EYWA
Early Warning System
for Mosquito Borne Diseases

EO creates
opportunities
for Health &
Epidemics

EYWA: A key tool to the epidemics arsenal

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

EuroGEO

NEXTGEOSS
European Data Hub and Platform

EuroGEO

Action Group EO4EViDence

(Earth Observation for Epidemics of Vector-Borne Diseases)
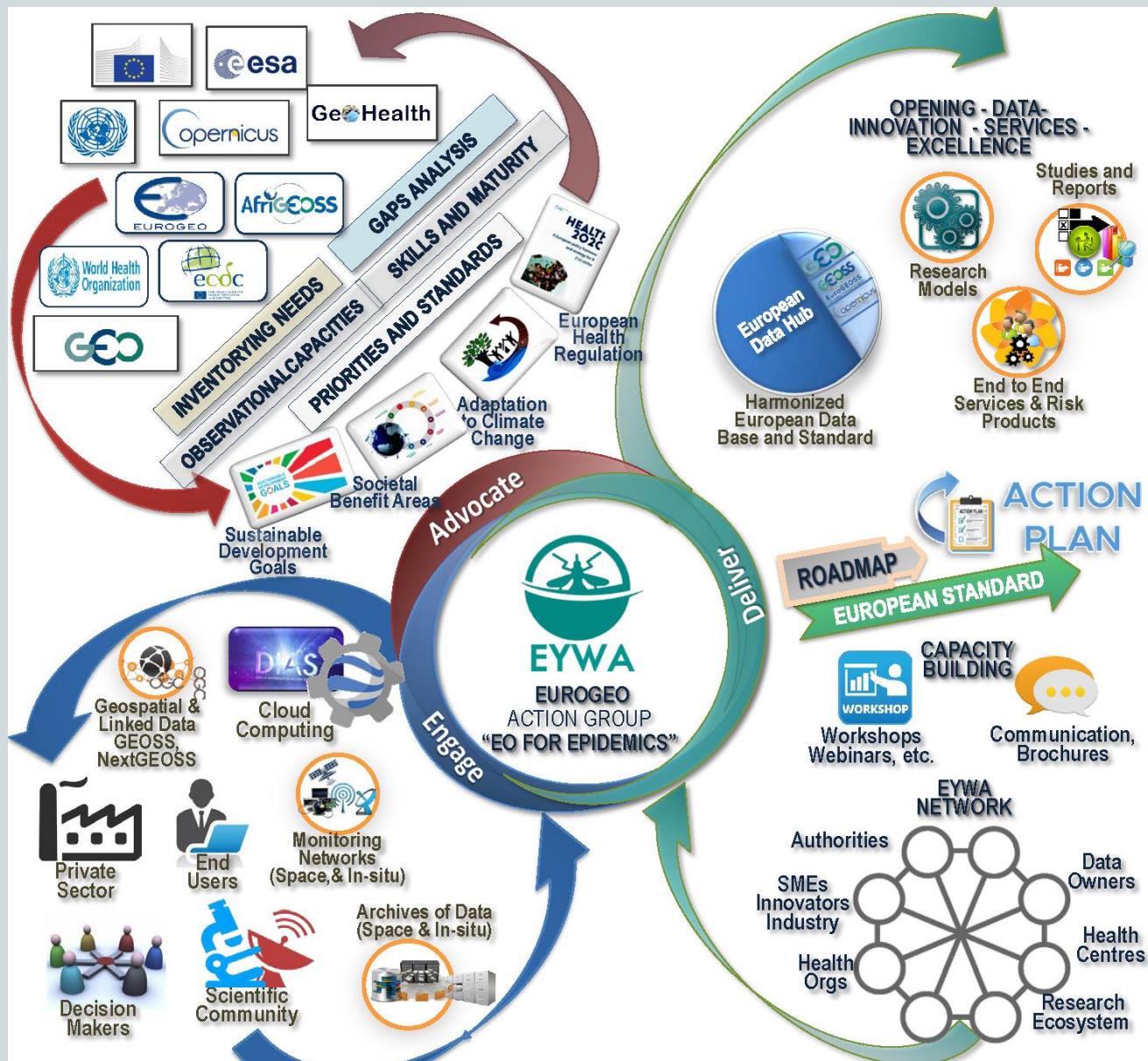
EYWA is a vision, a network, a European and even global standard.

