→ COPERNICUS IN ACTION

Fostering User Uptake of EO Services Through the Copernicus Masters and the Space App Camps

in partnership with

AZO Space of Innovation

European Space Agency

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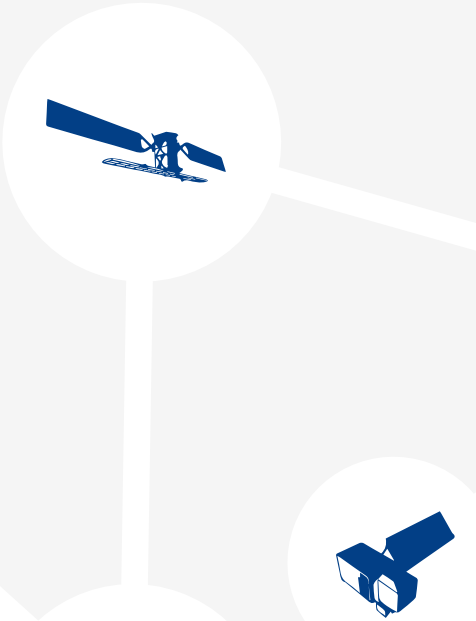


INTRODUCTION
EUROPEAN SPACE AGENCY

It is not every day that I have the welcome opportunity to write the introduction to an ESA publication. Doing it for the benefit of the Copernicus Masters competition and the corresponding Space App Camps reminds me of the spectacular Copernicus Masters awards ceremony I attended in October 2015, and of all the positive feedback I received on both the competition and the Space App Camp. These two events have now established themselves as popular initiatives designed to foster uptake in the Copernicus ecosystem, with various user communities benefitting from the undeniable success of this truly exceptional European flagship programme.

And successful it is: meanwhile, three Sentinel satellites have been launched – the last of them, Sentinel-3A, on 16 February 2016. The Copernicus programme is now fully operational, shaping the future of our planet to the benefit of us all. It is also helping to take us one step closer to our next overall goal: a “United Space in Europe”. This is the big picture in which I see Copernicus as an important element.

When the Copernicus Masters was initiated in 2011, launching an idea competition dedicated exclusively to Earth observation seemed like a bold move. ESA and the organisers, however, were convinced that a significant number of participants would be willing to invest their time and effort in developing ideas good enough to win the competition.

Along with its excellent partners, ESA has indeed succeeded in realising the Copernicus Masters as one of its visions for spurring the commercial use of Earth observation data in everyday life.

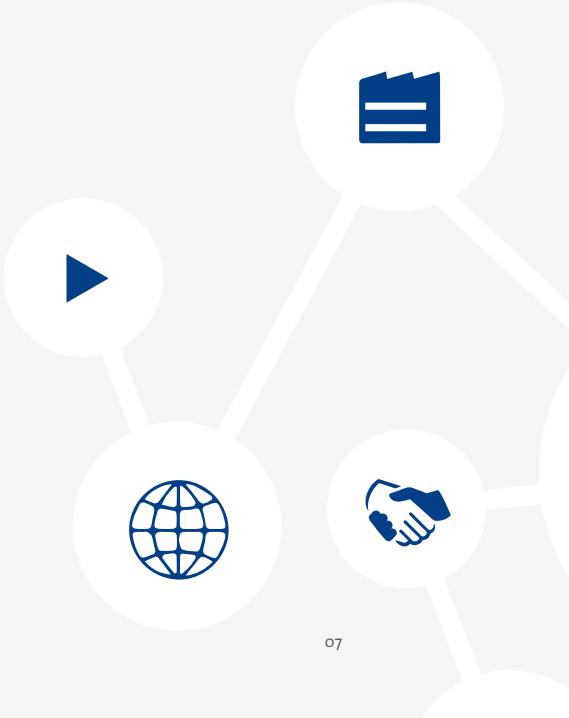
In 2012, the Space App Camp was then launched to address a completely different target group: app developers. For one week each year, this event brings together some of the most inventive programmers from all over Europe at ESA's ESRIN facility in Italy. This one-of-a-kind gathering has proven to be a highly fertile ground for the development of innovative apps that make Earth observation data – particularly from Copernicus – accessible to a wide range of citizens.

Today, we are happy to see that our initial vision has become a reality. We couldn't be more pleased with how these two initiatives have evolved since their inauguration. Previous winners and participants are now succeeding in transforming their applications into operational services, which shows how the Copernicus Masters and the Space App Camps have developed into a driving force behind the innovative use of Earth observation data. It also reflects the enormous potential Earth observation has in creating innovative, added-value products along the entire value chain – from monitoring agriculture and deforestation to providing real-time imagery for disaster relief – and stimulating economic growth in both Europe and the rest of the world.

We have witnessed a constant rise in the number of startups involved in commercialising Earth observation services since the Copernicus Masters and the Space App Camps were initiated, and we are confident that it will continue to grow with the launch of further Sentinel satellites. The commercialisation of space technologies, the foundation of new companies, and their interaction with society are all important pillars of ESA's future, which I refer to as "Space 4.0". Through the Copernicus Masters and the Space App Camps, supported by the ESA Business Incubation Centres (ESA BICs), we are providing the right tools and initiatives for tackling the challenges involved.

In this booklet, I invite you to learn more about the two protagonists, the Copernicus Masters and the Space App Camps. Bearing in mind that all of the roles, success stories, and benefits they provide to Europe and its citizens have their roots in the Copernicus programme.

Prof. Dr.-Ing. Johann-Dietrich Wörner
Director General
European Space Agency (ESA)



INTRODUCTION AZO

The Copernicus Masters and the Space App Camps came to life as part of ESA's and Anwendungszentrum GmbH Oberpfaffenhofen (AZO)'s vision of fostering the commercial use of Earth observation data in our daily lives. From the beginning, the large number of applications received have evidenced the enormous potential of these innovation competitions and confirmed that we have struck a market trend. Since then, AZO has received nearly 3,000 applications from close to 90 countries, and these numbers continue to grow.

Our innovation competitions have always been amongst the first to put forward topics such as Big Data and cloud computing, which are key resources for space applications. This has allowed us to shake up the market, exploit new market segments, and promote the Copernicus space programme. The Space App Camp took the initial idea – to commercialise EO data for everyday use – one step further by addressing app developers, who had not been a target group up to that point.

While the sole aim of the Space App Camps is to teach young and innovative minds about the value of Earth observation data, the Copernicus Masters is geared towards a wider audience. Through challenges in application fields such as smart cities, Big Data, intelligent transport, and agriculture and its search for both ideas and working prototypes, the competition attracts applications from various forms of enterprises.

The results from the past five years show that a majority of applicants in our competitions are startups, researchers, and small and midsize companies, but individuals and major companies have also submitted their visionary solutions.

Along with cash prizes, the winners of our innovation competitions receive an extensive promotion package designed to increase their visibility through our global innovation network and attract the attention of the industry and potential investors. Our partners provide the winners with further technical and economic support to increase the market readiness of their winning solutions. In addition, all participants in our innovation competitions are encouraged to join one of the ESA Business Incubation Centres, which offer funding, support, and networking opportunities.

Together with ESA and our world-class partners, we are capable of attracting the most innovative products and services based on Copernicus data in a multitude of application fields in each new year.

We wish to extend our special thanks to the European Space Agency, which has supported us from the very beginning and provided us with cutting-edge data from its Copernicus space programme. We would also like to thank our initiating partners, the German Aerospace Center (DLR) and T-Systems International GmbH.

Thorsten Rudolph
Managing Director
Anwendungszentrum GmbH Oberpfaffenhofen


AZO
Space of Innovation

REFERENCES OF INVOLVED PARTNERS

EUROPEAN SPACE AGENCY (ESA)

"I am proud to say that both the Copernicus Masters and the Space App Camps have evolved into a well-known fixture within the Earth observation community. These ideas competitions have proven to be the breeding ground for many successful business concepts and societal benefits. Very often it has turned out that what looked initially as a "too-good-to-be-true" idea has indeed made it to market maturity. The main reason for that: the unfailing enthusiasm of the "space geeks" behind the ideas and the support ESA provides for all participants, also in the form of the ESA Business Incubation Centers. This is Copernicus user uptake at its best, and there is more to come! "

Dr Thomas Beer
Copernicus Policy Coordinator
European Space Agency (ESA)

CLOUDEO

"The Copernicus programme provides a unique data source and will strengthen a whole new service industry. In order to establish a healthy ecosystem bringing the different commercial and public sources of data and software together with innovative service companies, CloudEO has established its cloud-based collaboration platform and marketplace. The Copernicus Masters programme is an excellently managed initiative which generates public awareness and brings promising new companies and ideas to this rapidly developing new geoservice ecosystem. Congratulations to ESA and AZO for establishing this success story!"

Dr Manfred Krischke
Co-Founder and CEO
CloudEO AG

GERMAN AEROSPACE CENTER (DLR)

"At the German Aerospace Center (DLR), we strive to enhance the usability of Copernicus Sentinel data for the wider community through a Copernicus Center that features easy access, processing capabilities, and the advantages of a common infrastructure. The Copernicus Masters is an excellent way to promote the Copernicus concept and foster the innovative use of data to meet the challenges of global change while benefitting the environment and humankind."

Dr Hubert Reile
Programme Director Space Research and Technology
German Aerospace Center (DLR)

"The Copernicus Masters has proven to be the breeding ground for many successful business concepts and societal benefits."

EUROPEAN SPACE IMAGING

"European Space Imaging is a long-term partner and advocate of the Copernicus Masters. Since its inception, we have seen the competition grow internationally to play an essential role in developing new networks and promoting the use of high-resolution satellite imagery in new ways and contexts. The Copernicus Masters has provided a platform for innovators to test their solutions, develop new products and create new business models centered on optical satellite imagery and we are very happy to be a supporter."

Adrian Zevenbergen
Managing Director
European Space Imaging GmbH

T-SYSTEMS INTERNATIONAL GMBH

"The Copernicus Masters and interaction with its participants over the past years have shown us how relevant information technology and, in particular, cloud computing will be to advance and accelerate the use of Earth observation data in society and industry. To provide a solution that satisfies the demand for secure data storage, simple functions, reasonable costs and personal support we see as T-Systems' responsibility, the Copernicus Masters serves as an excellent platform to prove this."

Jurry de la Mar
Account Director
T-Systems International GmbH

SATELLITE APPLICATION CATAPULT

"Competitions are about recognising great ideas and giving people the opportunity and profile to realise their business ambitions. As a Copernicus Masters partner, we support entrants in accelerating their ideas into commercial viability through specialist business and technical guidance. In turn, our Sustainable Living Challenge winners have the unique opportunity to showcase their ideas on a European stage, attracting attention and support from the competition's extensive network."

Stuart Martin
CEO
Satellite Applications Catapult

NATIONAL CADASTRE AND MAPPING AGENCY

"The Copernicus Masters is the best platform for attracting young entrepreneurs and innovators in developing outstanding solutions and applications based on state-of-the-art Earth observation data. Also, it is a marvellous forum for presenting genuine ideas and cutting-edge applications to a wide range of audiences. That's why the NCMA has chosen to support the Copernicus Masters initiative in its effort to attract interest in the development of innovative cartographic displays based on Earth observation data and the implementation of such displays, particularly in mobile device environments."

Dr Panos Lolonis Panagiotis
Member of the Scientific Council
National Cadastre and Mapping Agency S.A.

"The Copernicus Masters Challenge is an excellent way to promote the Copernicus concept and foster the innovative use of data."

ABOUT COPERNICUS

By rising to the global challenges of climate change and the ever-growing demands placed on the environment, the European programme Copernicus is set to take a significant step forward in the way we care for our planet. Copernicus is one of the most ambitious Earth observation programmes to date and a cornerstone of Europe's ambitious activities in space. It responds to the needs of its users and ultimately serves European citizens – both directly through its products and applications and indirectly through its social, economic, and environmental benefits.

The Copernicus programme is conducted under the overall leadership of the European Commission, which is acting on behalf of the European Union.

The EU's main partner in this endeavour is the European Space Agency (ESA), coordinating the Space Component which is at the heart of the programme. In addition, the European Environment Agency (EEA) gathers data from a network of various airborne and ground-based sensors.

Copernicus thus consists of a complex system of systems that collect information from multiple sources, including the aforementioned sensors and Earth observation satellites. The Space Component comprises two types of satellite missions:

the dedicated Sentinel missions, which were developed by ESA specifically to meet the Earth observation needs of Copernicus users; and the Contributing Missions, which involve a number of existing and planned Earth observation satellites from other space agencies or organisations that also provide data to the programme.

Further information can be found at www.esa.int/copernicus or www.copernicus.eu.

Source: ESA, EC

The Sentinels, each of which carries state-of-the-art technology, provide a unique set of observations. The data generated are not only open to users worldwide, but also provided free of charge. This enables Copernicus to contribute to the development of a wide variety of innovative applications and services tailored to specific public or commercial needs. As a result, business opportunities are emerging in air-quality forecasting, flood warning systems, early detection of drought and desertification, early severe-weather warnings, oil-spill detection and drift prediction, sea-water quality, crop analysis, forest monitoring, changes in land use, agriculture, food security, and humanitarian aid – to name just a few areas.

ABOUT THE SPACE COMPONENT

Copernicus services are realised through the integration of data collected from space, from the air, at sea, and on the ground. The Space Component, however, forms the heart of the programme. This component allows for the delivery of a wealth of data from six new families of Sentinel satellites, which are being developed specifically for Copernicus by ESA. In addition, data from more than 30 additional Contributing Missions are used to complement the Sentinel missions. ESA ensures that the data from the Sentinels and Contributing Missions are channelled through a unified system and made available for Copernicus services. The majority of the Sentinel missions is based on constellations of two satellites to optimise global coverage and revisit times.

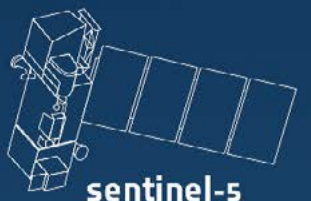
Data from the Sentinels are fed into six types of services – marine, land, atmosphere, emergency, security, and climate – to benefit the environment and the way we live. These data are used in myriad areas, including in mapping land cover and changes in the way land is being used, improving agricultural practices and forest management, monitoring the oceans for maritime safety and efficiency, and tracking pollution in the air we breathe.

Once the data are received on the ground, a network of corresponding archiving centres provides systematic data processing. All data products are archived and disseminated to users online.

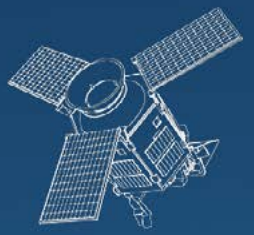
While the ground segment of each Sentinel mission includes specific components, all the related facilities are united to form the Copernicus Space Component Ground Segment.

In particular, access to the Copernicus Space Component (CSC) data is coordinated through the CSC Data Access System. Here, the data flowing from the various ground segments and missions are streamlined as transparently as possible for users.

The Copernicus Space Component Ground Segment and the Data Access System are coordinated by ESA.



sentinel-5

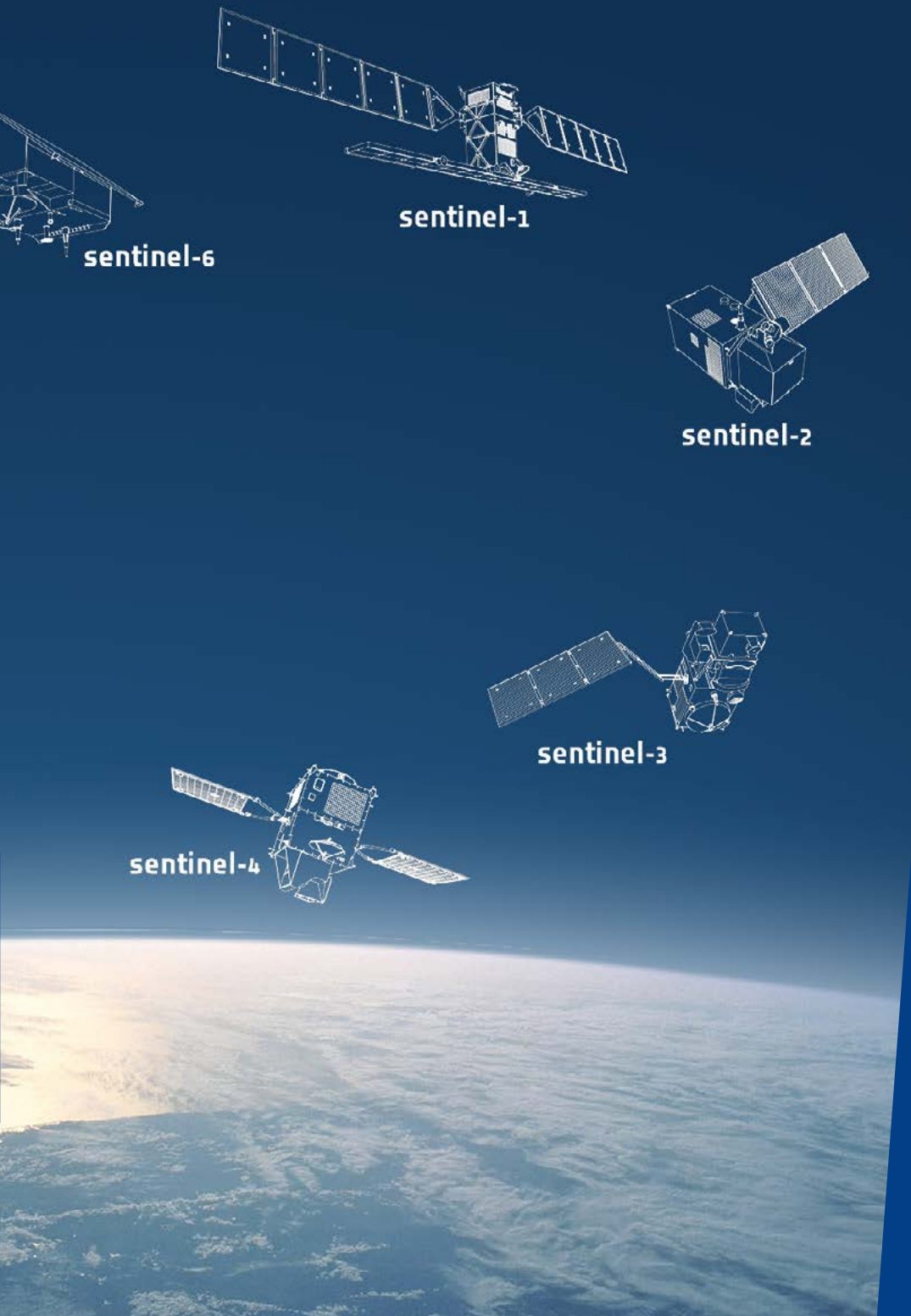


sentinel-5p

The Sentinels also offer key information that supports rapid responses to natural disasters and aids humanitarian efforts in times of crisis.

Further information can be found at www.esa.int/copernicus or www.copernicus.eu.

Source: ESA, EC



These are the currently six Sentinel families:

→ Sentinel-1 is a polar-orbiting, all-weather, day-and-night radar imaging mission for land and ocean services. The first Sentinel-1 satellite, Sentinel-1A, was launched on a Soyuz rocket from Europe's Spaceport in French Guiana on 3 April 2014. Sentinel-1B was launched in April 2016.

→ Sentinel-2 is a polar-orbiting, multispectral high-resolution imaging mission for land monitoring to provide, for example, imagery of vegetation, soil and water cover, inland waterways and coastal areas. Sentinel-2 can also deliver information for emergency services. Sentinel-2A was launched on 23 June 2015 and Sentinel-2B will follow in the second half of 2016.

→ Sentinel-3 is a multi-instrument mission to measure sea-surface topography, sea- and land-surface temperature, ocean colour and land colour with high-end accuracy and reliability. The mission will support ocean forecasting systems, as well as environmental and climate monitoring. Sentinel-3A was launched on 16 February 2016. Sentinel-3B is scheduled for launch in 2017.

→ Sentinel-4 is a payload devoted to atmospheric monitoring that will be embarked upon a Meteosat Third Generation-Sounder (MTG-S) satellite in geostationary orbit.

→ Sentinel-5 is a payload that will monitor the atmosphere from polar orbit aboard a MetOp Second Generation satellite.

→ Sentinel-5 Precursor satellite mission is being developed to reduce data gaps between Envisat, in particular the Sciamachy instrument, and the launch of Sentinel-5. This mission will be dedicated to atmospheric monitoring.

→ Sentinel-6 carries a radar altimeter to measure global sea-surface height, primarily for operational oceanography and for climate studies.

MARKET OVERVIEW

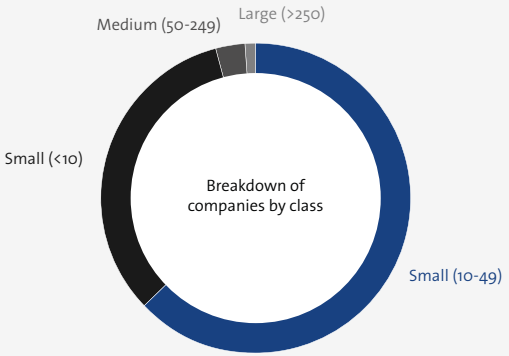
As one of Europe's flagship programmes in space, Copernicus provides decision-makers with valuable geospatial information. It is having a strong impact on the EO market, with an estimated EUR 7 billion being invested into the sector, leading to new satellites, data sources and commercial relationships.

This market research is based on a 2015 survey of the EO services industry that was conducted by the EARSC*. It has been supplemented with facts and figures ascertained by the Copernicus Masters and the Space App Camps.

MARKET OVERVIEW

Industrial Landscape

More than 500 companies (in Europe and Canada) are currently active in the Earth observation (EO) domain.
This industry is strongly fragmented and comprises four main organisational forms: micro companies with fewer than 10 employees, small enterprises with 10 to 49 employees, midsize companies with 49-249 employees, and large companies with more than 250 employees. The market is dominated by micro and small companies (96%), leaving the meagre market share that remains to be held by midsize and large companies.

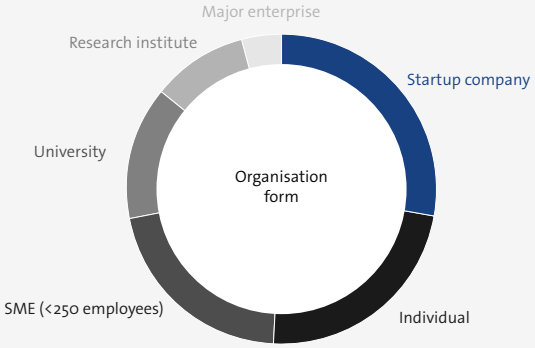


These numbers are also reflected by the Copernicus Masters, which has received nearly half of its entries from companies with fewer than 250 employees since 2011.

Most European EO companies are located in the United Kingdom, followed by Germany, Italy, the Netherlands, Canada, and France. This shows that the EO market has significant growth potential in most European countries. The Copernicus Masters generally also receives the most submissions from the countries listed above.

The majority of EO companies are privately owned, which indicates that the industry is dominated by startups. Small and micro companies are also responsible for the 8.7% annual enterprise growth witnessed in the industry over the past five years. The period from 2012 to 2015 was marked by the launch of new North American (mainly micro-) satellites backed by new business models. One of the first to recognise this trend was the Canadian company UrtheCast, which started its business with on-board ISS imagers.

The Copernicus Masters was one of the first entities to promote this concept by choosing UrtheCast as the winner of the T-Systems Big Data Challenge in 2011.



This clearly shows that the competition has its finger on the current pulse and detects trends in their early stages.

