



Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East and Balkans and Developing Links with GEO related initiatives toward GEOSS



<http://geocradle.eu>

GEO-CRADLE: Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS



GEO-CRADLE Regional Workshop in Sofia



*Addressing regional needs in the Balkans by enhancing Earth
Observation uptake and relevant business performances*

<http://geocradle.eu>





Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East and Balkans and Developing Links with GEO related initiatives toward GEOSS

Thematic Areas

linked with the UN SDGs



Adaptation to Climate Change (ACC)

13 CLIMATE ACTION



3 GOOD HEALTH AND WELL-BEING



11 SUSTAINABLE CITIES AND COMMUNITIES



15 LIFE ON LAND



Improved Food Security – Water Extremes Management (IFS)

2 ZERO HUNGER



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



Access to Raw Materials (ARM)

1 NO POVERTY



2 ZERO HUNGER



Access to Energy (SENSE)

7 AFFORDABLE AND CLEAN ENERGY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



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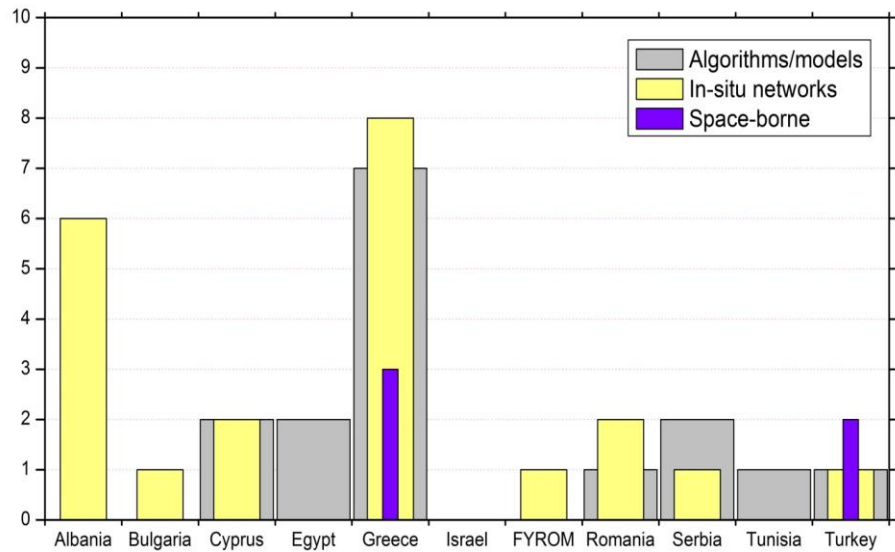
The ACC Pilot (Adaptation to Climate Change)

The ACC pilot will pave the ground for the holistic monitoring and forecasting of region-specific atmospheric components, ECVs and hazards, in line with the standards and vision of GEOSS and Copernicus for information extraction and service delivery regarding the Climate SDG.

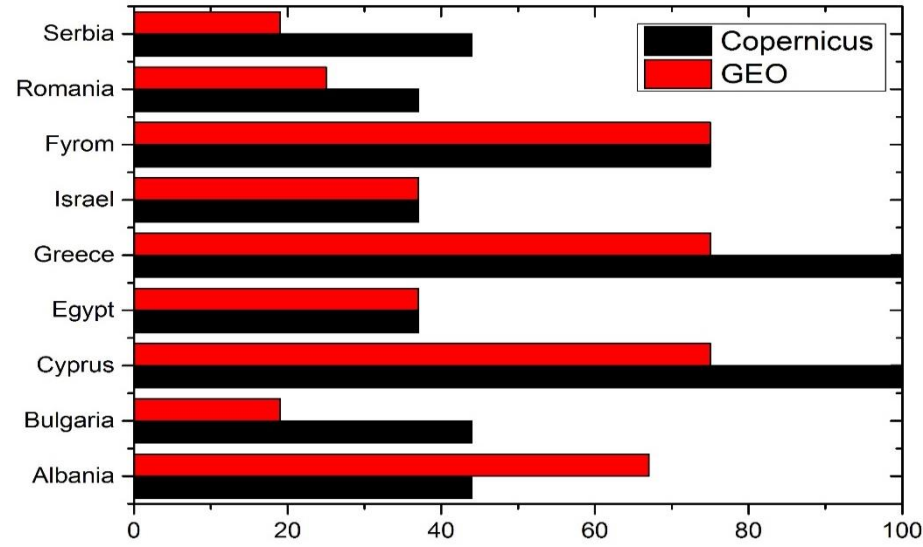
Specifically, the GEO-CRADLE ACC will provide 3 services on respective thematic pillars:

1. Desert dust services
2. Regional climate change services
3. Air quality services

Gap Analysis of the Regional Climate related Capacities



End-User Awareness on Copernicus and GEO

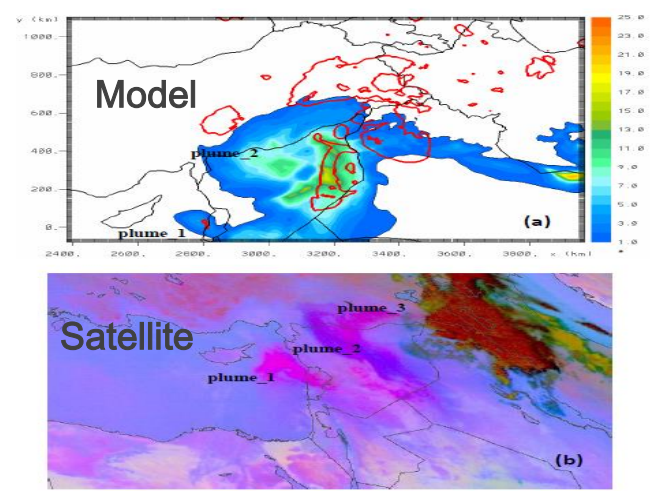
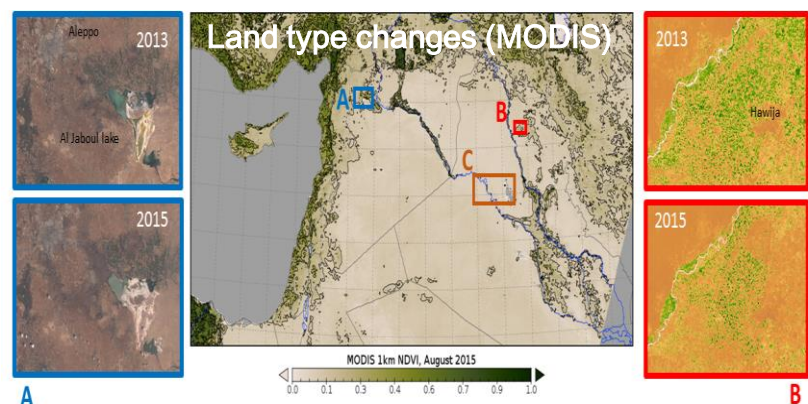


