



Operational Unit “BEYOND Centre of EO Research & Satellite Remote Sensing”



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Research Director of IAASARS | NOA

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Lead Copernicus Coll GS Activities

National Delegate in EU Space Copernicus &
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URL: <http://members.noa.gr/kontoes/>

<https://scholar.google.gr/citations?user=UVzxtmUAAAAJ&hl=en>

HELLENIC
MirrorSite



SENTINELS
GREEKHUB

Satellite Access
Polar Orbit

Sentinel Missions
Federated Access

BEYOND Center

- Established in 2013
- Hosted and operated at the premises of the National Observatory of Athens
- Receives competitive funding **2,5-3ME annually**



Fast Facts:

www.beyond-eocenter.eu

Poised to open Science, Innovation, Know How & Services, as well as offer Infrastructure, Capacity Building & Education for the ultimate benefit of:

- Societies**
- Researchers,**
- Decision and Policy Makers,**
- NGOs,**
- Sectors & Value Adding Industry**
- Startups**
- Entrepreneurs**
- International Institutions**



Mandated by Copernicus EU & Global Earth Observation Inter-governmental Organization (GEO)

Act as Regional Coordinator in North Africa, Middle East, Balkans, and Black Sea for EO service uptake in the support of Civilians and the Sectors (Agriculture, Biodiversity, Energy, Climate, DRR, Health) – Endorsed by GEO Ministerial Decision in Kyoto 2019

Regional Support Office (RSO) of UNSPIDER for DRR

Leading partners of EuroGEO Action Groups for: (a) Disasters and (b) Health

Indicative Services of BEYOND for Civil-Sector Resilience

FireHUB: Forest fire monitoring and management service based on satellite remote sensing

The FireHUB system of EO services predicts, detects and monitors in real time the evolution of wildfires in Greece while it simultaneously models the smoke dispersion. It generates daily active fires and burnt areas in Europe, N. Africa, Middle East, Balkans, and Black Sea countries. Through Copernicus CEMS and third party activations, FireHUB delivers fire risk and historical fire regime assessments worldwide.

More information: <http://beyond-eo-center.eu/index.php/web-services/firehub>

FloodHUB Flood monitoring service

The FloodHUB system of EO services is activated as soon as a major flood event occurs and gives a near real-time operational picture of the disaster using hydrological and hydraulic modeling. It dynamically leverages satellite remote sensing observations, crowdsourcing and in-situ sensor data.

More information: <http://beyond-eo-center.eu/index.php/web-services/floodhub>

GeoHUB Geohazards monitoring service using satellite radar interferometry

GeoHUB system of EO services exploits primarily SAR imagery and employs interferometric techniques to assess ground deformation. It generates products for diachronic monitoring of earthquakes, volcanoes, landslides and urban subsidence. The GeoObservatory is activated for any earthquake and/or a volcanic eruption over the world.

More information: <http://beyond-eo-center.eu/index.php/web-services/geohub>

SolarHUB Nowcasting Solar energy continuous monitoring service

The SolarHUB system of EO services, SENSE and nextSENSE, exploits daily acquisitions of big satellite data with AI techniques and provides now-casting and short-term forecasting surface solar radiation and energy assessments over Europe, N. Africa, Middle East, Balkans, and Black Sea.

More information: <http://beyond-eo-center.eu/index.php/web-services/solarhub>

AgriHUB Satellite technology as a tool to shape agricultural policy and ensure food security

The AgriHUB system of services, exploits EO with state-of-the-art AI to monitor crops and food production, assess the good agricultural practices, and provides early assessments and warning on Climate Change impact in yield. It also supports decisions in relation to farmers' compliance with CAP.

More information: <http://beyond-eo-center.eu/index.php/thematic-areas/agriculture>

DustHUB Desert Dust Monitoring Service

The DustHUB system of EO services provides a three-day forecast of desert dust concentrations and dispersion over EU, N. Africa, Middle East, Balkans, and Black Sea. It informs on dust particle concentrations at all heights of the atmosphere, as well as dry and wet depositions of dust on the surface.

More information: <http://beyond-eo-center.eu/index.php/web-services/dusthub>

Early Warning System for Mosquito-borne Diseases (EYWA)

EYWA system of EO services forecasts and informs on the entomological and epidemiological risk for Mosquito-Borne Diseases (Malaria, West Nile Virus, Dengue Fever, Yellow Fever, Zika, Chikungunya) and supports the public health authorities to prevent the spread of diseases in thousands of settlements in Europe, Africa, and Asia continents.

