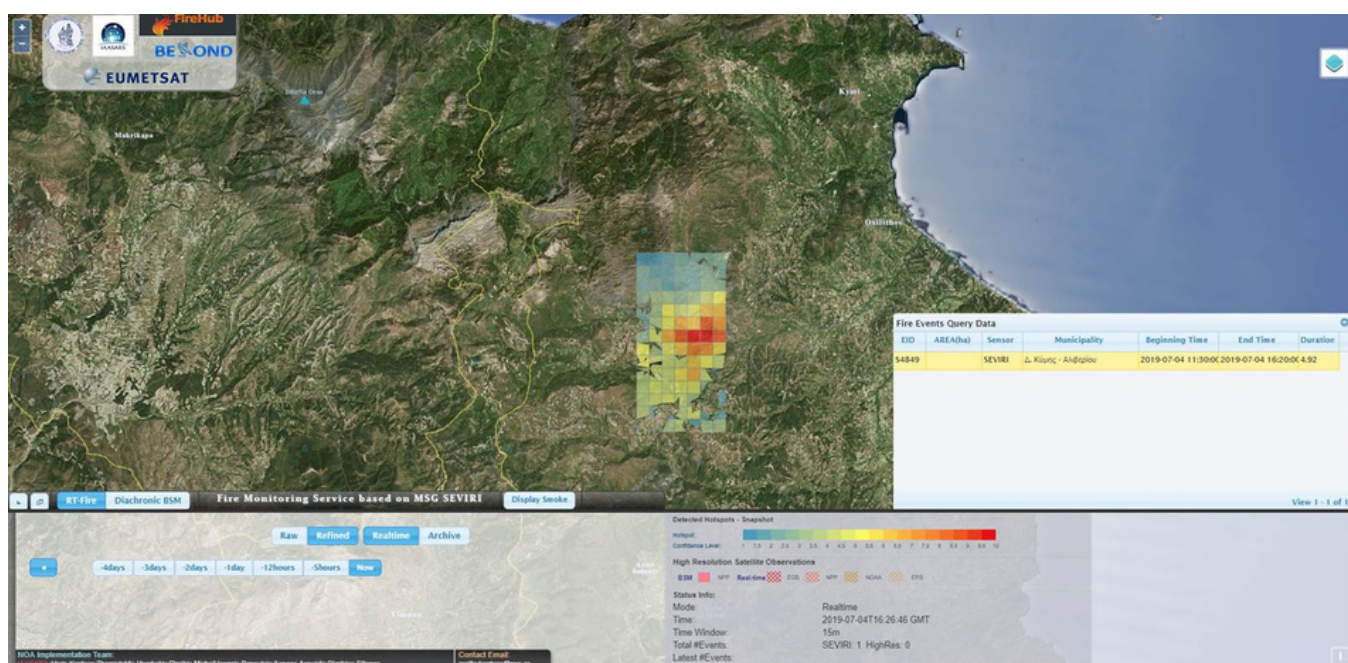
Rodrigo Da Costa, Executive Director of EUSPA.

Galileo/SAR is the only system delivering the Return Link Service (RLS). Galileo is designing new features to answer the operational needs of SAR units as closely as possible, to save even more lives. The Remote Beacon Activation Service (e.g. in the case of the disappearance of a plane or a vessel) and the Two-Way communication functionality (that allows rescue coordinators to send pre-programmed questions and instructions to the person in distress) is due to enter into preliminary testing shortly.



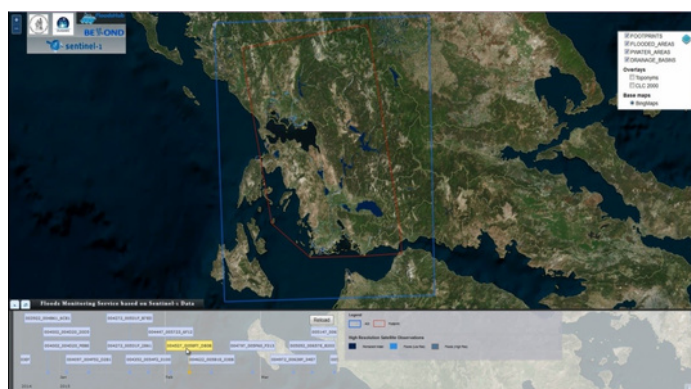
The role of Earth Observation in disaster management is central when it comes to disaster risk reduction, climate change adaptation, climate resilience, environmental and resources protection, food security and much more. Haris Kontoes, Beyond Research Director, illustrated two indigenous operational services developed by Beyond- EO Centre of Excellence.

FireHUB is an example of how a EO based solution can be used to respond to wildfires. Risk analysis, AI validated predictions together with fire and smoke dispersion maps, are made publicly available for open consultation. FireHUB products can be used from the early warning phase to the post-disaster one, supporting preparedness and mitigation capacity of relevant entities. Only in 2021, Firehub has been activated 14 times in the Attica region - one of the most affected during the last fire season.



Snapshot of Beyond's FireHub Platform. Credits: Beyond EO Centre of Excellence

The second service, the FloodHub, system was co-designed with local users to better respond to real needs. The platform delivers final and actionable information, allowing them to familiarise themselves with a technology-based solutions improved through capacity building mechanisms at both national and regional levels. Both the Fire and Flood Hubs integrate Copernicus data.



Snapshot of Beyond's FloodHub Platform. Credits: Beyond EO Centre of Excellence

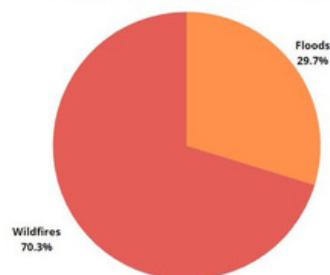
Copernicus offers a set of services helping authorities to take informed decisions in different fields among which are emergency and disaster management. As presented by Laura Bettili, Senior Expert at the Copernicus Emergency Management Service (CEMS), it comprehends a rapid mapping service and the Risk and Recovery Mapping both accessible by authorised national authorities.

The Copernicus rapid mapping service is active at all times. It can provide EO data in a time average spanning between a minimum of 24 hours to a maximum of 5 days. Over the last 10 years it has been activated mostly in conjunction with floodings, wildfires, windstorms, and humanitarian crisis.