ACC – Desert dust services

The September 2015 Middle East dust-storm results in dramatic reduction of visibility in Limassol
Mamouri et al., 2016, ACP



Landuse changes (desertification) and local meteorology increased the severity of this episode
Solomos et al., 2016, ACPD

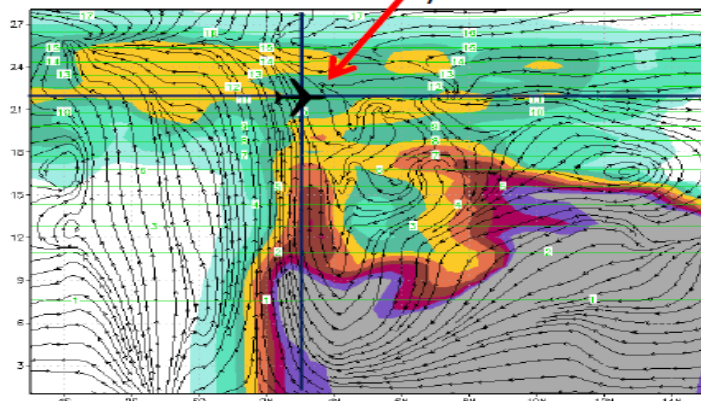


ACC – Desert dust services

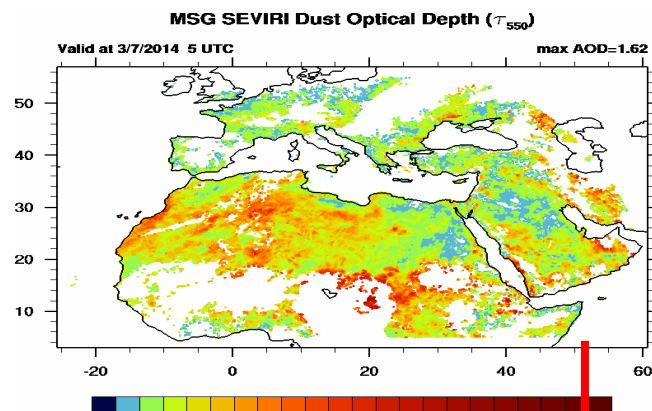
Dust effects on aviation safety
(AirFrance 2009 accident)



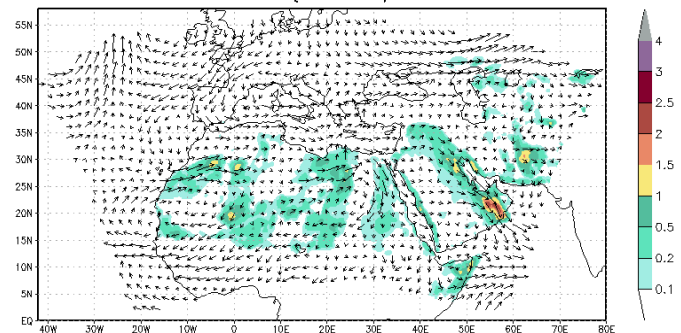
Dust concentration; Cross at 30W; 5S-15N
03UTC 24 July 1 Jun 2009



Optimization of the ACC dust forecast
with satellite data assimilation



NMME/DREAM Charadmexp
Dust Optical Depth (DOD) at 550nm and 2000m Wind
SEVIRI Assimilation Run (k=5x1.e-4) 15JUN2014 12UTC





ACC – Regional climate change services

Establishing a pilot regional climate change web application tool to retrieve climate variables and climate indices from high resolution regional climate projections in support of end-users and decision makers on climate change mitigation and adaptation policies.

- A need for reliable open access to weather and climate data is expressed by all countries of the RoI.
- For ACC is essential the use of future climate data from high resolution model projections for the RoI based on Regional Climate Models (RCMs).
- Need for uncertainty estimates in future projections based on ensemble versus individual RCM simulations.
- Plenty of open access data in databases but there is limited usability from non-experts.
- **Need for establishing a user friendly climate change web application tool for regional climate data download in support of intermediary and end users.**

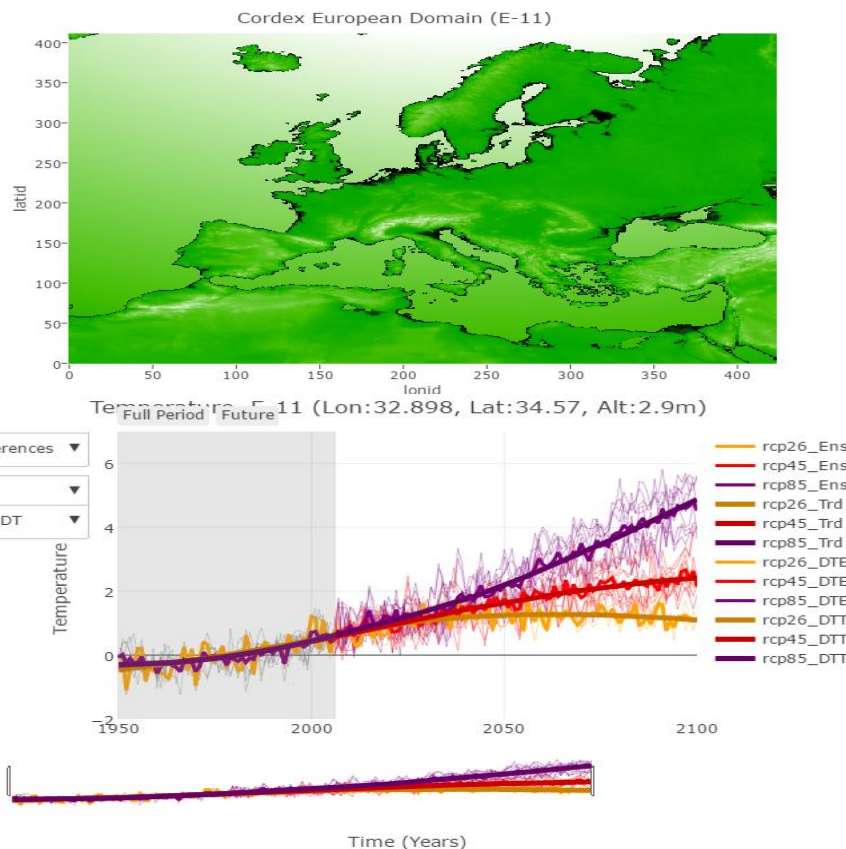
ACC – Regional climate change services

Indicative list of Climate variables and indices

Climate Indices	Relevance
CI1 Mean near surface temperature	Fundamental
CI2 Precipitation rate	Fundamental
CI3 Maximum near surface temperature	Fundamental, extremes
CI4 Minimum near surface temperature	Fundamental, extremes
CI5 Wind speed at 10m, 50m, 100m and 200m	Fundamental, Energy, natural disasters
CI6 Surface absorbed solar radiation	Fundamental, Energy, Tourism, Agriculture
CI7 95th percentile of rain day amounts	Extremes, natural disasters
CI8 95th percentile of wind speed at 10 m	Extremes, natural disasters
CI9 Annual greatest 5-day total rainfall	Extremes, natural disasters
CI10 Fraction % of total rainfall from events > long-term P90	Extremes, natural disasters
CI11 Number of events > long-term 90th percentile of rain days	Extremes, natural disasters
CI12 Number of frost days Tmin < 0 degC	Extremes
CI13 Heat Wave Duration Index	Agriculture, Tourism
CI14 Standardized Precipitation Index (SPI)	Agriculture, Water resources
CI15 Potential evaporation	Agriculture
CI16 Growing season duration (GSD)	Agriculture
CI17 Tourism Climate Index (TCI)	Tourism
CI18 Snow depth (SnowD)	Tourism
CI19 Heating Degree Day (HDD)	Energy
CI20 Cooling Degree Day (CDD)	Energy

