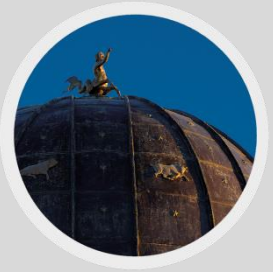
The National Observatory of Athens: Research, Specialized Services and its operational role!

National Observatory of Athens
1846 - 2017



Prologue

The National Observatory of Athens (NOA) was founded in 1842 on the hill of the Nymphs, across from the Parthenon, and is the oldest research institution in Greece. It currently consists of three institutes:

- one focusing on **astronomy, astrophysics, space physics and remote sensing**,
- one on **environmental research and sustainable development**, and
- one on **Geodynamics**.

It operates an extensive network of research facilities, such as telescopes and various sensing stations, supporting high quality basic and applied research. NOA collaborates with universities both in Greece and abroad, offering advanced training to students and young researchers. It hosts the UNESCO Chair for Natural Hazards, it operates the National Seismological Network and participates in numerous international networks.

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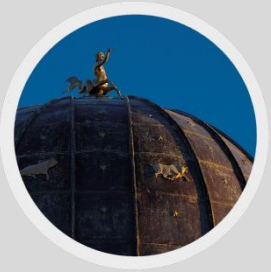
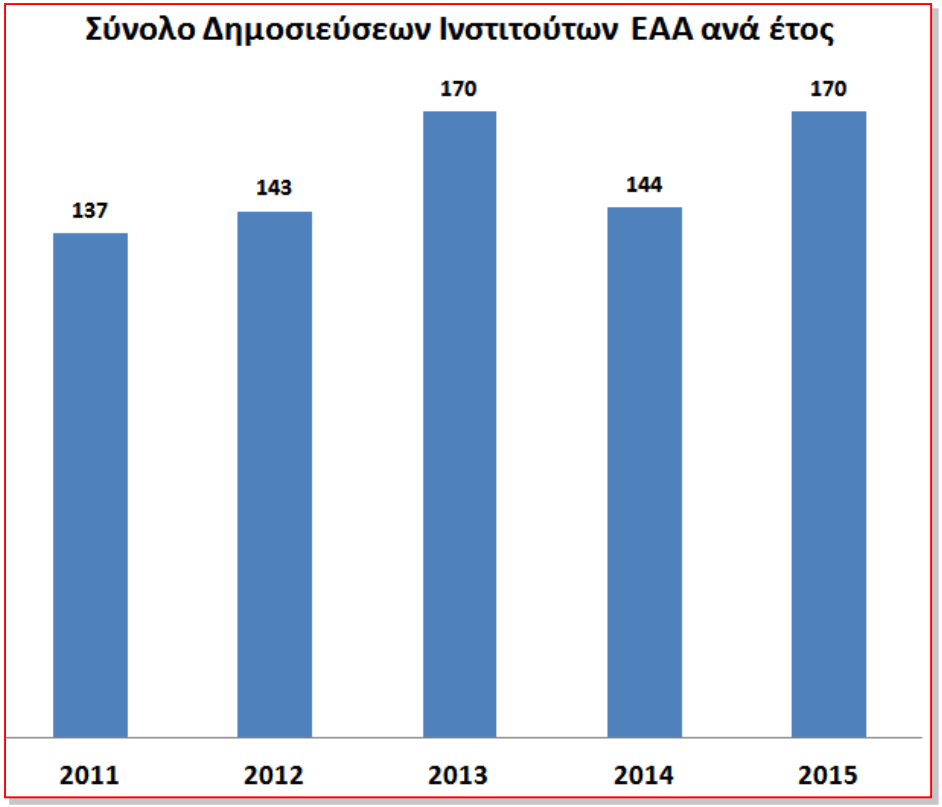
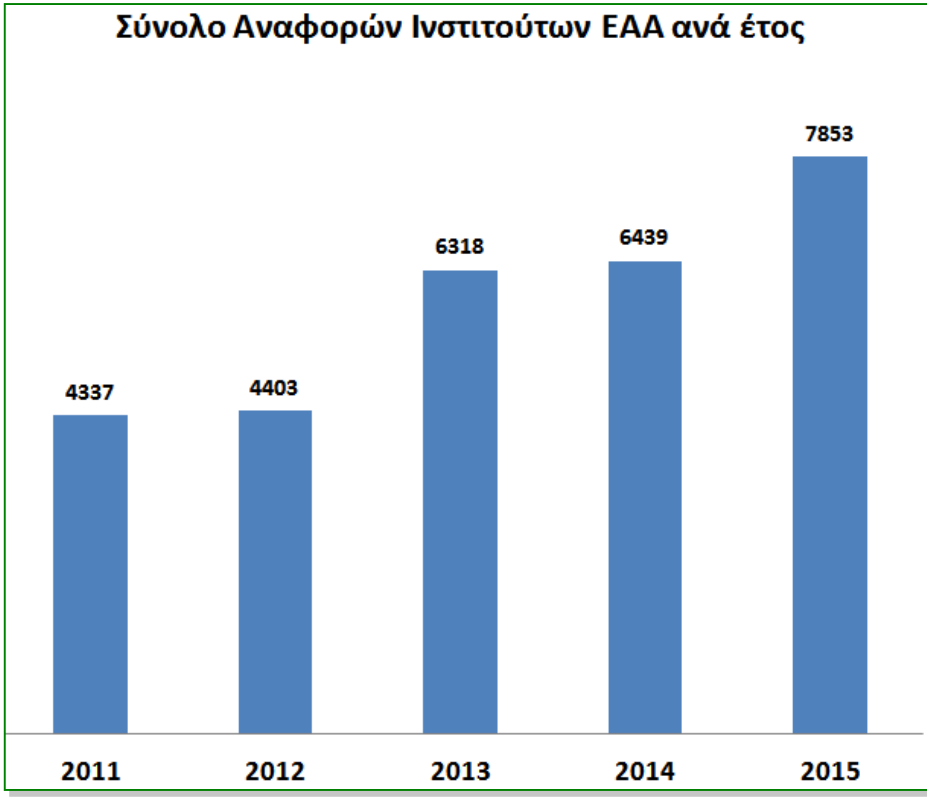