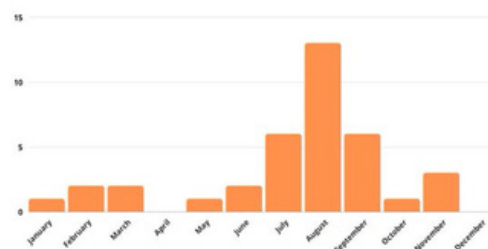


EMS Rapid Mapping Activations in Greece

CEMS Rapid Mapping Activations in Greece by Disaster Type (2012-2022 to date)



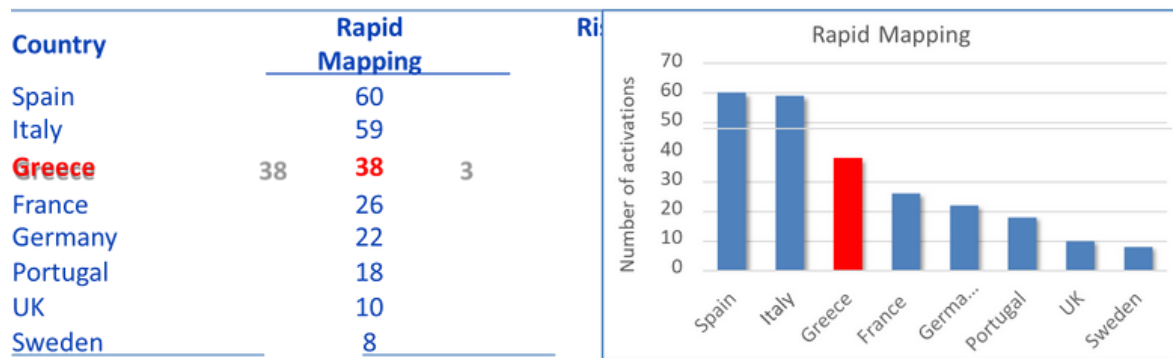
CEMS Rapid Mapping Activations in Greece by Month (2012-2022 to date)



EMS Rapid Mapping Activations in Greece. Image retrieved by Laura Bettili's presentation and the Copernicus Emergency Management Service

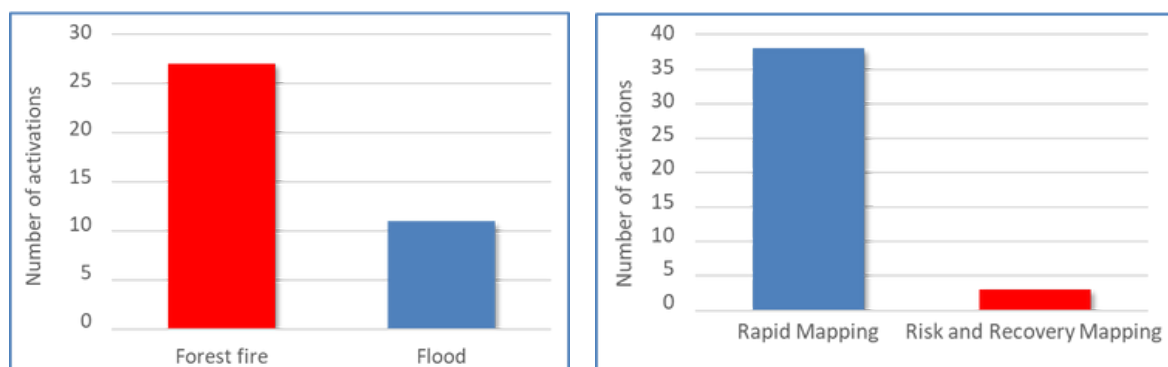
"Greece counts 37 activations making it the third country in Europe in terms of activations requested, after Spain and Italy".
Laura Bettili, Senior Expert at the Copernicus Emergency Management Service (CEMS).

Copernicus, hence, satellite based data and information has been widely used for disaster management by Greek authorities, especially the national Civil Protection. Over the past ten years the General Secretariat for Civil Protection (GSCP) activated the rapid mapping service 38 times for flooding (11 times) and forest fires (27 times) mainly concerning the Attika and Peloponnese regions. The number of activations increased overtime reaching a peak in 2021.

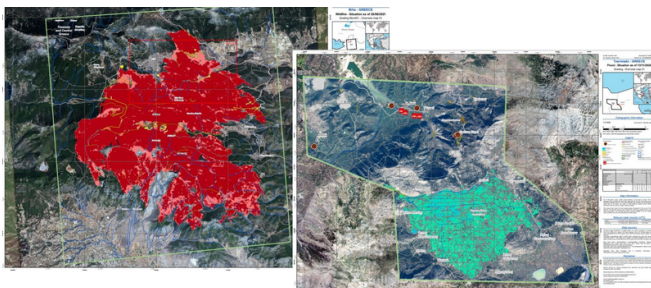


Copernicus Emergency Services in Greece. Image retrieved by Andreas Antonakos' presentation

The delivery of CEMS products depends on a series of factors including the time span between the disaster and the request of activation of the service, the availability of images for the affected area at the needed time, as well as more technical related aspects as cloud or smoke coverages.

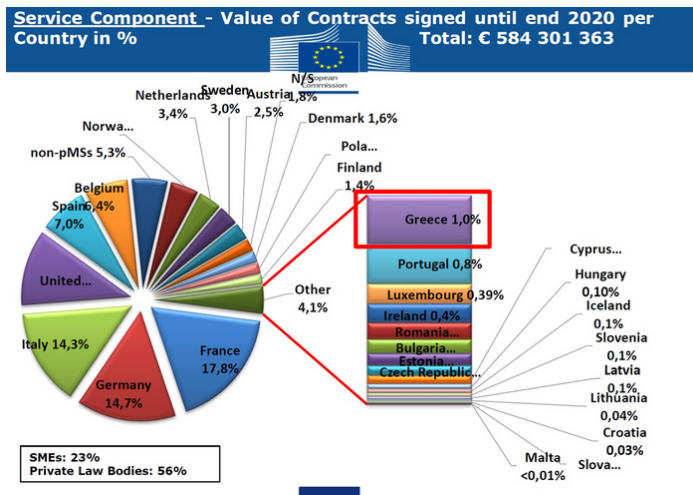


Copernicus Emergency Services in Greece. Image retrieved by Andreas Antonakos' presentation



Examples of CEMS Rapid Mapping Activation in Greece. Image retrieved by Laura Bettini's presentation and the Copernicus Emergency Management Service