Make use of high resolution RCM data (0.11°) for a number of climate variables from various RCMs and emission scenarios 1950-2100.

data source: EURO-CORDEX: <http://www.euro-cordex.net/>

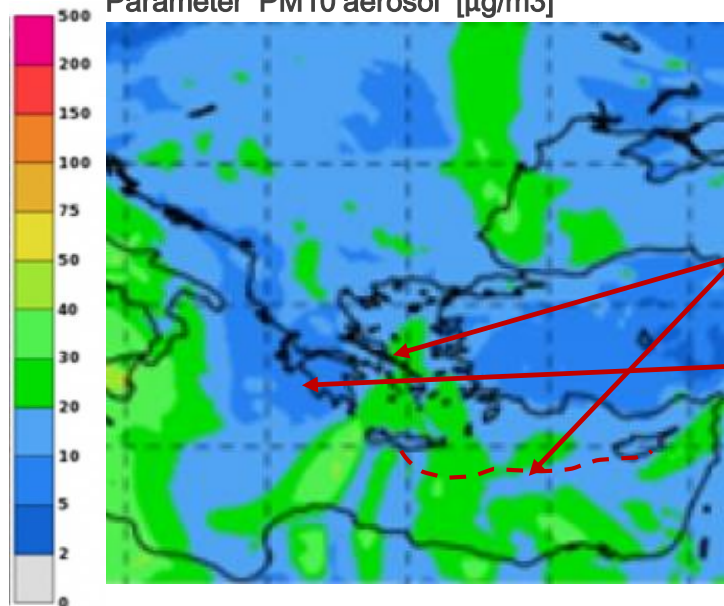


ACC – Regional air quality services

Evaluation of CAMS for regional air quality services

25/10/16 00 UTC CAMS forecast t+12

Model ENSEMBLE: Height level: surface, Parameter PM10 aerosol [$\mu\text{g}/\text{m}^3$]



Observational platforms



EUFAR

Athens - ACTRIS



NEO - ACTRIS



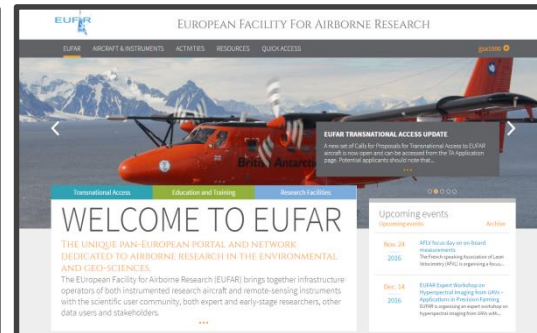
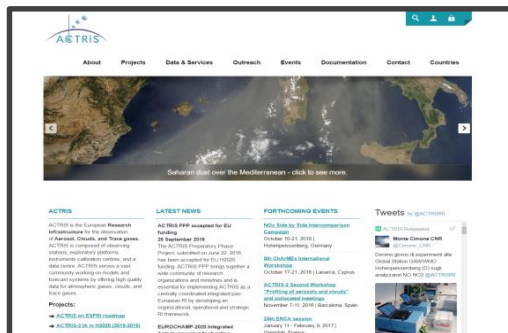
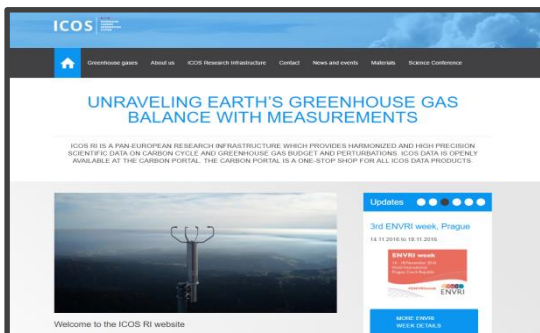
Finokalia - ACTRIS

A thorough evaluation of specific CAMS forecasts will be exploiting an intensive ACC pilot experimental campaign as well as other regional observational platforms



ACC – Regional air quality services

ACC experimental campaign for ACC service evaluation and optimization – April 2017





End-users expressing interest in the ACC pilot

(from the results of end user survey and gap analysis)

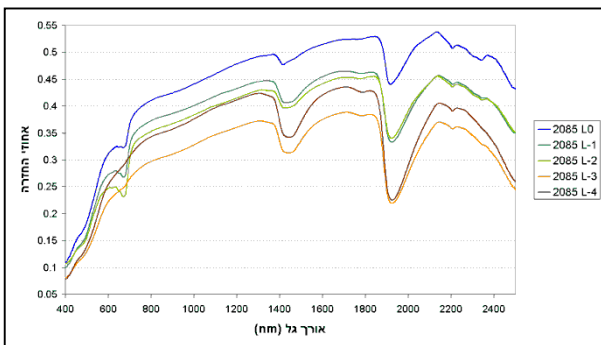
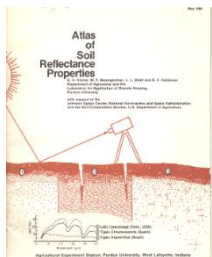
- Tourism sector for dust forecasting
- Meteorological agencies for dust forecasting
- Civil aviation for dust forecasting
- Insurance companies for Climate Change services
- Agriculture sector for Climate Change services
- Water river basin agencies for Climate Change services

Improved Food Security (IFS) – Water Extremes Management (WEM)

T4.2



Soil Spectral Library (Task 4.2 – IFS)