Revenue & Growth

In 2014, the total revenue in the Earth observation sector was EUR 910 million, representing a 7.6% p.a. increase since 2012 (EUR 786 million). The bulk of this revenue is generated by SMEs and large companies (50% and 35%, respectively), whereas micro companies account for just 9%.

European Earth observation companies are active all along the value chain, from satellite operation to hardware development. However, value-adding services have seen strong growth over the past several years; they now make up almost half of all companies' market segments. The EO market itself is still growing, as well, and SMEs are the leading employers in the industry. They employ nearly three-quarters of the 6,811 people working in the EO sector. In contrast, the employment figures pertaining to major companies have remained level. It is thus unsurprising that the employment rate has slowed down and that SMEs are mainly responsible for the current employment growth rate of 7.9% p.a.

Customers & Sales

The main customer of the EO industry is the public sector, including all levels of government, but also research and development sponsors. Private companies, international organisations, and academia combined account for 36% of the industry's customers.

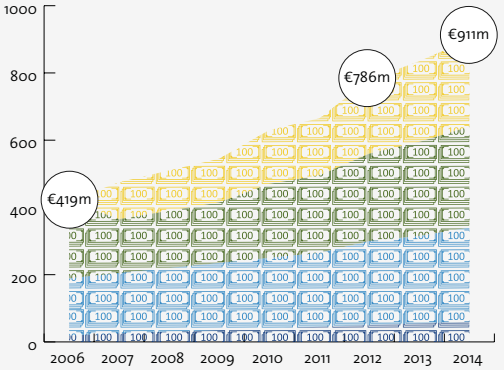
EO companies achieve the most sales activity in either their own domestic or the European market. They also generate revenue by utilising EO data in a multitude of market segments, with the top five being:

→ Security and defence
→ Environmental pollution and climates
→ Oil and gas
→ Maritime
→ Agriculture

In the past five years, the Copernicus Masters has reflected this trend with a total of 240 ideas received from the market segments listed above (except defence).

The vast majority of Earth observation data sales involve either optical data of different resolutions (70%) or radar data (23%).

Over the past few years, there has been a shift from medium- to high-resolution data (<2.5m), which has resulted in a decrease in the sales of imagery with a resolution less than 10 metres.



Total revenue over the period 2006 to 2014 (€ mio)

Micro and small companies rely to a large extent on free and open data, which has increased their resulting revenues by 30%.

In 2014, the total revenue in the Earth observation sector was EUR 910mn, representing a 7.6% p.a. increase since 2012 (EUR 786mn).*

Large
Medium
Small
Micro

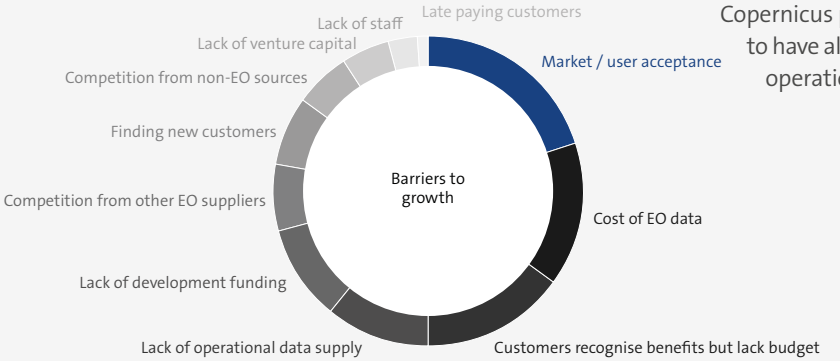
MARKET OVERVIEW

Strategic Issues

Due to the close ties between the public and private sectors, developments in both have a strong influence on the market and investments. Most companies are optimistic about their future revenue streams and overall growth. All levels of governments are seen as the biggest opportunity for growth, whereas NGOs are at the bottom of the list.

In order to accomplish further growth, however, some strategic problems need to be resolved. One major issue pointed out by the survey is that once a customer has realised the benefits of EO data, there is no structured market for acquisition. Furthermore, insufficient budgets vis-à-vis the cost of EO data are a barrier that prevents companies from achieving economic growth.

Thanks to its free and open data policy, the Copernicus space programme will allow companies to focus more on creating a structured market.



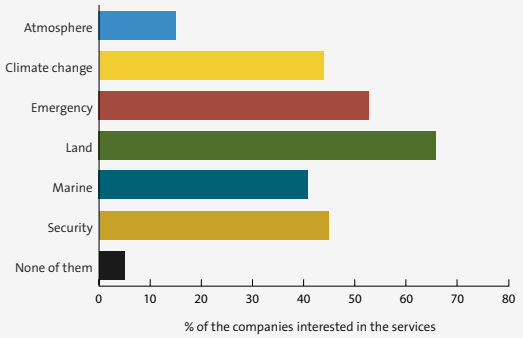
Copernicus

Copernicus is the world's most ambitious Earth observation programme to date. Despite not yet being fully operational, it is already fostering economic growth and additional revenue streams. According to the EARSC survey from 2015, the majority of EO companies are interested in the land and emergency services provided by the Copernicus programme, followed by security and climate change. This distribution is also apparent in the Copernicus Masters, with land, emergency services, climate change, and security having been the top four application fields over the past five years.

The industry considers Copernicus a game-changer for EO-based services and the market at large. Since Sentinel-1 became operational in mid-2014, the market has undergone a significant change with regard to value-added sales. The operational launch of Sentinel-1, -2 and -3 also had an impact on the sales of commercial data, as Copernicus data is free and open. The market will see further changes in the future, particularly in light of the Copernicus programme's objective to have all of its Sentinel satellites operational by 2021.

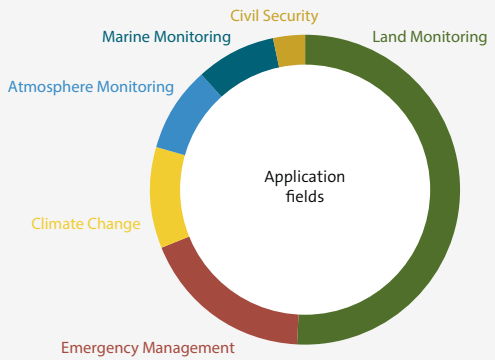
The operational launch of Sentinel-1, -2 and -3 also had an impact on the sales of commercial services, as Copernicus data are free and open.

The Copernicus programme is changing the market not only with its data policy, but also through a dedicated global campaign to raise awareness of the programme. The EO market is benefitting greatly from this campaign, as more companies and customers are recognising the advantages of using EO data.



Companies' interest in Copernicus services

The survey clearly reveals that companies are primarily benefitting from their access to Sentinel data. In addition, there is growing interest in participating in EU-funded projects.



While the community of commercial users is rapidly expanding, the potential of Copernicus data is currently constrained by some issues.

The companies surveyed by EARSC stated that one major problem relates to the difficulty of accessing Sentinel data. In addition, they criticised the lack of public support for the development of new products and services.

Generally, both the EARSC survey and the experience gained through the Copernicus Masters and the Space App Camps clearly indicate that the industry is strongly interested in the services Copernicus provides.

Trends & Outlook

Based on the EARSC survey, one can identify five significant trends for the years ahead:

Technology

Companies' growing interest in geospatial information systems (GIS) and unmanned aerial vehicles (UAVs) is another factor that is drawing their attention to Earth observation data. This could lead to more companies using EO data for their own specific purposes.

Data usage

Customer demand has shifted from medium-resolution data (>10m) to high- to very-high resolution data (<2.5m). Furthermore, data needs to be more current, easily accessible, and quickly delivered. In the coming years, more data will become available, which in turn will lead to the development of new application fields for EO data.

Copernicus

The Copernicus programme will also have a major impact on the EO market by providing free and open data. With improved data access, companies will increase their usage of Sentinel data. The EU-funded Horizon 2020 projects will also call for innovative new products and services, thus enhancing the support offered to young companies.

New financing sources

Companies of all sizes will benefit from increasing funding from governments and private investors. The Horizon 2020 funds will become available in Europe, whereas in the US, investors are expected to take higher risks and increasingly fund the technology domain.

New business ventures

As a result of the trends described above, the industry will see new companies emerge at a higher rate. The rising amount and availability of EO data will open up new application fields, creating opportunities for companies to act on a global scale. Meanwhile, privately funded satellite launches are also expected to have a major effect on the Earth observation market and the creation of new ventures.

**Source: eoSERVICESindustry – A Survey into the State and Health of the European EO Services Industry prepared by EARSC under assignment from ESA*

INTRODUCING THE COPERNICUS MASTERS AND THE SPACE APP CAMPS

Myriad industries and areas of public interest stand to profit from the advances of the Copernicus programme. On behalf of ESA, AZO and its world-class partners launched the Copernicus Masters in 2011 as part of its mission to foster user uptake of Copernicus services. Since its inception, the Copernicus Masters has evolved into a unique global initiative for Earth observation by bundling a wide variety of knowledge and expertise. It has proven to be both one of the strongest catalysts of cutting-edge applications in Earth observation technology and fertile ground for successful startup companies.

The valuable EO data also offer countless opportunities in connection with mobile applications. This is where the Space App Camp comes in, bringing programmers together to develop creative and innovative apps that make Earth observation data – particularly from Copernicus – accessible to a wide range of citizens. Each year, the App Camp unites programmers from across Europe to exchange ideas with like-minded people, tackle some of the world's greatest challenges, and make EO data accessible to a wide range of citizens via smartphone.

ABOUT THE COPERNICUS MASTERS

Earth observation and the Big Data it produces hold huge potential for the creation of innovative products and services. Myriad industries and areas of public interest stand to profit from the advances of the Copernicus programme. ESA, AZO and their world-class partners launched the Copernicus Masters in 2011 as part of their mission to foster user uptake of Copernicus services.

The Copernicus Masters is an international competition which awards prizes to innovative solutions for business and society based on Earth observation data. After receiving more than 700 submissions from nearly 60 countries, the organisers have selected and rewarded 40 winners over the past five years. These services offer an exciting glimpse

into the future of Copernicus services along the entire value chain and affirm the growing importance of Earth observation in virtually every sphere of our daily lives. A number of participants have already turned their winning applications into market-ready products. Previous winners have thus demonstrated the Copernicus Masters' ability to foster the development of value-added downstream services in various service domains of the Copernicus programme and stimulate economic growth, especially in Europe.

Since its inception, the Copernicus Masters has evolved into a unique global initiative for Earth observation by bundling a wide variety of knowledge and expertise. It has proven to be both one of the strongest catalysts of cutting-edge applications in Earth observation technology and fertile ground for successful start-up companies. As part of the ESA Business Incubation programme (at ESA BIC Bavaria), AZO also offers space for innovation in areas that are already shaping the future – the Internet of Things, Industry 4.0, smart cities, and renewable energy, for example. Both in the competition and at the ESA BIC facilities, the competition's organisers have seen interest grow in the commercialisation of Copernicus services in recent years and are confident that this success story will continue following the imminent launch of further Sentinel satellites.

www.copernicus-masters.com

After receiving more than 700 submissions from nearly 60 countries, the organisers have selected and rewarded 40 winners over the past five years.


Copernicus Master


European Space Solutions


masters

ABOUT THE SPACE APP CAMPS

Huge amounts of data from space, the kind produced by the European Earth observation programme Copernicus and its fleet of Sentinel satellites, offer countless opportunities in connection with mobile applications.

The Space App Camps bring programmers together to develop creative and innovative apps that make Earth observation data – particularly from Copernicus – accessible to a wide range of citizens. This unique one-week event was initiated by ESA in 2012 and has since been organised by AZO. It seeks to introduce app developers to Copernicus and to create awareness for the possibilities Earth observation data offers as a means of enriching mobile apps. Such data provides crucial economic and ecological information to an array of industry sectors: from energy, transport, logistics, and construction to aeronautics, healthcare, and telecommunications, myriad areas profit significantly from this global flow of information. Here, cloud platforms are highly effective at processing huge quantities of data and integrating them with the industry's dynamic business statistics in order to offer new digital services. This is why the Space App Camp cooperated with SAP for its Barcelona edition in 2015 and 2016, which gave developers access to the cutting-edge SAP HANA Cloud Platform.

Since this initiative's inception, around 400 developers from nearly 30 countries have applied to the Space App Camps, and more than 30 apps have been developed.

Each year, the App Camp assembles programmers from across Europe (who have little or no experience with Earth observation) to exchange ideas with like-minded people, tackle some of the world's greatest challenges, and make EO data accessible to a wide range of citizens via smartphone. Participants learn about the many ways in which satellite data can be used for mobile apps, make contacts all over Europe, and gain insights into how ESA operates.








Since this initiative's inception, around 400 developers from nearly 30 countries have applied to the Space App Camps, and more than 30 apps have been developed. A number of former participants are currently finalising their applications, have already transformed their ideas into operational services, or have founded a startup in order to bring their apps to market maturity. To make it easier to access Earth observation data and integrate it into mobile apps, the European Space Agency has also invested in providing a dedicated map API.

In enabling participants to focus directly on utilising WMS datasets to realise their app concepts, this interface has been a key component of the App Camps' success and has great potential to continue driving user uptake.

www.app-camp.eu

SPACE APP CAMP 2015

INITIATED BY esa

FACTS AND FIGURES

Through targeted marketing actions, the Copernicus Masters and the App Camps have reached potential participants from close to 90 countries around the world. In 2015, the Copernicus Masters and the Space App Camps have been featured in almost 1,400 press releases and articles to date, and the dedicated websites registered over 620,000 visits.

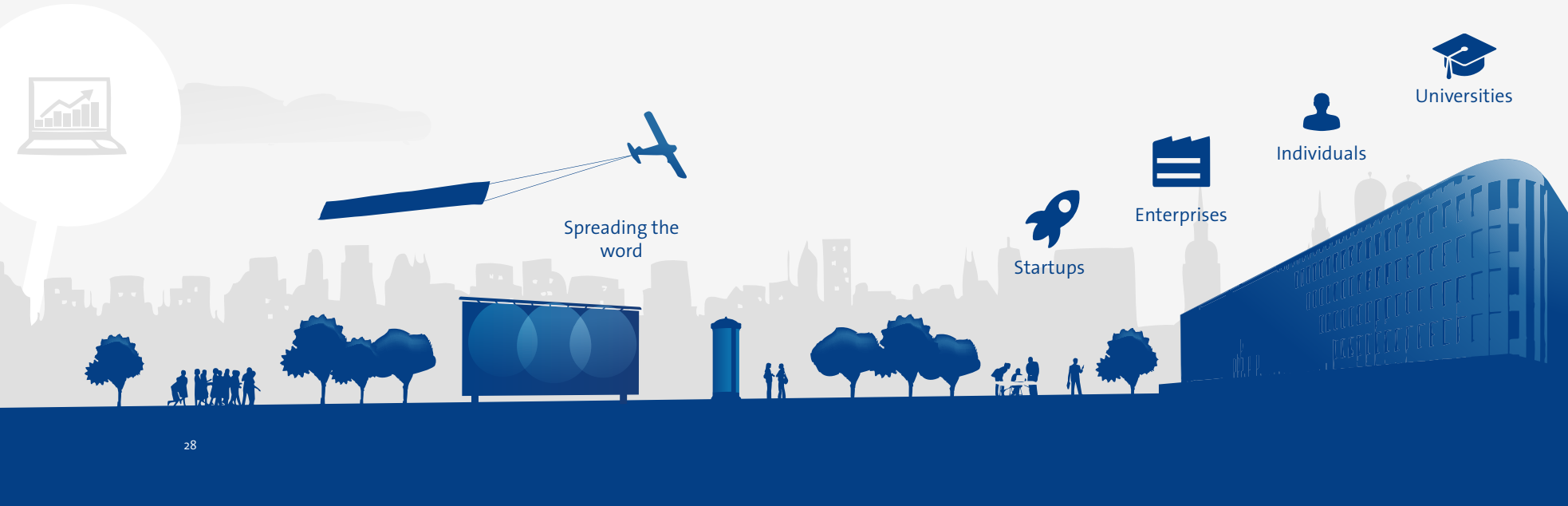
The innovation competitions related to the Copernicus programme have attracted close to 3,000 applicants from a variety of organisational forms. While almost half of all participants are active in startups or small and midsize enterprises, universities, research institutes, and major enterprises have also submitted their ground-breaking ideas.

GLOBAL OUTREACH

Spreading the word about the Copernicus Programme around the globe. So far, submissions from close to 90 countries have been received.

PARTICIPANTS

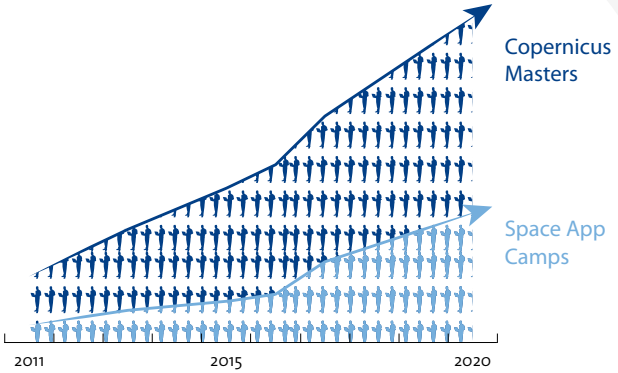
Myriad sectors are involved in the competitions creating added value for daily life and research.



Innovative ideas have been submitted and developed along the entire value chain and across all Copernicus application fields. Land monitoring and emergency management services are clearly the most chosen topics, comprising nearly 75% of all applications. The Copernicus Masters and the Space App Camps foster innovation in all sectors, bringing forth the founding of new ventures and economic benefits to established enterprises.

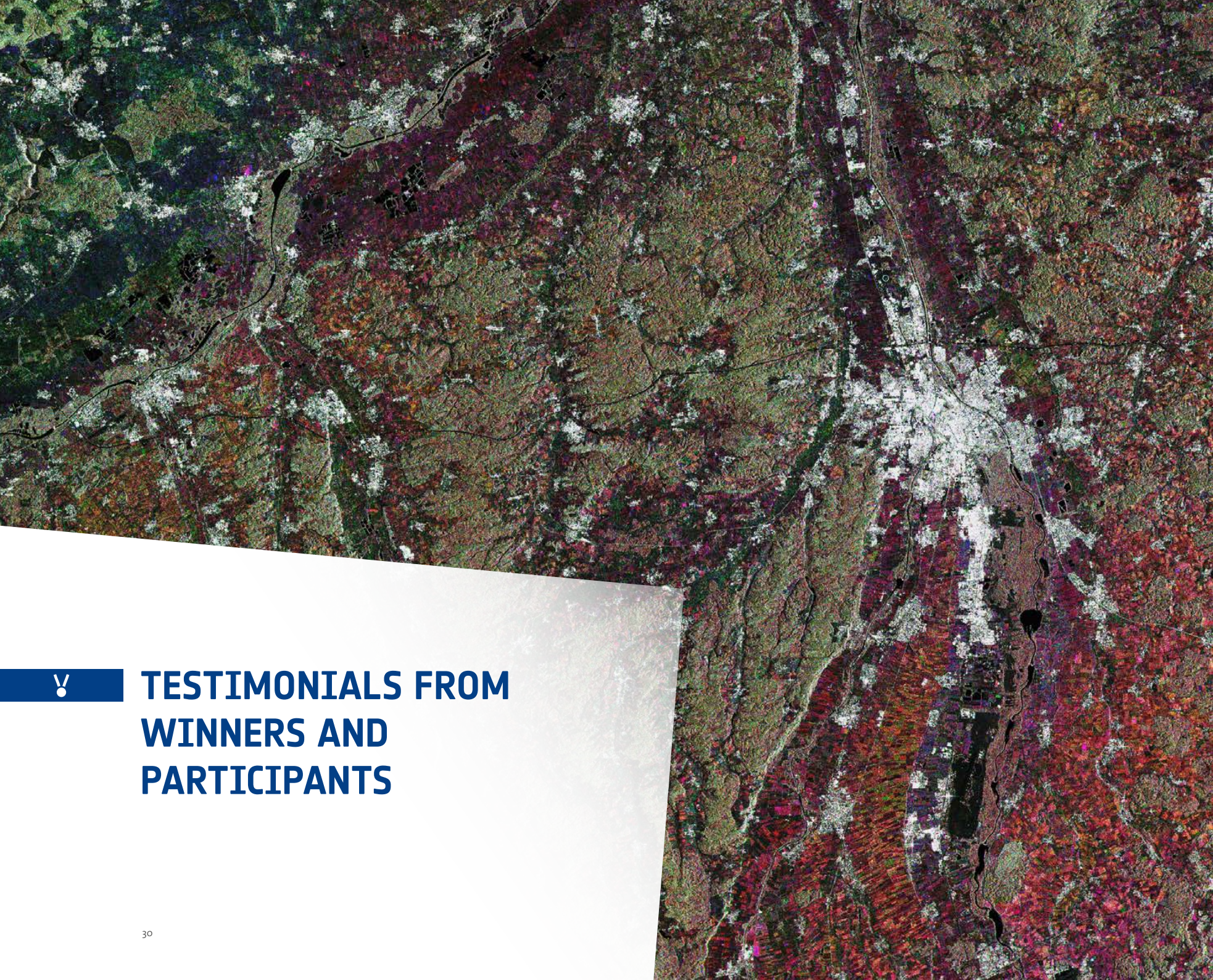
INNOVATION

Creating services and applications along the entire value chain.



Rising applications

Rising numbers of applications since the very beginning. In 2015, both events reached their all-time high!



TESTIMONIALS FROM WINNERS AND PARTICIPANTS

→Did you know?

Earth observation (EO) satellites can determine evaporation rates, enabling you to optimise your irrigation process.

EO satellites can detect crop health from an elevation of 700km.

Sentinel-1 delivers 1.5TB of data per day.

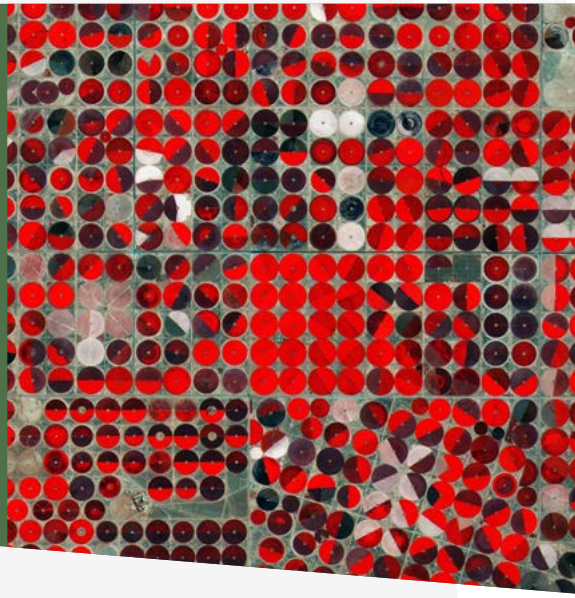
AGRICULTURE

Agriculture is the cornerstone of our food supply. It faces several challenges, however, from increasing soil strain, the availability of water, and extreme weather conditions to unsustainable farming practices. Farmers are often forced to overcome difficulties due to water shortages, expensive fertilisers, and other chemical products, which also have a negative impact on the environment. Here, Earth observation satellites allow for detailed, large-scale mapping of agricultural activities. This includes crop distribution and condition, the calculation of optimal planting and harvesting dates, and early-warning activities related to food security.

Satellite-based imagery can also be helpful in pinpointing problematic areas and facilitating surveys of specific hotspots, such as by comparing different years to highlight trend anomalies. Meanwhile, integrating this data into agronomic models makes it possible to forecast crop yields, which is key to anticipating market fluctuations – and thus to dealing with crises in food supplies and prices – at the continental and global levels.