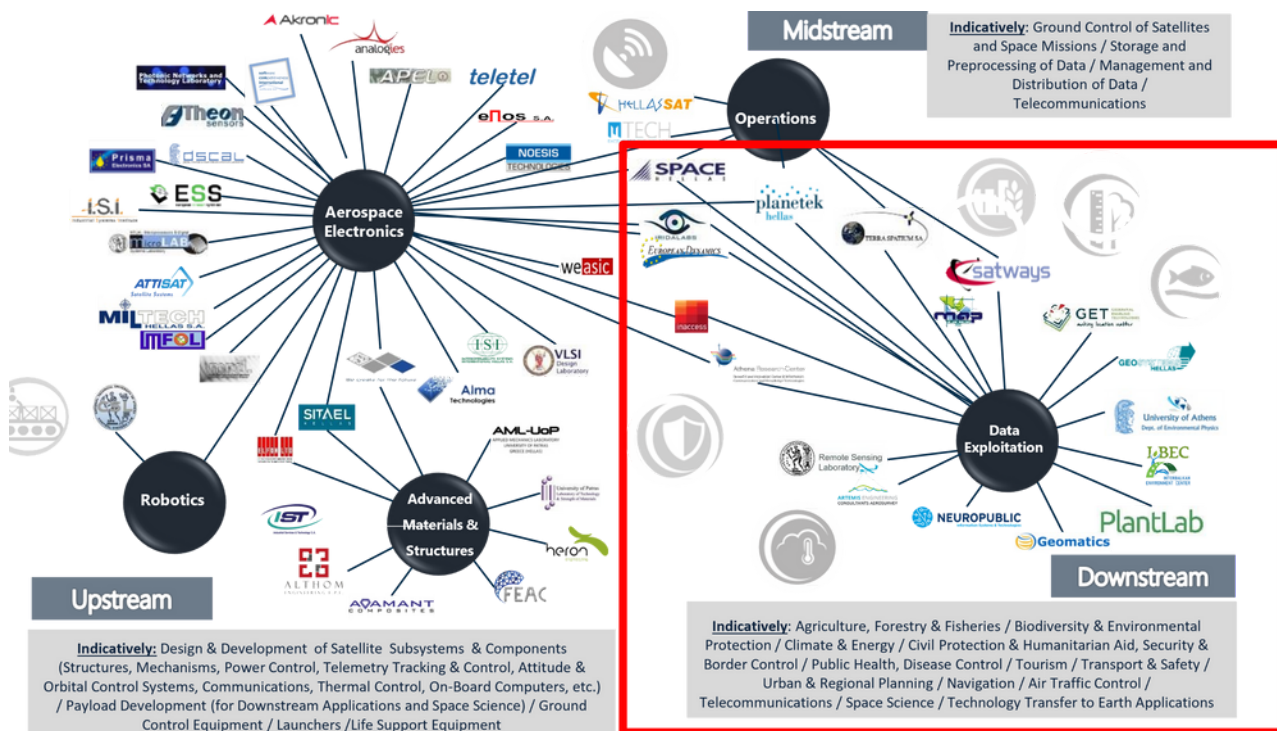
The Risk and Recovery Mapping supports prevention, preparedness, mitigation and recovery activities and it is thus operational only during working hours. It provides maps built integrating several EO data with information on exposure, vulnerability, and resilience for all types of hazards, and in post-disaster phases they can add impact assessment analysis. On May 18th, 2022, this service has been activated for Multi-risk analysis of the Delphi and Ancient Olympia archaeological sites to produce hazard, exposure, vulnerability and geo-data risk and maps to prepare evacuation plans.



"Copernicus programme sensitively contributes to the overall economy, stimulate entrepreneurship, increase revenues and create specialized jobs."
Stelios Bollanos, Co-founder & Director of Planetek Hellas.

Copernicus Value of Contracts signed until 2020 per Country in %. Image retrieved by Stelios Bollanos' presentation and the European Commission

As reported in the last EARS Industry Survey 2021 between 2006 and 2020, Greece managed to boost the local space ecosystem marking a steady increase in revenues and EO employees. In the country, the space downstream segment is rapidly flourishing as illustrated by the capacity to gain about 1% of the overall Copernicus' service components contract. The development of this part of the space value chain, tightly linked with other digital technologies is crucial to multiplying economic growth.



Thematic focus of the space value chain in Greece. Image retrieved by Stelios Bollanos' presentation

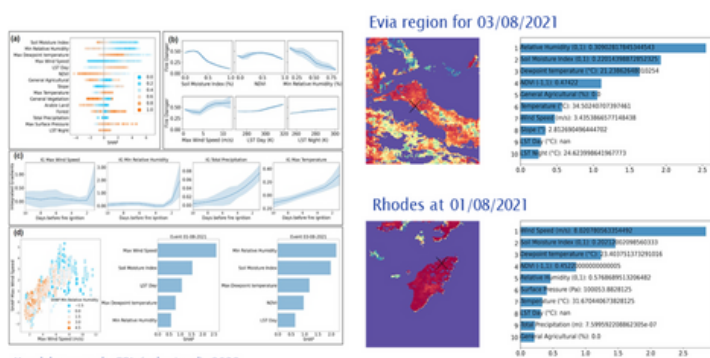
THE SERVICE PROVIDERS' PERSPECTIVE

What can space data contribute to prevention, preparedness, response, and recovery? The answer to this question comes from the multiple national examples that has been developed by Greek SMEs, research centres and public institutions.

"The National Observatory of Athens (NOA) is developing satellite-based solutions for disaster risk management integrating other technologies such as Artificial Intelligence (AI), to study the correlation between the rise of temperatures and the frequency of extreme weather events." - Ioannis Papoutsis, Researcher at the Institute of Astronomy, Astrophysics, Space Applications and Remote Sensing of the National Observatory of Athens.

One of the most visible effects of the correlation between temperatures and extreme weather is represented by wildfires.

At NOA, EO and AI are combined to develop a machine learning model predicting the likelihood of actual fires to take place. Data can be made available to first responders and planners with a one-day delay. This service developed as part of the international cooperative project **Deep Cube**, includes historical fires time series data over the last 10-15 years covering the Mediterranean region including meteorological contexts, burnt areas, vegetation, and land use. **Through machine learning, the emerging correlations are better understood and by using AI semantics it is possible to assess which geographic areas are more at risk than others.**



Artificial Intelligence and big Earth Observation data for enhanced disaster risk management. Image retrieved by Ioannis Papoutsis' presentation and Deep Cube Project

"Bringing AI and Copernicus together represents an opportunity to develop a new generation of products. The European Commission as well as national programmes are calling on researchers and industry to investigate this topic." **Vangelis Karkaletsis, Director of the Institute of Informatics & Telecommunications (IIT) at NCSR Demokritos**

Synergies between AI and Earth Observation are currently studied at the European level.

AI4Copernicus is an innovative Horizon2020 funded project. The main project goals are:

- 1- Integrate existing resources and EO data to provide access to training material and expertise enriching the AI4EU resources catalogue;
- 2- Foster the AI4EU and Copernicus communities to solve real problems of business and societal value, through Open Calls;
- 3- Drive the evolution, uptake, and impact of the AI4EU and the DIAS platforms.

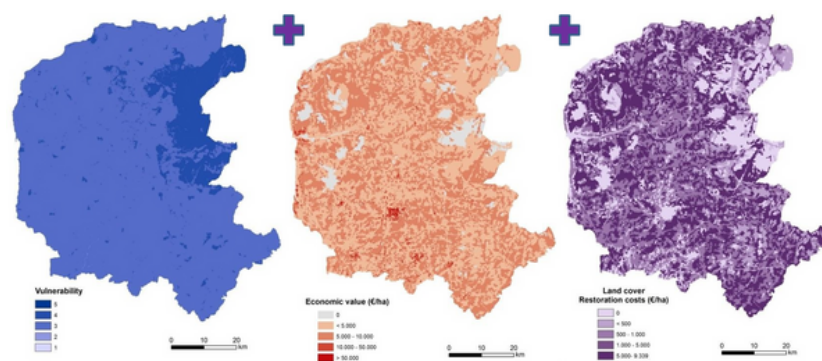
Effective prevention and sustainable recovery from wildfires are key for Mediterranean countries, highly exposed to wildfires. The **PREFER** project- **Space-based Information Support for Prevention and REcovery of Forest Fires Emergency in the MediteRanean Area** aimed at designing and developing a pre-operational demonstration of space-based end-to-end information service supporting the prevention, preparedness and recovery of local communities from forest fires in the Mediterranean area.