EYWA offers a scalable, reliable and sustainable early warning system, relying on Earth observation big data combined with entomological, epidemiological and socioeconomic data, to forecast and monitor Mosquito-Borne Diseases.
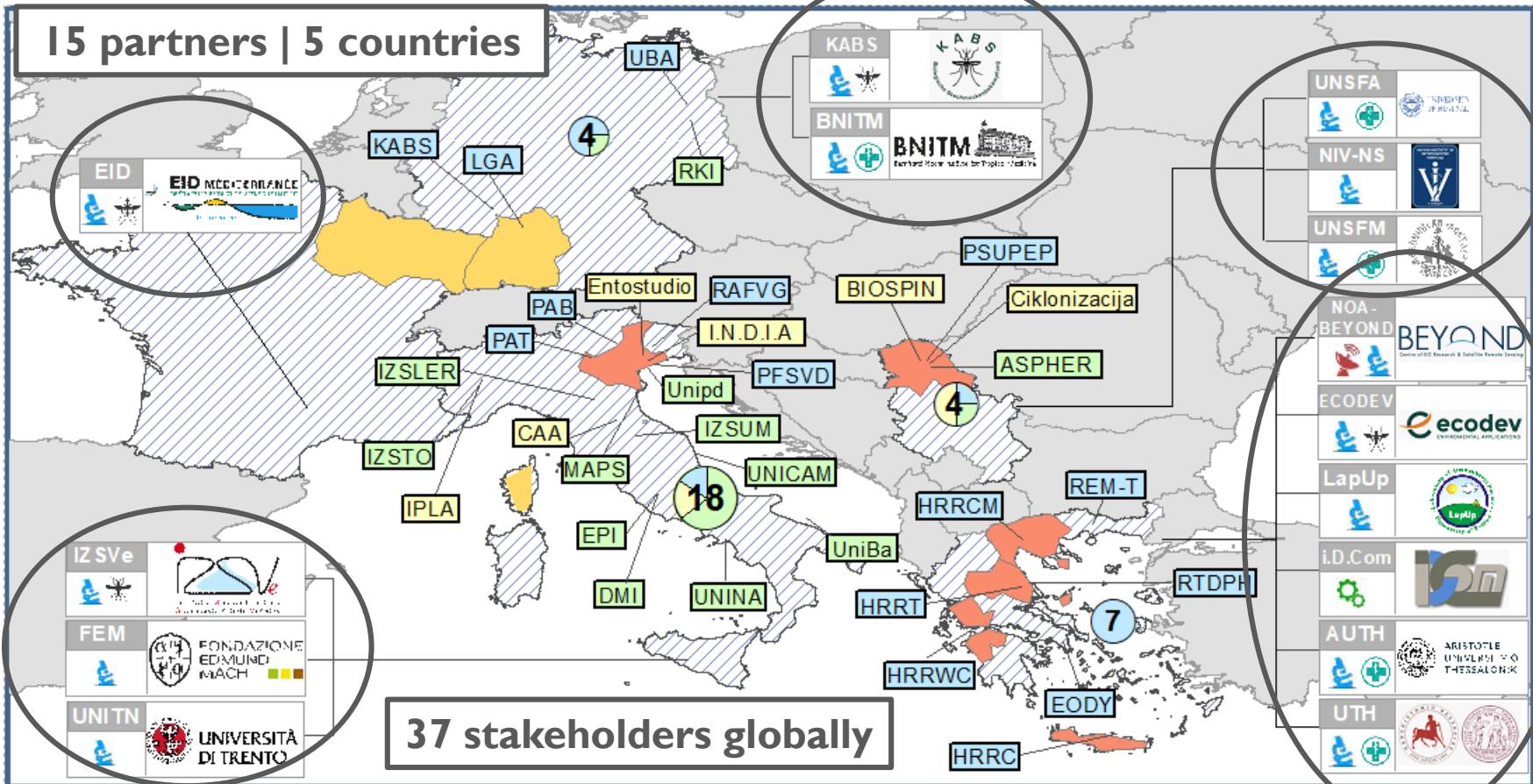
EYWA is built on the GEO triptych:

ADVOCATE
ENGAGE
DELIVER

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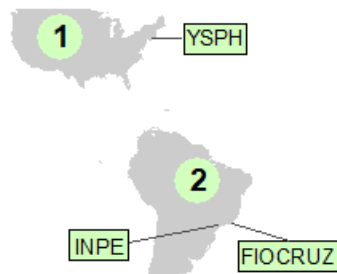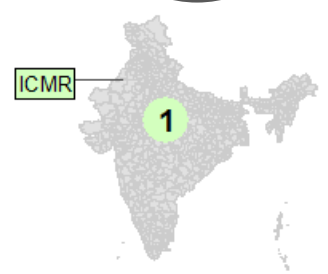
EYWA TEAM
"Together Everyone Achieves More"

Data collectors/providers

NOA - BEYOND, ECODEV, AUTH, UTH (GR)
IZSVe (IT)
UNSFA, NIV-NS, UNSFM (SRB)
KABS, BNITM (DE)
EID Mediterranee (FR)

Data manipulators & Platform development

NOA - BEYOND, i.D.Com (GR)

Data modelers

NOA - BEYOND, ECODEV, LapUp (GR)
FEM, UniTN (IT)

Mosquito controllers

ECODEV (GR)
KABS (DE)
EID Mediterranee (FR)

Decision makers

No. of EYWA partners

Medicine & Veterinary Medicine 6
Mosquito Surveillance 5
Mosquito Control 3
Earth Observation & Geospatial analysis 4
Predictive Modelling 5
System & Platform Development 4

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How EYWA competes

Free and open satellite Earth Observation and meteorological data

Open data

European technology

Copernicus Sentinels, CAMS, CLMS, CCS, CreoDIAS, GEOSS, Sentinels Greek Hub, Hellenic Mirror site

Streamlined and automated pipeline for EO, entomological, epidemiological and auxiliary data ingestion

Automation

Scalable

EYWA's generic models are designed to scale-up easily and were in pre-operational phase in 5 European regions

EYWA's generic and site-specific models can be transferred in multiple geographic regions

Transferable

Fully operational

EYWA is in successful operational use since April 2020 in Greece & Italy. From 2021 and onward, will be operational in more countries.
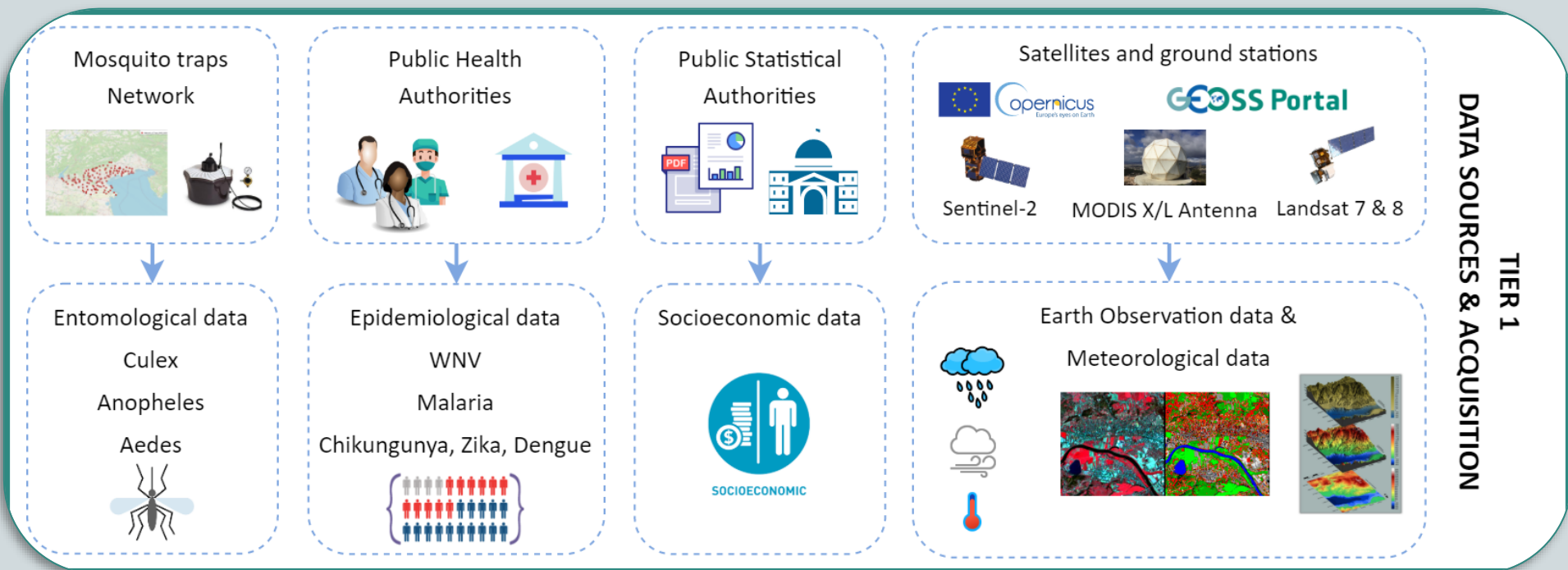
"EYWA is a robust and scalable Early Warning & Decision Support System that welcomes new partners from around the world to share data and transform scientific knowledge into decision-making & mosquito control actions"