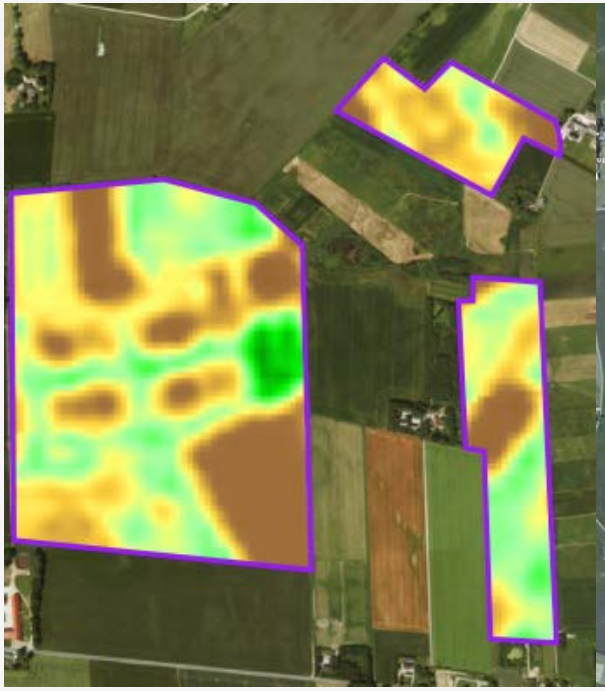
The Copernicus satellites

support the timely, accurate monitoring of current agricultural land use and changes therein, as well as the forecasting and identification of food security crises at the regional and national levels in Europe and worldwide.



Testimonials 2013–2014

CloudEO Farming Challenge 2014 and Winner of the Space App Camp Noordwijk 2014



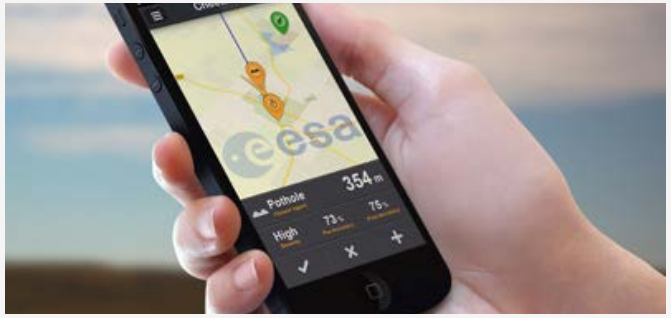
FieldSense – Simple Monitoring of Crop Health Using Satellite Data

The team of four computer science majors at the University of Aarhus, Denmark, had the idea to create an easy-to-use mobile app that uses satellite data to monitor crop health and assist farmers in their daily lives. Seeking to implement an innovative approach that would put satellite remote-sensing services in the hands of a large number of end users, the team participated in the App Camp 2014 at ESA's ESTEC location and ended up winning the competition. Utilising the Multispectral Imager (MSI) aboard Sentinel-2A and -2B, the four students will be able to examine plants' ability to perform photosynthesis. Their app produces coloured maps based on the difference between the red light absorbed by plants and the near-infrared light they reflect. By calculating the difference between sunlight and reflected light, FieldSense is capable of determining how much light plants absorb. This value, known as the Normalised Difference Vegetation Index (NDVI), serves as an indication of crop health, which FieldSense displays in the form of the aforementioned colour-coded maps. The winning FieldSense prototype demonstrated the app's ability to offer valuable and easy-to-understand information to farmers and aid them in refining their general treatment of crops.

After their App Camp experience, the team was motivated to take their idea further and turned their attention to the great opportunities the Copernicus Masters offers. CloudEO AG, which became a competition partner by sponsoring a new challenge in 2014, presented the perfect fit for the FieldSense app. By providing farmers with easy-to-use and up-to-date services designed to support improved operations, the team managed to come out on top in the CloudEO Farming Challenge. Along with great support from the challenge partner CloudEO and increased international visibility, winning the Challenge gave the four students the opportunity to join an accelerator and found the company Ceptu in 2015. Currently, the company is developing FieldSense as a tablet, mobile, and web service and plans to have it ready for the 2016 harvest season.

"The Copernicus Masters gave us the push we needed to get us where we are today!"

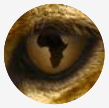
Manuel Ciosici, Brian Frølund,
Mikkel Kringelbach, and John Smedegaard
Ceptu IVS, Denmark
www.ceptu.com



Space App Camp ESRIN 2013 and Winner ESA App Challenge 2013

A full one-third of global food production is lost post-harvest. To address this global food security issue, Cheetah's novel approach combines crowdsourcing with Earth observation data and a focus on the production and transportation of crops in Africa. Cheetah amplifies the voices of relevant entities (transporters, consumers, growers, and public and private officials) by allowing them to report shortcomings in their value chain. The app also enables these players to tap into chains of horticulture intelligence, which leads to better-informed decisions, reduced costs/higher profits for businesses, lower market prices for consumers, fairer prices for growers, lower post-harvest losses, and better intervention by public/private agencies. Cheetah explores how data collected by the human-vehicle sensor web (on border delays, for example) can be integrated with new information obtained by Copernicus. By helping to voice spatial and temporal issues in agro-food value chains, the app exemplifies the usefulness of Copernicus and crowdsourcing in post-harvest assessment and aids in reducing related losses.

Cheetah – Taking on a Billion-Dollar Problem in Africa

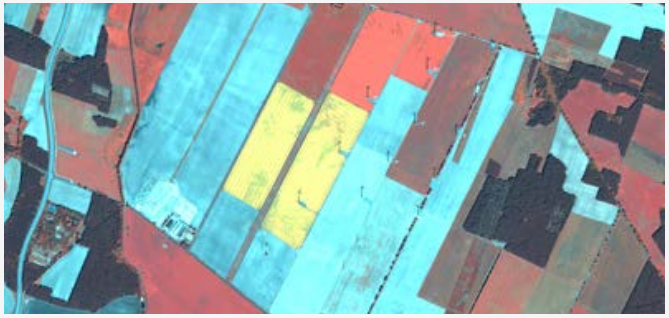


Valentijn Venus and team
the Netherlands
cheetah.ujuizi.com

Winner European Space Imaging High-Res Challenge 2013

The concept behind CAMEA services is designed to facilitate environmentally friendly agriculture through monitoring (supported by Copernicus remote-sensing techniques) and support for precision-farming activities. Instead of merely recording the state of crops, these services provide effect-oriented input for agronomic operations on European farmland. In practice, the winning concept aims to answer the "Why?" of the resulting relationships between crops and yield. A feasibility study of CAMEA services began on 1 November 2015 with the support of ESA following their rebranding under the name YIELD. The implementation is being coordinated by an SME specialised in Earth observation (GeoData Services Ltd.) and managed by the Challenge winner with the involvement of agricultural users from Hungary. Based on its current development road map, YIELD services are expected to debut on the market in early 2018.

CAMEA – Certification of Agronomy for Marketing Environmentally Friendly Agriculture



CAMEA

György Fülöp
Corvinus University, Hungary
www.uni-corvinus.hu

Testimonials 2014–2015

Space App Camp Noordwijk 2014

Sea Care

Illegal, unreported, and unregulated (IUU) fishing is one of the major threats to the marine environment and the food security that depends on it. Sea Care is a mobile platform, also using Sentinel data, that helps solve the universal problem of illegal unreported fishing by providing a mobile application seafarers can use to report IUU fishing activities to the authorities. Vessels large and small can profit from the tracking provided by Sea Care's Automated Identification System (AIS), which reflects the platform's commitment to ensuring that all fishing vessels are following the same rules. Governments, local administrations, and security and environmental agencies are examples of entities with a potential direct interest in the IUU fishing reports generated by Sea Care. After all, the more undeclared income it reveals in connection with illegal activities, the more the taxes a country can collect.

Daniel Gaston, Alberto Romeu,
Vicente Sanjaime, and Jorge Sanz
Prodevelop SL, Spain
www.prodevelop.es

Winner ESA App Challenge 2014

The Fallen Trees mobile app project monitors wind-thrown forests and addresses the acute demand for inventory functions when big storms strike. Satellite-based monitoring inherently covers large areas and offers a quick and efficient alternative to manual methods involving helicopters, UAVs, and other light aircraft. The ability to obtain an accurate damage overview in short order along with precise directions for forest harvesting services is essential for land owners, insurance companies, and the forestry industry at large. High-resolution Sentinel-1 radar

Fallen Trees – A Storm Inventory Management App

imagery, combined with a short satellite revisit interval of just a few days, will bring advanced land-monitoring technology to a broad audience of forestry stakeholders. The company is currently pre-incubated at the newly opened ESA BIC Sweden and applied for incubation in March 2016.

"The Copernicus Masters offers many exciting opportunities to innovate and disrupt existing markets."

Anders Wihlborg
The Code Company AB, Sweden
www.codecompany.se

Winner University Challenge 2015

Foresight Crops is an insect swarm prediction application. It utilises satellite data and ground observations to model and predict swarms of locusts and other insects that destroy crops around the world. Farmers will benefit from reduced crop damage and less environmental impact thanks to more targeted use of pesticides. Satellite data will be used to compute the Normalised Difference Vegetation Index (NDVI) and Soil Moisture Index (SMI), which will be used in an algorithm to identify areas at high risk of swarm activity. Historical satellite data will be correlated with swarm records and analysed to model long-term trends and probability estimates in swarming patterns. Along with crowdsourced observations from local farmers, satellite imagery and weather data from Sentinel-2 and -3 will be used to provide information on active swarm locations. Foresight Crops has also placed second in the SAP Mobile App Competition in 2015, which shows the importance of the service. SMS alerts and warnings can be activated for affected farmers, who can also request expert advice through the application.

Foresight Crops – Insect Swarm Prediction Modelling

Dr Oluropo Ogundipe
University of Nottingham, United Kingdom

Winner CloudEO – The Going Live Challenge 2015

The world's population will reach 10 billion people by 2050. This presents an urgent and widely recognised need for farmers to increase food production by 70%. To meet this challenge, Gamaya – an end-to-end business concept – is developing an innovative and comprehensive framework for large-scale farmland analytics. By integrating a novel hyperspectral imaging camera with algorithmic expertise, it translates data from the camera into actionable information for agricultural businesses. Gamaya deploys the camera on drones and relies on synergies with the Sentinel satellites to provide agronomists and farmers with timely, large-scale diagnostics on crop issues. The solution thus empowers them to achieve significant economic gains, including a 30% increase in yield, a 40% decrease in costs, and a 70% decrease in disease-related risks, all of which reduces negative impacts on the environment.

Crop Analytics – The Future of Farmland Diagnostics

Nicolas Ackermann and team
Gamaya SA, Switzerland
www.gamaya.com

Testimonials 2015 – 2016

Space App Camp Barcelona 2015 and Winner of the SAP special prize

Agrai

Agrai is an application concept designed to help farmers increase crop yield and organise their work. It analyses satellite imagery and weather data to produce accurate predictions of how well a crop is growing and offers recommendations on when it should be fertilised, irrigated, and harvested. The concept relies on data from Sentinel-1 and -2, as well as the SAP HANA Cloud Platform.

"The Space App Camp provides a great place to come up with your next big idea! The overall event was fantastic; it was a great learning experience for everyone and a chance to network with bright minds from all across Europe."

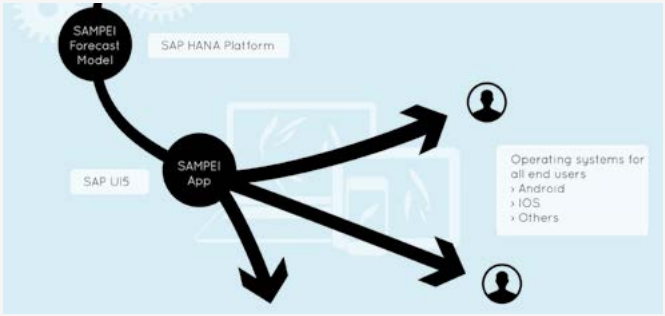
Henrik Skogström, Aarni Koskela, Matti Määttänen, Otso Rasimus, and Henrik Skogström
Boost Turku, Finland
www.boostturku.com

Space App Camp BCN 2015 and Winner of the ESA Prize

FarmIQ

FarmIQ analyses crowd sourced information to develop predictive agricultural models. The app harnesses the power of Earth observation (including data derived from the Sentinel satellites) and agricultural Big Data to provide state-of-the-art crop monitoring, predictive monitoring (including suggestions on field optimisations), and advance warnings regarding potential problems. The app concept was suggested to be offered in a product-as-a-service (PaaS) format.

Anda Truta -– Romania, Alex Dumitrescu – Romania, Alex Dantis – Romania and Julian Laval – France

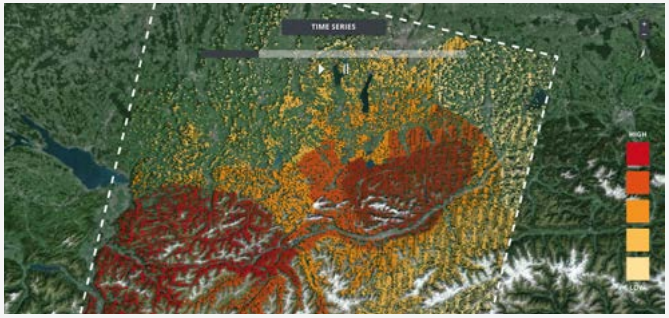


Space App Camp Barcelona 2015

SAMPEI is a precision fishing application capable of revealing potential fishing zones using satellite data. The process of locating fish shoals before deploying nets accounts for a good deal of the costs and risks involved in the fishing business. Fishing young or non-commercial-grade fish depletes the ocean's stocks with little to no gain for the fishers. Precision fishing aims to improve sea resource management with modern technologies like Earth observation. Identifying potential fishing zones with satellite data can help reduce fuel costs by as much as 40%. The SAMPEI app provides a standard prediction model based on Sentinel-3 temperature and chlorophyll data, along with proprietary variations that will take into account other sea characteristics such as salinity, depth, and currents.

SAMPEI

Alessandro Amici, Giuseppe Cammarota, and Giordano Pezzola
B-Open Solutions Srl, Italy
www.bopen.it



Space App Camp Barcelona 2015

Forest managers worldwide are influenced by insect outbreaks destroying their forests. One type of these insects, bark beetles, can destroy entire forests within just a few weeks. Viridian Raven offers a solution to help combat these bark beetles. With the use of data from the Sentinel-satellites, Viridian Raven provides an early warning system for forest managers. This makes it possible to take prevention measures that can save trees. Viridian Raven was created during the ESA App Camp in 2015. After winning the pre-selections in the Netherlands, and becoming second in the finals, Viridian Raven has been incubated in the ESA Business Incubation Centre in Noordwijk, the Netherlands. With the support received from ESA BIC, the startup has grown quickly and is working on saving trees worldwide.

Viridian Raven

Wendy Mensink and Lisa Broekhuizen
Viridian Raven, the Netherlands
www.viridian-raven.net

Testimonials 2016

GAIA – Predict Plant and Crop Diseases Using Earth Observation Data

Winner Space App Camp ESRIN 2015 and Space App Camp Barcelona 2016

The GAIA app collects all the relevant measurements from satellite data e.g. the Sentinel satellites (and, as an added option, in-situ) sensors in order to match areas of interest with possible diseases. This will allow farmers to benefit from early warnings and predictions as they evaluate their at-risk crops. Detailed knowledge of exact field conditions will help farmers save not only water, but every other type of resource as well. The GAIA service will detect diseases as soon as (or even before) they appear. This will depend on several parameters, such as temperature, humidity, and soil moisture. Meanwhile, the service will also assess the likelihood of diseases and, upon achieving sufficient accuracy, even provide farmers with corresponding solutions. The team has recently founded their company GAIA Solutions Ltd. and has partnered with the Health and Environmental Management Society (HEMS) in Nepal to use real data to train their machine learning algorithm. GAIA was furthermore able to acquire partners for software and hardware development.

Lukas Böhler, Pablo García-Nieto Rodríguez,
Pascal Weinberger, and John Zachilas
Gaia Solutions Ltd., United Kingdom
www.meetgaia.com

Climate-Smart Crop – Reliable Long-Term Weather Forecast for Agriculture

Space App Camp Barcelona 2016

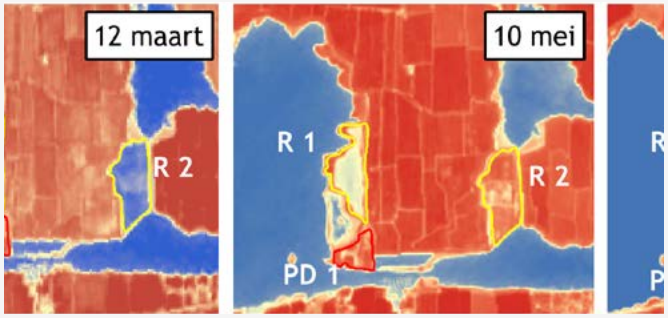
Climate change is increasing the vulnerability of winter crops to cold as seasonal temperatures become more variable. Crop decisions therefore require timely and reliable weather forecasts that are easily accessible to growers. The Climate-Smart Crop solution is focused on the delivery of agricultural risk management products derived from seasonal climate forecasts (1-5 month outlooks). These forecast products, which are resolved on a fine spatial scale using satellite data (including Sentinel data) will be layered and reported. The target group mainly consist of farmers and agri-businesses, but could also include consultancies, insurances and authorities.

Christopher Nankervis, Phaninder Pasupula
Weatherlogistics Ltd., United Kingdom
www.weatherlogistics.com

Space App Camp Barcelona 2016

VanderSat – Inundation Monitoring of Fields

The service designed by VanderSat aims to aid the Dutch government in inspecting agricultural fields. As part of the environmental welfare policy of the European Union, farmers can receive a subsidy for inundating their land for a certain period of time. In the Netherlands, this inundation period runs approximately from February to May, with farmers receiving a subsidy of EUR 2,000 per hectare on average. To make this process more effective and efficient, VanderSat has developed a system that is based solely



on satellite data from the Copernicus programme. VanderSat focuses on both radar and optical satellite images in a multi-sensor and multi-frequency approach, which makes it possible to inspect 100% of the fields. In addition, VanderSat generates multiple observations during the entire inspection period instead of just one, enabling the inspectors to receive advance warnings. As the inundation subsidy is a European policy, the service will be made available to other countries as well.

Michael van Klink, Thijs de Leeuwen, Anne de Nijs, and Robin van der Schalie
VanderSat, Netherlands
www.vandersat.com

→Did you know?

Forests are great at capturing carbon. EO satellites can determine their storage potential to help provide for a more sustainable environment.

The first 3D model of Australia's Great Barrier Reef was created using EO satellites.

Sentinel-2's high-res multispectral imager can detect changes in vegetation.

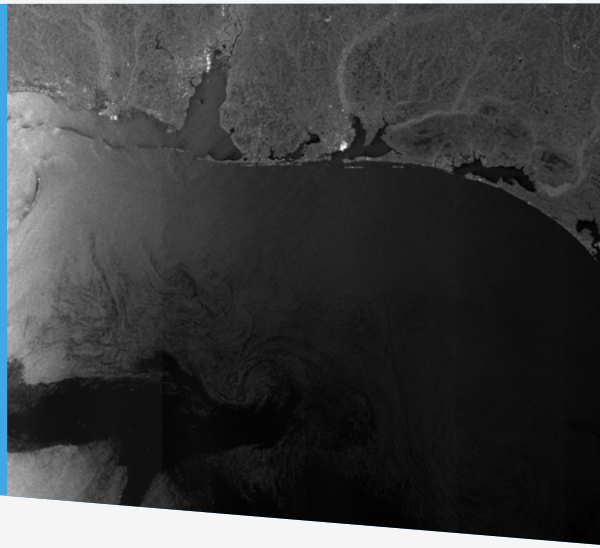
ENVIRONMENT

The data delivered by the Copernicus programme is extremely useful in every area of environmental protection, from status quo assessments to the sustainable management of valuable resources. It permanently monitors land, atmospheric, and ocean environments and provides timely, accurate information on the state of our planet. This information can in turn be used to support applications in many different domains, including forestry management, air quality, and oil spill detection. Spills from vessels, offshore platforms, and oil pipelines severely pollute marine and coastal habitats, causing enormous damage to the natural environment and the economy.

Rapid detection and early warnings of marine oil spills enable regional and national coastal authorities to catch polluters in the act of dumping waste illegally and to respond quickly to large accidental spills. Monitoring large sea areas from the air is time-consuming, expensive, and usually not feasible for pollution detection authorities. One satellite image can capture more than 100,000 square kilometres of sea surface, making this a very efficient way to check for oil spills.

Copernicus provides

satellite-based services to efficiently detect illicit discharges, identify polluters, and track the evolution of oil spills.



Testimonials 2011 – 2012

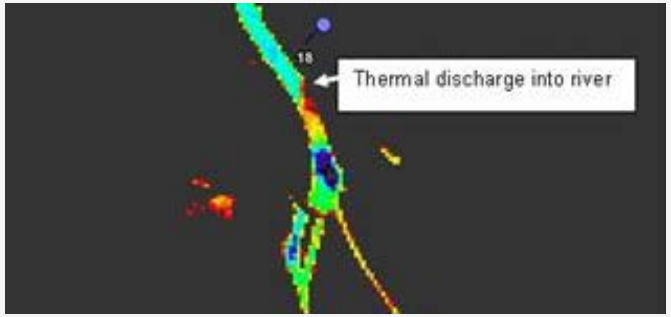
Winner Ideas Challenge and Copernicus Master 2011

DeforestAction EarthWatchers is about empowering world citizens in rainforest monitoring by integrating Earth observation, social media, human computation, and collaborative intelligence. It involves millions of volunteers in analysing near real-time satellite imagery to help halt illegal deforestation. This project can build upon Copernicus monitoring services and imagery from Sentinel-1 and -2 missions. Large areas can be monitored using crowdsourcing (allocating a small area to each group) on a specially designed webGIS. The system is also linked to social media to enable cooperation and collaborative intelligence. This high-performance application is capable of receiving data from numerous data sources, including

DeforestAction EarthWatchers – Crowdsourced Tropical Forest Monitoring

videos and imagery captured by cameras aboard the International Space Station (in 2014) and streamed through an interactive platform provided by UrtheCast (winner of the T-systems Cloud Computing Challenge in the 2011 Copernicus Masters competition). Geodan is also excited to announce that its platform has been exported to South America. The company has partnered with Greenpeace Argentina and redeveloped parts of its open-source software, enabling the creation of a new version called “Guardianes”. It also provides a new approach to education by involving students directly in the conservation effort and going beyond classroom lectures on deforestation. A crucial component deploys ground teams to verify illegal deforestation suggested by EarthWatchers and engage local authorities if necessary. The world’s forests are disappearing and most deforestation is done illegally.

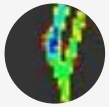
Dr Eduardo Dias and team
Geodan, the Netherlands
dfa.tigweb.org/earthwatchers



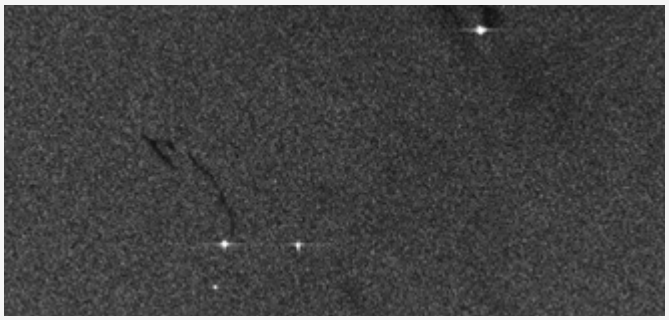
Winner DLR Environmental Challenge 2011

This idea involves using Earth observation data from the Copernicus space programme to monitor the environmental impacts of cooling water discharges from Thermal Power Plants (TPPs) under the increasing effects of climate change. TPPs tend to be sited on coastlines or near inland bodies of water. This affords proximity to ready supplies of cooling water that can be easily returned back into its source environment. However, due to the onset of climate change, it is possible that the receiving bodies of water may be unable to accommodate TPP discharges temperature-wise without adverse environmental impacts. Especially where inland and coastal floral and faunal species are currently living in temperature regimes towards the upper end of their tolerance levels, the impact of discharged cooling water can be severe. This could result in TPPs being required to reduce generation or shut down operations, increasing the risk of blackouts and/or leading to price increases as alternative sources of power are used. The Earth observation monitoring capability proposed here will enable the end user to assess environmental impacts associated with the discharge of cooling water back into the environment.