AI4Copernicus project offers to external partners a series of opportunities - the open calls on AI&EO for industrial domains, societal challenges, scientific experiments, and citizen social challenges. They aim at supporting the creation of an open, inclusive, and sustainable AI-EO innovation cycle bridging the gap between AI- and data-driven innovation while providing economic, social & environmental benefits.



AI4Copernicus in a nutshell. Image retrieved by Vangelis Karkaletsis presentation and AI4Copernicus project

The Information Service consisted of a centralized system for archiving, visualization, and delivery to end-users of spatial product, such as seasonal fuel maps, seasonal hazard maps, vulnerability maps, seasonal risk maps, daily hazards maps and prescribed burning maps.



Extended Vulnerability Map. Image retrieved by George Eftychidis presentation and PREFER Project

THE END-USERS' PERSPECTIVE

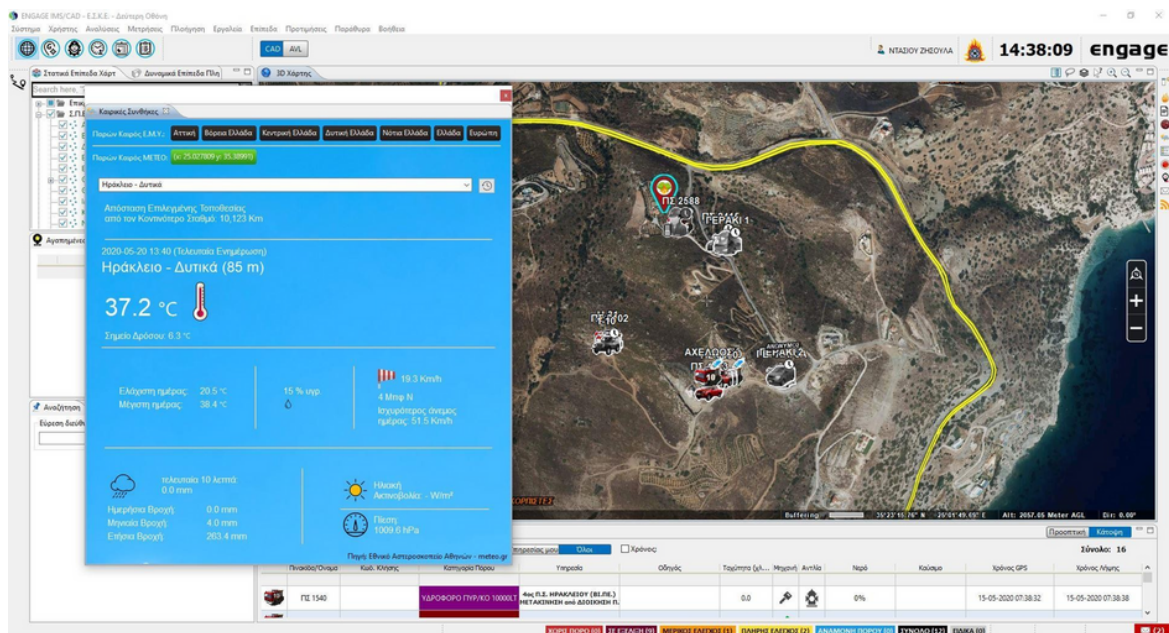
A different perspective on satellite-based solutions in the disaster management field is offered by end-users. Spanning that share their best practices and lessons learned stemming from the use of satellite applications in their daily operations.

The system gathers data from citizens, fire patrols, municipalities, navy, coast guard, as well as webcams and infra-red images from 13 regional prefectures scattered over the national territory. To complement the system, the Hellenic Fire Corps developed a suite of mobile and web apps to support main actors and general public to report on incidents and emergencies.

"The Hellenic Fire Corps represents one of the Greek public authorities using satellite data daily. The Corps developed a real-time operational system to facilitate the collection of recordings on hazardous events."

**Zisoula Ntasiou – Fire Lieutenant
Colonel in the Hellenic Fire Corps**

Besides infra-red, Copernicus Sentinel images are used for map production for geospatial intelligence and decision-making support. Since 2013 the Hellenic Fire Corps collaborates with the National Observatory of Athens to exchange data, know-how and services developed and provided within the responsibilities and activities of both parties.



Meteorological data collected by the Hellenic Fire Corps. Image retrieved by Zisoula Ntasiou presentation

One of the oldest applications of geospatial data is to inform Armed Forces to rapidly react in the case of disasters. Such a service is delivered since 1889 by the Hellenic Geographical Army Service (HAGS), the oldest greek referenced service of the country.

The Hellenic Army Geographical Corps illustrated the three main phases of disaster risk management cycle supported by their services:

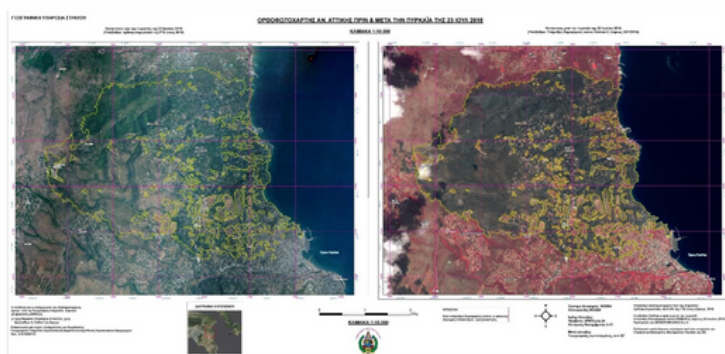
- **Risk Management Planning;**
- **Crisis Response;**
- **Post event assessment and restitution.**

Maps are provided through a rapid deployment of overlaid EO images before, during and after an event occurs.



Geo solutions for disaster management. Image retrieved by Panagiotis Fragkos presentation

The challenges of the HAGS in providing up-to-date maps and information are the availability of satellite imagery both in terms of time and quality (deriving from weather uncertainty, such as clouds and storms); orbital sensors restrictions related to the observations including jurisdiction, privacy and resolution and the need for more processing automation that currently requires cumbersome methods and long procedures.



Pre, During & Post Event Special Purpose Orthomaps for Disaster Management. Image retrieved by Panagiotis Fragkos presentation

Develop solutions that perfectly respond to the needs of the users is key to favour their wide adoption. Instead of implementing a top-down technology-push approach executed for research purposes, the Beyond Centre is revolving this methodology centralizing the users and developing solutions addressing actual needs to ensure market sustainability maximising the service adoption in operational practices.



ResAGRI Vulnerability and Hazard Map. Image retrieved by Nikos Bartsotas presentation

The service effectively combines climatological, earth observational, in-situ and state-of-the-art numerical weather prediction data in high resolution, towards a more sophisticated monitoring of precision agricultural needs. This user-centric approach has been tested in different sectors among which Agro-insurance.

One example entails the need expressed by the insurance firm InterAmerican to develop diversified agricultural parcels' primes instead of offering a flat insurance rate over a region.

Floods, intense rain or unexpected cold among other extreme events damage crops and negatively affect areas dedicated to farming, decreasing soil fertility. In Greece, Inter-American supports both farmers and agri-food companies to recover from such events through dedicated insurance schemes.

The ResAGRI solution helps in optimising the development of targeted primes. Beyond analysed and merged 40 years' of satellite data with the damage record hold by Elgar, the public insurance authority that farmers are mandated to use in Greece.