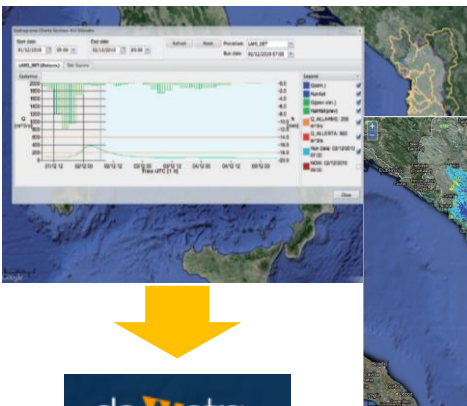


Prediction (spectral based) models of field moisture and clay content

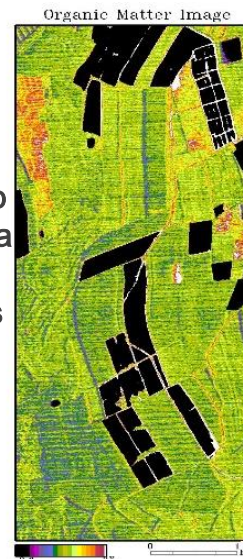
Property	SEC, SEP, SEL	R^2_m	Prediction equation	Assignments
Soil Field Moisture (SFM)	0.045, 0.14, 0.016 0.027@	0.645 0.847@	$wl_0.739 * 0.378179 + wl_1.65 * 0.389602 - wl_0.689 * 0.184370 + 0.062336$	1.65 μm -reflectance slope 0.688 μm -reflectance slope 0.739 μm -reflectance slope/chlorophyll
Organic Matter	0.003, 0.015, 0.002	0.827	$wl_0.722 * 0.135211 + wl_2.328 * 0.034358$	0.722 μm -chlorophyll remaining

Property	SEC, SEP, SEL	R^2_m	Prediction equation	Assignments
Soil Field Moisture (SFM)	0.045, 0.14, 0.016 0.027@	0.645 0.847@	$wl_0.739 * 0.378179 + wl_1.65 * 0.389602 - wl_0.689 * 0.184370 + 0.062336$	1.65 μm -reflectance slope 0.688 μm -reflectance slope 0.739 μm -reflectance slope/chlorophyll
Organic Matter	0.003, 0.015, 0.002	0.827	$wl_0.722 * 0.135211 + wl_2.328 * 0.034358$	0.722 μm -chlorophyll remaining

Flood Forecast Model (Task 4.2 – WEM)



Pixel by pixel map on Sentinel-2 data using the prediction models



Sentinel-2 Satellite

Concept of T4.2

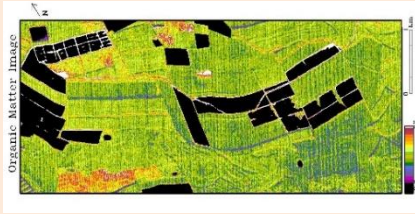
- Generate a Regional Soil Spectral Library
- Resample the models into Sentinel-2 spectral configuration
- Predict soil attributes using spectral base models
- Apply the models on a pixel by pixel basis on Sentinel-2 (reflectance) data to create soil moisture and clay content maps
- Transfer the thematic maps to the DEWETRA platform
- Apply the thematic maps into the flood models
- Assess the added accuracy obtained from the suggested concept



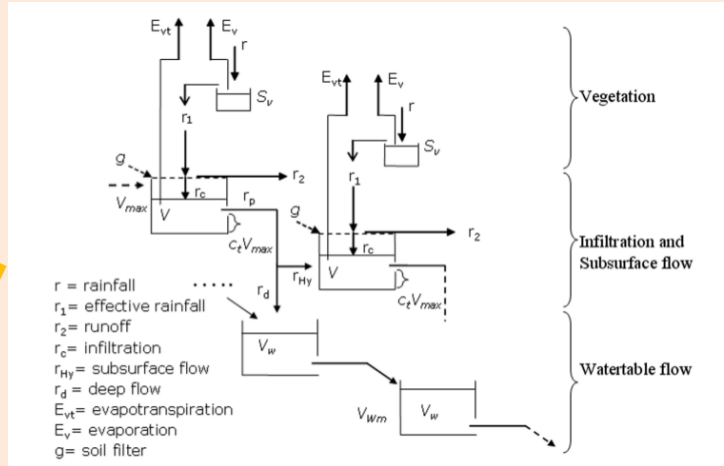
The Connection -



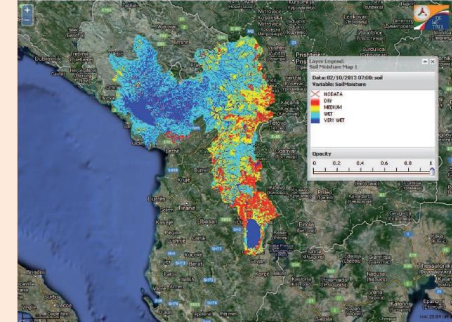
Field moisture and clay content



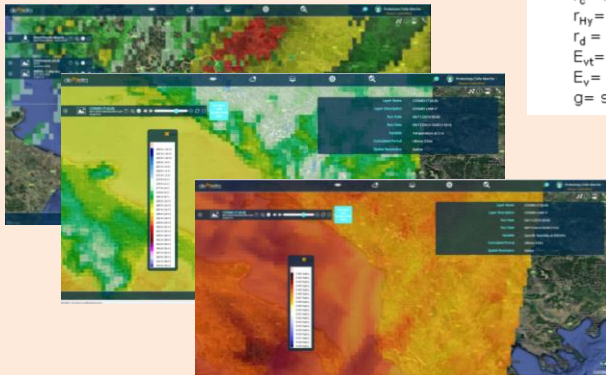
CONTINUUM Hydrological model



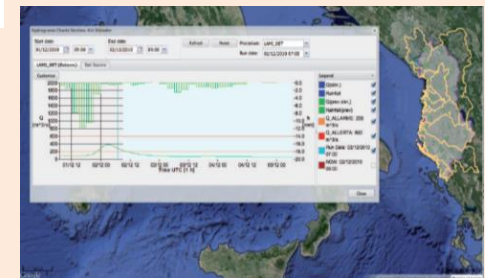
Output Layers



Input Layers



Output Layers



myDewetra implementation at Regional scale:

Weather forecast model outputs global scale (e.g. GFS), land use/land cover maps, exposed elements (e.g. OpenStreetMap), satellite based rainfall observation (e.g. GPM, TRMM) and global scale flood risk hazard (e.g. GAR2015 hazard maps).