More information: <http://beyond-eo-center.eu/index.php/web-services/eywa>



Agriculture



Disasters



Climate



Energy



Coordination



Procurement



Epidemics



Capacity Building

- 20 cross-sector services
- 14 service platforms open to the global public/stakeholders

Hellenic Mirror Site & Services



Hellenic Mirror Site:
56K products
published per month
(37.5 TiB)

Greek DataHub Relay:
12M Products per Year:
S-1: 800k, S-2: 7.300k,
S-3: 3.400k, S-5P: 690k

Mirror Site: > 330 TiB of satellite data are acquired annually, a volume that is equivalent to three times the entire 7-year archive of the Envisat mission

Node#3 CollGS
Product Downloads in one year

45 M products
20 PiB of data

→ Management/monitoring of >100 VMs, 1200 CPU Cores, 1.5 Pbytes Storage Rolling Archive

→ Sync and disseminate daily 60.000 Sentinel mages

→ Operation of 8 Services/Hubs:

- ❑ **Collaborative Hub** (Node 3): Access to S-1/2/3 data from all Copernicus Participating States (EUMETSAT, Airbus etc.)
- ❑ **International Hub**: Access to S-1/2/3 data from International partners (NASA, USGS, NOAA, Australian Geosciences, etc.)
- ❑ **DIAS Hub** (Node 3): Access to S-1/2/3 data from DIAS partners (Atos, Creotech etc.)
- ❑ **AfricaCast Hub**: Access to S-3 data for EUMETSAT, for Africa
- ❑ **S5Pre-Ops Hub**: Access to S-5P data for all the users globally
- ❑ **S5P Expert Hub**: Access to Sentinel-5P Calibration and Validation data for expert users
- ❑ **Greek DataHub Relay**: Access to S-1/2/3/5P data for selected users not eligible for the Collaborative or International Hubs
- ❑ **Hellenic Mirror Site**: Access to S-1/2/3/5P data in Mediterranean

FACT SHEET

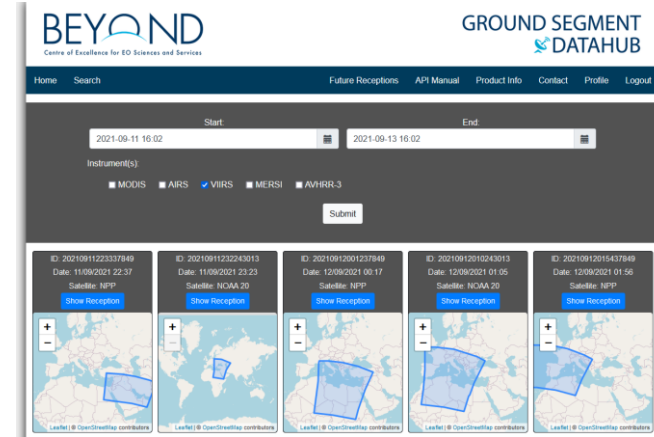
S-1	S-2	S-3	S-4	S-5P	S-5	S-6
Radar	High Resolution Optical	Medium Resolution Optical & Altimetry	Atmospheric Chemistry (GEO)	Atmospheric Chemistry (LEO)	Atmospheric Chemistry (LEO)	Altimetry
A	A	A	A	A	A	A
3 Apr. 2014	23 Jun. 2015	16 Feb. 2016	2021	13 Oct. 2017	2021	21 Nov. 2020
B	B	B	B	B	B	B
25 Apr. 2016	6 Mar. 2017	25 Aug. 2018	2027	2027	2027	2025

Hellenic Mirror Site & Services



Web Interface Search and Download of Products: Filter by sensing date and sensor, View thumbnail and footprint, Download product

RESTful API: Filter by sensing date, sensor, satellite, product name, View product details in JSON format, Download product



Polar Orbit Antenna X-/L- BAND
300TB Live Archive MODIS (EOS Terra/Aqua), VIIRS (NPP/JPSS), AVHRR/3 (Metop-A/B, NOAA-19)
Geostationary Antenna: METEOSAT SG
Operation 24/7

- More than 200000 Level-1 and Level-2 products archived
- 50TiB total product volume
- Download: ~12500 products per month (~3 TB)
- Mediterranean Region

In a nutshell BEYOND in figures

01

14+ Service/Data Platforms open to the global public and involved users.