Through the obtained database it was possible to identify areas in distress after an incident, avoiding time and resource-consuming evaluations by an agronomist. It was also possible to develop a satellite-based early-warning forecast on a regional scale, and a fraud protection system where farmers can avoid deceptive client applications in the vicinity of extreme weather events.

ResAGRI Weather Risk								
iLot Number	WRF-2day				GFS-10day			
	Extreme Temperature	Gale Winds	Heavy Precipitation Event	Hailstorm Risk	Extreme Temperature	Gale Winds	Heavy Precipitation Event	Hailstorm Risk
6295466982356								
6059046202034								
3753561273005								

ResAGRI Weather Risk. Image retrieved by Nikos Bartsotas presentation



Granular Club Map. Image retrieved by Georgios Zanakis presentation

"Farmers need digital solutions for a more efficient and sustainable productivity driven by innovation to overcome farmers' challenges as optimization of plant timing."

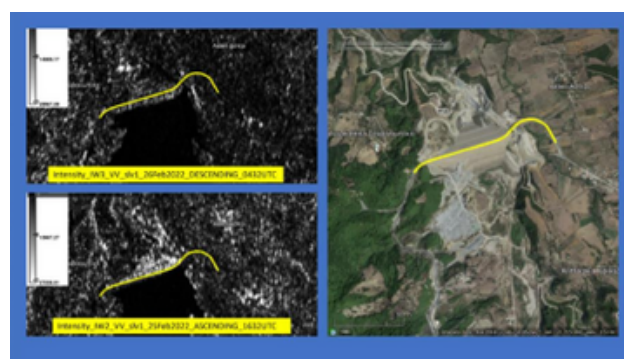
Georgios Zanakis - Marketing and Development Manager at Corteva

PROION has been developed to monitor critical infrastructure in close cooperation with end users. Key takeaways from the applied process relate to the need for training and consultancy service to fully exploit the data.

The PROION project demonstrates the importance to disseminate satellite-based knowledge derived from projects, promoting the development of free access to open data platforms that could help increasing the use of satellite-derived products.

The Granular Hub is a farm management software helping growers professionals to build and sustain their business. Such software provides the farmers with data driven crop models and insights through satellite high frequency data including weather forecasts, soil moisture information, and literature on seed germination to boost the productivity of the yields.

Satellite-based land monitoring is an asset for many industries as demonstrated by PROION, that integrates SAR calibration measurements from Sentinel-1, Cosmo Sky-Med and TerraSAR-X to detect soil deformation in the tectonically and seismically active area of the so-called Greek "Superstite" within the Achaia region.



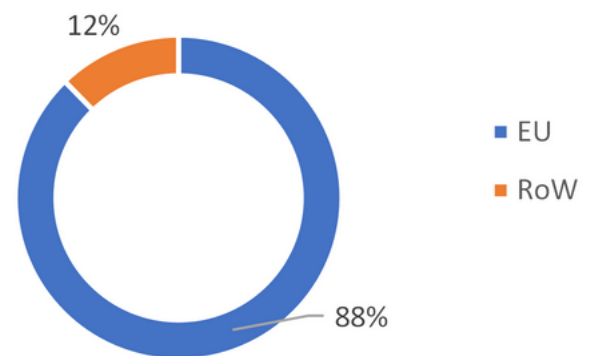
PROION satellite-based land monitoring system. Image retrieved by Christos Kontopoulos presentation and PROION project

THE SURVEY RESULTS

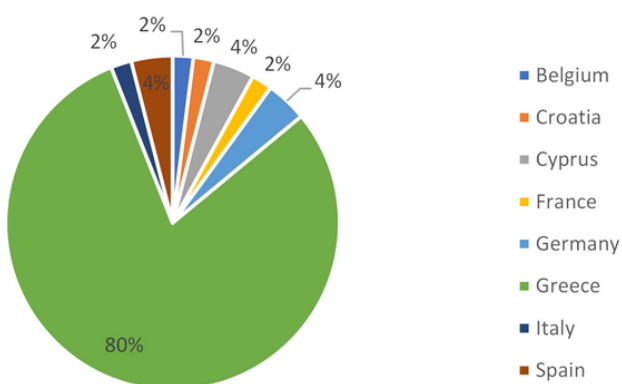
To guide the discussion a survey has been distributed to many Greek users participating to the event. The main purpose was to collect insights on the first-hand experience of users on the validation, integration, and use of satellite-based data and services for disaster risk management. It was composed of a set of questions designed to investigate the motivations that led or could lead users to adopt satellite-based solutions, the related benefits and challenges.

Launched in Mid-May, the survey was completed by 63 respondents, however only 57 could be considered as complete and valid replies and thus used for the following analysis.

Despite the national scope of the event and the targeted distribution of the survey it is interesting to note that eventually it reached out beyond the Greek and European borders. Replies have been filled by users from UK, Albania, Turkey, South Africa, India and Ghana considered as the rest of the world (RoW).



Geographic distribution of respondents. Data elaborated by Eurisy

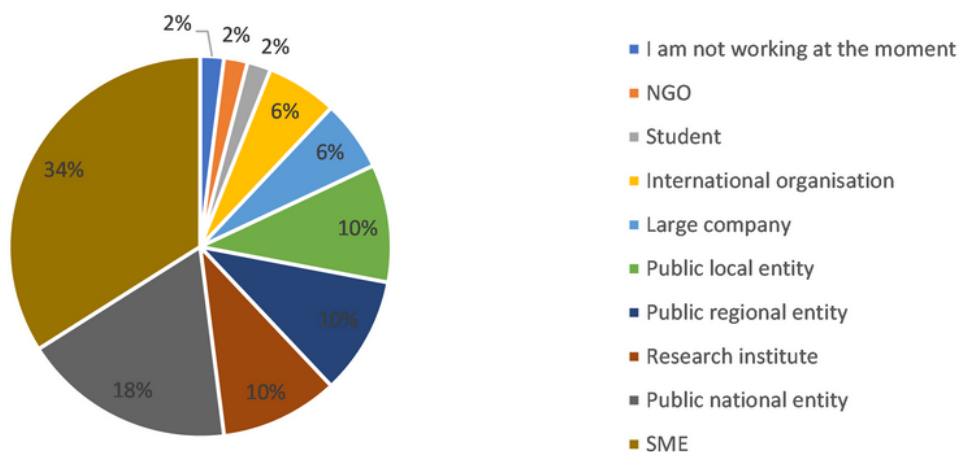


Overview of the EU respondents. Data elaborated by Eurisy

EU respondents represented the majority of the sample: 80% are from Greece, while the rest is scattered in other EU members' countries. From now onwards the results presented take into account only the EU sample.