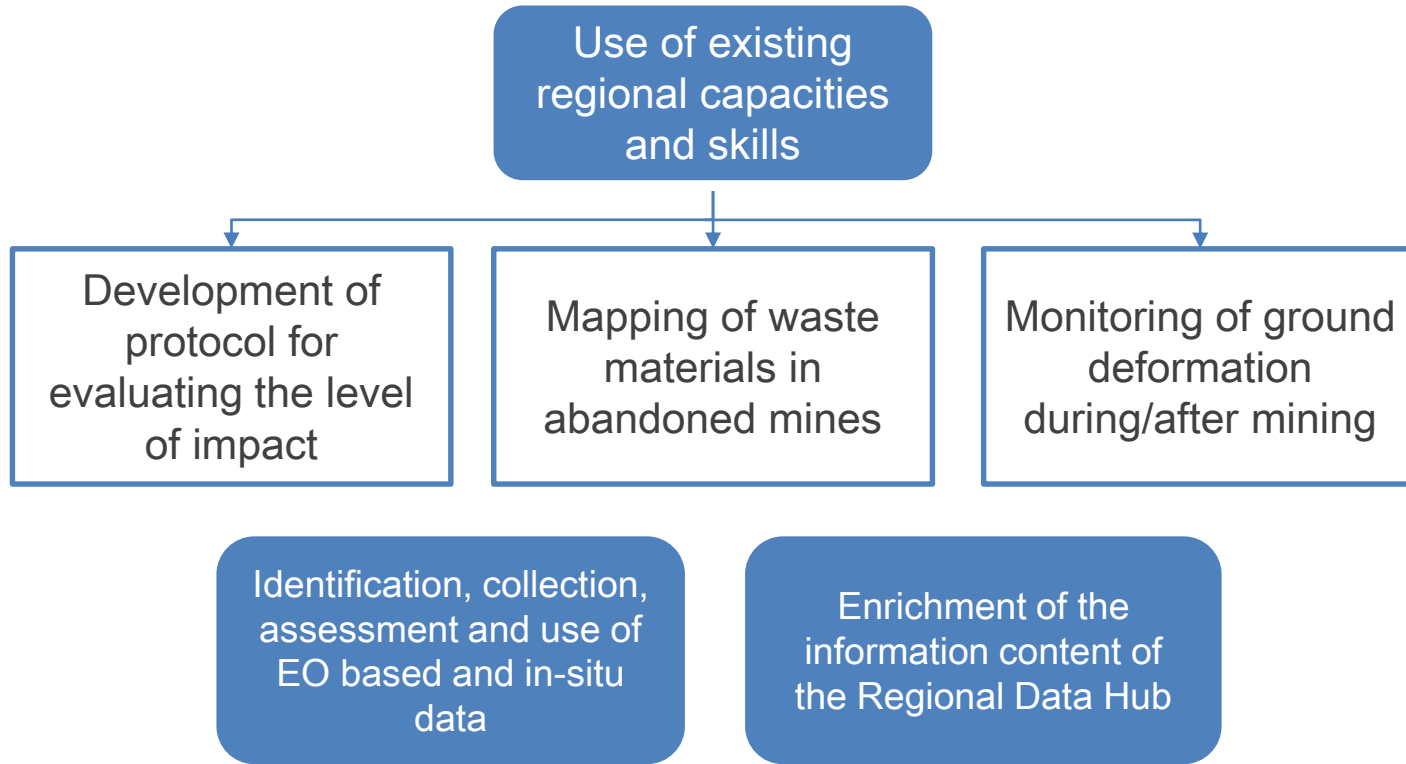
myDewetra implementation at Basin scale:

- identification basin “test-case” (e.g. DRIN-BUNA basin in Albania)
- selection of the time period for hydrological forecast (e.g. November 2016)
- ingestion soil moisture and clay content maps into Continuum hydrological model
- run and comparison of results from hydrological modeling with and without soil moisture and clay content maps
- value added evaluation
- publication and sharing of the results by myDewetra and connection to GEO-CRADLE Data Hub



Access to Raw Materials (ARM)

Establishing a roadmap for long-term monitoring, mapping, and management of mineral deposits in a severely under-explored ROI.



T4.3 answer to the need defined by WP3

- Five proposals on raw materials pilot projects were submitted from Greece (two) and Cyprus (three)
- Selected examples of the pilot studies sites (Greece and Cyprus) present most interesting mining and post-mining areas which are going to be analysed from the point of view applicability of the EO methods
- The elaborated methodologies will be the main goal of the pilot. The elaborated EO methodologies will be useful for better management of the mining and post-mining areas and reduce their impact on the surrounding areas
- It is expected that the methodologies elaborated on the examples pilot site will have a universal character and could be applied for other RoI



T4.3 answer to the need defined by WP3

Greece

Monitoring of Illegal Quarrying

Objective: Roadmap for the use of Earth Observation data & techniques for mapping and monitoring “Quarries”

Environmental Monitoring of Ayios Filippos Abandoned Public Mine of Mixed Sulphide Ores – Kirki Village (North Greece)

Site Information: Ayios Filippos sulphide Pb-Zn deposit

Objective: Creation of a database to include satellite data and other thematic, physical, environmental, geomorphic, geologic, socio-economic information pertaining to factors that affect post-mining restoration activities.



Marble extractive waste - N. Greece





T4.3 answer to the need defined by WP3

Cyprus

Three mines with different characteristics located on the Troodos Ophiolite

Abestos mine (abandoned – under restoration)

Skourriotissa (operating - massive sulfides)

Kokkinopezoula (abandoned -massive sulfides)

Objectives: Roadmap for

- Use Space born data to assess possible instabilities in waste dumps in order to take the proper remedial measures
- Use Space born data to map the waste dumps of abandoned mines in order to select locations for borehole drilling for the assessment of the waste dumps for secondary mineral resources
- Use Space born data to assess the stability of reprofiled waste dumps in under restoration mines and take the necessary measures if needed
- Use Space born data to record the behavior of the leaching heaps of the operating mine in Skourriotissa and look for instabilities and possible environmental pollution



Abestos mine



Skourriotissa



Kokkinopezoula

Refined pilot scope Access to Raw Materials

The aim of the feasibility study for the selected pilot test sites is to establish a roadmap for long-term monitoring, mapping, and management of mineral deposits in a severely under-explored ROI.



SOLar Energy Applications

The Solar Energy Nowcasting System (SENSE) pilot

T4.4

pmod *wrc*

Access to energy (Sense), Partners: PMOD/WRC, NOA

Sense: a solar energy now-casting system +

Purpose:

- demonstrate ways to maximize value and benefits at the RoI
- Create synergies with public and private sector (solar plants, energy distributors, solar energy related end-users)

Provision of (tailored to end-user):

- Now-casting of solar radiation and solar energy
- Long term solar energy atlases for various areas with high temporal and spatial detail
- Solar radiation related products (real time and forecasts) related with: health (UV Index (melanoma), DNA damage, cataract, Vitamin D efficiency), agriculture (photosynthesis), scientific..