EYWA incorporates 10-years time-series of Copernicus (Sentinel-2) and other space-based data (Landsat-7 & -8, MODIS and ERA-5) in addition to in-situ entomological, epidemiological, socioeconomic and crowdsourcing data.

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EYWA System Architecture

A suite of APIs is developed and opened for automatic:

- **Data Harvesting**
- **Data Pre-processing**
- **Index Data Derivation and Conversion for ODC/DB**
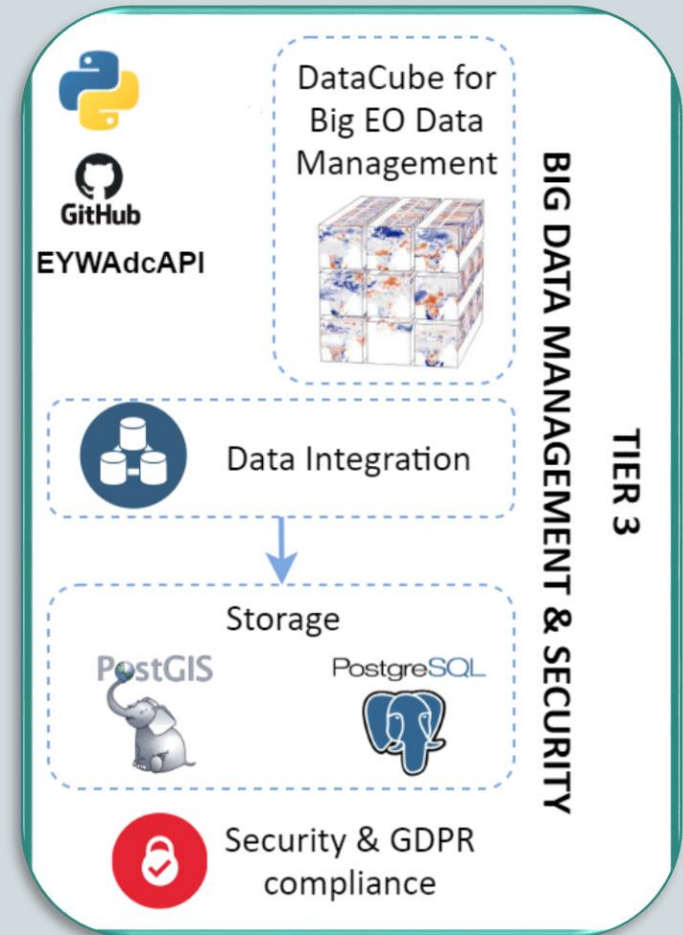- **Raw/Value Added Data Sharing and Opening**
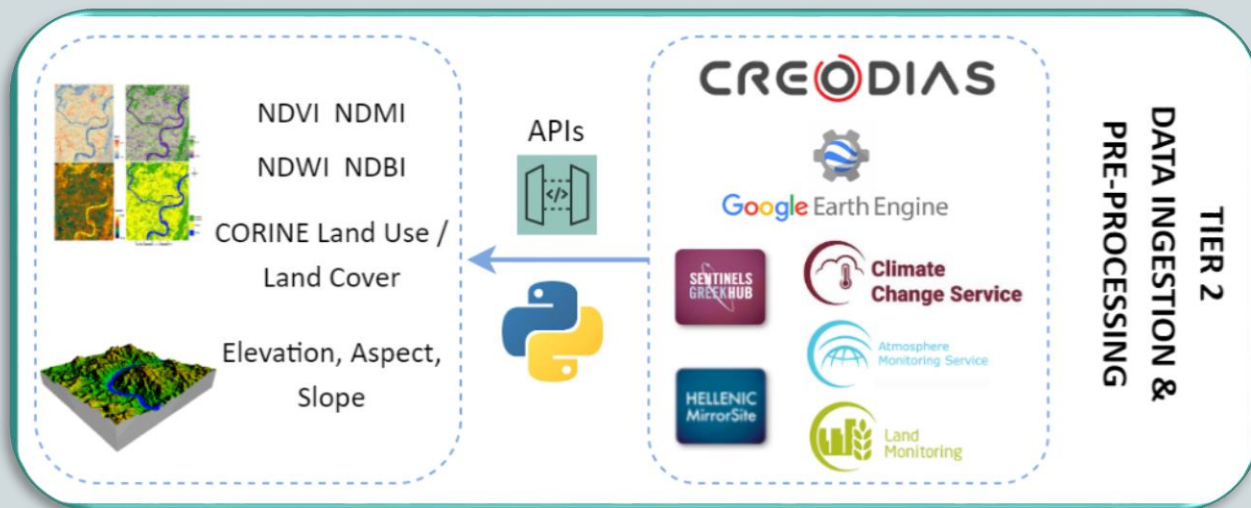
Satellite data harvesting and processing, exploiting European and non-European services:
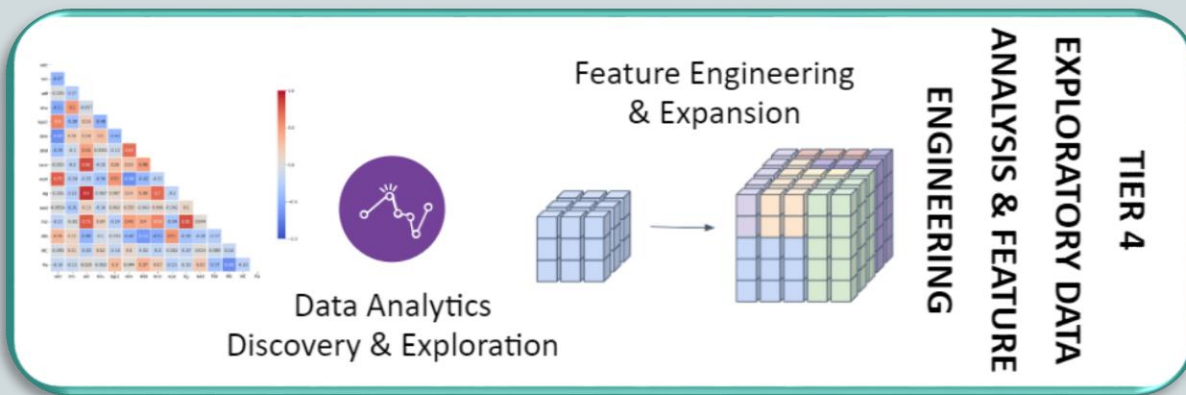- Umbrella Sentinel Access Point of the Hellenic Mirror Site (an API that constitutes 100% EU innovation and has been developed by BEYOND-NOA in the framework of the NextGEOSS and EOPEN EU projects)
- CreoDIAS and Google Earth Engine