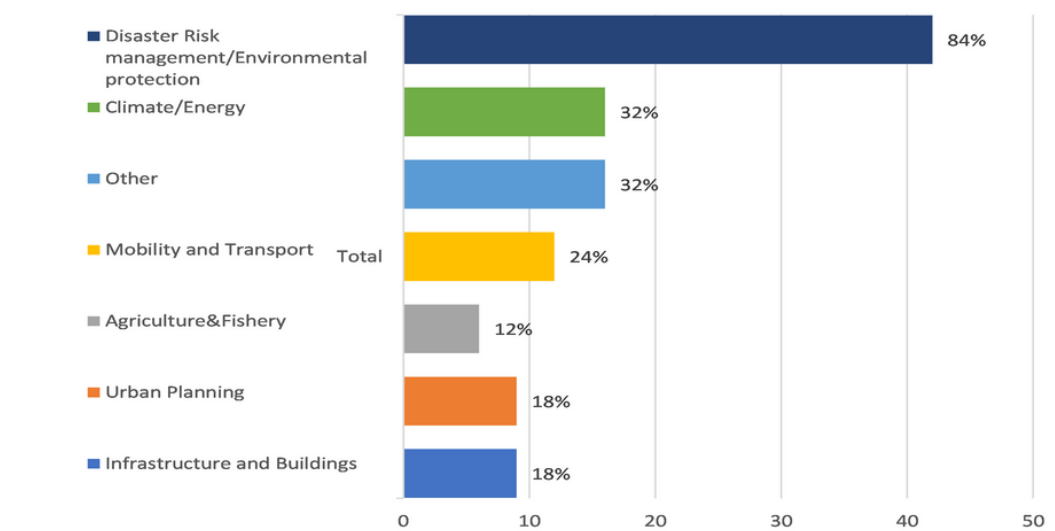
There is a consistent distribution of replies between private entities counting for about the 40% (considering both SMEs and Large companies) and public entities marking up 38% of the total (including all the levels from national down to regional and local authorities).

Within the private respondents, many comes from SMEs, very likely intermediate users often referred to as downstream service providers whose business is to different extents relying on the processing of raw or semi raw satellite data to which they add value to deliver accessible and exploitable information to end users.



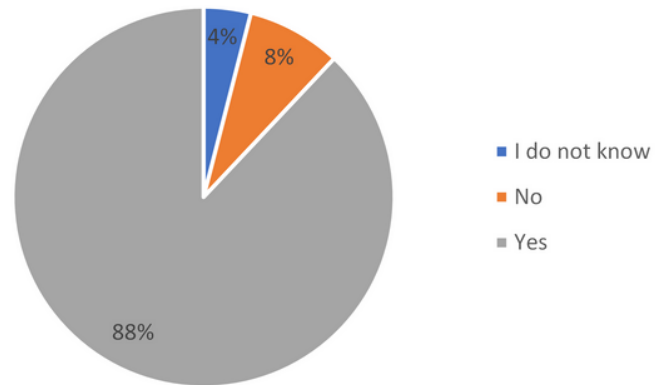
Classification of the organisations of the respondents. Data elaborated by Eurisy

According to the data collected, the 84% of the survey respondents declared to be working in the field of disaster risk management and environmental protection. Among the other categories 32% of the participants acknowledged an impact of their work on the fields of climate and energy, while others including mostly tourism and leisure as well as insurance and financial services.



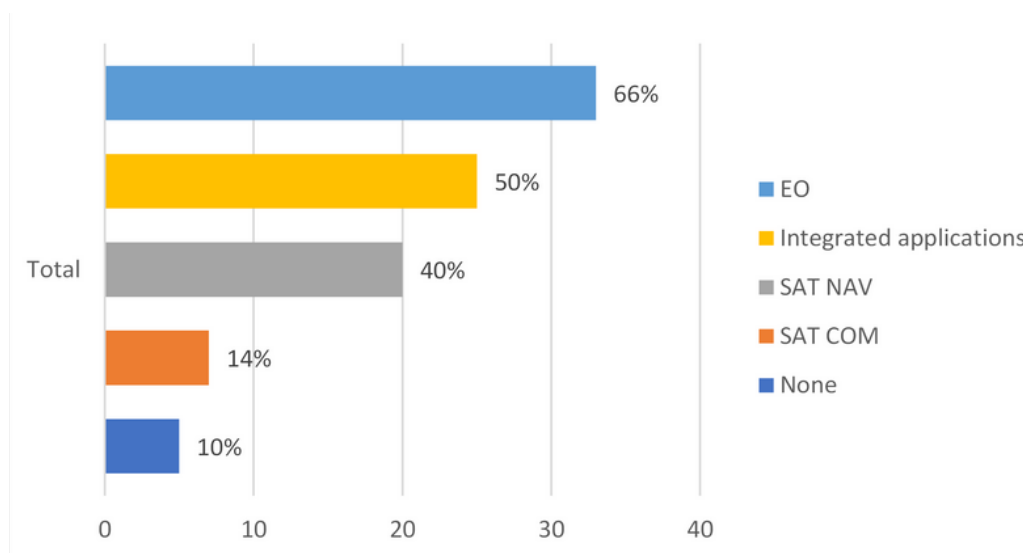
Fields of activity of the respondents. Data elaborated by Eurisy

The survey respondents have been asked about their awareness, interest, and actual use of satellites data and solutions. The results show a very high interest or actual use of satellite data and services, reaching the 88% of the total sample.



Interest in satellite data and solutions of the respondents. Data elaborated by Eurisy

The high percentage of interest and previous use of satellite data/solutions could be biased by the background and field of operations of the respondents. It is important to consider that the survey has been mostly filled by users' part of the Eurisy network, meaning that are individuals exposed to innovation technologies. The respondents pertaining to the private sector declared to have used at least once or thought about using satellite data or solutions. The situation is slightly different if taken into consideration public entities where 7% of them are do not know about it and the 14% never used or even though about using it.



Satellite technology used by the respondents. Data elaborated by Eurisy

The sample of respondents looks aware of the benefits offered by satellite solutions for their sector of reference: 66% of the respondents declared to have actively used EO data and/or solutions.

Earth observation, satellite communication and navigation are vital tools in the disaster management cycle.

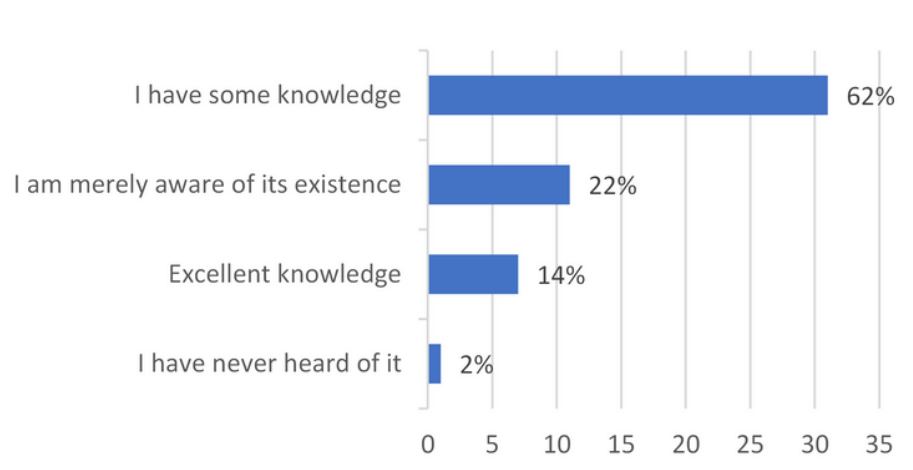
Satellite remote sensing provides decision-makers and civil protection authorities objective and timely information. This is the case for early warning systems, but also for information on the extent of a disaster.