Application: anywhere (RoI)



The Solar Energy Nowcasting System (Sense)

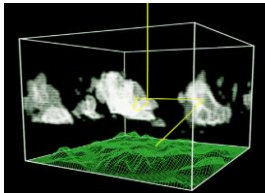
Satellite Data



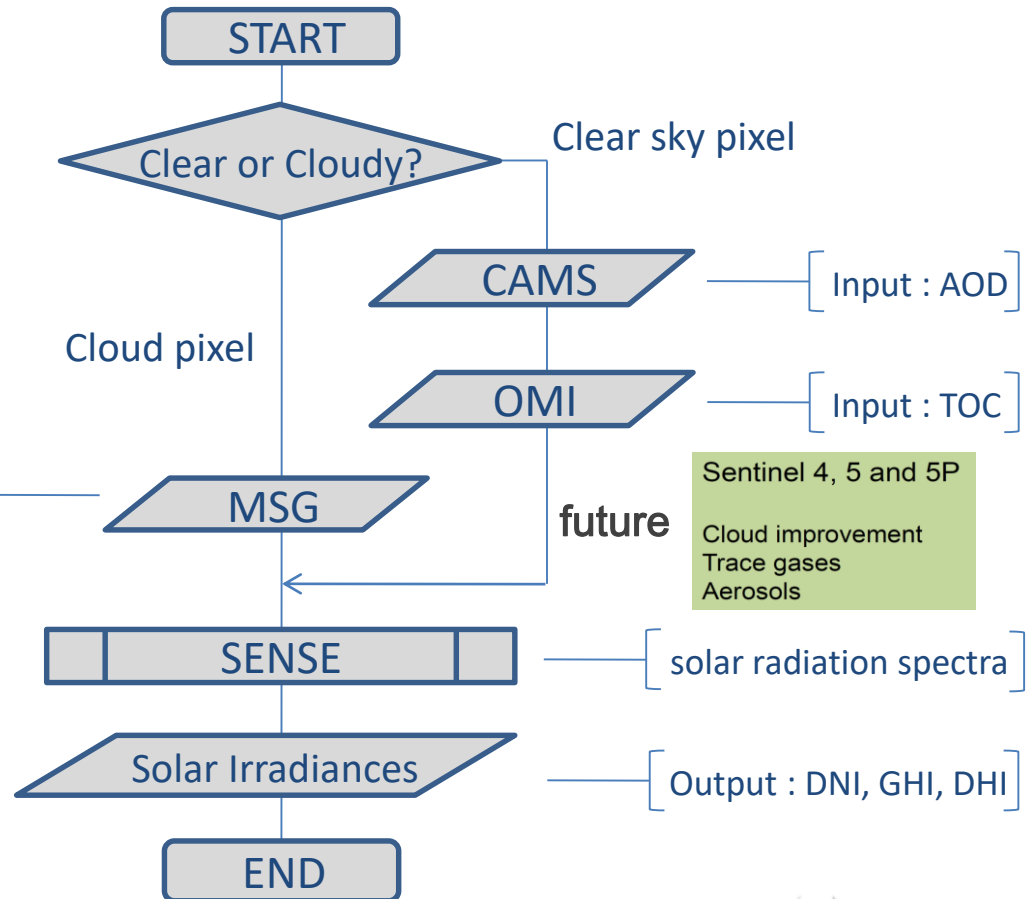
Copernicus Atmospheric Monitoring Service



Radiative Transfer models



Neural networks



Long term funding: Science towards applications

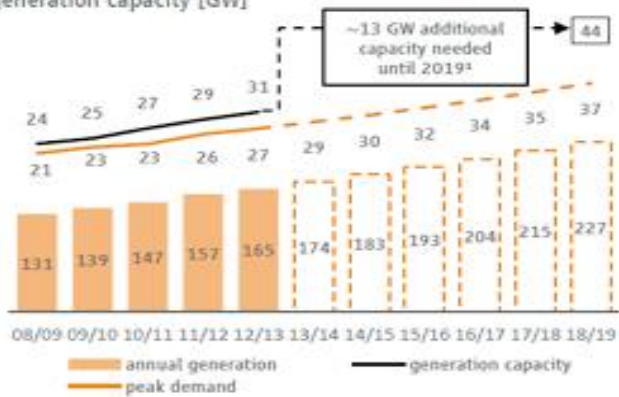
- Private sector (PV parks, energy solutions apps, ships, health related SMEs)
- Public sector (energy operators, EPAs, public information sectors e.g. weather and meteorology related bodies)
- Government based initiatives (municipalities, touristic destinations)
- EU projects (Scientific development, user oriented products, case studies)
- Copernicus/GEO related calls

Purpose

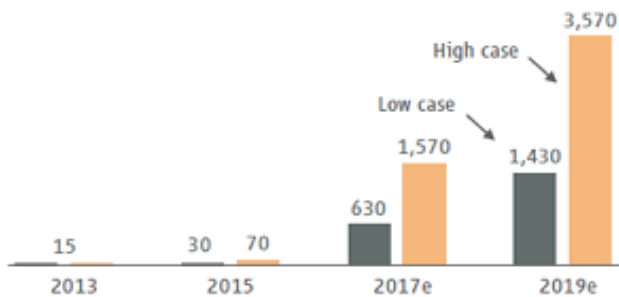
- demonstrate ways to maximize value and benefits at the RoI
- Sense can be implemented anywhere on RoI – tailored products
- create synergies with public and private sector (solar plants, energy distributors, solar energy related end-users).
- Through GEO-Cradle, new projects, conferences to “advertise” the product.
- Spin-off opportunity.

Energy consumption in North Africa and Middle East

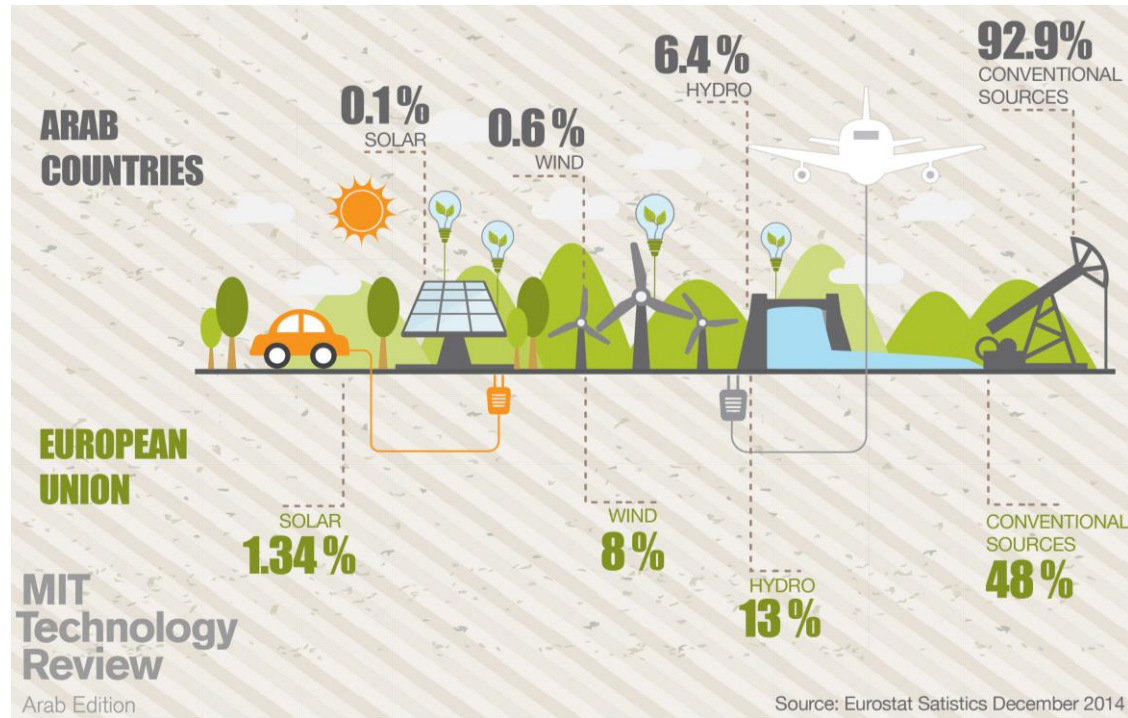
Annual power generation [TWh], peak demand [GW] and generation capacity [GW]