FUNDAMENTAL RESEARCH & EXCELLENCE

International Methodology of value the research excellence

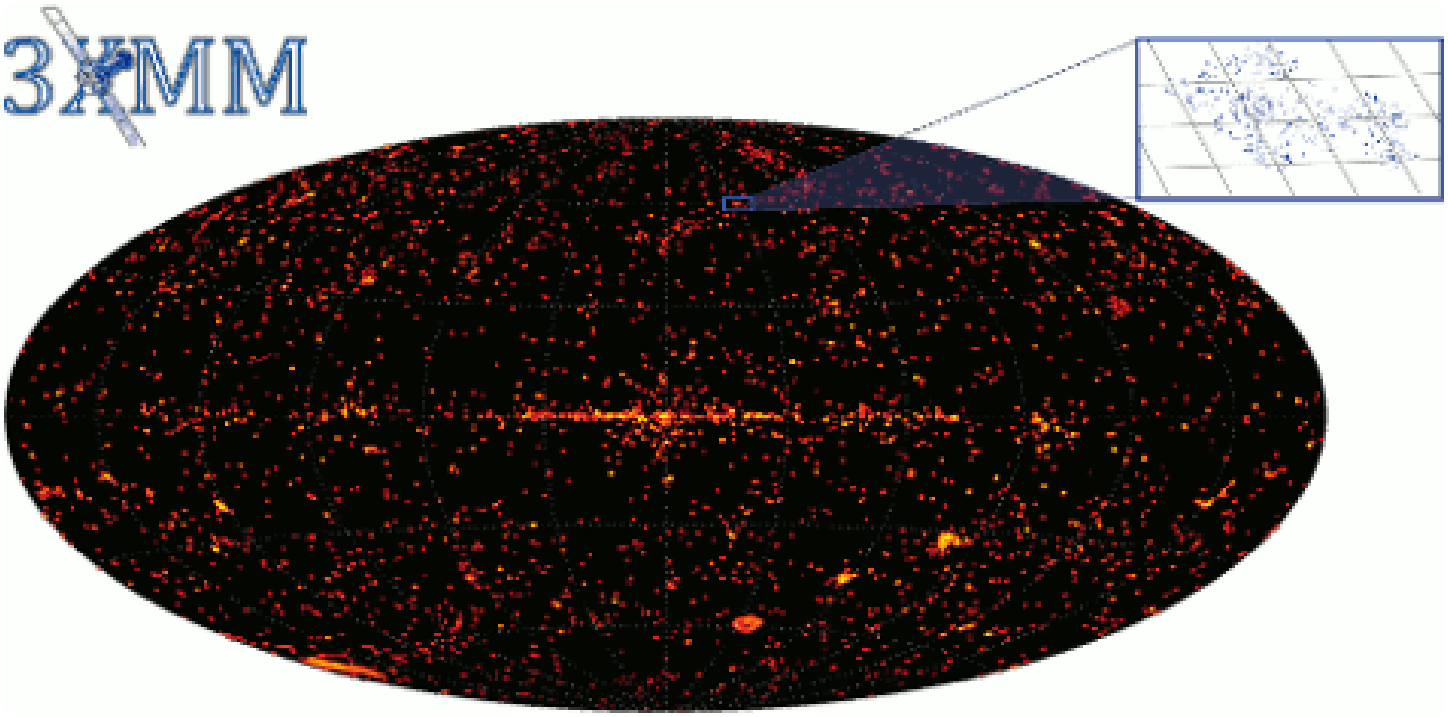




HIGH-ENERGY ASTROPHYSICS

PHOTOMETRIC REDSHIFTS IN THE LARGEST X-RAY SOURCE CATALOGUE.

The 3XMM catalogue compiles all these serendipitous detections and is the largest X-ray catalogue ever produced, containing about 470,000 unique sources covering a total area of 1,000 deg^2 or the sky.

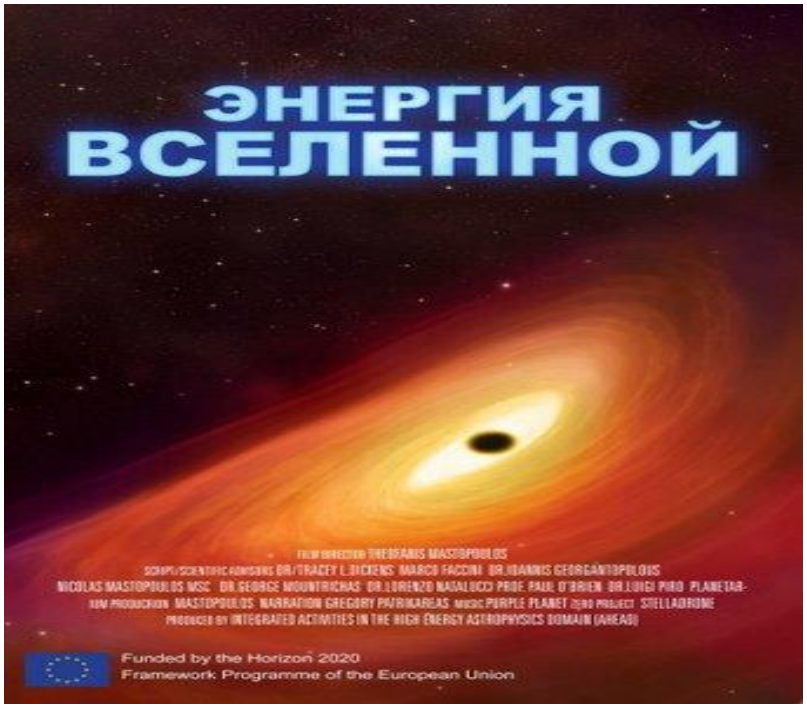


The X-ray group at NOA has derived photometric redshifts (including their errors and probability distribution functions, PDFs) for the whole 3XMM catalogue, using machine-learning techniques (TPZ; Carrasco Kind & Brunner 2013). This project is funded by ESA (PRODEX) and will provide a legacy to the wide astronomical community by estimating accurate photometric redshifts for more than 40,000 X-ray sources.

HIGH-ENERGY ASTROPHYSICS

The AHEAD (Activities for High-Energy Astrophysics) project

Funded by the **European Commission** in the framework of an **Horizon-2020 project**, access to large scale facilities. **This project aspires to unify the efforts of High-Energy Astrophysics groups towards public outreach activities**. The group produced a **30-min Planetarium video** that describes the High Energy Phenomena to the general public and is suitable for dome theatres. The movie has been played in more than 200 theatres around the world (~70 in USA) and has been translated into at least nine languages (English, German, Japan, Spanish, Telugu, Hindi, Korean, Russian and Ukrainian). It was awarded by the first price in an international competition in Korea.

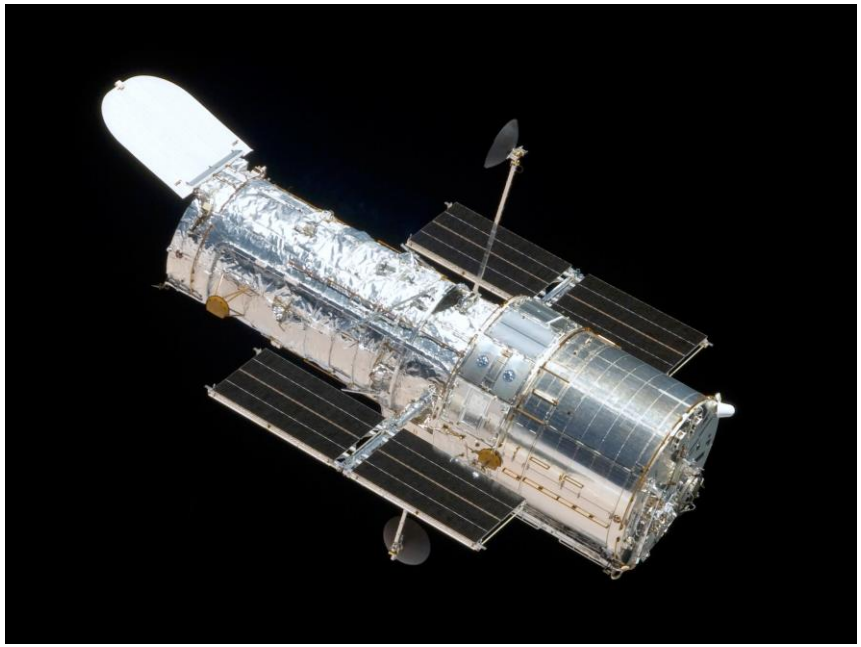


Διαφήμιση στα ρώσικα της ταινίας για πλανητάρια, που δημιούργησε η ομάδα Ακτίνων-Χ του Ε.Α.Α.

Hubble Catalog of Variables

NOA: A. Bonanos (PI & Project Scientist), + 13 scientists

Athena RC: 2 scientists , **ESA:** A. Nota (Technical Officer)+ 2 **STScI:** B.C. Whitmore, +5



Objective: define an algorithm that will detect and validate a candidate variable source within the *Hubble Source Catalog* (HSC), producing the *Hubble Catalogue of Variables* (HCV).

esa

IAAΔET

ATHENA
Research & Innovation
Information Technologies

NELIOTA lunar monitoring program

NOA: A. Bonanos (PI), + 15 scientists, **ESA:** V. Navarro (Technical Officer), +2

Objective: Determine frequency and distribution of small near-earth objects (NEOs) via lunar monitoring.