20 Civil Protection Authorities receive Copernicus EMS Risk and Recover Services, **10 Industries** and **Associations** of Professionals (e.g. Farmers, Corteva, PTO, Interamerican Insurance) and **100+ Stakeholders** in 22 Countries and deliver services

03

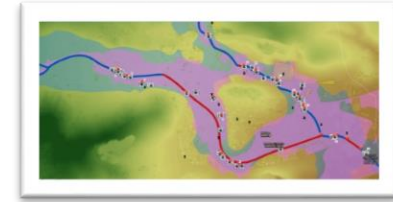
> 20 innovative services (Service Hubs) in the Sectors of (a) **Energy**, (b) **Health**, (c) **Agriculture**, (d) **DRR** → **Services leveraging Big Data, AI, ML, DL, Multi Source Data Modelling and Assimilation**

100+ Risk & Recovery Activations at national level yearly
3+ backend modules for the management of Big EO Data

02



<https://perifereia-attica.beyond-eocenter.eu/dashboard/demo>

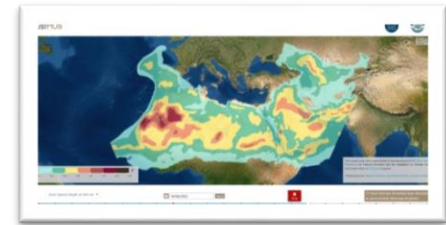


<https://www.arcgis.com/apps/View/index.html?appid=35da5148b81a41eb84140314c854ad98>



<http://ffis.beyond-eocenter.eu/http://195.251.203.238/seviri/>

04



<http://dusthub.beyond-eocenter.eu/>



Big Data Collection

Automated identification, collection and efficient storage of massive amounts of Satellite and Meteo Data



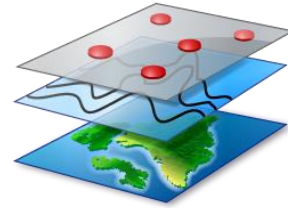
Data Processors & Management

Scalable pre-processing of data such as correction, cloud masking, ARD product generation



Level-3 Products

Analysis of large areas of interest, objects classification, trends detection, data fusion, cloud removal



Applications & Services

APIs and Web Applications developed aiming at providing users alerts, data access, data visualization and a series of online tools

Data → Knowledge → Decision Support





Operational Unit “BEYOND
Centre of EO Research & Satellite
Remote Sensing”



EO creates
opportunities
for Health &
Epidemics



An Early Warning Tool to the epidemics arsenal

Unveiling the EYWA System From the challenge...to the solution

Haris Kontoes
Research Director
(Operational Unit BEYOND Centre | IAASARS | NOA)

www.beyond-eocenter.eu

On behalf of EYWA team



Winner of the first “EIC Horizon Prize
on Early Warning for Epidemics”

Learn more here:



Earth Observation for Epidemics
of Vector-borne Diseases /
EuroGEO Action Group

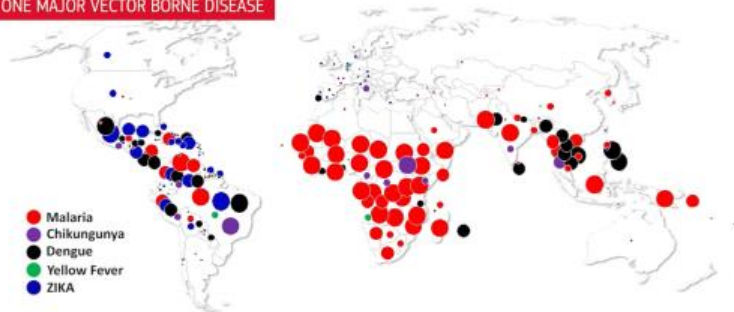


The e-shape project has received funding from the
European Union’s Horizon 2020 research and
innovation programme under grant agreement 820852

Introduction | MBDs: A global problem to be addressed

80% OF THE GLOBAL POPULATION

LIVES IN THE AREAS OF AT LEAST
ONE MAJOR VECTOR BORNE DISEASE



Re-emergence of significant mosquito born disease, including outbreaks, reported native and imported cases (2017-2019)

- Climate Change, globalisation and other drivers are altering ecological conditions for mosquitoes.
- Mosquito-Borne Diseases (MBDs) are present in **over 100 countries**.
- 700,000 deaths per year.
- Malaria**, most lethal for kids aged under five in the sub-Saharan regions.
- Europe** a “hot spot” of **West Nile Virus**.
- Chikungunya** and **dengue fever** increased 40% over 1950¹.

1. [https://www.thelancet.com/action/showPdf?pii=S0140-6736\(20\)32290-X](https://www.thelancet.com/action/showPdf?pii=S0140-6736(20)32290-X)

EYWA & West Nile Virus in Europe

Greece

- ❑ 1702 cases and 227 deaths in the past 12 years.
- ❑ EYWA supports 4 regions with a total of 2500 settlements and 3.8M people.