PV market forecast Egypt (cumulative installations) [MW]



Source: Apricum market model Q4/2015



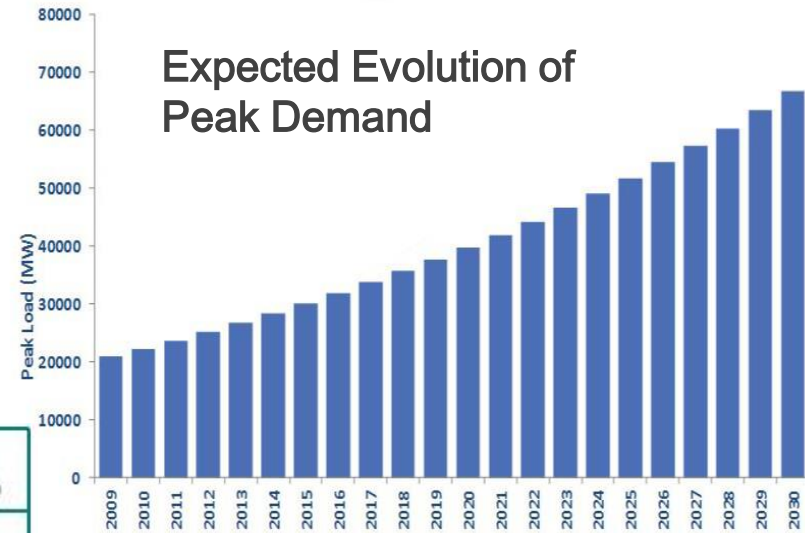


Identifying gaps at RoI

Solar energy - Greece



	PV (MW)
1998	0.07
1999	0.1
2000	0.2
2001	0.3
2002	0.8
2003	1.4
2004	1.7
2005	2
2010	4
2015	7



Definition of the specific pilot sites

Region	Product	Maturity	User
Greece	Energy Nowcasting + forecasting	high	Independent Energy Operator
Egypt	Nowcasting + solar atlas	Mod	Dep. Of Energy Egypt
Aegean and Adriatic sea	Solar UV Index	Mod	Superfast ferries