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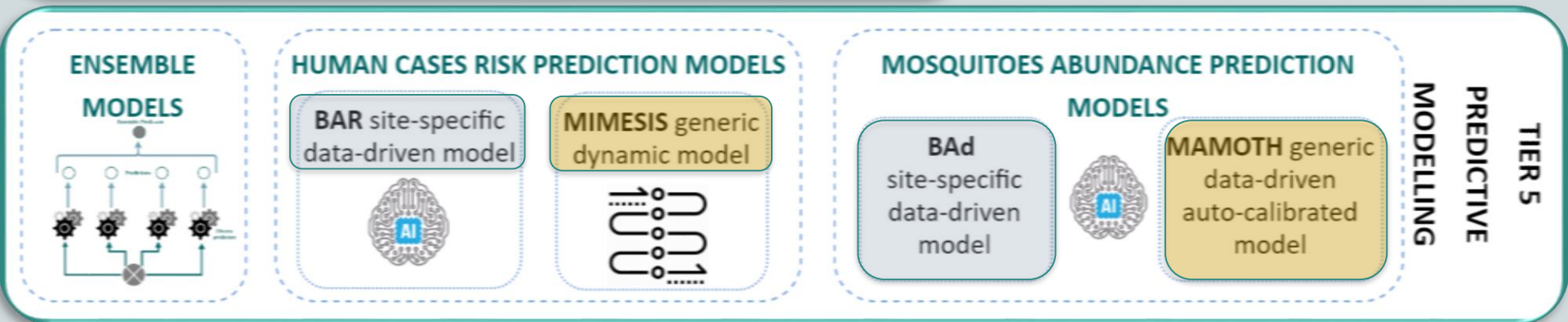Epidemics

EYWA System Architecture

- Big Data management (**278 TB and counting**)
- [Open Data Cube (ODC)](#) technology, state-of-the-art tool for Earth Observation and other data fusion, feature engineering and data analytics
- All these processing steps are available through the dedicated Python API "**EYWAdcAPI**" at [BEYOND-NOA's GitHub](#) profile in the [epidemics repository](#)

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EYWA System Architecture

TIER 4 EXPLORATORY DATA ANALYSIS & FEATURE ENGINEERING

Feature Engineering & Expansion

Data Analytics Discovery & Exploration

A "mammoth" feature space of at least 10-years time-series of data for every mosquito-traps network in nine regions in Europe.

TIER 5 PREDICTIVE MODELLING

ENSEMBLE MODELS

HUMAN CASES RISK PREDICTION MODELS

BAR site-specific data-driven model

MIMESIS generic dynamic model

MOSQUITOES ABUNDANCE PREDICTION MODELS

BAd site-specific data-driven model

MAMOTH generic data-driven auto-calibrated model

How is this plethora of independent data transformed into meaningful scientific knowledge?

EYWA has a factory of dynamic and data-driven models, learning about the dynamics of mosquitoes' abundance and mosquito-borne diseases transmission, and providing monthly, weekly, daily predictions.

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EYWA System Architecture

TIER 6 — KNOWLEDGE REPRESENTATION & EXPLANATION

Mosquitoes abundance and human cases risk prediction maps & statistics

Reports for end-users

Predictions results dissemination to the relevant Public Health Authorities through monthly reports and the EYWA Web Platform

TIER 7 — EYWA WEB SERVICES

Web Platform UI
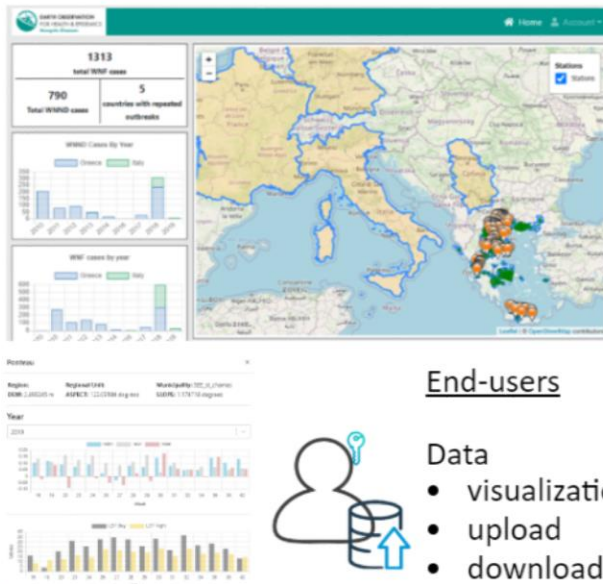
Mosquito Vision application
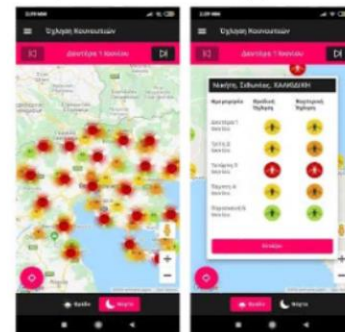
End-users