EOPPAD – EO of Power Plant Aquatic Discharges



Will Aicken
United Kingdom



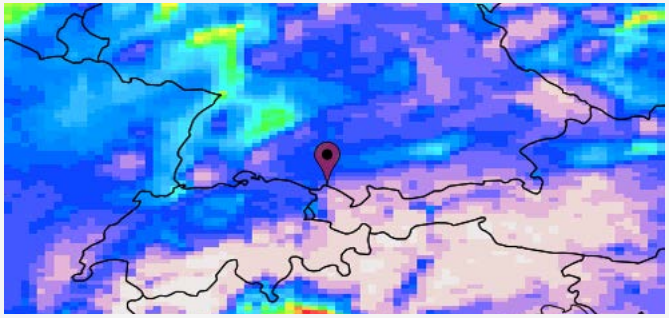
Winner Ideas Challenge 2012

Sentinel-1 and -2 data will be used to build a comprehensive map of existing oil extraction platforms in specific areas of interest, which will present an alternative, independent source of information to official lists. Alerts will be issued directly according to a set of defined criticality watermarks through a direct connection to customer-specified interfaces. By offering different service levels (SLAs), MOSP-RIOS hopes to provide an efficient portfolio of cost-effective options to each customer and thereby match the level of service provided to the actual criticality at hand. QA4EO (Quality Assurance Framework for Earth Observation) information will be kept as a record of the measurement accuracy used. The proposed service will collect and analyse satellite data at every pass (day and night) over selected regions fully automatically and in near-real time. Customers will be notified immediately of possible oil spills, thus providing for a fast and efficient alert system. A similar approach will be adopted to detect gas flaring and immediately warn customers about specific platforms. The innovative combination of oil spill and gas flare monitoring will expand control in a cost-effective manner while driving cleaner, more sustainable drilling.

MOSP-RIOS – Off-Shore Oil Spill & Gas Flare Monitoring

Daniele Di Erasmo and team
Serco SpA., Italy
www.serco.com

Testimonials 2012 – 2013



Space App Camp ESRIN 2012

The 4Sense app is a mobile game concept developed on Android. It seeks to raise the profile of Copernicus services amongst the public and integrate them into people's daily lives. At the same time, 4Sense also aims to identify users' needs in order to facilitate the development of Copernicus services going forward. The concept of the app involved players acquiring points (named as "Sentinels") by performing four actions: sensing, sharing, searching, and securing. The Copernicus services are represented in the game by a Copernicus character that interacts with players. There will be an international ranking for all participants, with the best players competing to enter into the 4Sense Hall of Fame.

4Sense

Ali Nadir Arslan – Finland, Dimitrios Damopulos – Greece, Manuel Grizzonet – French, and Joao Xavier – Portugal

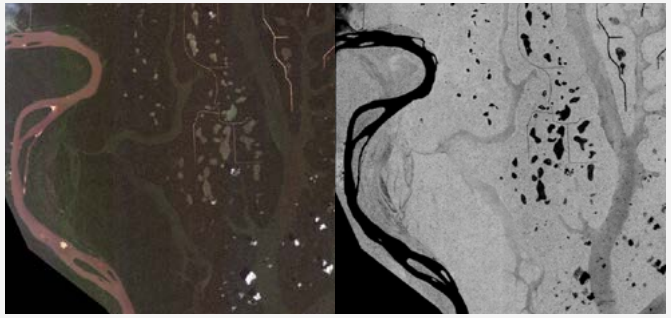
Space App Camp ESRIN 2012

The ShareAware app aims to provide a platform for connecting people who are concerned about the environment. Both the general public and industry professionals can use the app to understand, learn about, prepare for, and react to environmental events such as deforestation. The app is divided into different environmental "themes" that enable the user to browse datasets and either learn about environmental problems such as deforestation or even report disastrous

ShareAware

events by creating a "callout". Callouts make it possible for the user to either write a short message or post an image to create awareness. The app uses Copernicus data to create easy-to-understand information for the general public and detailed information for industry professionals.

Ognen Ivanoski – Macedonia, Hannah Kaufmann – Germany, Helge Staedtler – Germany, and Stanislav Sumbera – Czech Republic



Space App Camp ESRIN 2012

The mobile application TeakGuard uses Copernicus satellites and in-situ data to support forest management agencies in taking action against illegal logging. By merging the information and services from current contributing missions with data from Sentinel-1, -2, and -3, incidents of illegal deforestation or more general changes in land use can be detected. Once identified, the incidents are cross-matched with a database of TeakGuard users who have expressed an interest in carrying out fieldwork in specific areas. Since the main goal is to verify and document cases of deforestation, the app's target group comprises forest managers, eco-guards, NGOs, and local (indigenous) populations.

TeakGuard

Dragos Catalin – Romania, Dan Lund Christensen – Denmark, Alberto Romeu – Spain, and Mathias Stevens – Belgium

Space App Camp ESRIN 2013

The mobile application Breathe More, Live More provides air quality maps for cities based on Earth observation data. The app aims to process air quality information from Sentinel-5, which has a higher resolution and more parameters than other services currently available. Since the target group is the general public, crowdsourcing is a major aspect of the application; users can rate the air quality at their current location to earn points which they can then spend on vouchers from industry partners. The crowdsourcing data also contribute to the improvement of the air quality data models in use.

Breathe More, Live More

Jonas Lekevicius – Lithuania, Diogo Mourão Simões – Portugal, Timo Toivanen – Finland, and Michalis Vitos – Greece

Testimonials 2014

Winner DLR Energy & Environmental Challenge 2014

Seagrass ecosystems serve as sealife nursery grounds, a form of wave protection, a source of oxygen, a buffer against coastal erosion, and more. While this makes them the third most valuable ecosystems in the world, new conservation strategies are needed to combat the dangers seagrass now faces. The major problem is that the distribution of seagrass is unknown, which is what the Global Seagrass Monitoring Initiative (GSMI) aims to rectify. It aspires to create a global network of NGOs, universities, and ecotourism businesses to analyse multi-spectral and hyperspectral imagery for seagrass mapping using a proven methodology. Using satellite data from the Copernicus programme will allow for rapid, consistent, accurate, and repeatable mapping of seagrass distributions in order to assess degradation rates and the efficacy of restoration efforts while highlighting key conservation units. This is a vital step in ensuring the persistence of one of the world's most ecologically and economically important habitats.

Seagrass in HD – Global Seagrass Monitoring Initiative

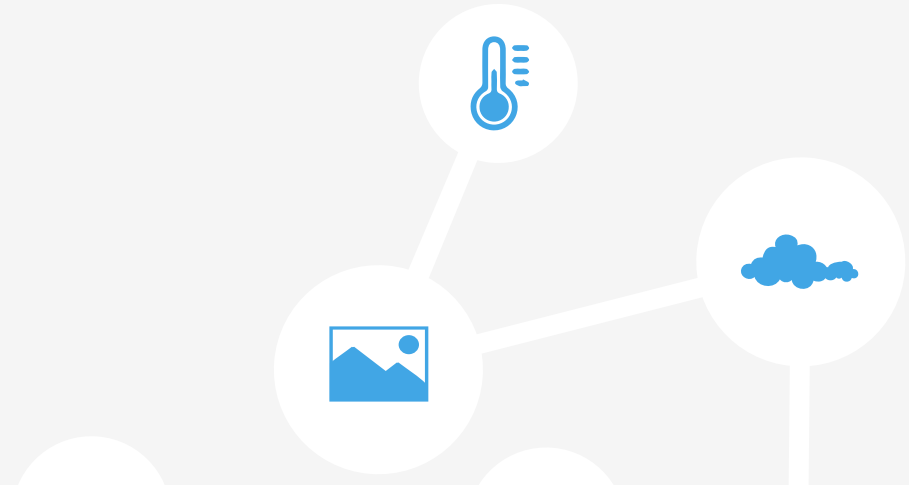
Dimosthenis Traganos and team
Global Seagrass Monitoring Initiative, Greece

Space App Camp Noordwijk 2014

The idea behind this app is to make air pollution information accessible to anyone who cares about healthy living. Using data from the Sentinel satellites and their contributing missions, enviQ makes getting daily air quality ratings as easy as checking the temperature. Furthermore, data from the European Environmental Agency and the German Aerospace Center (DLR) are used to provide more accurate output. The app, with its simple but attractive user interface, targets the end user market.

enviQ – Air Quality Information for All

Johannes Orgis – Germany, Danny Preussler – Germany, Krzysztof Stopa – Poland, and Adam Wlodarkiewicz – Poland
www.enviq.eu



Space App Camp Noordwijk 2014

Sapelli – A Data Collection and Sharing Platform for Illiterate Users

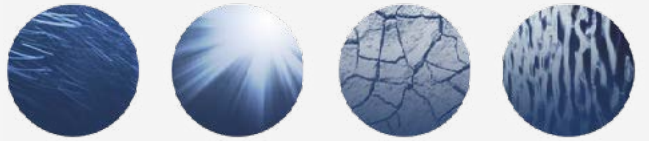
The Sapelli app aims to provide indigenous people with tools that empower them to take action to protect their local environment and way of life. Based on imagery from Sentinel-1 and Sentinel-2, the app identifies logging areas and gives indigenous people the possibility to designate their territory and claim their rights against the logging companies. Furthermore, other areas of environmental importance to the community can be monitored for changes along with corresponding resource assessment. The app is a great environmental monitoring tool for all indigenous peoples and any other individuals who are illiterate or have no prior experience with digital technology or maps. The app has been tested with the Mbendjele tribe in the Congo Basin of Africa. Even though Sapelli is already in use, the team is conducting further research to build GIS systems for indigenous communities.

Julia Altenbuchner – Germany, Georgios Liaros – Greece, Dimitrios Ververidis – Greece, and Michalis Vitos – Greece
www.ucl.ac.uk/excites/software/sapelli

Winner Space App Camp 2014

WaterSense

In Italy and Spain e.g., about half of all water resources are used for agriculture. The mobile application WaterSense uses Sentinel-1, -4, and -5 data to support farmers in irrigating their fields and reducing water usage. Combining data from the Sentinel satellites with general information on weather and soil type, the app monitors the soil moisture in a specific area and can also provide forecast estimates. This allows the farmer to easily identify field areas with low soil moisture in order to apply targeted irrigation.



Designed for both farmers and commercial operators of irrigation plants, the app optimises the irrigation of crops and helps save water in the process.

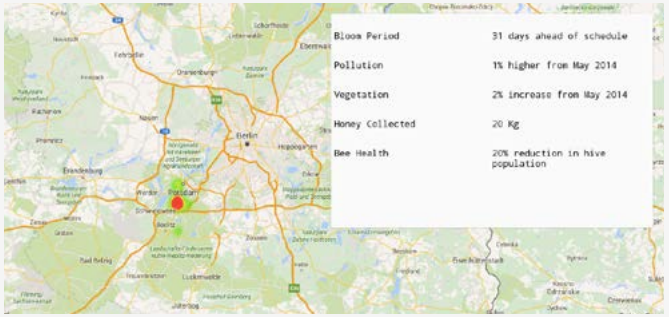
Manuel Ciosici, Brian Frølund, Mikkel Kringelbach, and John Smedegaard
Ceptu IVS, Denmark
www.ceptu.com

Testimonials 2015

Winner DLR Energy & Environmental Challenge 2015

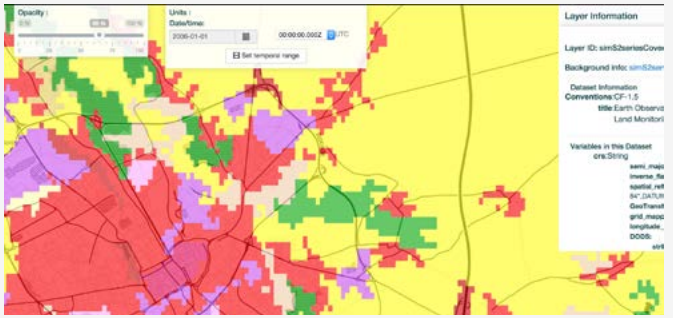
Bees play a vital role for crops and wild plants and thus have a major effect on food security and the preservation of biodiversity. The rising bee mortality rate is a warning signal. This cloud-based, data-powered platform crowdsources beehive data from beekeepers. It also uses Earth observation data from the Sentinel satellites on patterns of land use and cover, pesticide levels, and other farmland pollution to determine the best areas and locations for growing

Beehive Locations – Monitoring Habitats with Satellite Data



and cultivating beehives. Bees play an extremely important part in the global food supply chain, including a large part of fruit and vegetable pollination. The current bee population is at risk due to climate variations and the use of pesticides. This platform mainly seeks to give beekeepers information on the suitability of areas for beekeeping while factoring in farmland use and cover, pesticide levels, and other pollution. Those that find their current location to be unhealthy for bees will thus be able to move their hives to a more suitable area.

Deepak Bhatia
Poland



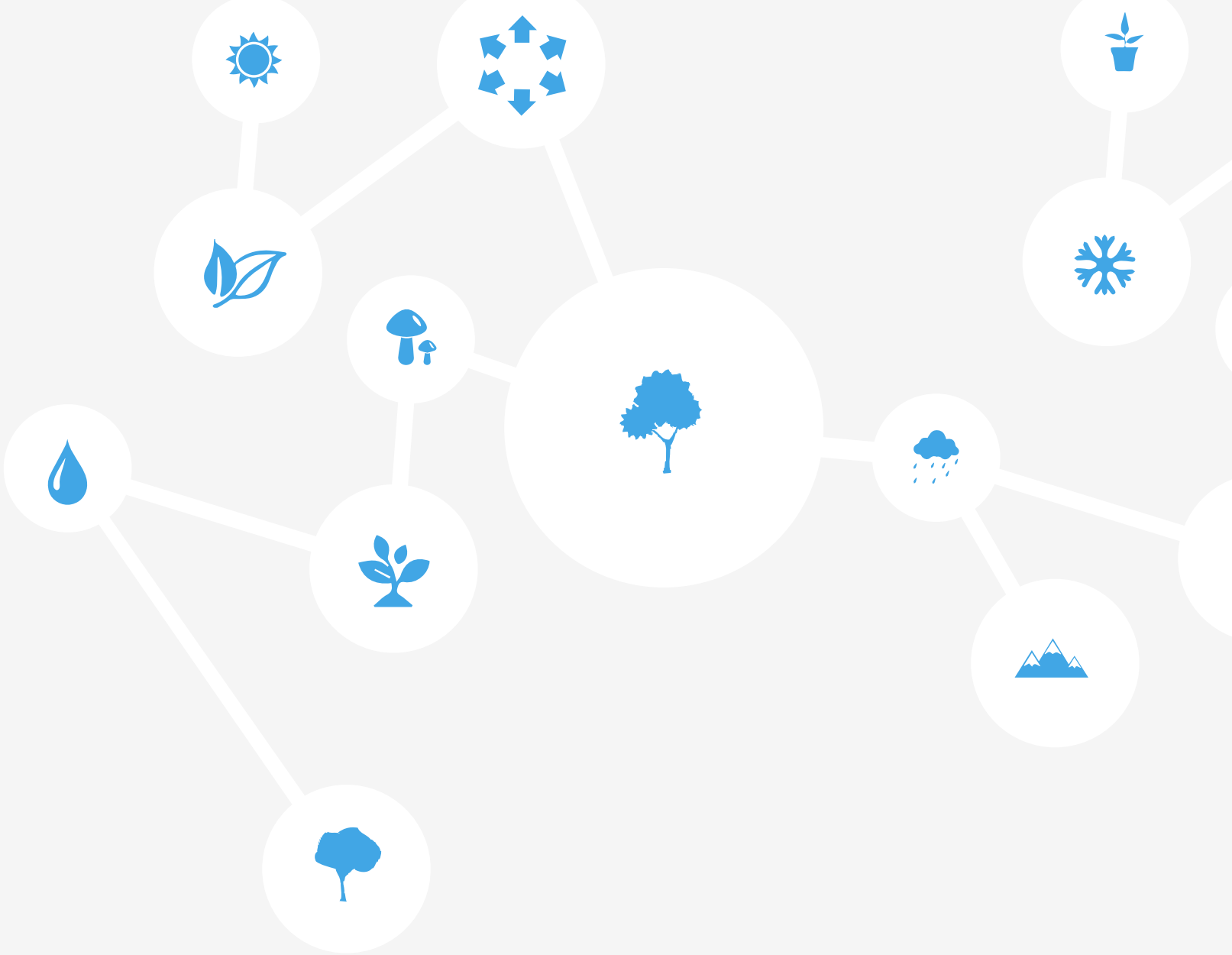
Space App Camp ESRIN 2015

Biome is a service that gives researchers an easy way to collect data for environmental studies. The approach of the Biome service is twofold, as it facilitates data collection as well as analysis. Researchers can create a project outline, define the data that should be collected, and customise the mobile app through a user-friendly web interface. The app can then be downloaded by field scientists for in-situ data collection and assessment. Later, the researchers can use the web interface to analyse the collected data. The in-situ data can also be combined with satellite-derived imagery (Sentinel-2, Sentinel-3, and Sentinel-5 data) and data to maximise the overall data output.

Biome

"Hard work, but great fun to be around in an inspiring atmosphere with great people and their visions."

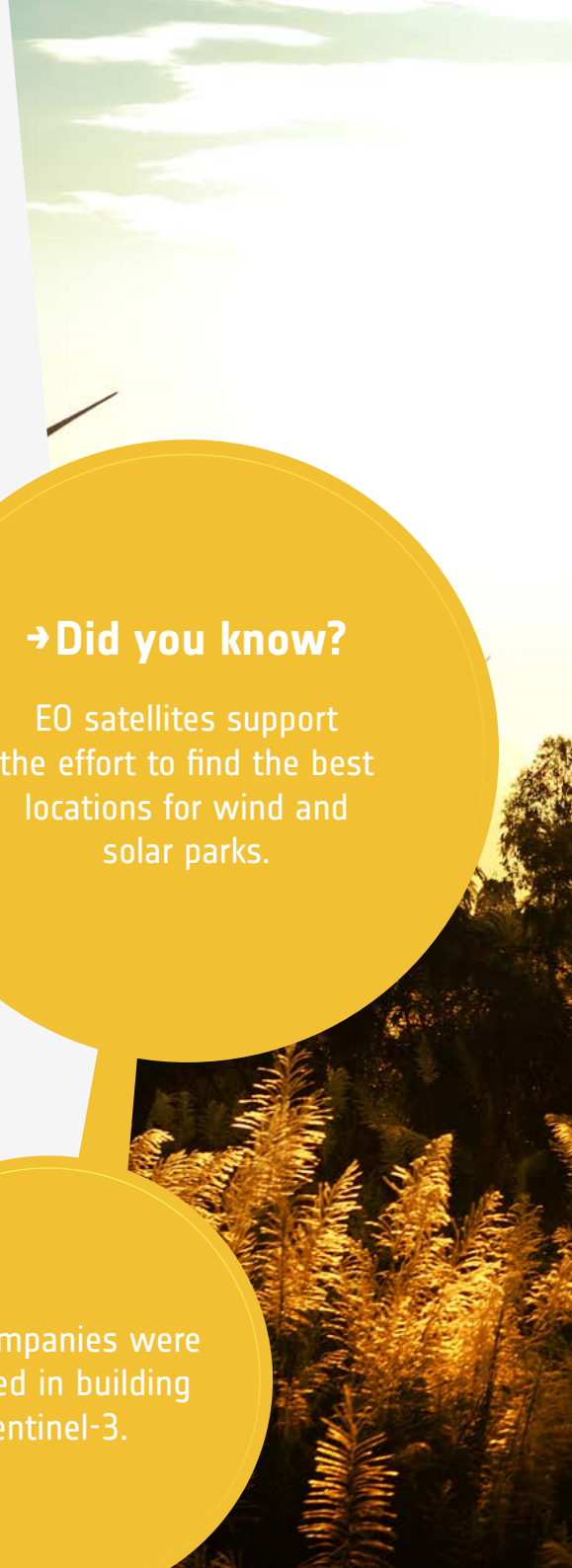
Spencer Dixon, Ferdinando Primerano, and Andrea Ross
UNEP – WCMC, United Kongdom
www.biome.space



CLIMATE & ENERGY

The international community agrees that burning fossil fuels for energy is one of the causes of global climate change. With the threat of peak oil approaching, renewable energies such as solar and wind power are on the advance worldwide. By 2020, a substantial amount of the EU's energy supply should be provided by renewable sources. The Copernicus Marine Environment Monitoring Service, for instance, provides information relevant to offshore wind farms, such as wind speed, wind fields, and wave size and frequency.

These parameters are crucial in determining where wind energy can be generated in the most cost-effective way whilst reducing the risks of damage. In the case of solar energy, the Copernicus satellites facilitate the mapping of available solar radiation by monitoring the spatially and temporally highly variable clouds and aerosols that impact it. This allows for a geographically continuous assessment of the Earth's solar resources and provides long-term time series at high spatial resolutions.



→Did you know?

EO satellites support the effort to find the best locations for wind and solar parks.

EO satellites monitor the ocean for energy purposes – waves and currents are a future source of renewable energies.

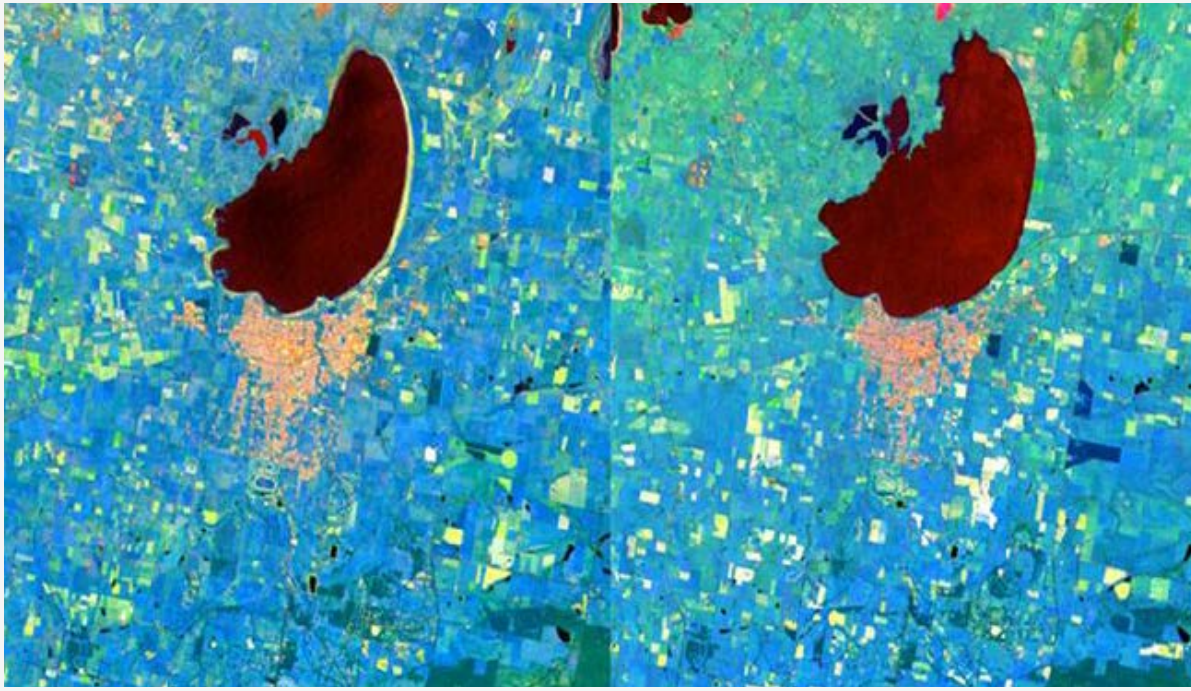
100 companies were involved in building Sentinel-3.