Develop a highly automated lunar monitoring system using NOA's 1.2m Kryoneri telescope, and conduct an observing campaign for 2 years.

Impact flashes will be available online: http://neliota.astro.noa.gr/

neliota

NELIOTA lunar monitoring program

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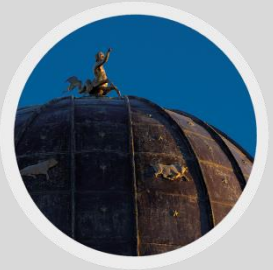
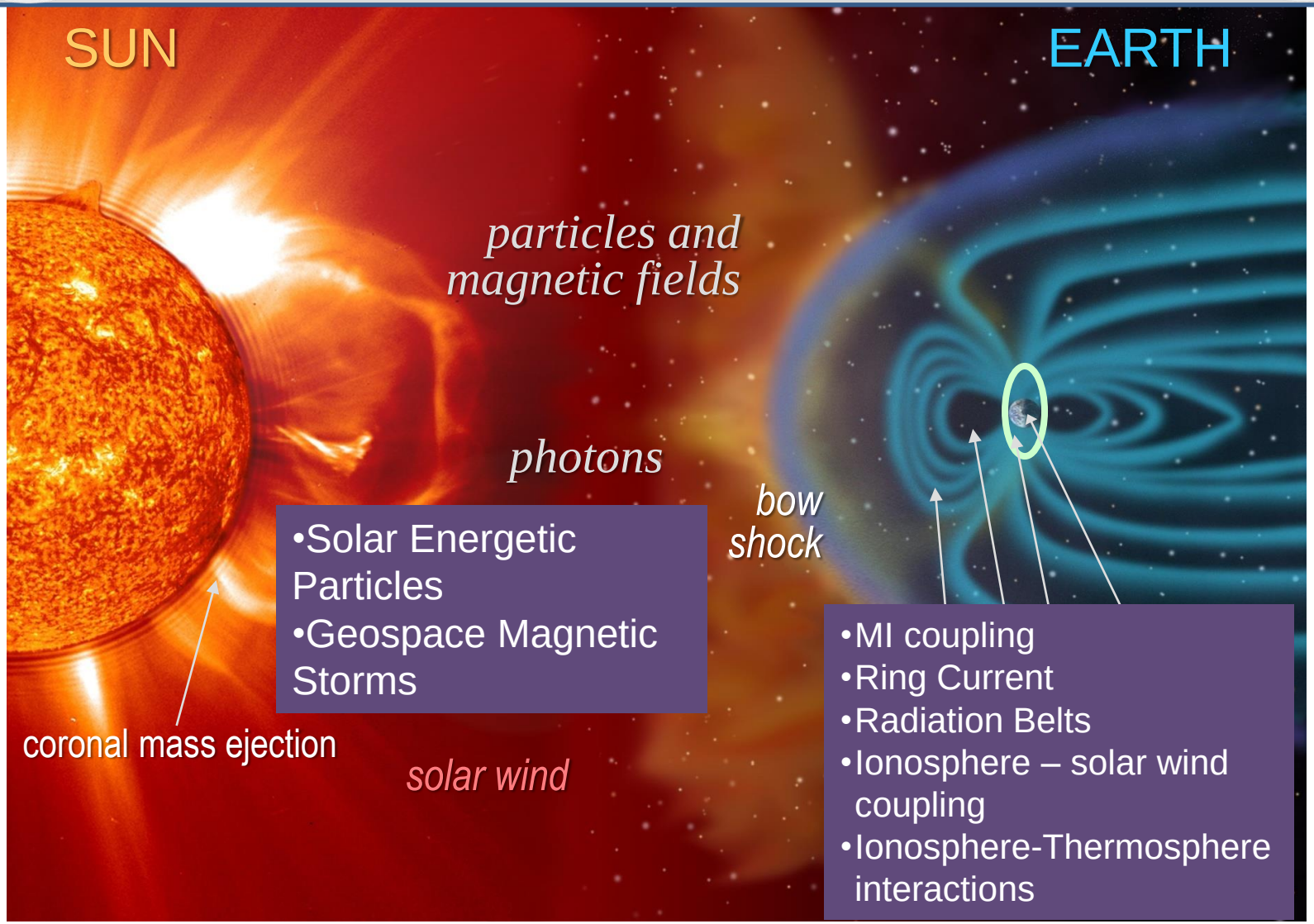
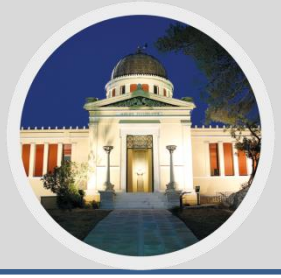


Space Physics Research at NOA





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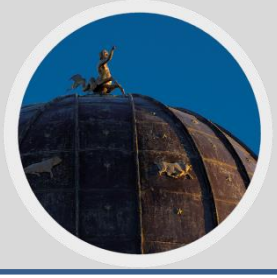
Scientific Goals



➢ Solar Atmosphere

Magnetic coupling and **heating** of the solar atmosphere

➢ Heliosphere

Investigation of **space plasma physics phenomena** at the Sun, the interplanetary space and the Earth and other planets;

Design of **space instrumentation**;

Origin, acceleration, transport mechanisms of solar energetic particles and their **radiation effects** to astronauts.

➢ Earth's Magnetosphere

Evolution of **geospace magnetic storms**

Enhancement of **the ring current**

Radiation belt dynamics and the influence of **electromagnetic waves** on the **energization** and **loss of radiation belt particles**.

➢ Earth's Ionosphere and Plasmasphere

Development of **realistic models that reconstruct the electron and ion density distribution in 3D** taking into account: solar flares; magnetic clouds and fast solar wind streams; lower atmosphere effects

Modelling **space weather effects** on HF communication systems, on satellites and on aircraft flight support and landing systems. Identification and tracking of **travelling ionospheric disturbances**.