Pilot #1: IPTO

➤ IPTO is the Independent Power Transmission Operator for Greece

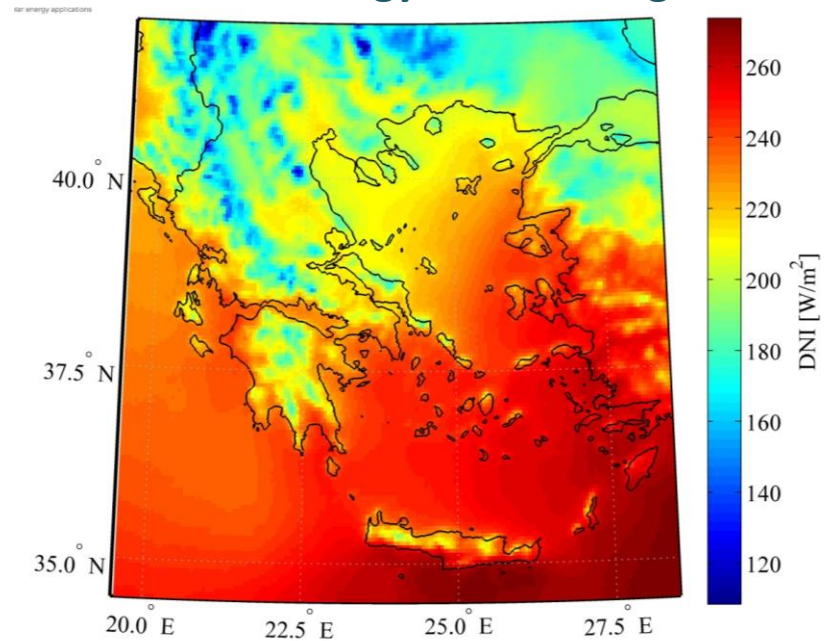
➤ Control the energy demands



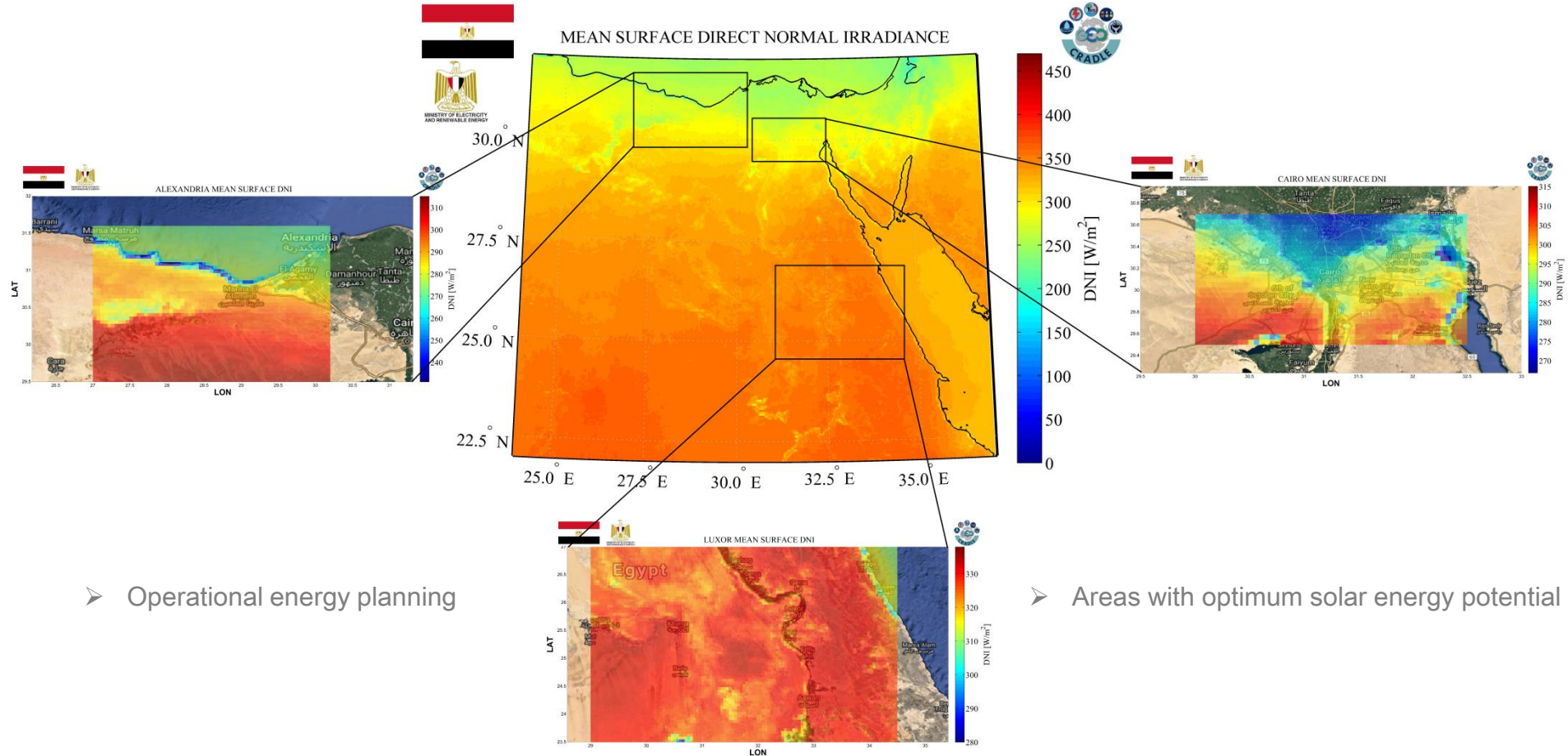
ΑΔΜΗΕ
ΑΝΕΞΑΡΤΗΤΟΣ ΔΙΑΧΕΙΡΙΣΤΗΣ
ΜΕΤΑΦΟΡΑΣ ΗΛΕΚΤΡΙΚΗΣ ΕΝΕΡΓΕΙΑΣ



Solar Energy now-casting



Pilot #2: Ministry of electricity and renewable energy of Egypt



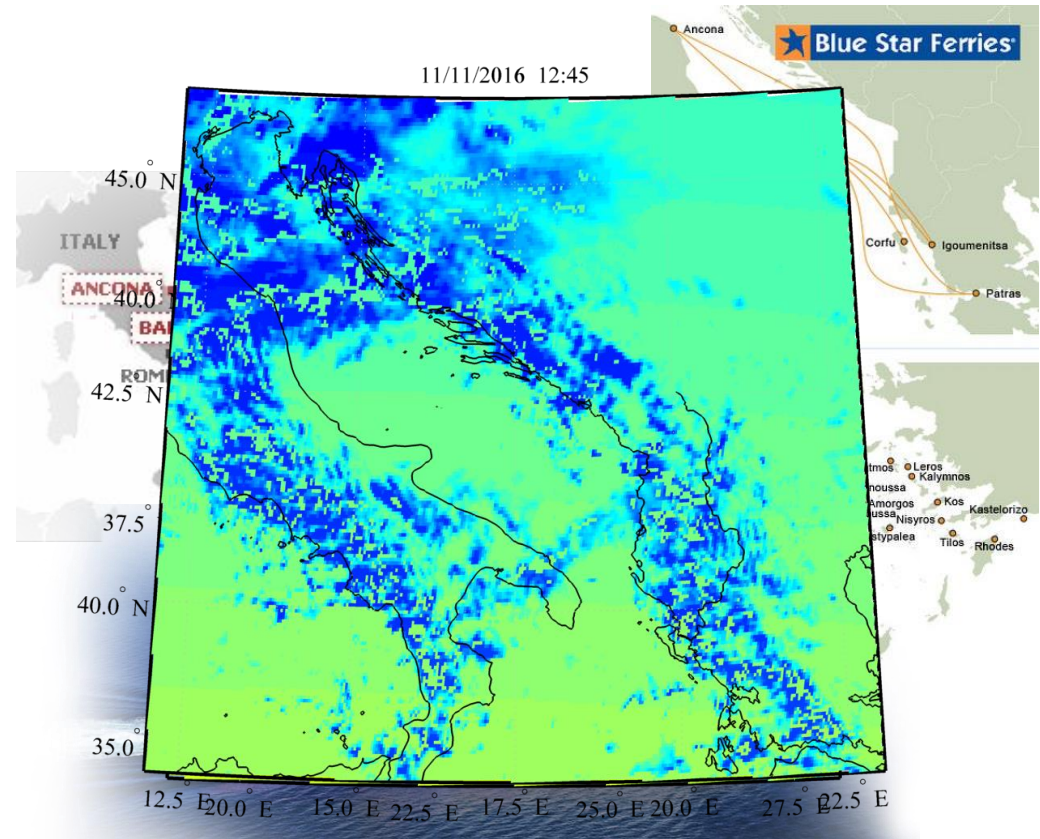
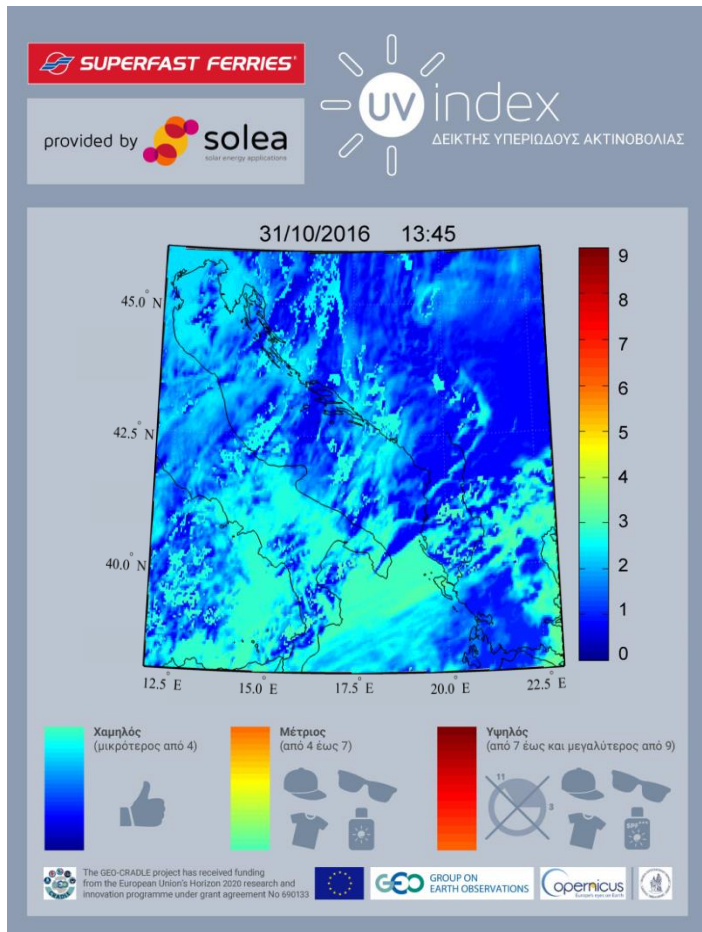
➤ Operational energy planning

➤ Areas with optimum solar energy potential

➤ Optimum locations for CSP & PV installations using solar Atlas energy maps



Pilot #3: Attica Group





Coordinating and integrating state-of-the-art
Earth Observation Activities in the regions of
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thank you!

For more information

<http://geocradle.eu/>