Copernicus can support

the efficient exploitation of renewable energies, which will help to meet the growing global energy demands without increasing CO_2 emissions.

Testimonials 2012 – 2015

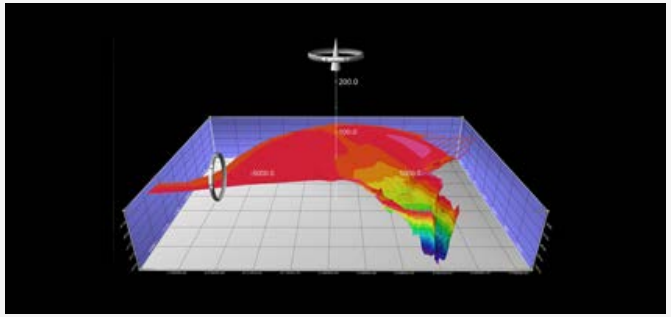
Winner DLR Environmental Challenge 2012



ThermCERT – Thermal & Carbon Efficiency Reporting Tool

ThermCERT addresses the need for a European policy on improved energy efficiency of houses and buildings. It uses available ground-based data and merges them with thermal infrared Sentinel satellite imagery to support the energy certification of buildings. Reducing thermal wastage in buildings – particularly over a large area or in large-scale buildings – is a key factor in the global drive to reduce carbon emissions. Entire estates, regions, or cities often need to be measured, especially to highlight the "worst offenders." Multiple incentives and systems have been introduced to help support investment in building sectoral thermal-efficiency schemes. Measurement, reporting, and verification (MRV) are key. The proposed solution aims to use space-derived data to enhance quality and scanning frequency over the lifetime of thermal investments by initially focusing on large-scale buildings or extended thermal projects over a larger area than individual Energy Performance Certificate (EPC) ground (or air) scans can provide. It will also highlight geographical areas with poor thermal output. A key aim is to increase the detail and quality of thermal output measurements and optimise the corresponding financial returns, increase the effectiveness of carbon credits/trading, and provide advanced tools for MRV and the promotion of thermal efficiency investments.

Steve Lee
Stevenson Astrosat Ltd., United Kingdom
www.astrosat.biz



Winner Astrium Radar Challenge 2013

With new renewable energy efforts focusing on the untapped potential of our seas, wave and tidal technologies are becoming a major source of future energy. WaveCERT extends Astrosat's "CERT Suite" of renewable, low-carbon measurement, verification, and reporting technologies to support this valuable source of green energy. The system provides vital remote (space-based) modelling, which allows for prediction, monitoring, and surveying of tidal and wave potential anywhere in the world. The technology and service employs an innovative combination of bathymetric data from radar altimetry and near real-time or archived SAR data (e.g. Sentinel-1 data) with highly advanced hydrodynamic modelling. In an entirely remote approach, the hydro-modelling reflects the exact topography, fluid flow, and dynamics of the site under observation to produce final reports on its potential energy in any season.

WaveCERT – Wave + Current Energy Reporting Tool

Steve Lee
Stevenson Astrosat Ltd., United Kingdom
www.astrosat.biz

Space App Camp Barcelona 2015

Malevich is a smart tool for decision-makers in the data-driven solar market. The app is powered by a combination of Earth observation (EO) and business data analytics. Based on imagery and data from Sentinel-2, an algorithm recognises every new solar panel on Earth about every five days. A second algorithm analyses geo-, climate, and economic data in real time. The Malevich app will be able to produce forecasts and predictions for the solar energy market and could increase long-term sales. Furthermore, the concept behind the app could be transferred to other market segments to create additional added value. The general mission of the Malevich app is to empower business on Earth with intelligence from space.

Malevich

MALEVICH

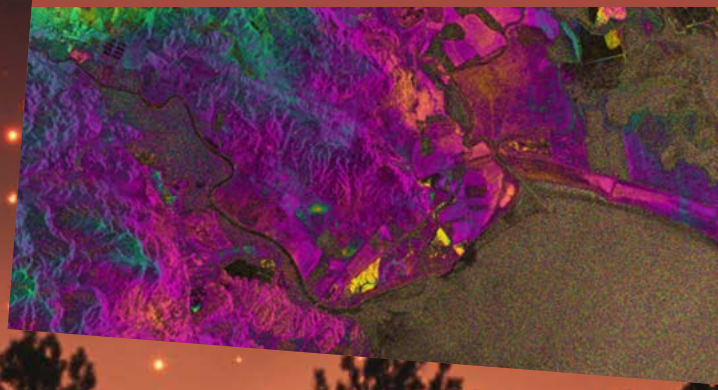
Rahul Narayan – India, Alexander Potapov – Russia,
Eldar Rakhmatullaev – Germany, and Christian Strobl – Germany

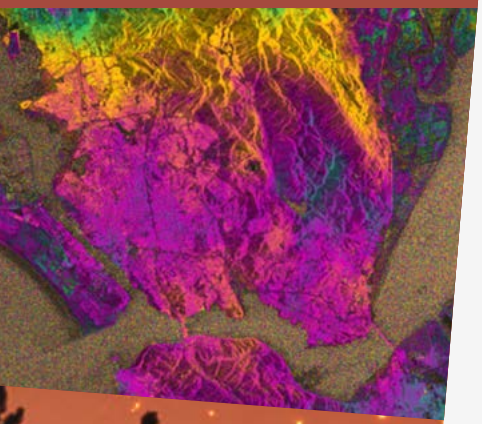
EMERGENCY & SECURITY

Every year, natural and man-made disasters cause humanitarian crises, leading to thousands of people fleeing their homes and ending up in refugee camps, makeshift shelters, or even living out in the open. Vulnerable regions and their populations are being further pressured by climate change, which is causing more severe and more frequent extreme weather. The Copernicus programme provides valuable information that makes it possible to monitor and map natural disasters such as landslides, floods, and wildfires. In addition, a variety of services utilise the opportunities provided by Sentinel satellite data to develop forecasting models. In disaster mitigation, a well-planned response is vital to assuring the safety, health, and security of citizens and minimising the economic costs. Copernicus's satellite-based services thus provide timely and accurate geospatial information to support governments, agencies, and aid workers in managing post-disaster coordination.

In addition to

offering information for monitoring, mapping, and managing disasters, the Copernicus programme is the basis for a number of services that make forecasting possible.





→Did you know?

The Copernicus Rapid Mapping service can provide maps within three hours of a catastrophe.

Earth observation data help to fight forest fires and floods, and support prediction of such events.

The only geostationary Copernicus satellite, Sentinel-4, will be delivering data every hour.

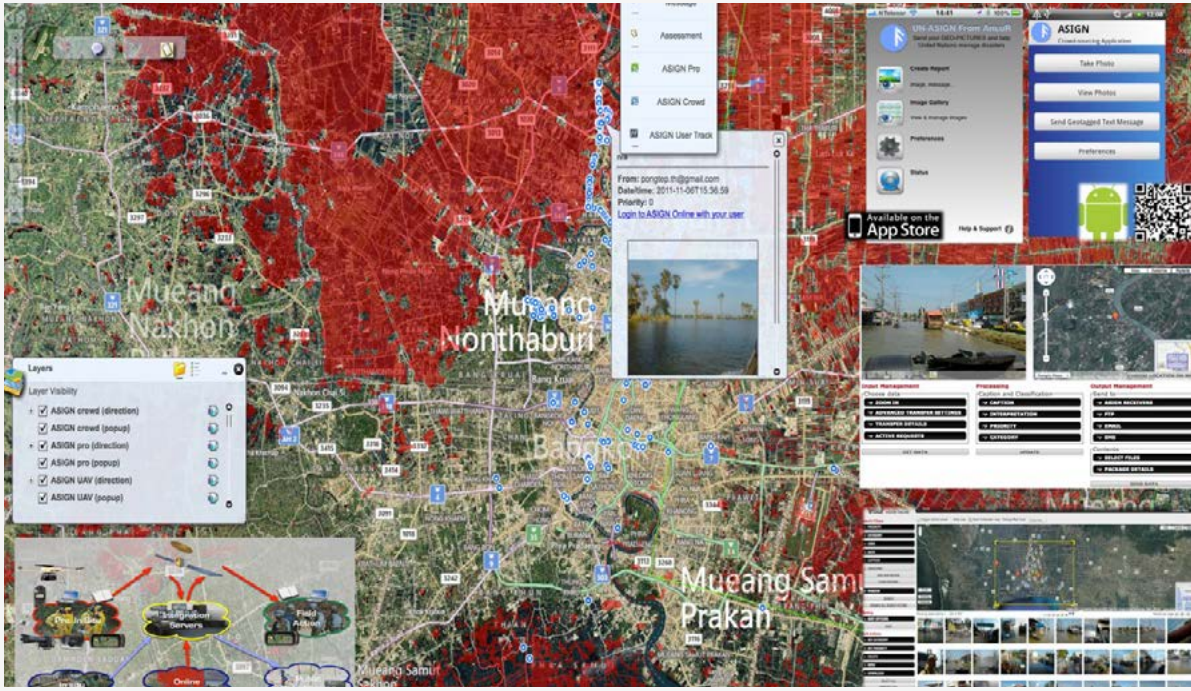
Testimonials 2011 – 2012

Winner ESA App Challenge 2012

AnsuR entered the Copernicus Masters with a product consisting of a web-based assessment and decision portal for visual data. Furthermore, an associated app for field collection of time and location tagged in-situ photos, which can be merged with the Earth observation data, allows trustful and reliable crowdsourcing. The solution was created within the FP7 project GEO-PICTURES in collaboration with the United Nations (UNOSAT). The apps "ASIGN Crowd", along with "ASIGN Pro", improve flood assessments based on Sentinel radar images by using crowdsourced in-situ validation. With the app, all observations can be captured in a geo- and time-tagged photo, which is then sent

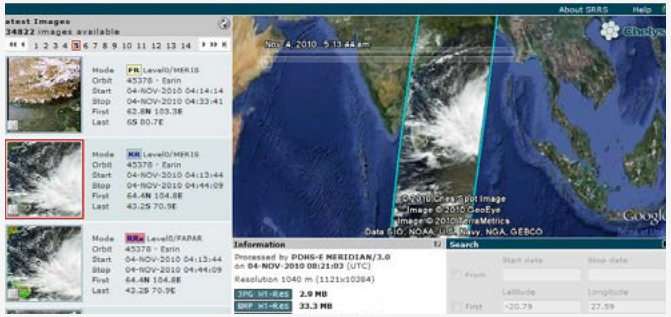
ASIGN / GEO-PICTURES – Crowdsourced, In-Situ Visual Copernicus Validation

in near-real time to a UN server in Geneva for the implementation of further actions. Having already been tested during the 2011 floods in Thailand, ASIGN makes crowdsourcing more reliable and offers a valuable tool for much more than just emergency management.



"Winning the Copernicus Masters and having our idea evaluated by third-party experts really boosted our confidence in the work we are doing. The win also paved the way for attracting further public investors and our application for H2020 funding."

Dr Harald Skinnemoen and team
AnsuR Technologies AS, Norway
www.ansur.no



Winner Best Service Challenge 2011

In emergency situations, responding as quickly as possible is key. When the type of emergency depends on the use of satellite data, it then becomes necessary to plan the acquisition, processing, and distribution of this data and have teams ready 24 hours a day, seven days a week to respond. The Satellite Rapid Response System (SRRS) was created by CHELYS with the precise intent to make satellite data (including Sentinel data) available as quickly as possible in the form of images and value-added products. SRRS is able to perform real-time processing on most satellite data from ESA and NASA missions in order to make the data received from Earth immediately available (two minutes after acquisition) and transform it into products that can be instantly analysed. The strength of SRRS lies in its ability to process raw data without having to wait for it to be refined into higher-level products. This means that the system is not dependent upon data processing times at reception centres and can provide images and other data that are ready to be studied by users and researchers.

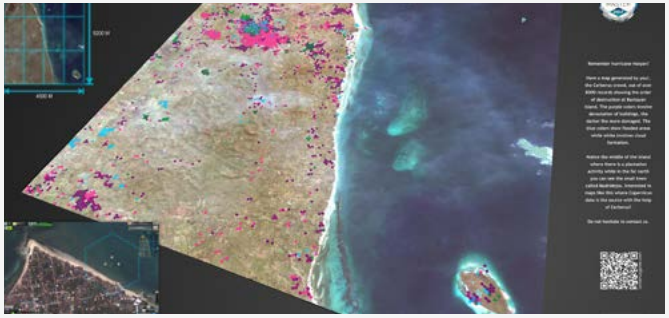
SRRS – Satellite Rapid Response System

Luca Mellano
CHELYS, Italy
www.chelys.eu

Winner European Space Imaging High-Res Challenge and Copernicus Master 2012

The crowdsourcing system Cerberus, which entered the ESA BIC Noordwijk following its success in the Copernicus Masters 2012, enables the general public to map inaccessible areas of special interest using satellite data. As recent years have shown, the application fields for Cerberus are myriad. The first Cerberus campaign, for example, focused on mapping the damage caused by Hurricane Haiyan in 2013. With the help of crowdsourced mapping, the system was able to produce operational maps indicating flooded areas, obstructed roads, and other damage. Other campaigns have included locating refugees using very high-resolution imagery and detecting illegal logging in the rainforests of Ghana using multispectral data from Sentinel-2.

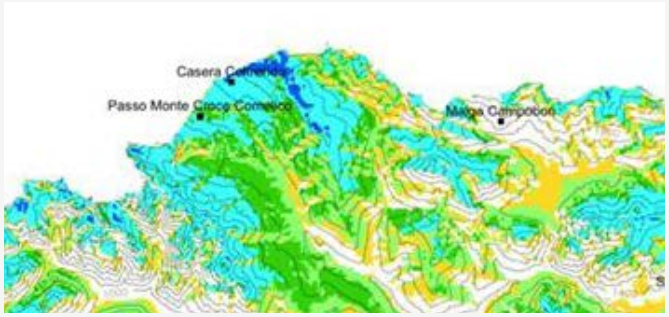
Cerberus – Crowdsourcing and E-learning Platform



"Winning the Copernicus Masters was a huge catalyst that has helped BlackShore get to where it is today!"

Hans Van't Woud and team
BlackShore Creative, the Netherlands
www.blackshore.eu

Testimonials 2012 – 2014



Winner Best Service Challenge 2012

SnowMonit is designed to improve services that enhance snow avalanche information with Earth observation data (Sentinel-1, Sentinel-2, Sentinel-3). It monitors snow accumulation, depth, and water equivalent in order to exploit maps as a service while increasing the predictability of mountain hazards and the management of resources (water, energy). This near real-time service will open the door to high-resolution situational awareness for nowcasting and warn-on-forecast applications. Warning services for snow and avalanches very often cover remote areas that are not easily accessible and prone to natural or man-made disasters. The quality of Earth observation data can significantly impact spatial and temporal resolution in the effort to solve major safety problems in a timely manner. This basic information is strengthening the operational performance of forecast models currently used to assess snowpack stability. Meanwhile, SnowMonit will enable all stakeholders along the risk management value chain to access advanced services and evolved data ready to use over the Internet.

SnowMonit – Monitoring Snow and Water Equivalent

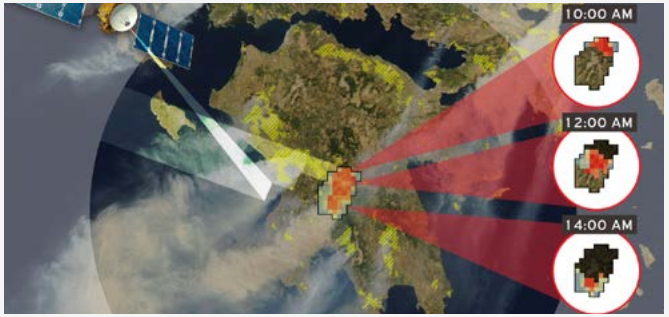
Francesco Bartoli and team
Geobeyond Srl., Italy
www.geobeyond.it

Winner European Space Imaging & Skybox Imaging High-Res Challenge 2014

The goal of this winning project is to provide a snapshot of how emerging types of Earth observation capabilities – such as agile constellations of small satellites, high-definition video, and new regional systems – can help meet the requirements involved in verifying non-proliferation and disarmament. It will thus support international security through an example application designed to monitor prohibited nuclear weapon-testing activities. An international community of experts will analyse Earth observation imagery (including data from the Copernicus programme) of a case-study test site in North Korea at a range of weekly, daily, and sub-daily intervals. The Nuclear Test Sight project brings together an international community of experts from academia, non-governmental organisations, and industry to identify future possibilities for research, development, and engagement in non-proliferation and disarmament verification. The case study was launched on a web portal that allows invited experts to view and comment on the images to identify key components and analyse activities at the various sites. The interactive aspect of the online portal is currently ongoing and the final results were published in a report in December 2015.

Nuclear Test Sight – Frequent Global Imagery for Non-Proliferation and Disarmament

Tamara Patton
Vienna Center for Disarmament and Non-Proliferation, Austria
www.vcdnp.org



Winner Best Service Challenge 2014

FireHub is a service platform that consolidates a real-time (five-minute basis) fire detection and monitoring application at a spatial resolution of 500m, large-scale burn scar mapping during and after wildfires, and a smoke-dispersion forecasting tool by integrating space technologies (including Copernicus data) with geospatial information and meteorological data. FireHub was recently upgraded to cover medium- and high-resolution images from a multitude of polar-orbiting satellites in order to increase its accuracy. The platform's target users comprise fire brigades, forestry services, civil protection authorities, emergency teams, rehabilitation organisations, insurance companies, societies, and the private sector.

FireHub – A Space-Based Fire Management Hub

"The Copernicus Masters has showcased the most innovative solutions for business and society based on Earth observation data. It is an amazing honour for anyone to participate or even win in the competition."

Dr Charalampos (Haris) Kontoes and team
The National Observatory of Athens (NOA), Greece
www.space.noa.gr

Space App Camp ESRIN 2014

The Lookout app uses satellite data from the Copernicus programme to provide a monitoring and warning tool for wildfires.

Using data from Sentinel-1 and Sentinel-3, the app shows current wildfire hazards and displays their status on a colour-coded map. To determine high-risk areas for wildfires, the app also takes historical data into account. Furthermore, a crowdsourcing feature allows the user to report new fires immediately and to update the condition of existing hazards. Lookout aims to attract end users as well as local authorities, emergency response teams, and local governments.

Lookout

João Antunes – Portugal João Gonçalves – Portugal,
Rob Knapen – the Netherlands, and Daniel Zinkiewicz– Poland

Testimonials 2015

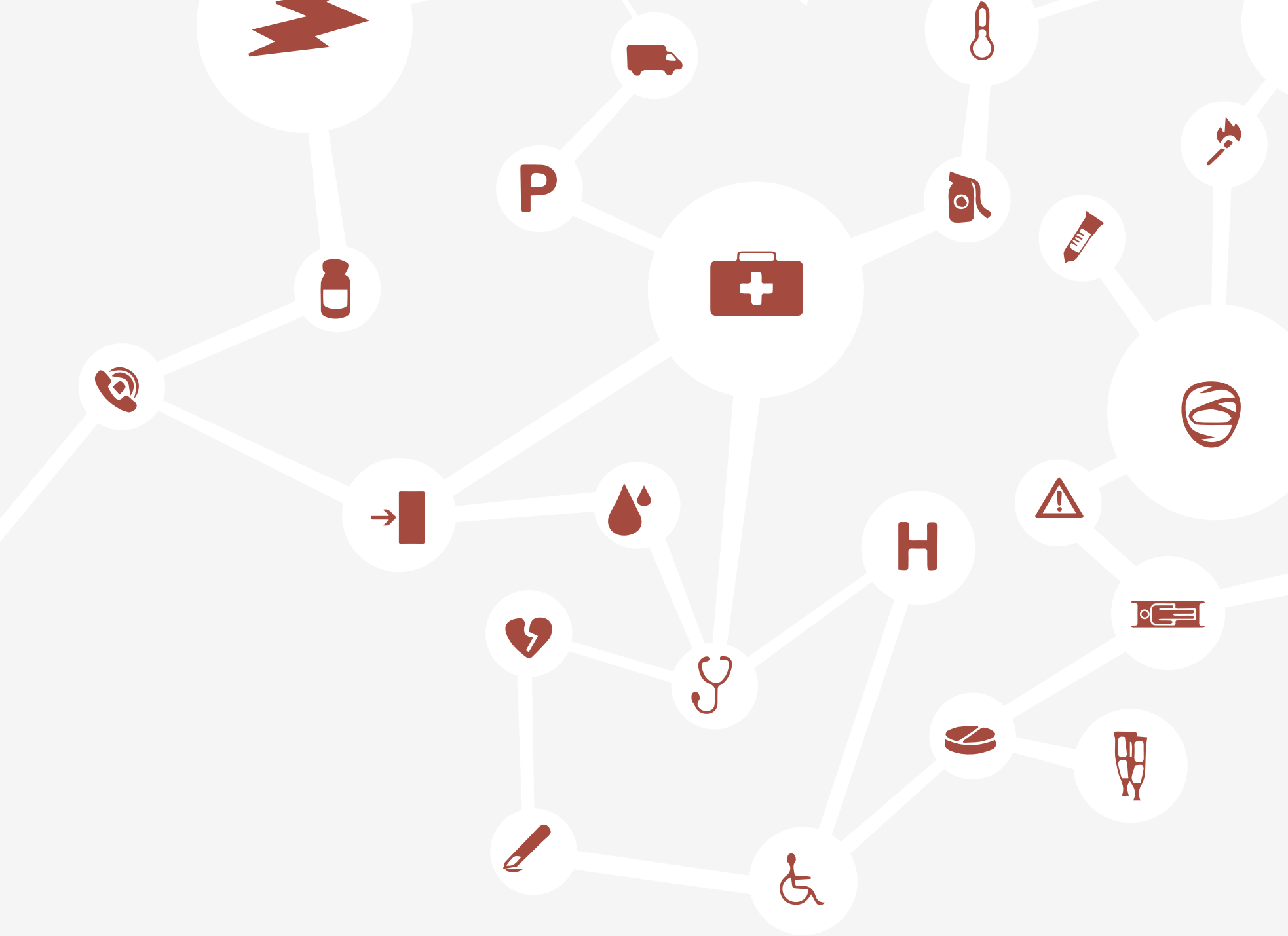
Winner Smart Cities and Intelligent Transport Challenge by the Satellite Applications Catapult 2015

The eXude system by Astrosat provides an advanced flood-monitoring tool that makes use of the latest SAR and radar altimetry data-processing techniques for flood identification and mapping, including in urban areas. The system will be developed with a range of Copernicus data in mind, especially SAR data from Sentinel-1 and radar altimetry data from Sentinel-3 and Sentinel-6, which are due to be deployed. To provide added information to the eventual product layer, high-resolution optical data from Sentinel-2 can also be used to identify and classify key features of critical infrastructure to assist in providing a useful added-knowledge service. As it evolves, Copernicus data will be able to facilitate a high level of service by providing reliable data of different types that can be assimilated to comprehend flood situations, which is not possible by focusing on single data types.

eXude – Flood Monitor and Drain Effectiveness

"Winning the Copernicus Masters enabled Astrosat to gain the attention of big companies within the industry and prove to them that we are a reliable future partner."