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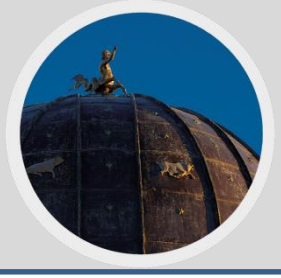
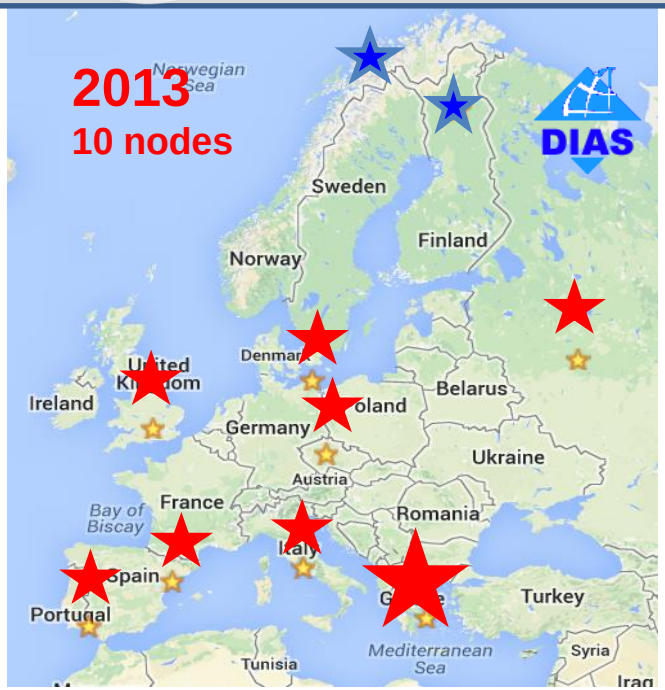
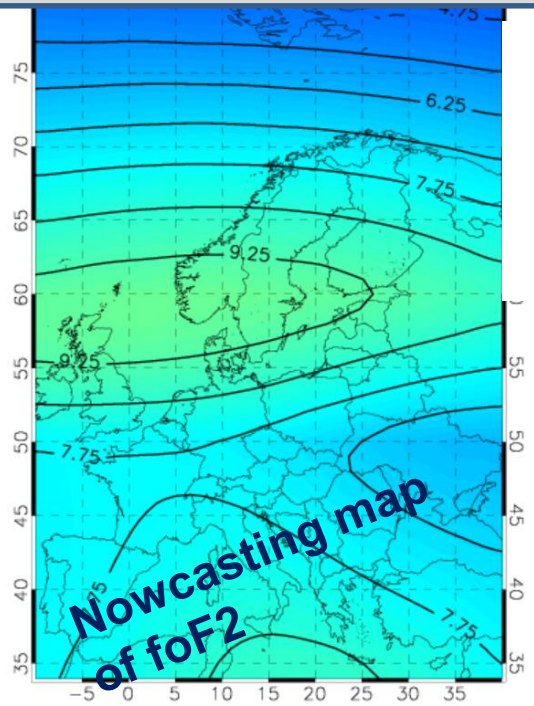
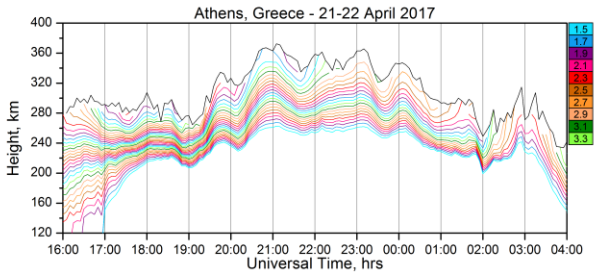
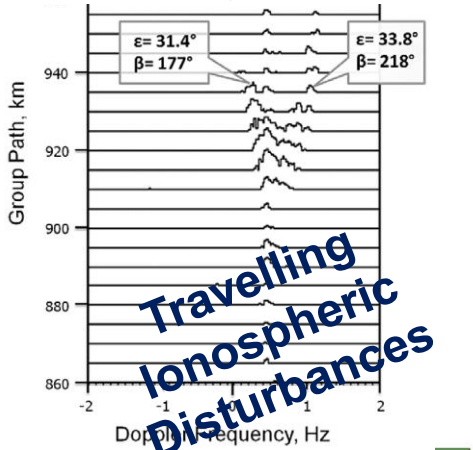
DIAS: European Digital Upper Atmosphere Server
Characterizing the ionosphere in real-time



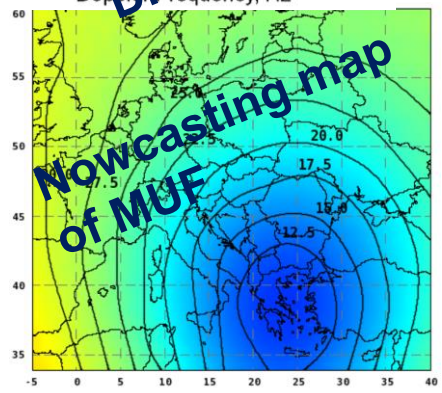




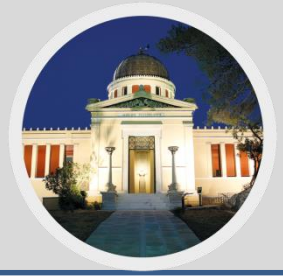




- Coordination & Central processing node: NOA – IAASARS
- Participating data nodes: 10 ionospheric stations, vertical & oblique soundings
- Subscribed users > 900 (in 2015)
- On demand services to: ESA-SSA, NOAA (US), ESPAS (FP7 RI)
- Modeled areas: bottomside/topside ionosphere and plasmasphere
- Supporting data : Spacecraft data from L1, solar & geomagnetic indices from NOAA, GNSS maps from ROB



http://dias.space.noa.gr



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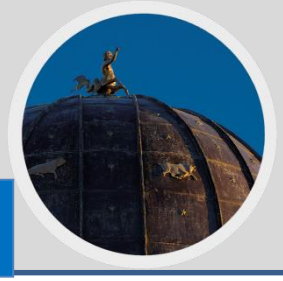


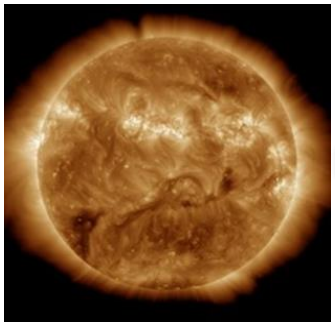
SPACE WEATHER REGIONAL CENTER

FORSPEF

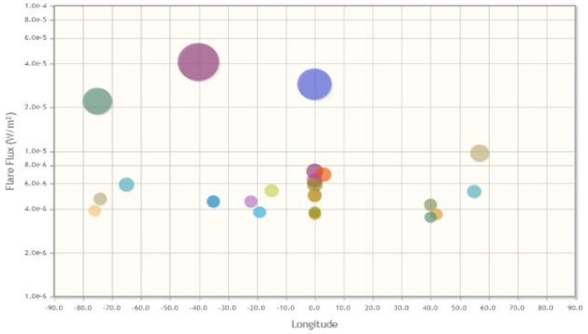
ASPECS
Advanced Solar Particle Events Casting System

HESPERIA

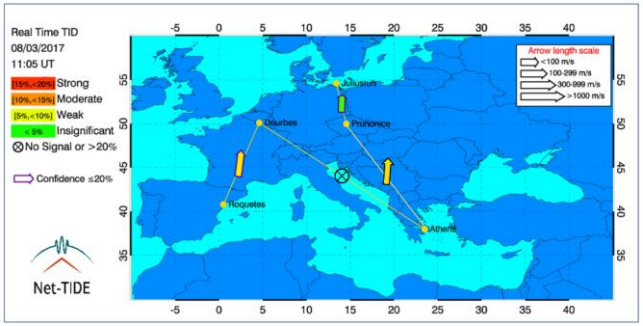
Net-TIDE

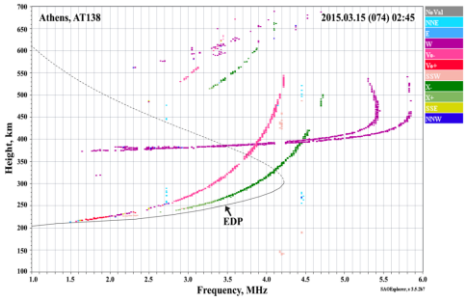


Solar Observations



Flare Peak Day:Time	LON	Flare Flux	SEP Probability	NOAA AR
20160215-11:06:14	W55	C5.3	0.042	0
20160217-20:35:37	W00	C4.9	0.039	0
20151222-13:45:27	E74	C4.7	0.038	0
20151222-03:40:20	E75	M2.2	0.127	0
20151221-11:10:45	W00	C5.0	0.04	0
20151221-10:29:14	W00	C5.9	0.046	0
20151221-05:40:53	W00	C7.3	0.055	0
20151221-01:07:49	W00	M2.9	0.156	0
20151221-00:00:06	W00	C3.7	0.031	0
20151216-09:08:11	W03	C6.9	0.052	0
20151213-10:41:07	E35	C4.5	0.036	0





Development of forecasting tools of space weather effects in the geospace (Solar Energetic Particles) and in the Earth's Ionosphere