Data
- visualization
- upload
- download

Open data sharing through the EYWAopenAPI

NEXTGEOSS

GEOSS Portal

EYWA & open data sharing

NEXTGEOSS DataHub & EYWAopenAPI

EYWA is an autonomous European Initiative, building upon the Open Innovation, Open Science and Open to the World vision for Europe.

Analysis ready 10-years' time-series of environmental, meteorological and geomorphological data for every mosquito-traps network in 9 European regions. Accessible through:

- The "EYWAopenAPI" (http://epidemics.space.noa.gr/api_v2/)
- NextGEOSS DataHub

Who is it for?

Public Health Professionals

Scientists

Public

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EYWA in Action

EYWA's **operational implementation in 2020** (TRL>7) with a demonstrated impact in:

- Greece (Regions of Central Macedonia, Thessaly, Western Greece and Crete)
- Italy (Veneto region)

forecasting *Culex* mosquito populations and West Nile Virus outbreaks in 2020.

EYWA's **pre-operational test in 2020** for:

- *Culex* (WNV) abundance prediction in Serbia (Vojvodina region) and Germany (Baden-Württemberg region)
- *Anopheles* (Malaria) in Italy (Veneto region)
- *Aedes* (Chikungunya, Dengue, Zika) in France (Grand Est and Corsica regions)
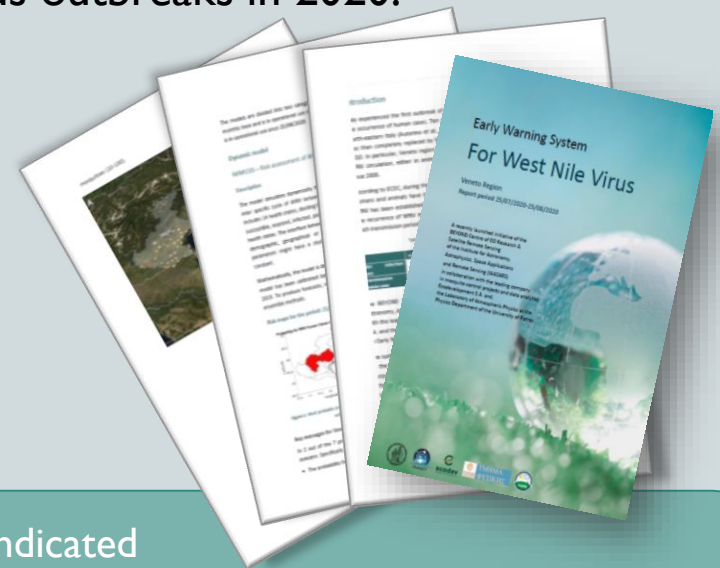
The reports indicated
- Up-to-date epidemiological status of the Region
- The state-of-the-art models used
- The estimated human risk
- The mosquito abundance predictions for the month

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EYWA in a nutshell

- Plethora of satellite and in-situ Earth Observation data
- Entomological, epidemiological, crowdsourced, socioeconomic and auxiliary data
- State-of-the-art technological tools

Leveraging scientific knowledge and ultimately proving that EO can improve our understanding in the field of epidemics

The pivotal role of EYWA is to become a key lever for Public Health authorities and decision makers, support preparedness and timely strategic design of the health system response actions, and raise citizens awareness on the expected risk, with a view to fight Mosquito-Borne Diseases.

Thank you!

Contact us
Kontoes@noa.gr
(Coordinator of EuroGEO Action Group for Epidemics)
(Lead Partner of EYWA)

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

EuroGEO

Partners

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