The NextGEOSS Project

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• Overview
• System
• Development & Integration
• Pilots
• Engagement & Dissemination
OVERVIEW

NextGEOSS: The European GEO Data Hub
NextGEOSS

- Next generation centralised hub for Earth Observation data and processing
- The European contribution to GEO

H2020 SC5-20-2016 call: *European data hub of the GEOSS information system*

- 10M€, 27 partners, 3.5 years

**Concept**

- Provides *access to data* to the European users communities, together with *Cloud resources*, seamlessly connected to provide an integrated ecosystem for supporting applications
- Strong emphasis on *engaging the communities* of European providers and users
Increasing amount of data:
• More and more missions being launched every year
• Missions collecting more and more data

High Complexity:
• Processing Earth Observation data typically requires specific knowledge

Huge Potential:
• A large amount of information can be extracted
Collaborative Systems:

- Several institutions and companies working on solutions
- Exploitation Platforms
- C-DIAS: Copernicus Data Information Access System
- H2020 Space calls devoted to EO
- Calls in other themes
NextGEOSS Objectives

1. Engage communities promoting innovative GEOSS powered applications from Europe

2. Deliver the next generation data hub and Earth Observation exploitation for innovation and business

3. Advocate GEOSS as a sustainable European approach for Earth Observation data distribution and exploitation
DEIMOS Engenharia: Project coordinator (WP1) and the leader of WP7 (Business Opportunities and Services), will be in charge of the Data Connectors, the Workflow Monitoring, and will also lead the High Resolution Mapping for Territorial Planning.

DEIMOS Space: Lead User Management activities (in WP5) and participates in the Data Provider QoS / Operations Model Consistence of Information (in WP2), in the Workflow Monitoring (in WP5) and in Communication and Dissemination (in WP8).
DLR: In charge of liaison with data providers (WP3) including GEOSS community. Improvement of data connectivity in terms of discovery and access directly at the data centers, acting on the providers’ side. Moreover, DLR will be responsible to integrate innovative applications dedicated to research activities using the data hub infrastructure. These activities will be focused on addressing Societal Challenges through the uptake of GEOSS data by academia.
NOA: Participates in the WP6 Innovative Research Pilots and in the Engagement actions with Data Providers. Also participate in WP3 (Data Federation and Uptake), in particular in the federation of the Sentinel Collaborative Ground Segment and in the Synergies and Engagement of Communities (WP4), supporting the Engagement with GEO Flagships, Initiatives and Community Activities.
VITO: VITO leads the land related activities in the Data Federation and Uptake (WP3), and lead Innovative Research Pilots (WP6), while also providing two pilots: one on Agricultural Monitoring (IP1) and another on Crop Monitoring Supporting Food Security (BP2). VITO also participates in the Engagement activities (WP4).
MeteoSwiss: Leads the task on Data Federation and Uptake for Atmosphere data (in WP3) with the objective to improve interoperability of atmospheric data centres.

WMO: Participates in the Data Federation and Uptake for Atmosphere data (in WP3).

NILU: Participates in the Data Federation and Uptake for Atmosphere data (in WP3).
**CLS**: Leads Data Federation and Uptake of Marine data (in WO3), enabling full compatibility and connectivity with CMEMS. CLS will also work on User Management (in WP5) and in Communication and Dissemination activities (in WP8).
**Viderum**: Leads the Data Hub implementation (WP2), being responsible for the development of the Data Catalogue that will integrate references to all earth observation data provided by GEOSS including consortium partners' data.
Terradue: leads the User Integration Support (WP5) in a cloud platform framework for developing and hosting the pilots.
EGI: Will identify the best solutions to get applications and pilots up and running on an integrated cloud platform, serving as a matchmaker for users and the appropriate service provider(s) across the EGI Federation and beyond.
**TEAM**

**OGC-Europe:** Leads the Synergies and Engagement activities (WP4). Its main role is to engage with the GEO Data Providers, GEO activities and Foundational Tasks and to bring the results back into the standards process for the 550 OGC members worldwide. Will lead Citizen Observatories Data Uptake activities (in WP3), proposes a Smart Cities pilot (BP3), and participates Communication and Dissemination activities (in WP8).
Universitat Autònoma de Barcelona: Will work on data and metadata standards, especially the Community Feedback Mechanism (in WP2), participates in the Engagement with GEO Flagships, Initiatives and Community Activities (in WP4) and in pilots IP1 (Time Series Analysis for Agricultural Monitoring and IP2 (Biodiversity) and dissemination tasks (in WP8).
**BLB:** leads WP8 on Communication, Dissemination, and Assessment, supporting also the setup of Online Open Courses with designing and running webinars. BLB is also involved in the Citizen Science activities (in WP3), the Engagement activities (in WP4) and the Cold Regions pilot IP4.
University of Reading: Leads the organisation of the NextGEOSS Training Events (in WP8), participates in Data Mining and Discovery and Community Feedback Mechanisms (in WP2) and leads the activity on Stimulating GEOSS Powered applications (in WP4).
TEAM

EARSC: EARSC will be the leader of task 7.5. “Opening up to the Private Sector” and will participate actively in task 8.4. “Sustainability”.
**EuroConsult:** Leads tasks related to the Business Innovation and the Sustainability (in WP8).
SatCen, NERSC, Wageningen University and Research University of Twente, HS-RS, ARMINES, CNR-IREAN, DMI, European Dynamics:

Additional pilot activities and engagement of private sector.
GOVERNANCE

27 Members (1 rep. per partner)
Chair: Bart De Lathouwer (OGCE)

8 Members (WP Leaders)

Izabella Freytag

External Advisory Board

EC

Project Coordinator

Management & Coordination Support Team

General Assembly

Executive Board

WP1

Nuno Catarino (DME)

João Andrade & Vânia Fonseca (DME)

Christopher Kraft (Viderum)

Julian M.-Arne (DLR)

Bart De Lathouwer (OGCE)

Pedro Gonçalves (TDUE)

Erwin Goor (VITO)

Nuno Grosso (DME)

Bente L. Bye (BLB)

WP2 Leader

WP3 Leader

WP4 Leader

WP5 Leader

WP6 Leader

WP7 Leader

WP8 Leader
SYSTEM

NextGEOSS: The European GEO Data Hub
DataHub harvest and register data, providing links to original sources.