ΕΣΠΑ 2007-2013
η περιφέρεια στο επίκεντρο της ανάπτυξης
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης - Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης (ΕΤΠΑ), στο πλαίσιο του Ε.Π. Ανταγωνιστικότητα και Επιχειρηματικότητα (ΕΠΑΝ ΙΙ) και των Π.Ε.Π. Αττικής, Π.Ε.Π. Μακεδονίας - Θράκης

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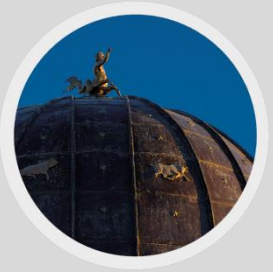


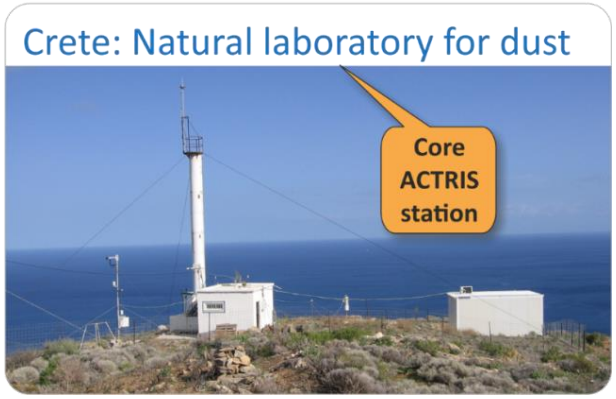
FUNDAMENTAL RESEARCH & EXCELLENCE

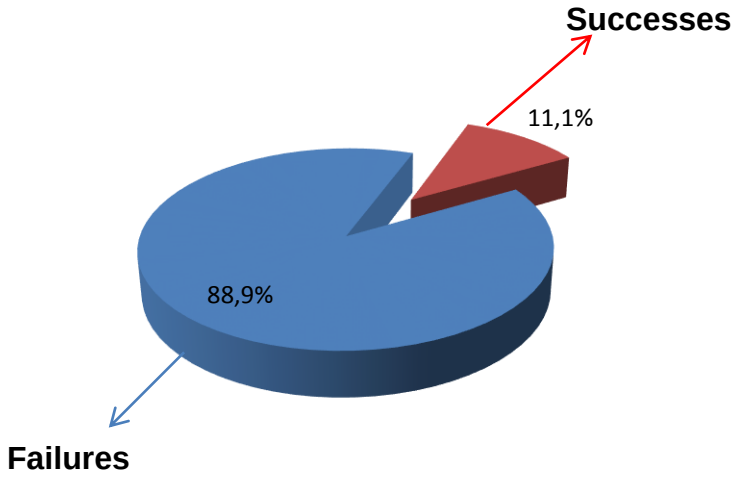
D-TECT *Amiridis B.*

Development of innovative techniques for the study of Mineral Dust and the impact assessment on:
- Global Energy Budget
- Climate change W
- Weather phenomena
- Biochemistry Human health

Year 2016
2305 candidates
314 successful (11%)

1st success ERC
in NOA's history.
D-TECT





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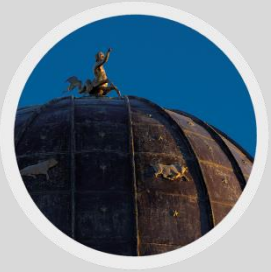

Specialized Services offered by NOA

NATURAL HAZARDS:

- Prediction/Forecast,
- Localization,
- Real-time management,
- Record results
- Impact forecasting,

Assessment of hazard, vulnerability and risk for diverse natural disasters, and elaborate mitigation measures

What is Natural Hazard?

Earthquakes, tsunami, landslides, forest or urban fires, volcanic activity, storms, floods, severe lightning effects, ultraviolet radiation, solar storms, Saharan dust & climatic impact

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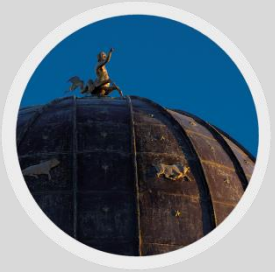

Specialized Services offered by NOA

NATURAL HAZARDS:

With the use of Ground based and Space based data collections systems and with the use of scientific analytical model and information analysis algorithms.

Recipients of our services:

OASP, Fire-Brigade Service Operations Center, General Secretariat for Civil Protection, Disaster Recovery Department, Ministry of Transportation, Ministry of Environment, ADMIE, Hellenic Meteorological Organisation, Other Organisations, Local and Regional Authorities, Forestry, Citizens, Enterprises

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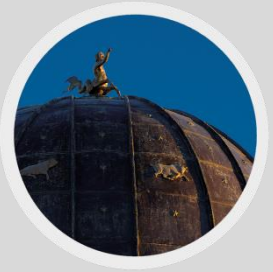
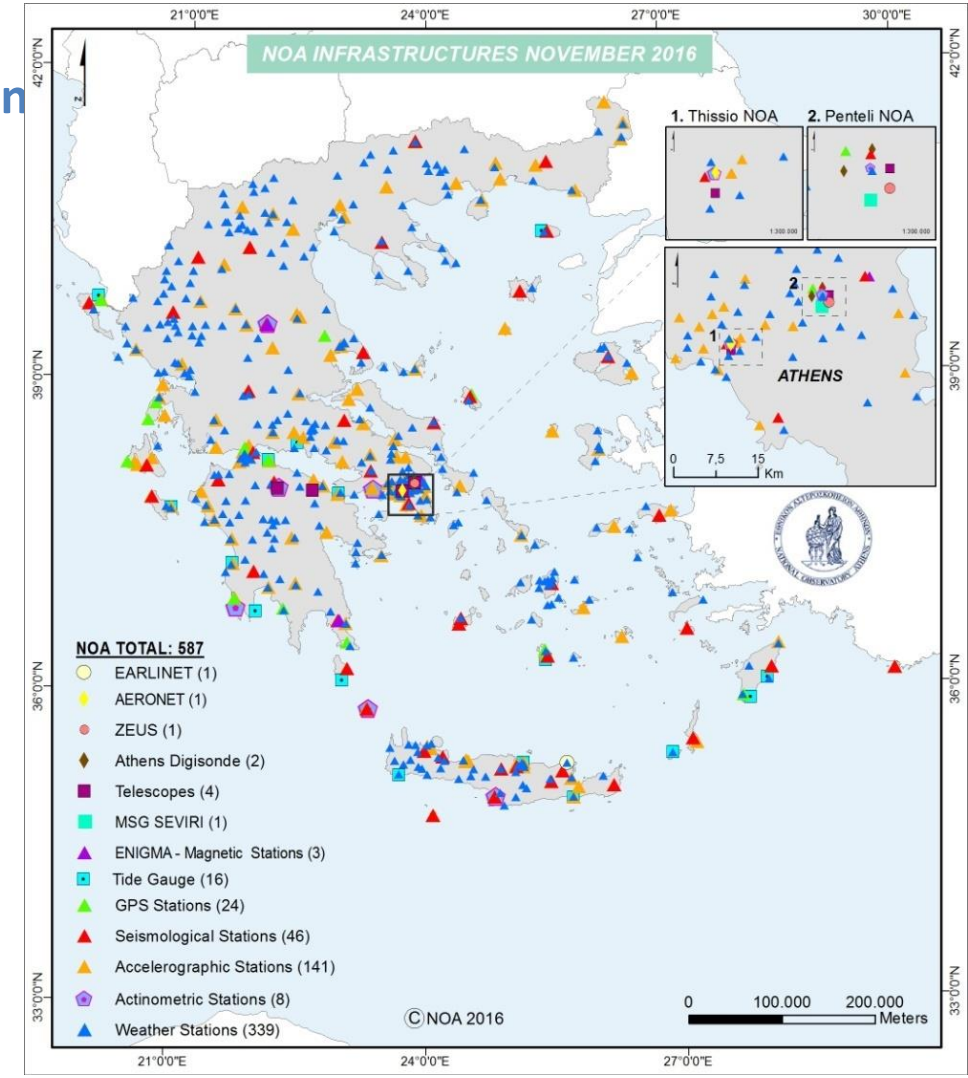