Satellite communications helps organising and coordinating support systems and search and rescue operations proving reliable and secure coverage anywhere. They are crucial before, during and after a disaster occurs.

GNSS applications provide rescue teams with accurate positioning on critical infrastructures and affected populations. The sensors contribute to disaster risk management, for instance, geo-locating critical resources and facilities.

The respondents have been asked to report on their level of awareness of the Copernicus Emergency Management Service (CEMS). Considering that Greece is one of the EU countries with the highest number of activations of the service, this should lead to assume that the highest level of awareness of the services lies within the public authorities in charge of the first response and the development of mitigation and adaptation strategies.

The majority of the respondents declaring excellent knowledge are either from SMEs or research institutes, underling the need for more awareness in the public sector on the potential for the Copernicus Services to support decision making and policy development.



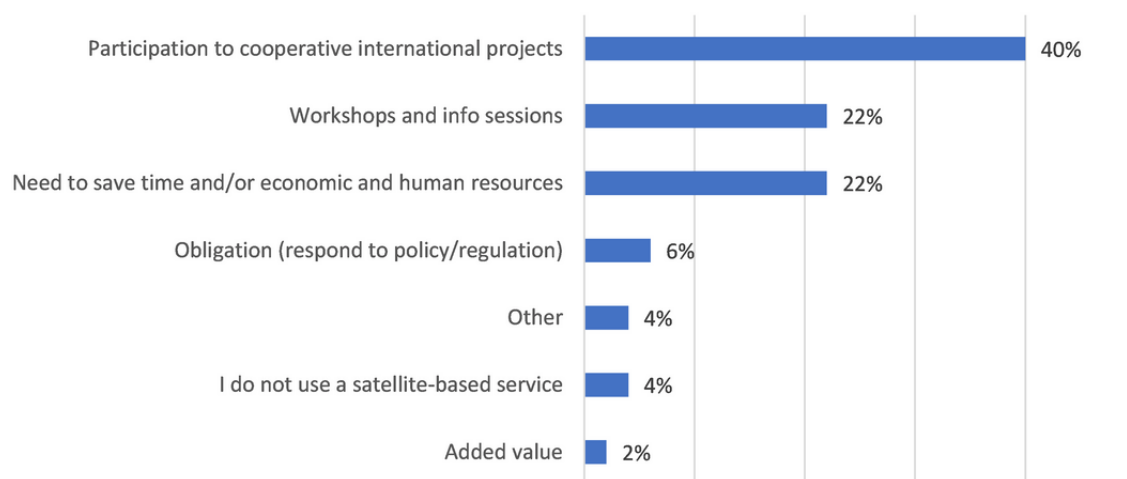
Copernicus CEMS awareness. Data elaborated by Eurisy

It is interesting to understand in which context the respondents have been using satellite data and/or solutions. The main reason 40% of the respondents decided to use satellite data derives from the participation in international cooperative projects allowing them to:

- Assess the benefits of satellite applications for specific challenges with a limited impact on the user budget.
- Consider innovation as a growing opportunity for the organisations and the sectors in which they operate.

22% of the respondents turned to satellite-based solution to save time or economic and/or human resources, indicating that there is a number of users with a certain knowledge about the benefits of the integration of satellite derived information in their workflow.

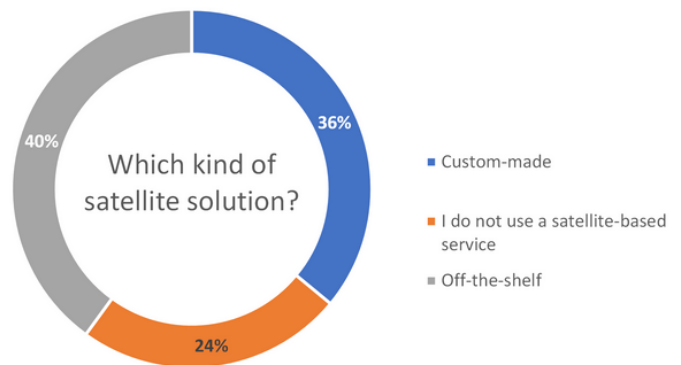
Only 2% of the sample indicates as “added value” to their working processes the reason that made them using satellite-based data and information. This means that among the participants a very limited number of people has a solid understanding of the benefits deriving from the integration of satellite-based information.



Rationale on the use of satellite-based solutions. Data elaborated by Eurisy

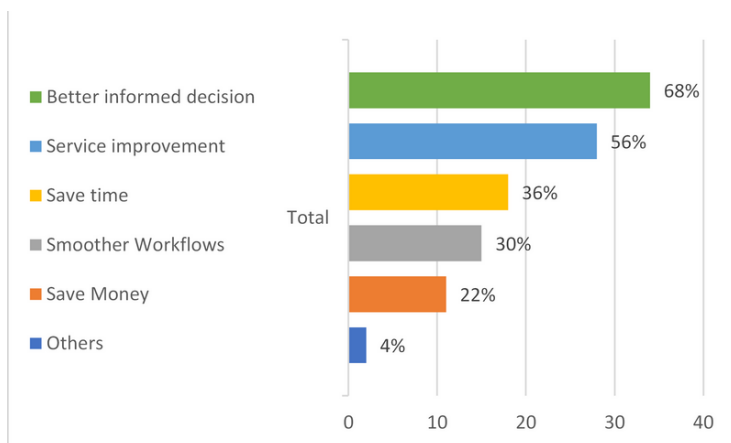
The participation at dedicated workshops and info sessions on the actual use and benefits of satellite applications seems to be an effective tool to promote the use and integration of those solutions.

Among the respondents currently using satellite solution there is an even distribution between those integrating a custom made solution, very likely through a co-design process. These kind of solutions are certainly better responding to the actual needs of the user, nonetheless they might require a longer time to be developed and a more active participation in the selection and validation of the data from the users themselves.



Type of satellite solution adopted. Data elaborated by Eurisy

40% of the sample declared to use off-the-shelf solutions indicating that within the sector there is an increasing number of commercial solutions that meets the requirements of the users and that can be seamlessly integrated.