Entomological risk predictions powered by the BAd (Ecodev) and MAMOTH (BEYOND/NOA) models.

Epidemiological risk predictions powered by the BAR (Ecodev) and MIMESIS (Uni of Patras) models.



Italy

- ❑ EYWA supports 2 regions with a total of 757 municipalities and 540K people.
- ❑ Entomological risk predictions powered by the MAMOTH (BEYOND/NOA) model.
- ❑ Epidemiological risk predictions powered by the BAR (Ecodev) and MIMESIS (Uni of Patras) models.



UNIVERSITÀ DI TRENTO



FONDAZIONE EDMUND MACH

Serbia

- ❑ Vojvodina region 37 municipalities and 1.9M people.
- ❑ Entomological risk predictions powered by the MAMOTH (BEYOND/NOA) model.



Germany

- ❑ Baden-Württemberg region 74 municipalities and 11.1M people.
- ❑ Entomological risk predictions powered by the MAMOTH (BEYOND/NOA) model.



BNITM

Bernhard Nocht Institute for Tropical Medicine

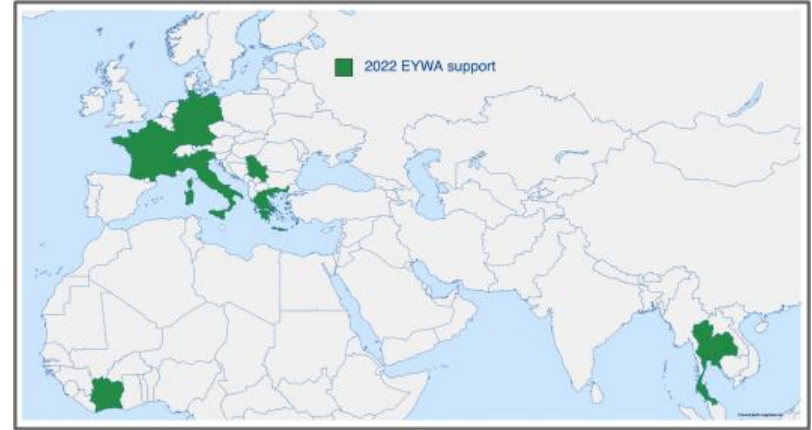
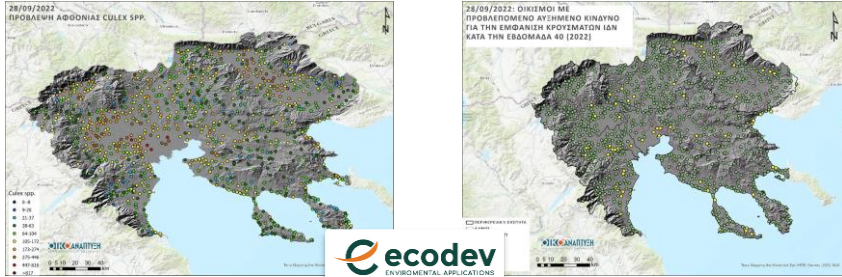


France

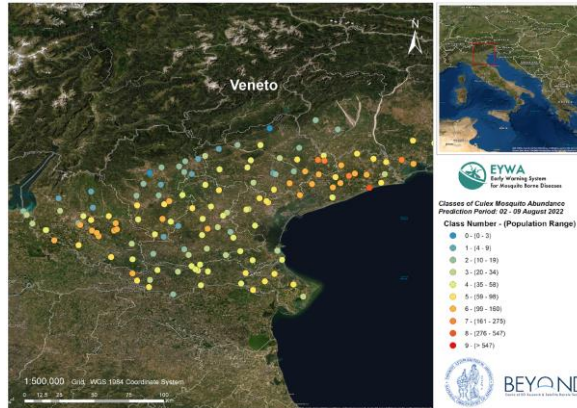
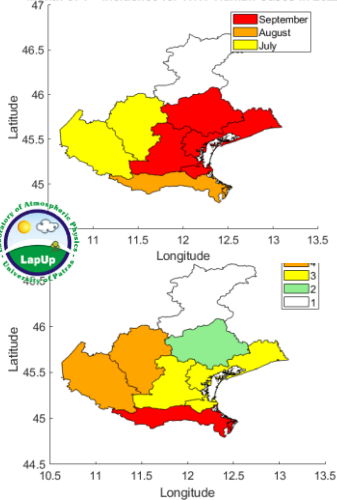
- ❑ 3 regions / 9935 municipalities and ~12 M people.
- ❑ Entomological risk predictions powered by the MAMOTH (BEYOND/NOA) model.