Ground-based Research Infrastructures (more than 550 station

- **340** meteorological stations – on line database (METEO)
- **46** Seismographs
- **141** Accelerators
- **24** GPS stations
- **8** Radons stations
- **16** Tide Gauges (National Tsunami Center-UNESCO)
- **8** Magnetometers
- **4** Telescops
- **1** Ionospheric Station
- **Radars**
- Lidar (laser)
- Atmospheric Chemistry Laboratory (portable)
- **2** UAV's



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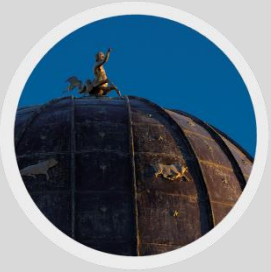
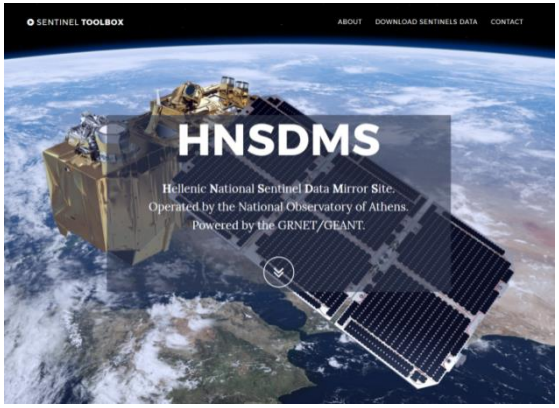
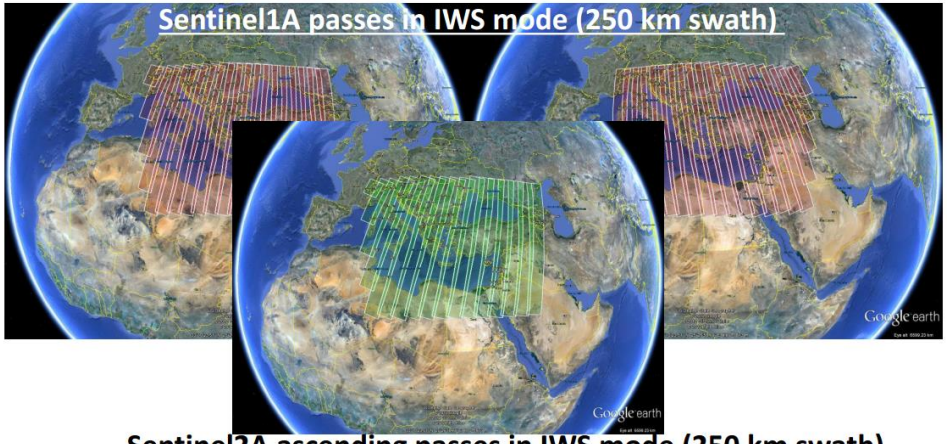


Space based Research Infrastructures

Centre of Excellence for monitoring Natural Hazards. (BEYOND FP7, H2020)



1. The 1st Collaborative Ground Segment (Mirror Site) for Sentinel satellite missions was signed between ESA and NOA on 12 May 2014.
2. The Hellenic National Sentinel Data Mirror Site that is operated by the National Observatory of Athens (NOA) and powered by the GRNET S.A. (Greek Research and Technology Network), is entering a new era making one step forward towards the recommended architecture for the so-called “Copernicus Integrated Ground ss”.



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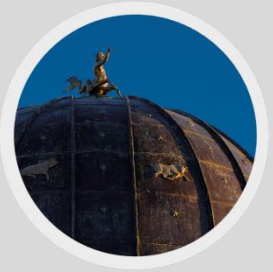

Space based Research Infrastructures

Centre of Excellence for EO-based monitoring of Natural Hazards. (BEYOND FP7, H2020)

The National Observatory of Athens participated in the **Best Service Challenge of the Copernicus-masters competition** with the operational EO based fire management service, which was developed in the framework of the **BEYOND project**. The submitted service is entitled **"FireHub: A Space Based Fire Management Hub"**, and has been elected as the winner of the Best Service Challenge of the Copernicus Masters 2014 by an experts committee.

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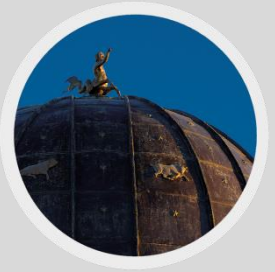


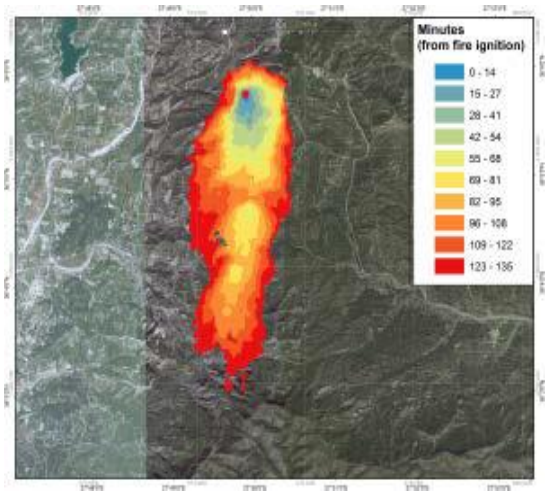
Service: Fires Monitoring - FIREHUB

- Real-time Fire Monitoring System
- Diachronic Mapping of Burned Areas over Greece (1984-2013)
- Fire Smoke Dispersion
- Fuel Maps

Use Case: Forest Fire, Chios, August 2012

•~100,000 hectares of forest land and arable and about 40% of the mastic trees are the burned area of the devastating fire in Chios that broke out in August 2012. BEYOND Center team was monitoring the fire activity and provided in real time the related data to the Business Center of the Fire Brigade.

The FireHub was able to detect the resurgence of the fire in the evening, since the airborne instruments stopped acting in the area.



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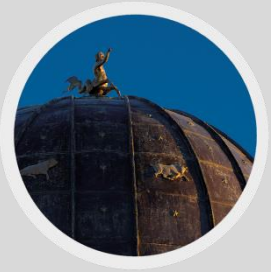

Service: NOA has the operational and tactician monitoring of the seismicity in Greece, as well as tsunamis and geophysical disasters.

1. Servicing 24/7 monitoring and processing of the recorded seismic activity in Greece
2. Servicing 24/7 tsunami monitoring. Provision of the service with UNESCO international commitment. Updating to the National entities (Greek Civil Protection, Organization for Anti-seismic design and protection) in a 24/7 basis, as well as for the recorded seismic activity in Greece to the general public.
3. Earthquake Precursory Phenomena monitoring by innovative Radon recording methods.

