GEO-CRADLE:

Fostering regional cooperation and roadmap for GEO and Copernicus implementation in North Africa, Middle East and Balkans

Funded under H2020 - Climate action, environment, resource efficiency and raw materials
ACTIVITY: Developing Comprehensive and Sustained Global Environmental Observation and Information Systems
CALL IDENTIFIER: H2020 SC5-18b-2015
Integrating North African, Middle East and Balkan Earth Observation capacities in GEOSS
Project GA number: 690133
Total Budget: 2,910,800.00 €
… is a unique EU funded Coordination Action running at regional level;
… is looking at the territories of North Africa, Middle East and Balkans;

It seeks to identify common needs, create synergies, and integrate capacities;

Fosters the regional cooperation and integration of monitoring capabilities and networks, as well as scientific skills;

Define and communicate goals that are clear and beneficial from societal and market wise point of view, and also realistic and in line with the domestic priorities and user needs;

Proposes/sets up large scale regional initiatives based on the Earth Observation (space based and in-situ) for capacity building and also addressing societal priorities in the thematic areas of the project such as Adaptation to Climate Change, Access to Raw Materials, better exploitation of the renewable Energy resources, and Food Security.

- **Promote** the uptake of EO services and data in response to regional needs.
- **Support** the effective integration of existing Earth Observation Capacities in the region.
- **Facilitate** the engagement of the complete ecosystem of EO stakeholders in the region.
- **Enhance** the participation in and contribution to the implementation of GEOSS and Copernicus in North Africa, Middle East and the Balkans.
Thematic Areas

- Adaptation to Climate Change (ACC)
- Improved Food Security – Water Extremes Management (IFS)
- Access to Raw Materials (ARM)
- Access to Energy (SENSE)
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What is Copernicus? An overview

Copernicus will be served by a set of dedicated satellites (the Sentinels) and contributing missions.

The EU will place a constellation of almost **20 more satellites in orbit before 2030**

Copernicus is a flagship European Union Space Programme aimed at developing European information services and EO market based on satellite Earth Observation and in-situ data.

Copernicus adopts a **full, free and open data policy**

A tool for **economic development** and a driver for the **digital economy**

**SPACE**

**TECHNICAL COORDINATION BY**

**SENTINELS MISSIONS OPERATED BY**

**CONTRIBUTING MISSIONS**

**SERVICES**

- **ECMWF**
- **Copernicus Sentinel Service**
- **European Environment Agency**
- **FRONTEX**

**IN SITU**

- **EU Member States**

**COORDINATED BY**

- **European Commission**
- **Group on Earth Observations (GEO)**
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.
GEO community is creating the Global Earth Observation System of Systems (GEOSS) to better integrate observing systems and share data by connecting existing infrastructures using common standards.

More than 200 million data resources in GEOSS that span all GEO’s thematic areas.

GEO convenes expertise from across different disciplines, coordinates activities, promotes broad and open data policies, ensures global collaboration, identifies gaps, assesses maturity in relation to EO, and reduces duplication in the areas of:

- Biodiversity and Ecosystem Sustainability
- Disaster Resilience
- Energy and Mineral Resources Management
- Food Security
- Infrastructure & Transportation Management
- Public Health Surveillance
- Sustainable Urban Development
- Water Resources Management
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25 Partners, 3 Continents, 1 Team

- **GEO-CRADLE** brings together a highly-complementary team combining a strong background in GEO-related coordination activities with proven excellence in the field of Earth Observation:
  - Leading research institutes and universities
  - Highly-esteem international associations
  - Service Providers with strong regional presence

NATIONAL OBSERVATORY OF ATHENS Coordinator
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

The Project Pillars

The GEO CRADLE Regional Data Hub (GC-RDH) is going to provide its users with a transparent discovery and access mechanism of the GEOSS portal’s resources, and other regional portals! This mechanism will heavily rely on the GEO Discovery and Access Broker (DAB) APIs, which is a middleware component in charge of interconnecting the heterogeneous and distributed capacities contributing to GEOSS; part of the GEOSS Common Infrastructure (GCI) since November 2011.
The Regional Priorities

Priority Definition Workflow

- Identify national EO recommendations as perceived from GEO-CRADLE partners.

- Propose a priority framework
- What are the criteria to consider in the definition of priority goals?

- Builds upon the national priorities the regional priorities by looking at the commonalities of national actions with the RoI as well as the specificity of the region.

- Validate the action plan with decision makers.
- How to ensure that the action plan is in adequacy with real needs in the RoI?
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

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
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