Steve Lee
Stevenson Astrosat Ltd., United Kingdom
www.astrosat.biz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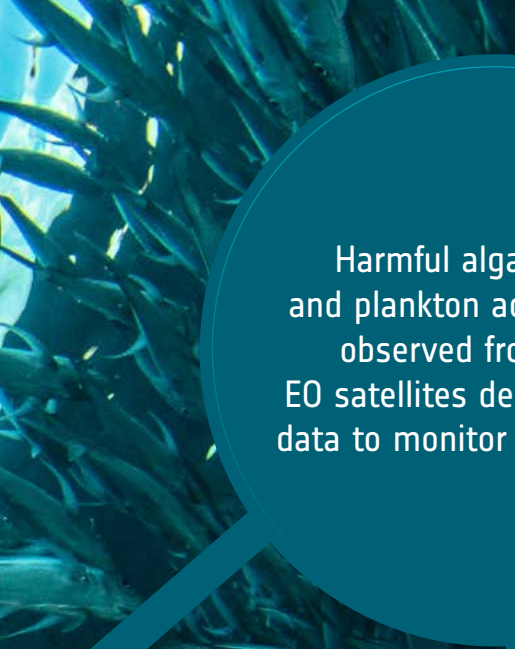
MARITIME

With their unparalleled diversity, marine ecosystems provide food for humanity and have an effect on the global climate – but they are also very vulnerable to change. The marine environment is becoming more and more exposed to a multitude of threats due to factors such as overfishing and the increased discharge of pollutants. One example is harmful algae blooms (HABs), which have grown both more frequent and expansive in recent years. Natural blooms of plankton can form HABs, which in turn pose an environmental hazard to humans and animals alike.

The Copernicus programme provides frequently updated global data that satellite-based services can leverage to detect and monitor HABs. This enables scientists to investigate the phenomenon and alert the general public if necessary. Furthermore, the Sentinel satellites facilitate monitoring of the marine environment on a global scale, which opens up opportunities for services in the areas of sustainable aquaculture, marine transport safety, and water quality in general.

→Did you know?

EO satellites can detect oil spills from ships and drilling platforms to monitor and prevent ocean pollution.



Harmful algae blooms and plankton activity can be observed from space. EO satellites deliver valuable data to monitor these events.

Copernicus provides

regular and systematic reference information on the physical state, variability, and dynamics of marine ecosystems in Europe's regional seas and the oceans of the world.

ESA's SpaceDataHighway collects data from satellites and relays it in near real-time at 1.8Gbit/s.

Testimonials 2011 – 2013

Winner ESA App Challenge 2011 / T-Systems Cloud Computing Challenge 2013

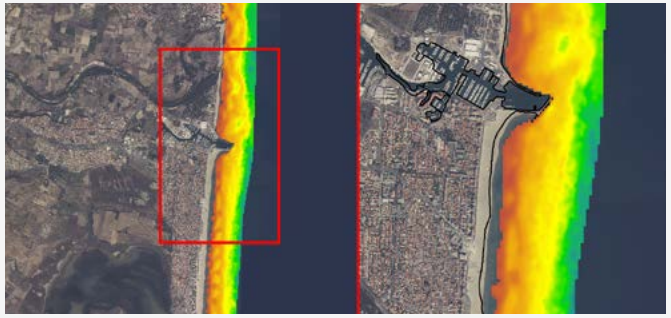
A spin-off of the German Aerospace Center, EOMAP has won two Copernicus Masters Challenges since its foundation. In the competition's very first year, the company entered the ESA App Challenge with an innovative approach to providing water quality monitoring to the mass market. The "Aquamap" app uses optical and multispectral satellite data, which will also be provided by Sentinel-2 and -3, as well as data received from contributing missions to measure key parameters of water quality (turbidity, chlorophyll content, harmful algae blooms, etc). The mobile application offers information in a fast, convenient format to end users and professional companies.

AquaMap – Near Real-Time Water Quality Services on Mobile Phones / Operational Satellite-Derived Bathymetry Service – Rapid, Spatial, Validated

Two years later, EOMAP won the T-Systems Big Data Challenge with its innovative approach to mapping shallow-water bathymetry with satellite data. The service uses Sentinel data to produce cost-efficient maps of coastal bathymetry in 3D with exceptional precision. With this new methodology, EOMAP has succeeded in covering areas previously thought to be unmappable. One of the company's most outstanding projects – the world's first complete mapping of Australia's Great Barrier Reef – was completed in late 2013 following its win in the Copernicus Masters competition.
Most recently, EOMAP published a highly anticipated shallow-water bathymetry map of the South China Sea. Its service has thus proven to be valuable not only to exploration companies, but also to research institutes and the general public.

"It is clear that the credibility and recognised excellence that come with winning a Copernicus Masters Challenge have raised EOMAP's profile in significant ways. This achievement has also aided the company in making business contacts and extending its network around the world."

Dr Thomas Heege and team
EOMAP GmbH & Co. KG, Germany
www.eomap.com



Winner Astrium Radar Challenge 2012

BALIST will provide fast, easy, and global access to bathymetry maps, using Sentinel-1 and -2 data, and depth change analysis at a lower cost than competing techniques. To further develop their idea following their Copernicus Masters triumph, the team from GEO-Transfert founded the startup I-Sea, which is now receiving support at the ESA BIC Sud France. In its current phase of development, the company is aiming to commercialise a full range of technical solutions capable of deriving bathymetry in shallow coastal areas around the world.

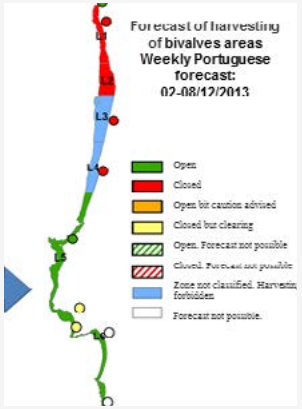
BALIST – The Nearshore Bathymetry Service from Space Using Sentinel-1 and -2

"Winning the Copernicus Masters accelerated our plans to create our own company based on an idea that we finalised around two years after the competition."

Dr Virginie Lafon and team
GEO-Transfert, France
i-sea.fr/fr

Winner Best Service Challenge 2013

HAB Forecast – Harmful Algal Bloom Forecast



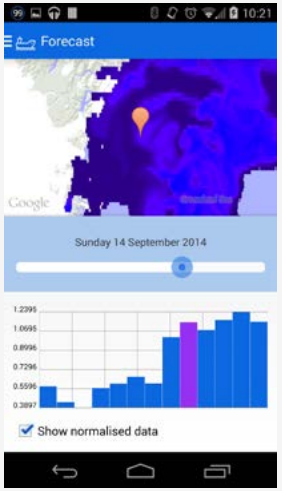
Reasons for the emergent interest in harmful algal blooms (HABs) are abundant, including concerns associated with human health; adverse effects on biological resources; economic losses attributed to recreation, tourism, and seafood-related industries; and the cost of maintaining public advisory services and monitoring programmes for shellfish toxins and water quality. In this regard the ASIMUTH project has developed short-term HAB alert systems for Atlantic Europe using a combination of information on the most current marine conditions (weather, water characteristics, toxicity, harmful algal presence, etc.) and high-resolution local numerical predictions (including data from the Copernicus Core Services). The study of HABs developed during ASIMUTH led to a better understanding of the physical, chemical, and ecological factors controlling these blooms, as well as their impact on human activities. The outcome was an appropriate alert system for effective management of areas that are usually associated with HAB events.

Julie Maguire and team
Daithi O'Murchu Marine Research Station, Ireland
www.asimuth.eu

Testimonials 2014

Space App Camp ESRIN 2014

Qinu

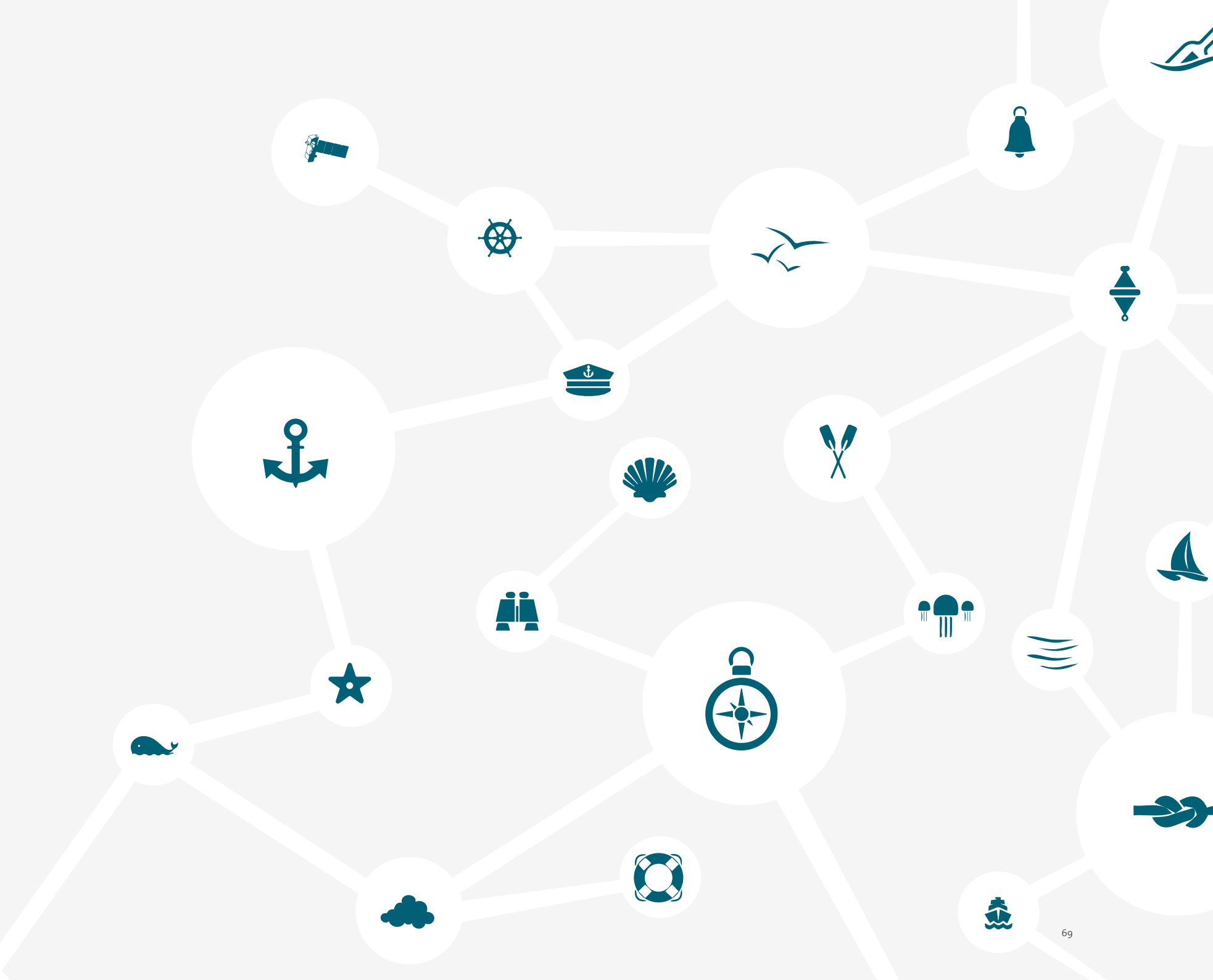


The Qinu app concept is designed to provide the latest data on ice conditions via smartphone to small-vessel fishing crews, which currently rely on radio systems or infrequently updated weather data. The concept is based on the Sentinel satellites' short revisit time and ice-flow and ice-density data from the Copernicus programme. The Qinu project aims to improve its target market's ability to provide the latest data on sea conditions to all seafaring vessels.

"The App Camp was an interesting and fun experience. The insights we received into ESA and the Copernicus programme's processes and capabilities was eye-opening. We enjoyed being given the opportunity to work with the data and to understand the programme's depth and reach."

Ryan Bateman – United Kingdom, Antonio Bertucci – Italy, Zvonko Grujic– Croatia, and Muhammed Ataul Munim – United Kingdom

www.novoda.com



PUBLIC HEALTH

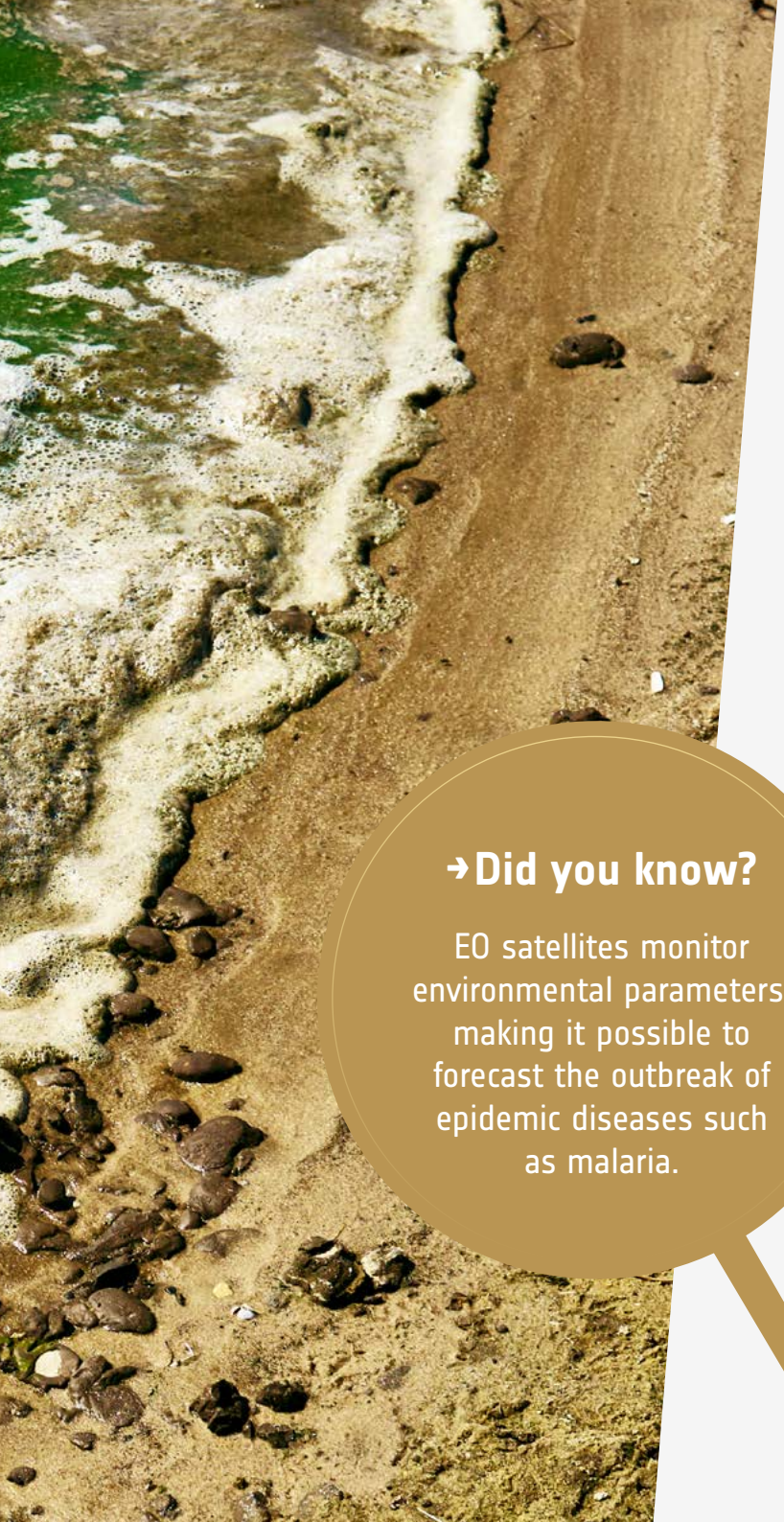
PUBLIC HEALTH

Of the multitude of factors influencing the health of humans, many are of environmental origin. Satellite-derived data helps to monitor these environmental factors, forecast their development, and take corresponding measures when necessary.

As populations grow and urbanisation increases, air pollution is one example of a phenomenon that is having a major effect on human health. Considering the adverse ramifications of air pollution, the ability to monitor, assess, and forecast pollutants from a global scale down to individual cities is fundamental. The Sentinel satellites are capable of measuring the most important air pollutants and providing large-scale information on their distribution in a cost-effective manner.

By contributing to

air quality monitoring and forecasts over Europe, Copernicus supports European policies designed to protect human health.



Air pollution through e.g. smog, smoke, and pollen can be monitored, and even forcast by using EO satellites.

→Did you know?

EO satellites monitor environmental parameters, making it possible to forecast the outbreak of epidemic diseases such as malaria.

An image taken by Sentinel-2 can be delivered and fully processed in less than 20 minutes.

Testimonials 2013 – 2014

Winner Ideas Challenge 2014

CyanoLakes is a concept for establishing a public information and warning system for cyanobacteria based on satellite-derived data.
The service utilises Copernicus imagery and data to provide information about harmful cyanobacteria blooms and nutrient enrichment in freshwater lakes to governmental authorities and other public organisations. As cyanobacteria blooms and their related products pose an immense health risk to animals and humans, the added value the CyanoLakes solution offers is a real benefit for the public.

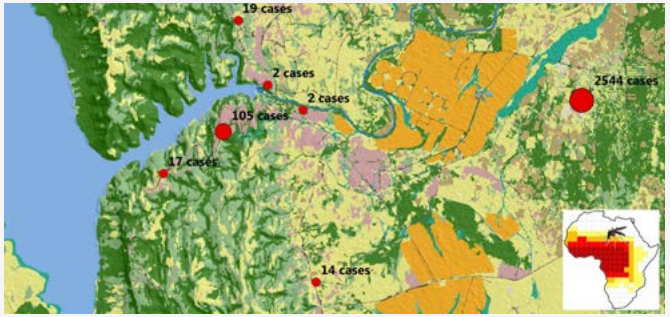
CyanoLakes – Cyanobacteria Public Info Service

Winning the Copernicus Masters Ideas Challenge raised awareness of both the problem and the solution, while the expert jury's approval of the potential and feasibility of CyanoLakes further boosted the concept's credibility. Since 2014, Mark Matthews has been advancing the CyanoLakes service and has managed to realise an initial version. In February 2015, CyanoLakes was officially registered as a company and was awarded a contract for a three-year funded project in cooperation with the government of South Africa shortly afterwards. The company is now awaiting the launch of Sentinel-3, which is equipped with the essential Ocean and Land Colour Instrument (OLCI).

Once the data is fully available, the CyanoLakes solution will be fully operational.

"Having my idea scrutinised by the expert Copernicus Masters jury was very valuable. It not only helped to precisely define the business concept, but also encouraged me to start a business."

Dr Mark Matthews
CyanoLakes, South Africa
www.cyanolakes.com



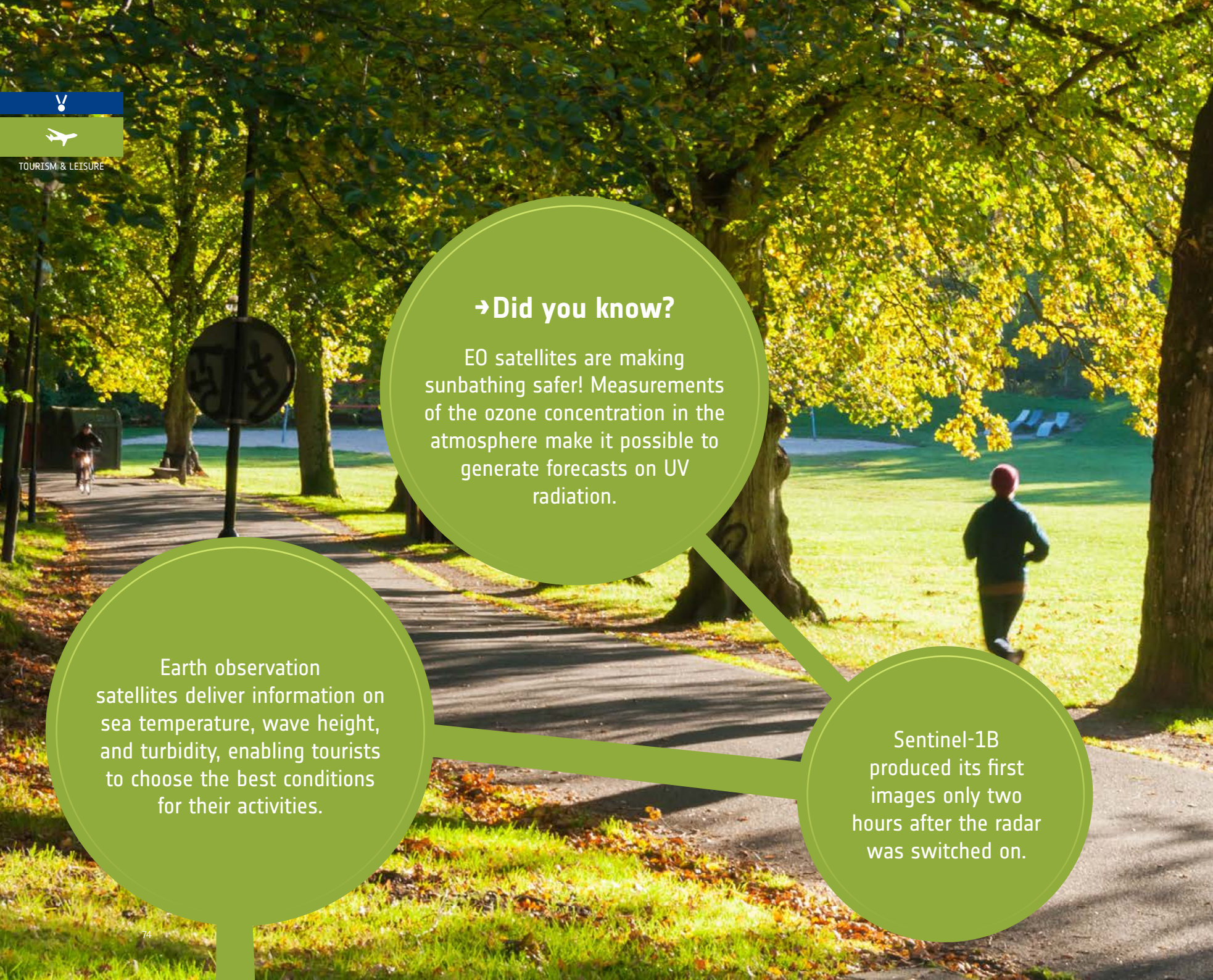
Winner Ideas Challenge 2013

National malaria control programmes use geo-spatial technologies (GPS, GIS, EO) for decision support during their activities, but often lack regularly updated and ready-to-use data on malaria-relevant environmental parameters. EyeOnMalaria aims to provide reliable and consistent EO data (mainly derived from the Copernicus programme) for use as actionable input, as well as in derivative products for assessing malaria risk and the daily work of the malaria control community.

EyeOnMalaria – Africa-Wide Monitoring of Environmental Suitability for Malaria Transmission

By using innovative Earth observation technologies with improved spatial and temporal data characteristics, national malaria control programmes will be able to target their interventions in terms of time and geography, thus improving their cost-effectiveness. The team behind EyeOnMalaria is currently looking for funds to demonstrate this approach at the national level.

RSS – Remote Sensing Solutions GmbH
Dr Jonas Franke and team
www.rssgmbh.de



→Did you know?

EO satellites are making sunbathing safer! Measurements of the ozone concentration in the atmosphere make it possible to generate forecasts on UV radiation.