Πίπτων βάρος

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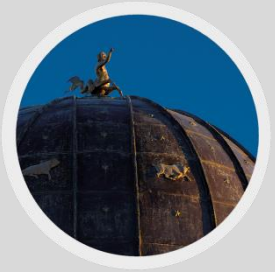
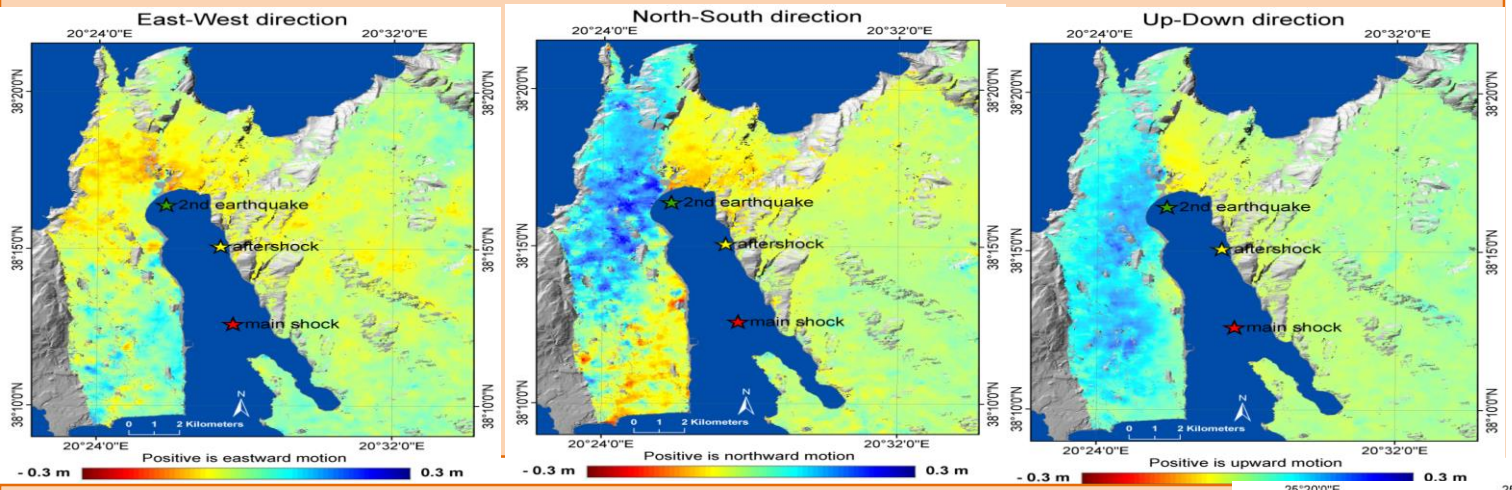
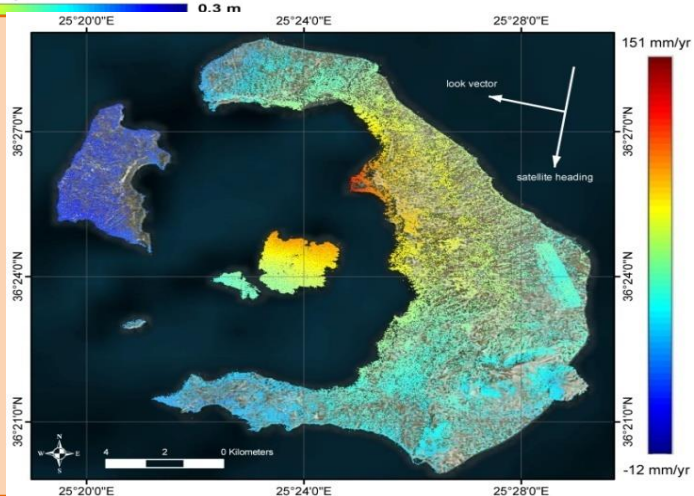


Service: MONITORING GEOPHYSICAL PHENOMENA - GEOHUB

Earthquake, Kefallonia island, February 2014



Volcanic Activity, Santorini, 2011-2013



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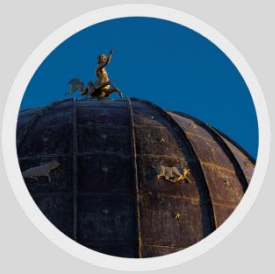
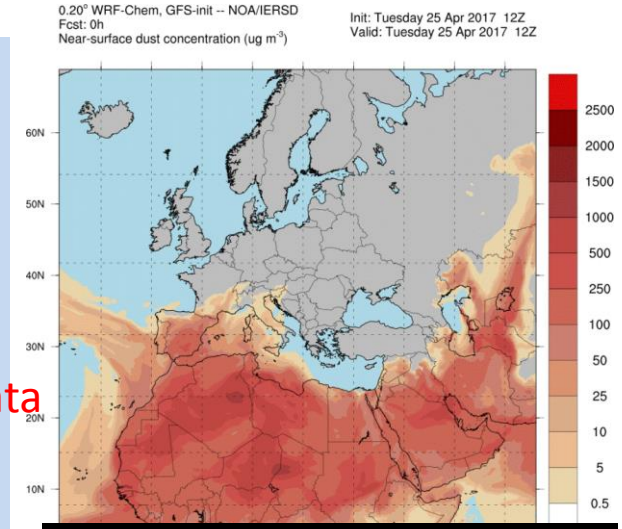


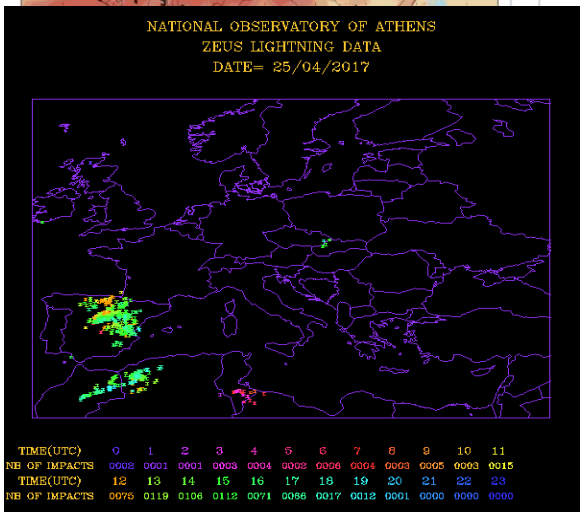
Service METEO: Weather Forecast (24/7) & related natural hazards

NOA produces business-focused weather forecasts with an emphasis on intense (METEO)

- Weather Forecast and related alerts
- Lightning & Storm Forecast
- Wave Forecast
- UV radiation forecast
- Dust Monitoring (provided data to WMO)

Use ground-based and satellite data





ZEUS long-range lightning detection network

With sensors in Spain, England, Denmark, Romania, Cyprus and Egypt

National Observatory of Athens
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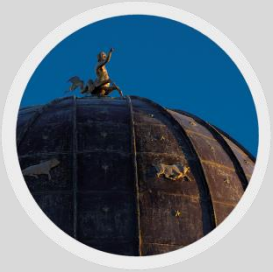
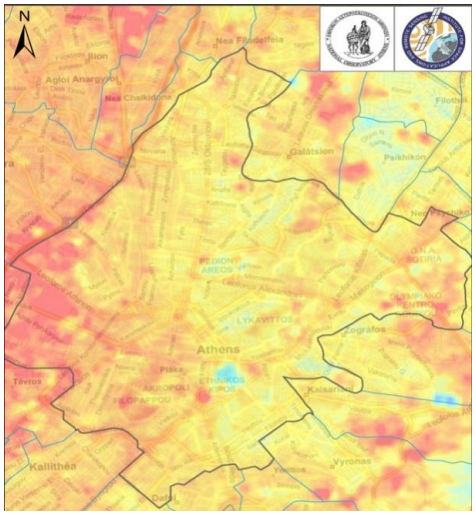
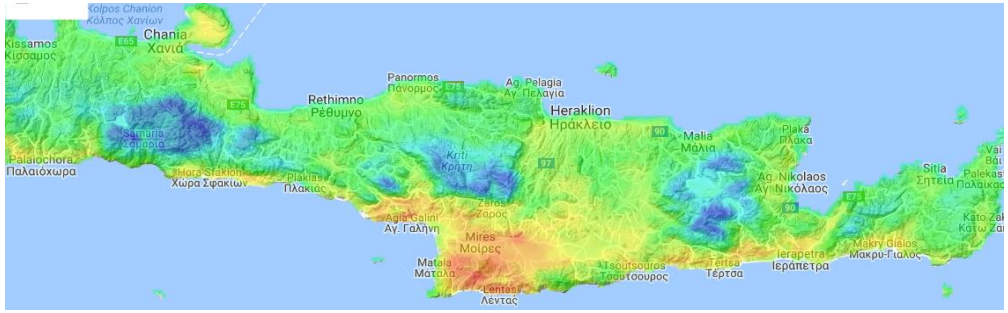


Continuous online monitoring of the urban thermal environment and heat waves .