http://geocradle.eu
## Indicative list of Climate variables and indices

<table>
<thead>
<tr>
<th>Climate Indices</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>C11 Mean near surface temperature</td>
<td>Fundamental</td>
</tr>
<tr>
<td>C12 Precipitation rate</td>
<td>Fundamental</td>
</tr>
<tr>
<td>C13 Maximum near surface temperature</td>
<td>Fundamental, extremes</td>
</tr>
<tr>
<td>C14 Minimum near surface temperature</td>
<td>Fundamental, extremes</td>
</tr>
<tr>
<td>C15 Wind speed at 10m, 50m, 100m and 200m</td>
<td>Fundamental, Energy, natural disasters</td>
</tr>
<tr>
<td>C16 Surface absorbed solar radiation</td>
<td>Fundamental, Energy, Tourism, Agriculture</td>
</tr>
<tr>
<td>C17 95th percentile of rain day amounts</td>
<td>Extremes, natural disasters</td>
</tr>
<tr>
<td>C18 95th percentile of wind speed at 10m</td>
<td>Extremes, natural disasters</td>
</tr>
<tr>
<td>C19 Annual greatest 5-day total rainfall</td>
<td>Extremes, natural disasters</td>
</tr>
<tr>
<td>C20 Fraction % of total rainfall from events &gt; long-term P90</td>
<td>Extremes, natural disasters</td>
</tr>
<tr>
<td>C11 Number of events &gt;long-term 90th percentile of rain days</td>
<td>Extremes, natural disasters</td>
</tr>
<tr>
<td>C12 Number of frost days Tmin &lt; 0 degC</td>
<td>Extremes</td>
</tr>
<tr>
<td>C13 Heat Wave Duration Index</td>
<td>Agriculture, Tourism</td>
</tr>
<tr>
<td>C14 Standardized Precipitation Index (SPI)</td>
<td>Agriculture, Water resources</td>
</tr>
<tr>
<td>C15 Potential evaporation</td>
<td>Agriculture</td>
</tr>
<tr>
<td>C16 Growing season duration (GSD)</td>
<td>Agriculture</td>
</tr>
<tr>
<td>C17 Tourism Climate Index (TCI)</td>
<td>Tourism</td>
</tr>
<tr>
<td>C18 Snow depth (SnowD)</td>
<td>Tourism</td>
</tr>
<tr>
<td>C19 Heating Degree Day (HDD)</td>
<td>Energy</td>
</tr>
<tr>
<td>C20 Cooling Degree Day (CDD)</td>
<td>Energy</td>
</tr>
</tbody>
</table>

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/](http://www.euro-cordex.net/)).

[http://geocradle.eu](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.

EUFAR

Athens - ACTRIS

Finokalia - ACTRIS

Observational platforms

http://geocradle.eu
Impacts of Climate Change

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The Regional Priorities
Improved Food Security (IFS)
Water Extremes Management (WEM)

Soil Spectral Library
(Task 4.2 – IFS pilot)

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

<table>
<thead>
<tr>
<th>Property</th>
<th>SFC, SEP, SEL</th>
<th>R²</th>
<th>Prediction equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Field Moisture (SFM)</td>
<td>0.045, 0.14, 0.016</td>
<td>0.645</td>
<td>$w = 0.073P + 0.3781 + w_0$&lt;br&gt;$w = 0.065P + 0.3962 + 0.06235$</td>
</tr>
<tr>
<td>Organic Matter</td>
<td>0.003, 0.019, 0.002</td>
<td>0.827</td>
<td>$w = 0.725P + 11.972 + w_0 + 0.0085$</td>
</tr>
</tbody>
</table>

Flood Forecast Model
(Task 4.2 – WEM)

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

Sentinel-2 Satellite
The Regional Priorities
Access to Raw Materials (ARM)

Establishing a roadmap for long-term monitoring, mapping, and management of Quarries, Mineral Deposits in the ROI.

- Use of existing regional capacities and skills
  - Development of protocol for evaluating the level of impact
  - Mapping of quarries and waste materials in abandoned mines
  - Monitoring of ground deformation during/after mining

- Identification, collection, assessment and use of EO based and in-situ data
- Enrichment of the information content of the Regional Data Hub
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.

Solar Energy Applications
The Solar Energy Nowcasting SystEm (SENSE) pilot

Solar Energy now-casting

Solar Atlases Energy Maps
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.

- Operational energy planning
- Areas with optimum solar energy potential
- Optimum locations for CSP & PV installations using solar Atlas energy maps

Solar Atlases
Energy Maps
Solar radiation related products
The GEO-CRADLE Contribution: Conclusions

1. **Submit to the EC a roadmap** with funding priorities in relation to capacity building, filling in gaps (networks, infrastructures, data sharing, skills), training, education, service provision, and business uptake at regional level.

   - **Guides** the implementation of GEOSS and the uptake of Copernicus in the Rol
   - **Assesses** the readiness and maturity of each country in the Rol
   - **Lays out** the actions for the long-term response to major regional challenges in the Rol
   - **Paves** the ground for a potential regional large initiative

2. **Engage the countries and regional stakeholders** in the data sharing process, the use of open standards, and facilitate the access of the local actors to existing portals, web servers, data repositories, and satellite image archives through big infrastructures such as GEOSS, the European Data Portal, Copernicus data/service portals, and any existing regional Data Hubs (e.g. GEO-CRADLE RDH).
The GEO-CRADLE Contribution: Conclusions

3. Generate and sustain a network stakeholders to ensure visibility, and sharing of knowhow, excellence, and skills between the local actors and their counterparts worldwide.

4. Deliver a prototype methodology and a detailed assessment on the nations’ (market and science) maturity in relation to EO. Compare the regional capacity/state-of-the-art with the ones of developed countries in space, and find the complementary roles where they exist.

5. Support the EO market uptake and internationalisation by,
   - Understanding the local market, and capacities
   - Mapping existing policies in sectors that may need support from EO
   - Facilitating access to open data
   - Mapping the local competitive landscape
   - Engaging the end-user community
   - Facilitating partnering with international interlocutors (companies, researchers, industries)
   - Building trust / Overcoming cultural and linguistic issues

6. Advance the role of the countries in GEO, and Copernicus by,
   - Setting up local GEO offices, Copernicus Relay Offices, and/or nominating official GEO representations at various levels
   - Strengthening the EO industrial/research dimension by using Copernicus & GEO as key drivers
   - Helping the stakeholders understand how they can benefit from and contribute to GEOSS & Copernicus
Thank You!