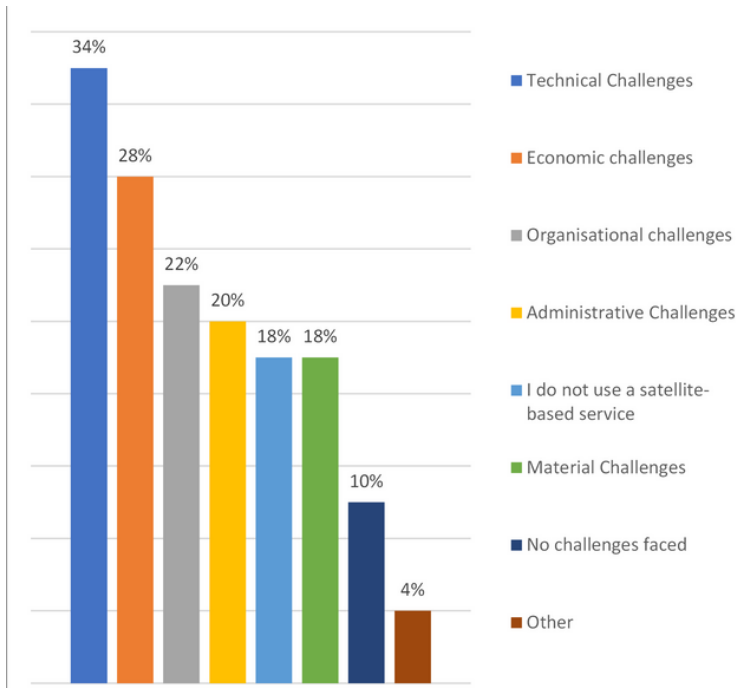


Benefits derived from the use of satellite-based solutions according to the respondents. Data elaborated by Eurisy

According to the outcome of the survey, the users that adopted satellite-based solutions identified a set of benefits. The use of space technology helped to take better informed decisions in most of the cases, considering that most of the respondents are active in fields of climate and energy, where the decision-making processes needs to provide accurate and quick decisions to preserve natural areas or to reduce the effects of climate change on infrastructures.

The 49.2% of the respondents reported that the space-based solutions had a relevant impact on the services offered by the responding entity. This can be read in parallel with those replies that assess an improvement on the workflow and a better time management.

Even though 40% of the respondents expect to still face challenges to use satellite services in the future, 70% of the respondents are planning to use satellite-based solutions in the future. Training sessions and more external funding could mitigate the challenges reported by respondents.



Classification of the challenges faced by the respondents. Data elaborated by Eurisy

A series of barriers still exist and- in the medium-long term- can affect the uptake of these solutions if actions are not taken by service providers and national space entities.

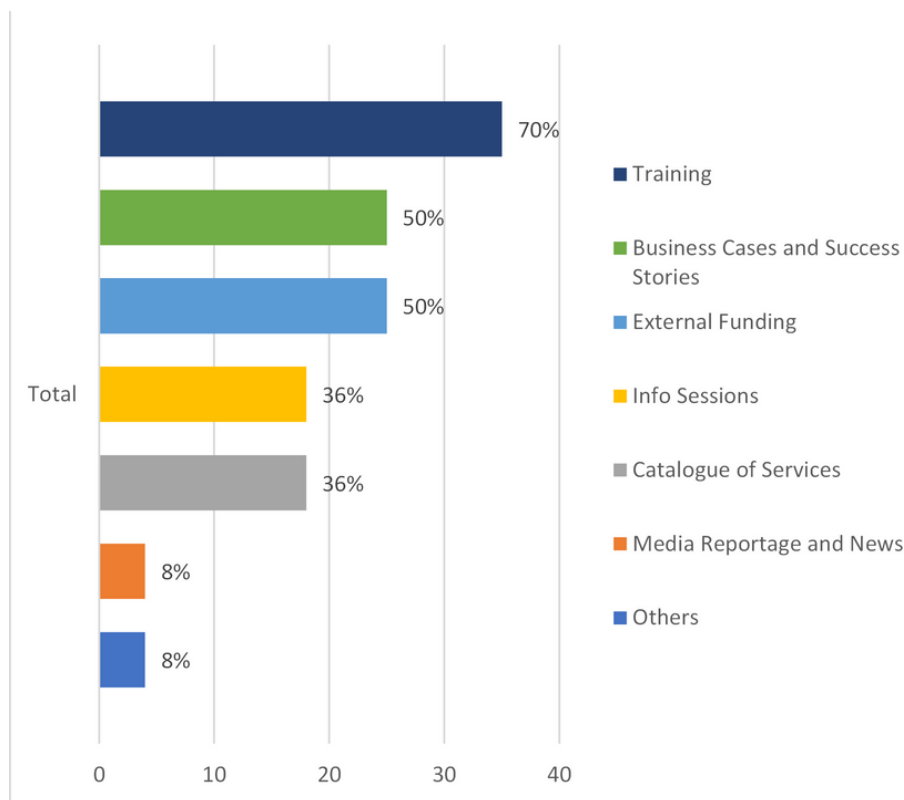
The biggest challenge faced by 40% of the users in the adoption of satellite based solutions is technical particularly referring to the difficulty to translate their needs into technical specifications and /or lack of appropriate infrastructure, difficulty to understand the technical use of the service.

Economic challenges with reference to the costs of the data/solution represent often a barrier to integration. This can also partially explain the high percentage of respondents indicating as the main driver for the use international projects allowing them with an easier access to funding and to expertise to familiarise with space-based technologies. 22% of the respondents experienced organisation, intended as internal challenges related to the lack of expertise within the staff as well as administrative barriers linked to red tape.

These challenges affect the possibility to stably integrate those solutions. About 38% of the respondents when asked if the maintenance of the service would be a challenge replied affirmatively. The reasons are again represented by the costs attached to the services as well as lack of skilled personnel.

To overcome those barriers hence supporting a more widespread uptake of the solutions the survey scrutinized the expectation of the users from external entities.

Workshops like the one organised by Eurisy and EUSPA could be powerful tools for people operating in the field of disaster risk management who are still skeptical on the adoption of satellite-based solutions or who want to know more about them.



Classification of types of external support for the adoption of satellite-based solutions. Data elaborated by Eurisy

Considering the request for more business cases and success stories, what should be improved at the local level are the interactions among stakeholders and service providers through events in Greek. From a European perspective, it could be highly impactful to provide more funding opportunities and calls for actions or innovation calls related to the use of satellite data for climate resilience and disaster management. An increased number of calls would mean more opportunities for non-space actors active in both fields to assess the potential of satellite-based solutions and to support the development of services targeting real-world needs.

CONCLUSIONS

Space technologies are part of the modern-day disaster risk management cycle, although they are not always used to their full potential. For the further integration of satellite applications in disaster risk management, public investments and incentives are key. In Europe this is demonstrated with the EU space programme. Bringing the different initiatives under one umbrella opens new synergies in the use of Earth observation, satellite communications, and positioning services. Involvement of the private sector also increases the uptake of satellite applications for disaster risk management.

The dissemination of cases and success stories can be a valuable tool to overcome limited awareness of how satellite-based services can increase disaster risk resilience. Within the disaster risk management cycle, satellite applications are not always considered by the end users. In particular during the phases of prevention and recovery, satellite applications have not been fully exploited.

A barrier in the adoption of satellite applications remains technical. Info sessions, trainings, and workshops facilitates the integration of space technologies in national disaster management decision-making processes. Overcoming a lack of trained staff can be achieved with a governmental approach towards the digitalisation of services, and a different mindset.

The participation in international cooperative projects offers potential users a safe test-bed to consider space-based technologies while limiting the risks and impact in case the solution would not properly respond to their needs.

Proper training and increasing the awareness of the capacity of satellite-based services are fundamental to boost user uptake.

ABOUT EURISY



**Eurisy is a non-profit
association of space
agencies and government
offices dealing with space
affairs in Europe.**

It is mandated and financed
by its members to increase
the access of society to
the benefits of innovative
satellite information and
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