Municipality of Athens is using this service!





By processing geostationary satellite data of coarse spatial resolution (3-5 km), using of state-of-the-art advanced image processing algorithms that enhance the spatial resolution of the satellite data to 1 km and retain the original excellent temporal resolution of 5 min. The data employed are acquired by the MS2-SEVIRI instrument and are retrieved from the EUMETCast station (METEOSAT 2nd generation) installed and operated by IAASARS/NOA.

It operates in real time.

ΕΘΝΙΚΟ ΑΣΤΕΡΟΣΚΟΠΕΙΟ ΑΘΗΝΩΝ
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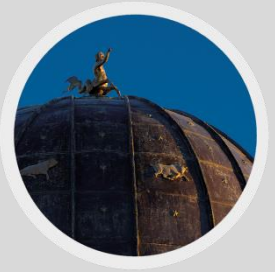
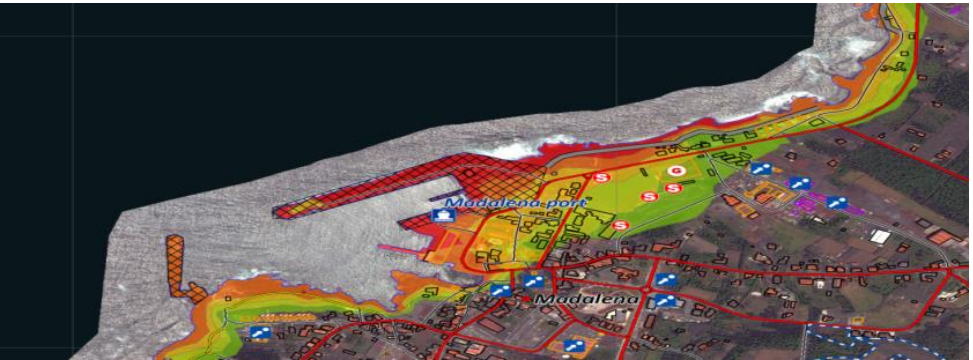
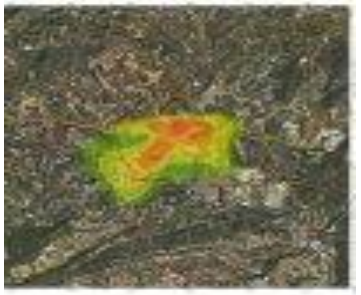


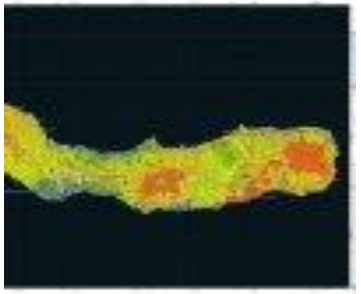
<u>SERVICE</u>: Estimation of Danger, Vulnerability and Risk to Natural Disasters and elaboration of evacuation plans etc.

- Within the **<u>Copernicus Emergency Management System</u>** this service can be activated by Civil authorities, and it has a Global coverage.
- Once activated it has to provide within 20 days all deliverables
- Covers all Natural disasters (π.χ. Fire, floods, earthquakes, tsunami, volcanic eruptions, earth, sandstorms, industrial accidents, etc)

Case: We were mobilized by Portuguese Civil authorities to study natural disaster risks for the Azores.







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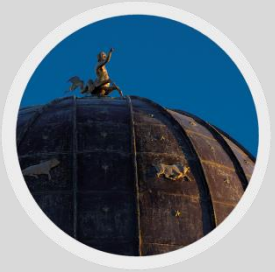

SERVICE: Quantification of damages of Natural Disasters using drones

We have 2 ***Drone Units*** which we use in order to monitor and quantify the damages from natural disasters (fires, earthquakes, etc).

Case: Forest Fire in Thasos – September 2016

• The Ministry of Infrastructure, Transport & Networks assigned to NOA the pilot mission to quantify the damages: 09/10/2016 using high-resolution imaging and analysis.

• We overflew the island for 3 days, imaging 16.188 km^2 and monitoring the damages in property and infrastructures.

NATIONAL OBSERVATORY OF ATHENS
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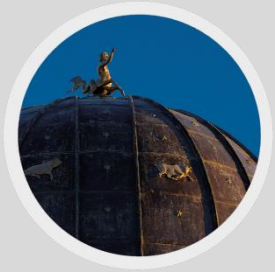
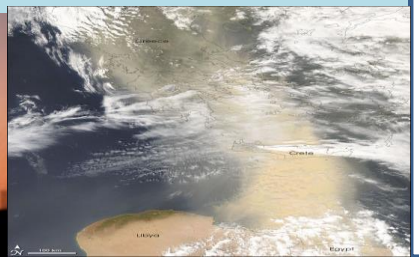


SERVICES Related to Atmospheric Environment

- Scientific Community
- Citizens
- End –users (Civil protection, fire services)
- Economic Sectors (Tourism, farmers, constructions)

Cases:

- Modeling and Observation of Sahara dust.
- Monitoring of Air pollution using state of the art Infrastructure.
- UV radiation and its impact on human health.
- Extreme hydro-meteorological events



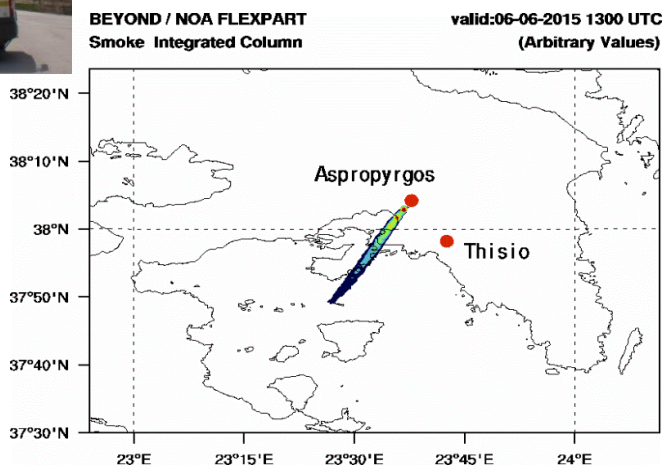
Immediate action to cases influencing public health

➢ Fire at a recycling unit at the outskirts of Athens

June 2015

➢ Immediate collaboration with Athens Prefecture and other public authorities

✓ Mapping
✓ Specific measurements
✓ Suggestion for measures to be taken



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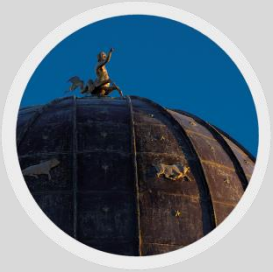

THE LEADING ROLE OF THE NOA AS COORDINATOR OF THE EXPANSION OF GEO-COPERNICUS IN 26 COUNTRIES

AS AN OUTCOME OF OUR SUCCESSFUL SPACE-APPLICATIONS ACTIVITIES:

The NOA was assigned, after an antagonistic call within H2020-Space the coordination of the scientific and logistic actions necessary in order to develop and the Global Space Program of Earth Observation GEO-CRADLE towards 26 countries (Middle East, Balkans, North Africa).

Thank you

Prof. Manolis Plionis
Director NOA