Working towards a solution



Month of 1st incidence for WNV Human Cases in 2022



What does EYWA offer?

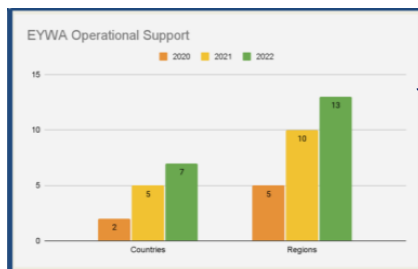
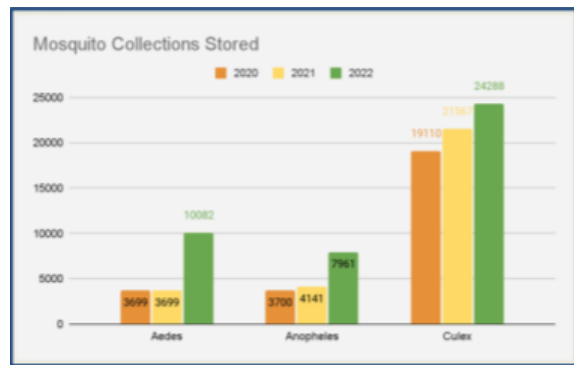
A couple of weeks/one month earlier it informs on mosquito abundance and pathogen transmission and suggests preventive and awareness door-to-door actions in the villages at risk

After EYWA:

EYWA set the stage for:

- Data federation and organization in one system
- Open big features spaces with environmental, entomological, health, socio-economic, climatic, etc data/indicators
- Delivers Validated Transfer Learning and Forecasting Models for Risk Prediction

A fragmented landscape



What is new in the concept of EYWA ?

Before EYWA:

- Siloed collections Entomological & epidemiological records
- Lack of indicators providing dynamics in the change of:
 - Environment, weather, landscapes hosting areas mosquitoes
- No Standardization in feature engineering to feed AI/Dynamic forecasting models
- No robust/transferable solutions

The EYWA journey up to date... in a nutshell

EYWA started its operations with 5 regions in 2 European Countries (Greece/Italy)

2020

2021

EYWA expanded to include 10 regions in 5 European Countries (France, Germany, Greece, Italy, Serbia)

EYWA further expands to support another region in Italy and Cote d'Ivoire in Africa operationally and Thailand in Asia pre-operationally.

2022

2023

EYWA is on track to support operationally Ghana in Africa, new regions in East Germany and the Milan region in Italy

In a nutshell

- EYWA is an established **impactful & transferable** Early Warning System.
- The system is **expanding** each year **to new regions** dealing with different climatic & socioeconomic conditions.
- The **sustainability** issue per use case is carefully examined and justified only if Institutional users are actively involved as co-designers
- Models are adapted in providing **early warning** and guiding **targeted** larviciding and **door to door** awareness based on **user feedback** at the end of each mosquito season
- The identification of **means/channels/networks** to disseminate the EYWA products are a high priority
- Established and **standardized collection and access** to EO and in-situ entomological and health records are key aspects of EYWA
- Highlights the power of **EO** in supporting **Communities** and **Health Systems** around the world.
- As part of the EuroGEO Action Group, EYWA **seeks for synergies** with on-going projects and initiatives (e.g. EO4Health).

Thank you!



Contact us

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@BEYOND CENTRE OF EXCELLENCE

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Greece

National Observatory of Athens (NOA) – BEYOND Centre of EO
Research & Satellite Remote Sensing

Ecodevelopment S.A

University of Patras – Physics Department - Laboratory of Atmospheric
Physics (LapUP)

Dimitrios Vallianatos (IDCOM)

Aristotle University of Thessaloniki

University of Thessaly, Medical School. Laboratory of Hygiene and
Epidemiology

Italy

Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe)

Edmund Mach Foundation

University of Trento

Serbia

University of "Novi Sad", Faculty of Agriculture, Laboratory for Medical
and Veterinary Entomology

Scientific Veterinary Institute "Novi Sad"

University of Novi Sad, Faculty of Medicine

Germany

German Mosquito Control Association (KABS)

Bernhard Nocht Institute for Tropical Medicine

France

EID Méditerranée

European Commission

Joint Research Center

Ivory Coast

Centre Suisse de Recherches Scientifiques en Côte d'Ivoire

Thailand

Vector Biology and Vector Borne Disease Research Unit, Department
of Parasitology, Faculty of Medicine, Chulalongkorn University