Earth observation satellites deliver information on sea temperature, wave height, and turbidity, enabling tourists to choose the best conditions for their activities.

Sentinel-1B produced its first images only two hours after the radar was switched on.

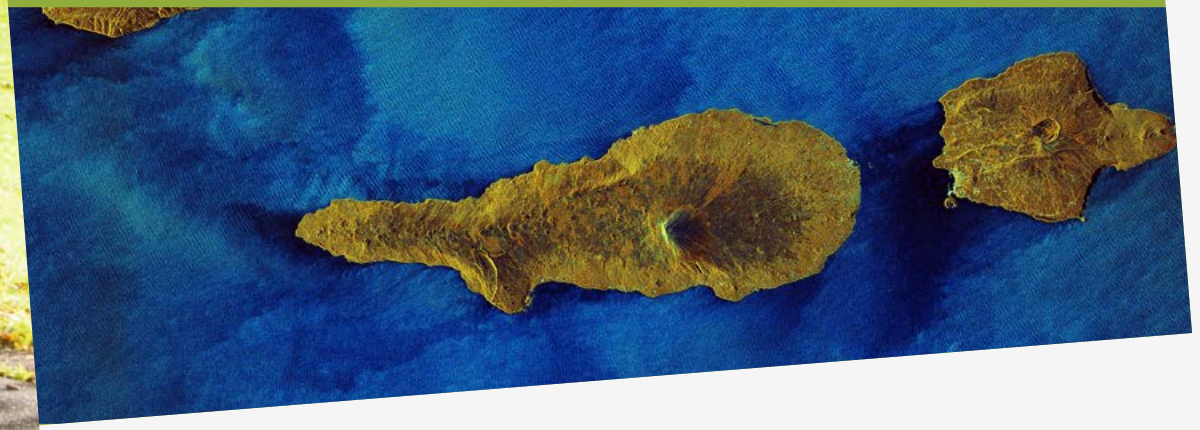
TOURISM & LEISURE

The Copernicus programme collects environmental data on the land, sea, and air, all of which are important to tourism and leisure applications. Meanwhile, the growing tourism industry and the increasing use of environmental apps on smartphones are lending increasing relevance to this application field. For instance, the Copernicus satellites provide information on water quality in swimming locations in near real-time. This data covers a number of parameters related to water quality status – including sea surface temperature, transparency and turbidity, and ocean colour measurements – which enable eutrophication assessments and the detection of harmful algal blooms.

The Copernicus satellites monitor the atmosphere to deliver data on air quality and UV radiation as well, both of which not only have an impact on our health, but also play a vital role in tourism. Together with the Copernicus programme's in-situ data, corresponding services make it possible to forecast the distribution of pollutants and the intensity of UV radiation.

The Copernicus space programme

provides data for every relevant field of tourism and leisure, which promotes the development of new applications for end users in Europe and around the world.

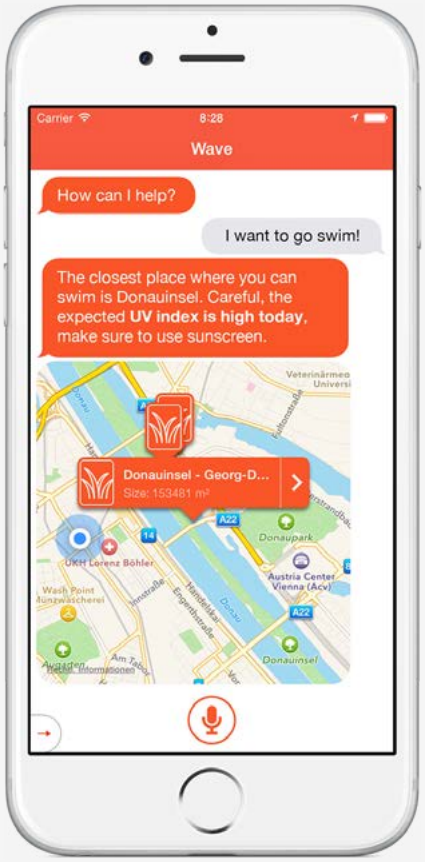


Testimonials 2012 – 2015

Winner ESA App Challenge 2015

Wave is an iOS voice assistant app that answers city-related questions including information derived from Earth observation satellites. Voice assistants answer questions asked in natural language, which makes them intuitive and allows for semantic searching and usage by visually impaired users. They are also faster than touch interfaces in many scenarios, as users can specify what they want to know more precisely without having to work through a complicated interface. Wave uses open data sources to answer questions. Users can ask things such as “Where can I swim?”, “How is the air quality today?”, or “Where can I get a city bike?” and receive a spoken and visual answer (such as a map or bar chart). The app will supplement its answers with Copernicus data and recommends sunscreen when UV radiation is high and warns of pollen when the user wants to cycle.

Wave – The City Assistant



As more Sentinels become operational, Wave also has tremendous potential to integrate further satellite data. Recently, Citybik.es has been integrated into the Wave app, which is now able to answer city bike requests in over 400 cities worldwide.

Patrick Wolowicz
subzero.eu software, Austria
subzero.eu/wave

Space App Camp ESRIN 2012

EnviSim – Discovering Climate Change

EnviSim (Environmental-Simulation) is an app concept for simulating how political and economic decisions affect the Earth's climate. The target audience includes anyone interested in global warming, climate change, and the environment at large. The user is able to simulate the effects of political and economic decisions on the climate and the environment over time by altering investments in industries, electrical energy production, transportation, technology, and more. At the end of each year, overlays or animations on a 3D globe show the effects of the user's decisions on various features of the environment, such as water temperature, sea level, agriculture, and air quality (mainly derived from the Copernicus programme). The user can also compare these effects with historical data for the simulated year or with predictions (for simulations of future years).

Botond Kis – Austria, Bart van Kuik – the Netherlands, Stefano Piamonti – Italy, and Thomas Pusztai – Austria

Space App Camp ESRIN 2012

GEOLife

GEOLife is a tablet application that introduces Earth observation to citizens in an easy-to-understand way. The app leverages Sentinel data to offer educational multimedia content. Furthermore, the Sentinel data are processed so that once a user has selected a topic of interest, environmental values for his or her current location are displayed. The app also incorporates a social feature with which users can interact and compare these values. GEOLife aims to educate the general public about the importance of Copernicus data in everyday life.

Graham Lancashire – United Kingdom, Sebastian Höbarth – Austria, Jaroslav Ozevic – Lithuania, and Michal Wojtysiak – Poland

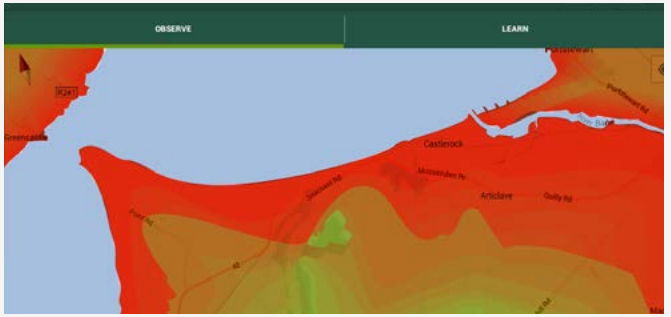
Testimonials 2013 – 2014

Space App Camp ESRIN 2013

The gaming app SpringESA seeks to create awareness of climate change and how it affects agriculture, fishing, and forestry. The Sentinel satellites and their contributing missions will provide climate data which the app will use to simulate the changing environment. In the game, the user can plant, grow, and harvest crops, fish, plant forests, and subsequently sell what they harvest. Influenced by the climate data from the Copernicus programme, the effects of climate change on agriculture are displayed as increases or declines in harvests. In this way, satellite-derived data will help draw attention to climate change amongst SpringESA end users.

SpringESA

Maja Adijoska – Macedonia, Lesly Houndole – France,
Jakub Kuzimski – Poland, and Freddy Paya – Canada



Space App Camp ESRIN 2013

Liferama is an app concept that uses Earth observation data to allow end users to find areas of interest. By combining different data sources, the app aims to produce maps that display the best conditions for a chosen activity. Depending on the parameters used for processing, the app is able to produce maps for fishing, gardening, surfing, and scuba diving. As such, it does not focus on one specific category; its target group can be expanded to deliver a variety of different parameters as the number of operational Sentinel satellites increases.

Liferama

Jaime Font – Spain, Martin Pelant – Czech Republic,
Stewart Taylor – United Kingdom, and Walter Verdese – Italy
apkpure.com/liferama/esa.appcamp.liferama

Space App Camp ESRIN 2013

The Thermal Guidance System app concept utilises satellite data to detect areas with high thermal updrafts. Updrafts are rising air currents that keep gliders aloft, but could also cause turbulence for other planes. Thermal Guidance System provides maps of these areas using data from the Sentinel satellites, as well as an augmented 3D view to assist pilots of gliders and small motorised planes. The app could also be used in flying unmanned aerial vehicles.

Thermal Guidance System

"I would recommend the Space App Camp to any developer with a passion for spaceflight, or simply an open mind for new projects and meeting new people."

Evangelos Georgiou – Cyprus, Ulf Küssner – Germany, Erik Unger – Austria, and Jip van Akker – the Netherlands

Space App Camp ESRIN 2014

Badespass provides users with easy-to-follow recommendations on the best bathing spots in their region. It makes use of the surface temperature, water, and air-quality data gathered by Sentinel-3 and Sentinel-5. Furthermore, the app will be further enhanced using weather data, weather forecasts, and in-situ measurements. Based on this data, Badespass is capable of recommending the best nearby lake or sea to the user. In addition, the user receives an overview of water quality in the surrounding region, which will stimulate interest in the importance of water quality and environmental protection.

Badespass

Benjamin Erhart – Germany, Holger Frank – Germany, Hannes Moser – Austria and Paul Steinhilber – Germany

Testimonials 2014 – 2015

Space App Camp ESRIN 2014

The Sun Tracker app uses data from the Sentinel satellites to report sunshine hours on mountain slopes. Based on the app's analyses, tourists are able to determine the location of the best conditions for various sports activities. The B2C app concept offers a great added value for everyday life.

Sun Tracker

Jakub Dubrovska, Vojt Dubrovska, Tomas Loukotka, and Kroslav Klech – the Czech Republic

Space App Camp ESRIN 2015

The Rocket Tourist concept enables users to find trending spots for their favourite activities anywhere in the world. Based on Sentinel data, the app evaluates the best locations for common activities like hunting for mushrooms, spotting shooting stars, or going scuba diving and suggests the one with the best possible conditions for the desired activity.

Rocket Tourist

Rocket Tourist also provides social functions that make it possible for users to find and rate spots within a greater community.

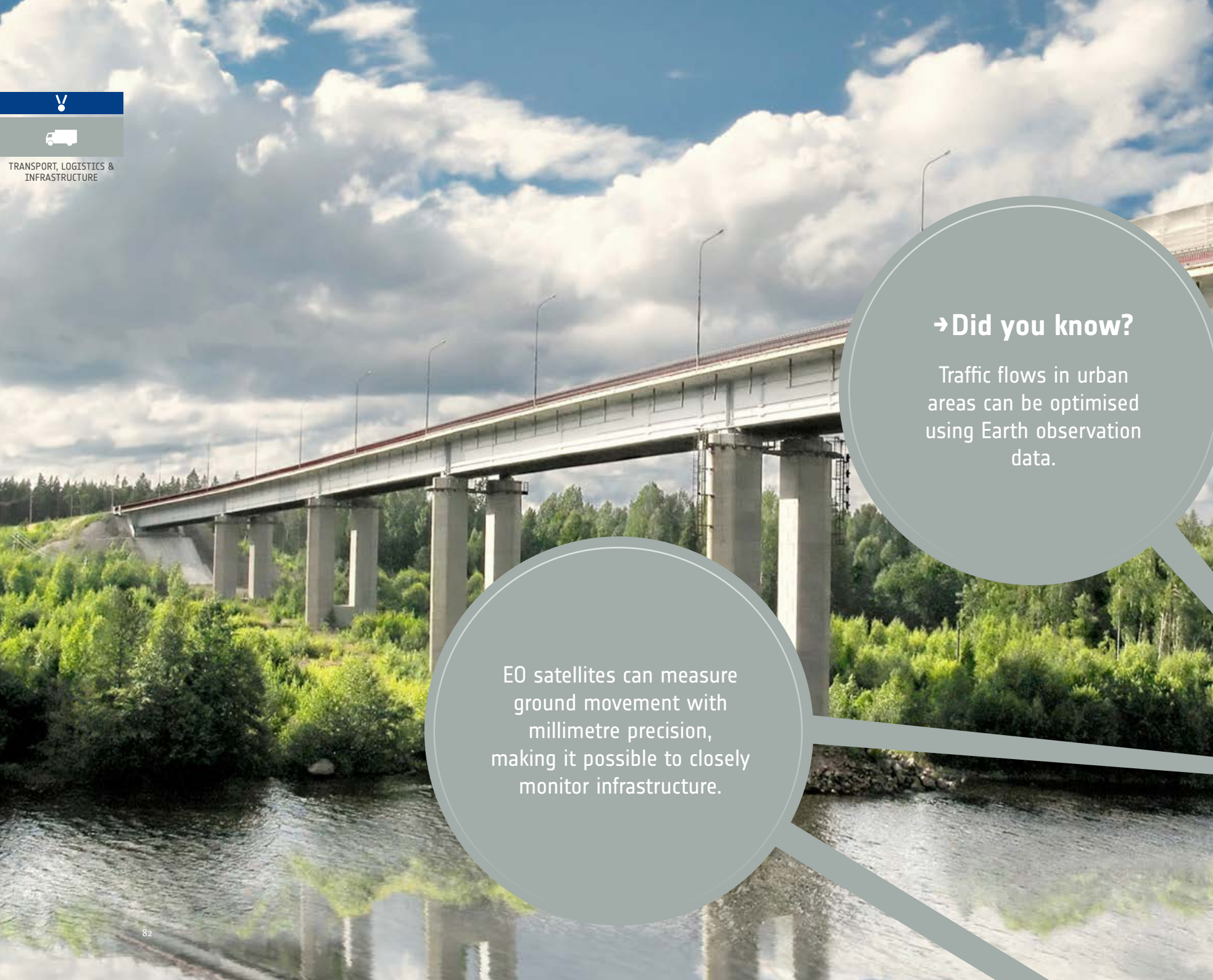
Simon Hofmann, Tobias Kaufmann, Johannes Staehlin, and Robert Weller
SAP SE, Germany
www.sap.com

Space App Camp ESRIN 2015

Pebly is an app for tourists that wants to improve holiday experiences by providing information on common activities. Based on land monitoring data from Sentinel-2, marine data from Sentinel-3, and atmospheric data from Sentinel-5, the app displays conditions for snorkelling, surfing, swimming, and sunbathing. For swimming and sunbathing, Pebly is also able to issue warnings if the current swimming conditions are too dangerous or if sunburn is likely based on the user's skin type. A simplified version of the app will be available on smartwatches, making it not only an ideal beach companion, but also a warning system that uses physical vibrations to call the user's attention to dangerous conditions.

Pebly

Lucian Baiesan, Tibor Hatala, Janos Szedlacsek, Istvan Udvari
Designatives Ltd., Hungary
www.designatives.com



→Did you know?

Traffic flows in urban areas can be optimised using Earth observation data.

EO satellites can measure ground movement with millimetre precision, making it possible to closely monitor infrastructure.

The Copernicus space programme was born in 1998, and its first Sentinel satellite was launched in April 2014.

TRANSPORT, LOGISTICS & INFRASTRUCTURE

Since solid transport services and a working infrastructure are key to assuring unrestricted movement, they constitute an important sector of the economy. However, the development of transport networks brings significant benefits to citizens, but often has negative effects on the environment. The future challenge for carriers, governments, and local authorities will thus be to meet the increasing demand for transport while reducing harmful environmental impacts.

The Sentinel satellites are capable of monitoring a multitude of environmental parameters that are relevant in the sustainable optimisation of transportation networks and the expansion of infrastructure.

The data Copernicus provides can support public authorities and carriers in implementing measures designed to meet future demand.

In the case of maritime transport, one of many application fields of Copernicus lies in supporting ship routing services by providing information on currents and sea ice. Meanwhile, Copernicus also aids in infrastructure maintenance by identifying areas at risk of subsidence and ground movements that are likely to destabilise buildings, bridges, or roads.

Copernicus supports

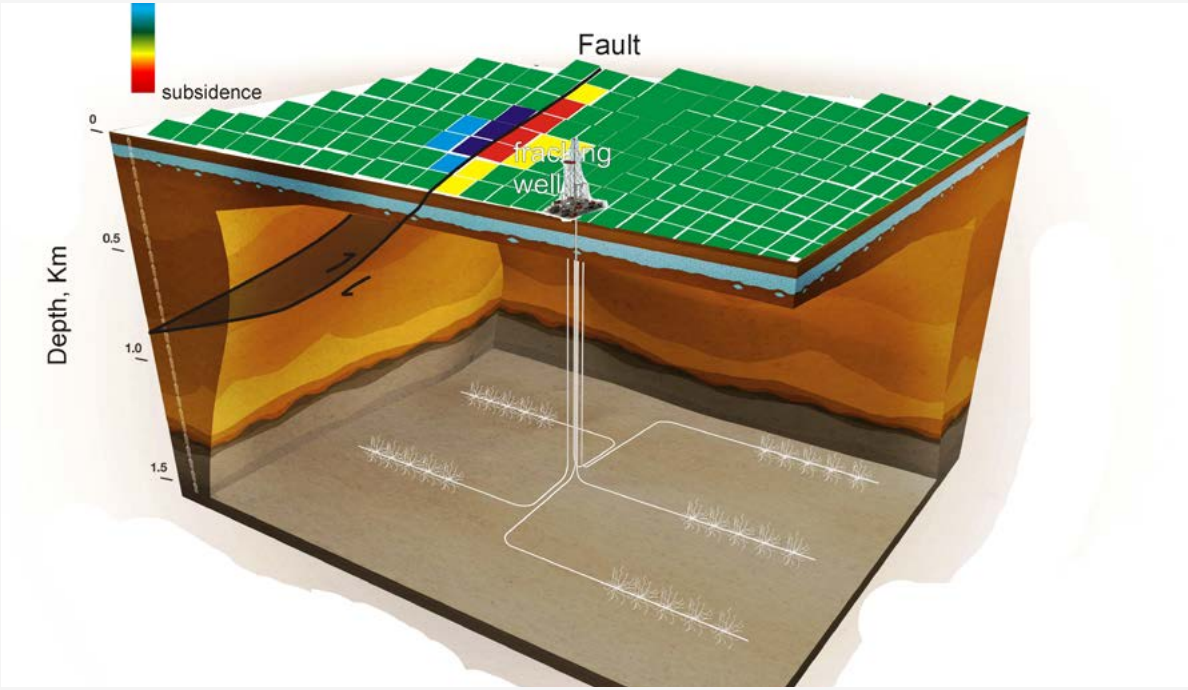
governments in finding sustainable solutions to the increasing demand for transport, logistics, and infrastructure.

Testimonials 2013 – 2014

Winner Radar Constellation Challenge by Airbus Defence and Space & Hisdesat and Copernicus Master 2014

PUNNET is a novel procedure that is designed to enable land stability monitoring and mapping with millimetre-level precision. The PUNNET service uses series of Satellite Aperture Radar (SAR) images to create maps of land surface deformation in the millimetre range. To monitor ground movement, a time series of satellite images is created using primarily Sentinel-1 Interferometric Synthetic Aperture Radar (InSAR) data, but also data from other satellite missions to increase precision. PUNNET gives companies, agencies, and regulatory bodies around the world a means of achieving ongoing cost-effective mapping

PUNNET – Land Stability Monitoring & Mapping

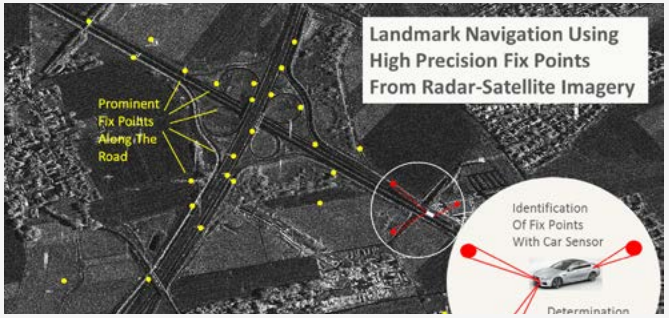


of geohazards and monitoring natural resource extraction. Encouraged by its win in the Radar Constellation Challenge and its nomination as the overall winner of the Copernicus Masters, the team decided to take its service to the next level. After establishing essential contacts and raising its profile, Paul Bhatia and Andrew Sowter created a spin-off from the University of Nottingham.

They founded the company Geomatic Ventures Ltd. in July 2015, and the team recently started their first commercial project with Innovate UK. Furthermore, the company has been incubated in the ESA Business Incubation Centre in Harwell, United Kingdom.

"As a pre-start-up, winning the Copernicus Masters encouraged us to take the first step into the industrial realm. The credibility we gained in the process enabled us to make rapid progress."

Paul Bhatia and team
Geomatic Ventures Ltd. / the University of Nottingham, United Kingdom
www.nottingham.ac.uk



Winner BMW ConnectedDrive Challenge and Copernicus Master 2013

The idea for this project was to use landmarks from geodetic Satellite Aperture Radar (SAR) to produce new high-resolution road maps and then use these landmarks for navigation (including data from Sentinel-1). After winning the Copernicus Masters, this high-potential project was renamed DriveMark and received funding from the Helmholtz Validation Fund. The first part of the project has already been realised, and development of the navigation concept has begun. The final goal is to enable precise car navigation for driver assistance systems and automated cars. The service uses high-resolution TerraSAR-X data and has developed an automated processing system to extract geodetic coordinates. In an extension of the DriveMark project, these landmarks will be used for precise car navigation within urban areas.

Landmark Navigation – With Radar Fixed Points from Satellites

Hartmut Runge
German Aerospace Center (DLR), Germany
www.dlr.de

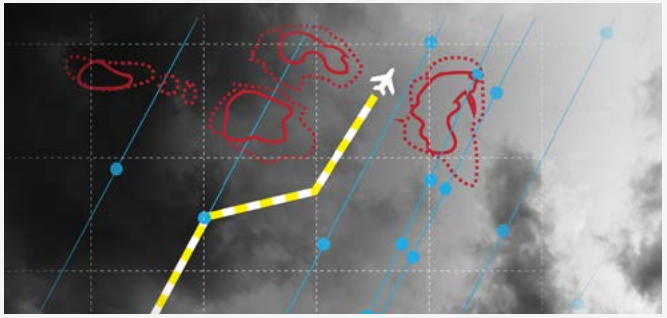
Winner Transport and Logistics Challenge by Satellite Applications Catapult 2014

Extreme weather events caused by climate change are negatively affecting our transport infrastructure. Roads, rails, and so on can all suffer from disruptions due to landslides and other such interruptions to service. Given the widely dispersed nature of transport infrastructure – especially in countries with large landmass but low population density, such as Canada or Sweden – rapid identification of these disruptive events before they effect services can be difficult, particularly in ultra-rural areas. SAR (e.g. Sentinel-1 data) and optical satellites offer the ability to rapidly examine "hot spots" pre-identified as potential problem areas by network operators and quickly report damage back to a transport infrastructure operator. Appropriate action can then be taken to minimise the disruption to the entire network and the end users who rely on it.

Transport Sentry – After-Event Transport Infrastructure Scanning

Steve Lee
Stevenson Astrosat Ltd., United Kingdom
www.astrosat.biz

Testimonials 2016



Space App Camp Barcelona 2016

Based on satellite data (including data from the Copernicus programme), the WxFusion prototype product “Cb-global” provides near real-time thunderstorm detection and forecasting up to one hour in advance (“nowcasting”) for much of the globe - and will soon cover the entire world. When given access to the SAP HANA Cloud Platform, aviation stakeholders can strategically plan flight routes and inform pilots well before they approach thunderstorm hazards. The resulting benefits include increased flight safety and reduced costs based on fewer detours, holding patterns, and other delays.

Cb-Global – Near Real-Time Thunderstorm Detection and Nowcasting for Aviation

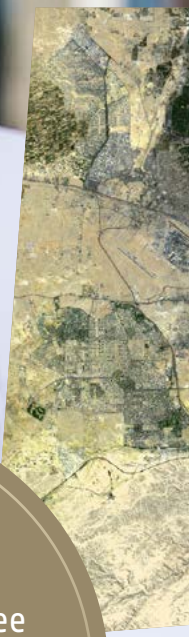
Arnold Tafferner and Caroline Forster
WxFusion, Germany
www.wxfusion.com

→Did you know?

Due to climate change, heat is becoming a more important issue for cities. With EO data, heat flows can be improved and citizens can start cooling off again.

EO satellites can support urban and regional planners in creating the cities of tomorrow by providing urban development maps.

Sentinel satellites are launched from three different locations: Korou (French Guiana), Baikonur, and Plesetsk (Russia).



URBAN & REGIONAL PLANNING

More than 50% of the global population lives in urban areas at present, and this percentage is expected to rise in the coming years. With increasing urbanisation, cities are facing significant planning challenges (in waste management, the exploitation of renewable energies, etc.) that can have a major impact on quality of life. At the same time, the areas surrounding cities are also being affected by changes in the way land is used.

The urban and regional

information the Copernicus space programme provides makes it easier for decision-makers to observe changes and react accordingly.

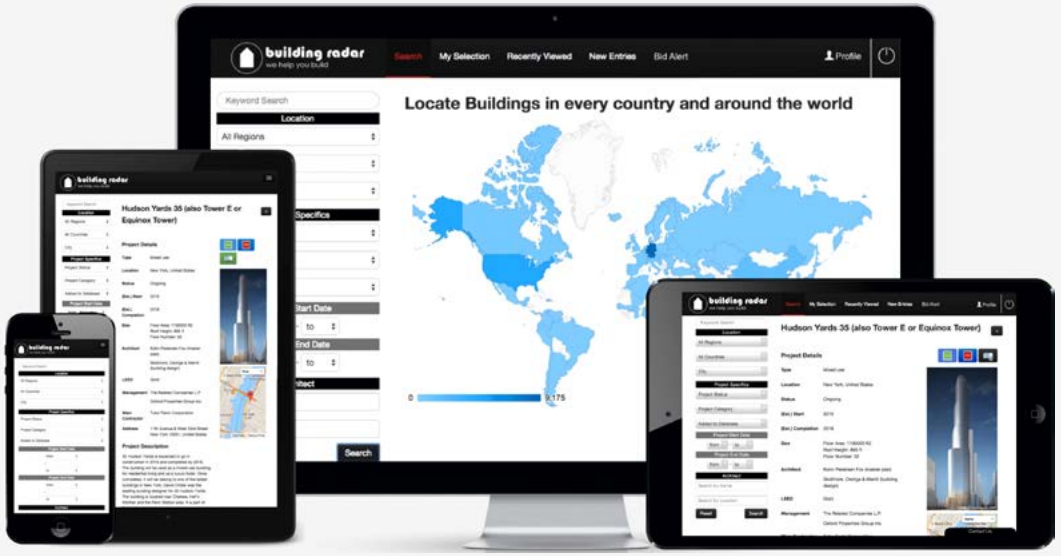
The Copernicus Land Monitoring Service, for example, makes use of satellite data to provide geographical information on land cover and land-surface temperature, which supports applications in areas such as spatial and urban planning.

As the gradual rise in sea levels endangers tropical atolls and large urban areas along the European coastline, climate change may also contribute to the need for urban and regional planning. Precise monitoring of changes in the mean level of the oceans is key to understanding potential socio-economic threats and planning coastal management activities, including adaptation measures such as coastal defence systems, improved building codes, and related restrictions. Here, Copernicus delivers continuous and reliable information about the extent and effects of rising sea levels in Europe's low-lying coastal areas.

Testimonials 2013 – 2016

Winner European Space Imaging High-Res Urban Challenge and Copernicus Master 2015 and Winner of the Space App Camp Barcelona 2016

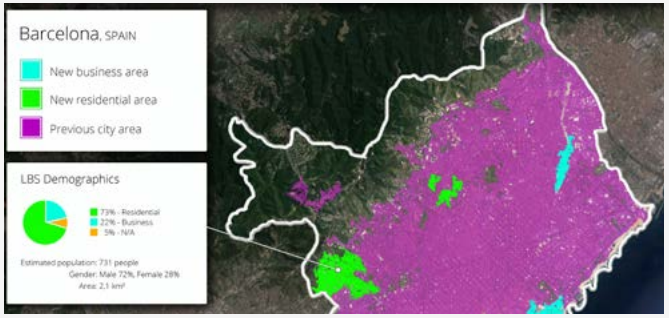
Building Radar has introduced an integrated solution for Sentinel-2 and VHR satellite imagery within a solid business model. This solution demonstrates the potential of satellite imagery for market-oriented products and services in a wide range of sectors. By combining satellite data, machine learning, and data mining, Building Radar provides an all-new monitoring and detection service for the construction industry. The Building Radar online platform, which already contains more than a million construction projects and over 200,000 company profiles, uses a custom-developed algorithm to identify new building projects around the world. Its customers include companies active in the new construction and maintenance sectors. With building project leads accounting for some EUR 72 billion in revenue each year, Building Radar makes it possible to verify online search results and track changes in projects by means of satellite imagery. The platform thus enables its users to monitor many different construction endeavours while providing much greater cost-efficiency than its competitors thanks to its innovative data research methods. In the next step, Building Radar will further develop its computer vision algorithms and train artificial neuronal networks in order to automate its analysis of building sites and the detection of changes therein. Very high-resolution imagery will be fundamental in training its neuronal networks. Building Radar's analysis of satellite images has great potential for further applications and services, as well: The Bavaria-based start-up is experimenting with possibilities in detecting road damage and analysing surfaces, infrastructures, and demography in pre-defined areas. This solution may open new doors for the use of precision satellite imagery in a worldwide context. Building Radar is the latest overall winner of the Copernicus Masters and has been undergoing incubation at ESA BIC Bavaria since early 2015.



Building Radar – Construction Detection and Monitoring

"Winning the European Space Imaging High-Res Urban Challenge and the Copernicus Masters grand prize is a huge honour for us. It shows that the international expert jury believes in our technology's potential to become something great."

Paul Indinger and team
Building Radar GmbH, Germany
www.buildingradar.com



Winner DLR Environmental Challenge 2013

Since winning the DLR Challenge in 2013, this city development tool has been renamed CUDA – Copernicus Urban Development Analyser. The team has also formed an international consortium with an industry partner, CGI, and associates from Norway, Spain, the United Kingdom, and Estonia. This consortium is now working on the further definition of the service and related developments. CUDA is a service that addresses the global megatrend toward urbanisation and the challenges it poses to infrastructures and the environment. To make sound decisions about future developments, accurate and timely information on current situations, past dynamics, and other ongoing trends is essential. CUDA will offer high-resolution information on global urban development based on data from the Sentinel-1 and -2 satellites and anonymous, mobile, location-based service (LBS) data. It will be developed in coordination with the Copernicus land-monitoring service to provide detailed information on urban development. The service will also offer an Application Programming Interface (API) for public data access and use in other services.

Urban Analyser – Your City Development Tool

Kaupo Voormansik and team
The University of Tartu, Estonia
www.ut.ee

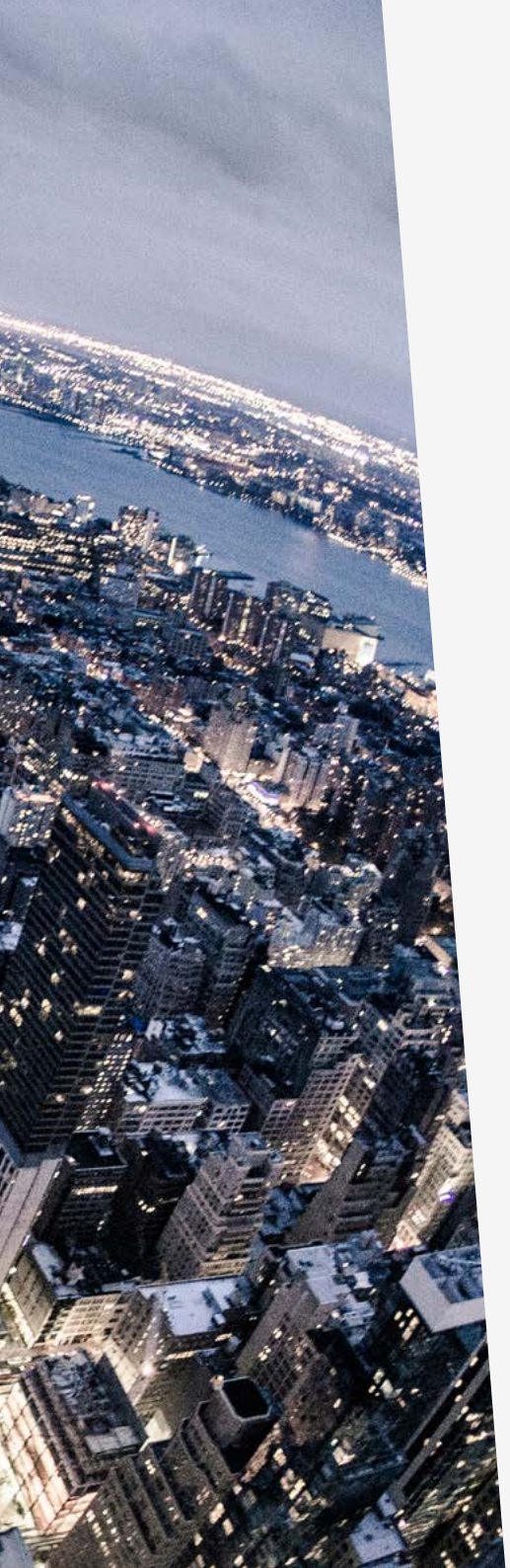
→Did you know?

In 2024, the market for commercial EO data is expected to reach USD 3.5bn.

(source Euroconsult)

More and more businesses are emerging thanks to the wealth of EO data available.

Copernicus data are free and open to users around the globe.



DISRUPTIVE & SUSTAINING INNOVATION

Digital technologies are becoming increasingly important in everyday life in the industrial realm and the public at large. Customers demand not only improved services, but also innovation to establish new market segments. The promotion of both disruptive and sustaining innovations is crucial in driving technical progress and keeping up with market needs.

Both forms of innovation add value to the market, either by creating new niche segments to challenge global players (disruptive) or by improving existing services based on customer needs (sustaining). Emerging new technologies provide fertile ground for entrepreneurial advancement and the development of innovative solutions.

The Copernicus space programme

encourages innovation in its various forms by providing a technological foundation of high-res satellite imagery and sophisticated Earth observation data. Innovative solutions based on Copernicus data have proven to be either disruptive or capable of offering improvements to the general public and industry.

TESTIMONIALS 2011 – 2014

Winner T-Systems Big Data Challenge 2014

In today's data deluge, we are far from understanding all the information we gather. Traditional technology is limited to fixed questions foreseen by programmers. The Science SQL query language, on the other hand, enables users to ask any question at any time on multidimensional datacubes – such as 1D series of measurements, 2D satellite images, 3D image time series, and 4D climate data. This concept is currently being added to the ISO SQL database language standard. Developed jointly by Jacobs University and rasdaman GmbH, this specification is based on many years of experience gained in inventing and productising the rasdaman system, a next-generation Big Data engine. Additionally, the

rasdaman – Science SQL on Petabyte Datacubes

operational insights obtained in running rasdaman on more than a thousand cloud nodes and on satellite and climate databases exceeding hundreds of terabytes have heavily impacted international geo-service standards in the Open Geospatial Consortium (OGC) and INSPIRE, along with ISO SQL. As it turns out, rasdaman's technology promotes science, but also allows companies to develop new business models. Furthermore, it has the potential to improve the flow of information between governments and citizens. Ultimately, rasdaman will contribute to the global democratisation of data access and joint data use on all levels.

Winning the T-Systems Big Data Challenge raised the profile not only of Science SQL, but that of rasdaman, as well. Having the idea evaluated by an expert jury also confirmed rasdaman's status as the leading service for integrating Earth observation data in a flexible and scalable way. Today, rasdaman GmbH and T-Systems International GmbH are collaborating on Big Data, remote sensing, and other data service projects. This has extended the user portfolio of rasdaman GmbH, which already provides its software to major stakeholders in large-scale Copernicus data dissemination – including the Earth Observation Data Centre (EODC) in Vienna and the European Centre for Medium-Range Weather Forecasts (ECMWF).

"The Copernicus Masters competition is very close to the market. As such, winning this Challenge not only makes it easier to establish relevant contacts, it boosts your industry credibility, as well."

Prof Dr Peter Baumann
Jacobs University and rasdaman GmbH, Germany
www.rasdaman.com

Winner T-Systems Cloud Computing Challenge 2011

UrtheCast Corp. is a Vancouver-based technology company that is developing the world's first ultra HD video feed of Earth, which will be streamed from space in full colour. Since winning the T-Systems Cloud Computing Challenge in 2011, UrtheCast has grown into an international, publicly traded company. Working with prominent aerospace partners from across the globe, UrtheCast has built, launched, installed, and is now operating its ultra HD video camera, Iris, on the ISS alongside its medium-resolution camera (MRC), which reached Initial Operational Capability (IOC) in 2014. Video and still-image data captured by the cameras will be downlinked to ground stations across the planet and displayed on the UrtheCast web platform, or distributed directly to partners and customers.

UrtheCast – Earth Video Camera

UrtheCast's cameras will provide ultra HD video and still imagery of Earth that will allow for monitoring of the environment, humanitarian relief, social events, agricultural land, and more. In 2015, UrtheCast entered into a definitive agreement with Elecnor, S.A. to acquire the Earth observation business Deimos. UrtheCast is thus set to take over the operation of the Deimos-1 and Deimos-2 satellites, along with the Deimos global archive of Earth imagery. Recently, Urthecast's Ultra-HD camera on the Deimos satellite has been used by Heineken® to promote the James Bond movie "Spectre". The "Spyfie" campaign utilised Urthecast's technology to take the first ever selfie from space.

"Winning the Copernicus Masters award introduced us to the industry in the best way possible. It put us in contact with the likes of the European Space Agency very early in our development while allowing us to showcase our go-to-market strategy, our vision for EO data, and our cloud computing strategy — all in front of the industry's leaders."

Scott Larson and team
UrtheCast Corp., Canada
www.urthecast.com

Winner T-Systems Cloud Computing Challenge 2012

WAMSAPs is a novel approach that facilitates continuous monitoring of man-made and natural environments in a more timely and comprehensive manner. Regular high-resolution, synoptic Earth observation imagery (including Sentinel data) and multi-sensor data streams acquired from fixed and mobile low-altitude Unmanned Aerial Vehicles (UAVs) and aerostat platforms are used to monitor and map key locations within a given area of interest. The system's operations – including deployment, acquisition, fusion, analysis, and visualisation – are fully automated.

WAMSAPs – Wide-Area Monitoring Using Spaceborne & Airborne Platforms

Rapid data acquisition by WAMSAPs' eco-friendly aerostats/UAVs (which typically takes just minutes) ensures that these compact platforms are non-permanent features on the skyline. The resulting output includes dynamic, multi-thematic data streams that can be transformed into a range of exciting new personalised, geospatial web services and applications that serve both the business to business and the wider consumer market. A cloud-based web services subscription model can also be implemented to ensure the system's commercial viability.

Dr Tim McCarthy and team
iGeotec Technologies Ltd., Ireland
www.igeotec.com

TESTIMONIALS 2014 – 2015

Space App Camp Noordwijk 2014

Safe.HUD is an iOS/iPad application developed for the Parrot ar.drone. It provides an augmented-reality HUD for Unmanned Aerial Systems (UAS) that gives UAS pilots enhanced safety features for situational awareness. Here, it incorporates space data from the Copernicus satellite missions and uses the Galileo satellites (EGNOS) for higher-precision GPS localisation.

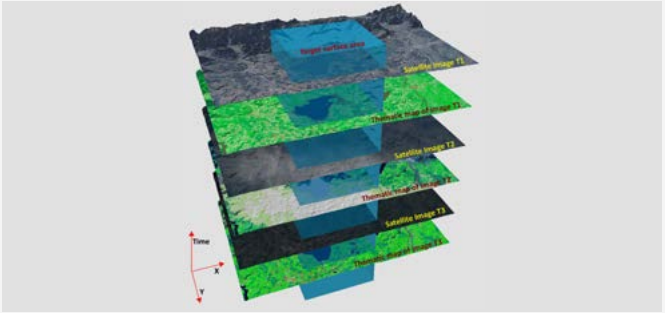
safe.HUD

Jip van Akker – the Netherlands, Evangelos Georgiou – Cyprus, Erik Unger – Austria, and Valdimir Veta – Macedonia

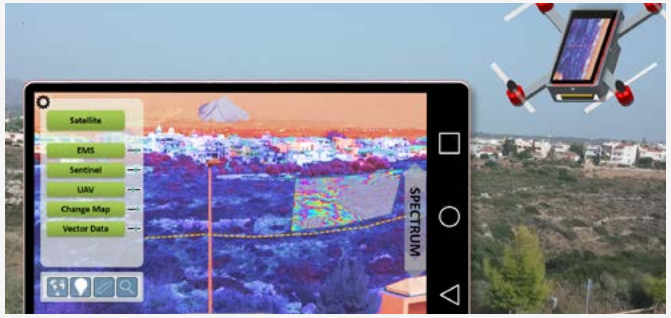
Winner T-Systems Big Data Challenge 2015

ImageQuerying (IQ) is an innovative application that simplifies and accelerates the analysis of big Earth observation image data (such as Sentinel-1 or Sentinel-3 data), by offering near real-time image comprehension and querying. The application is using the rasdaman database, which has won the T-Systems Big Data Challenge in 2014, as fundament for the processing. Based on low-level computer vision, IQ provides each image stored in a database with at least one thematic map generated through a fully automated process. Image objects can be tracked by the IQ inference engine over time in a manner resembling symbolic human reasoning. Users can also generate information layers by querying and combining the maps stored in the database. The ImageQuerying system can process any airborne/space-borne multi-spectral EO image with a radiometric calibration metadata file. The application quickly transforms image data into information, creating real value for the customer.

ImageQuerying – Real-Time Image Analysis and Querying



Dr Dirk Tiede and team
Department of Geoinformatics – Z_GIS, University of Salzburg, Austria
www.zgis.at



Winner NCMA Spatio-Temporal Data Visualisation Challenge 2015

CybEarth is a mobile app that provides augmented first-person views of reality. By positioning a mobile device over an area, layers of spatial data and Earth observation imagery are projected on-screen and dynamically matched to the camera's tilted field of view. The user can navigate in spectral and temporal scales and add geo-tags. The mobile device used can be adjusted on a prototype Unmanned Aerial Vehicle (UAV) platform to integrate real-time image data. The app incorporates any type of spatial information, including Sentinel SAR, multispectral, vector, and sensor data. CybEarth introduces a novel generic platform that embraces most Earth observation applications, including sea-, land-, and air-based environmental monitoring for violation reporting, natural disaster assessment through comparison of changes over time, and agriculture phenology. This promotes understanding of and participation in events on Earth.

CybEarth – First-Person Visualisation of EO Data

Asst Prof Panagiotis Partsinevelos and team
SenseLab, Technical University of Crete, Greece
www.senselab.tuc.gr

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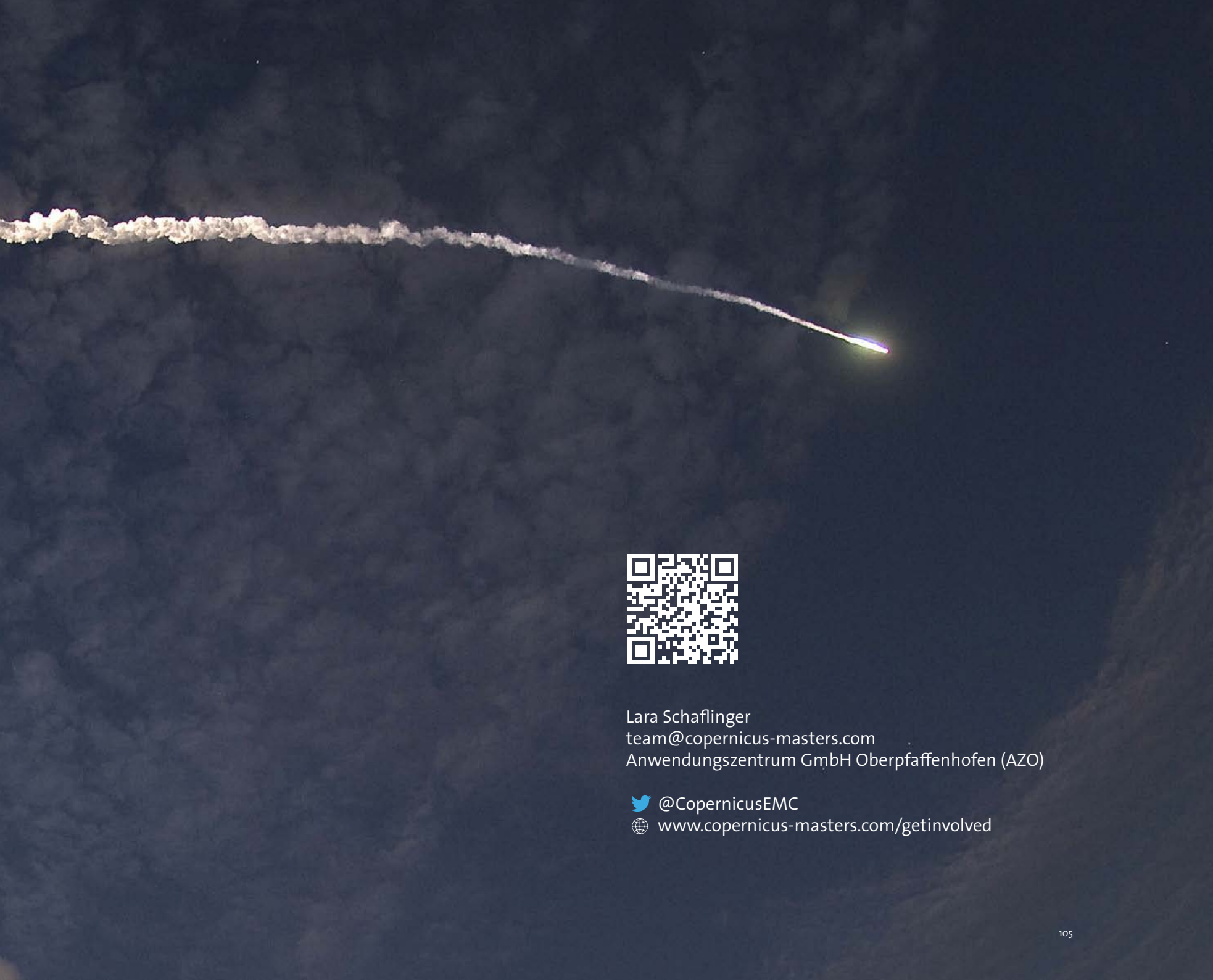
BECOME PART OF THE SUCCESS STORY



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→ COPERNICUS IN ACTION

Fostering User Uptake of EO Services Through
the Copernicus Masters and the Space App Camps

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