Discovery Enablers empower search on DataHub from users.

Access Enablers allow community hubs to create data buckets for access.

Enhanced distributed gateway from research and operational infrastructures.

Processing Enablers allow community hubs to deploy distributed ICT technologies.

Publishing Appliances deliver to the community hubs processed results.

Community Portals register selected products and services to GEOSS.
Four Project Phases

1. **Setup:** Initial system deployment
   - Alpha restricted release

2. **Ramp up:** Public versions
   - Beta version public release
   - First version public release (v1.0)

3. **Consolidation:** Second release versions
   - Update to first version (v1.1)
   - Second version (v2.0)

4. **Production:** Final updates
   - Update to second version (v2.1)
   - Third version (v3.0)

**First Reporting Period**

**Second Reporting Period**
Current Status

Ongoing:

• Initial deployment of catalogue & definition of metadata
• Interfaces & harvesting of datasets
  Sentinels, Copernicus Marine, Land & Atmosphere, Citizen Observatories & Commercial Data
• Setting up KPIs
• Preparing for integration of NextGEOSS pilots
• Starting engagement of communities, datasets & future pilots
• Setting up the Advisory Board
DEVELOPMENT & INTEGRATION

Development and integration of applications in the Cloud Platform
DEVELOPMENT ENVIRONMENT (Sandbox Service)

Remote cost-effective Virtual Machine to:
- the scientific algorithms
- Develop the service workflow (HADOOP MAP/REDUCE)
- Test the service before deployment on Cloud Environment

NextGEOSS already includes:
- Data Access tools – the Data Hub
- Data Processing tools
- Data Dissemination tools
- Common Functions
INTEGRATING PROCESSORS

Remote cost-effective Virtual Machine to:

- Processing jobs can be developed in any programming language supported by CentOS 6.5.
- C/C++, Java, Python (most common)
- Matlab and IDL can be used as well
- Other languages shall be analysed before
- Developers usually program on their local environment and then synchronize with the Sandbox through SVN/Github.
SERVICE DEPLOYMENT

- When Services are Validated they are ready for the deployment on a Cloud provider using as many resources as needed.
- Resources can scale up/down according to workload
- OpenNebula add-on jclouds4one (Infrastructure Driver co-funded by ESA)
- Service Operators can manage the service through Web Portal
- Service End Users can access the output products directly.
DEVELOP/DEPLOY SERVICES STEPS

1. Design Service
2. Develop Jobs
3. Define Workflow
4. Validate Service
PILOTS

Communities, promoting innovative GEOSS powered applications from Europe

- Engage the GEO and European communities towards understanding their needs, working together with GEO and Open Data policies
- Identify regional champions for innovative pilots and business oriented pilots
- Collect feedback, expectations and requirements from the public and private communities
- Target Essential Variables towards the SDGs
PILOTS

Innovative pilots

- IP1 Agricultural Monitoring
- IP2 Biodiversity
- IP3 Space & Security
- IP4 Cold Regions
- IP5 Air Pollution in Mega Cities
- IP6 Disaster Risk Reduction

Business pilots

- BP1 Territorial Planning
- BP2 Food Security
- BP3 Smart Cities
- BP4.1/2 Energy*

Contributing to the vision of GEO
Pilot Scope

- Scale up Time Series analysis tools to huge amounts of HR EO-data
- SAT EO-data & in-situ data

Pilot Objectives

- Extend Proba-V MEP & Copernicus Global Land Time Series Viewer with Sent-2 derived VGT indices
- REST and/or WPS end-points → WP3
- Extend prototype of Agro STAC (Spatial Temporal Catalogue for Agronomy) from FP-7 SIGMA → towards operations
- Temporal and attribute accuracy on WM(T)S: guidelines and prototype

Challenges

- Integrate with processing chains & data on public clouds
- Transfer to operations (in-situ)
Pilot Scope

- Essential Biodiversity Variables (RS-EBVs) for habitat mapping and monitoring

Pilot Objectives

- demonstrate the value of an European Data Hub for the creation of RS-EBVs, which leads to creating a GEOhub for EBVs by linking the key policy/user network groups (GEO-BON, CBD and IPBES) with the space agencies.
- demonstrate the use of the European Data Hub in terms high resolution RS-EBVs for habitat mapping (distribution, suitability and probability) in order to support the European Environment Agency (EEA) and its Topic Centre for Biological Diversity (ETC-BD). The integration of EO data with in-situ observations, vegetation relevés, will play an important role.

Challenges

- Incorporation of several RS-EBVs (e.g. phenology) to improve the distribution mapping of EUNIS habitats.
- How far can we integrate different aspects of the developed habitat modelling method (data & models) into Cloud Sandbox Solution?
Pilot Scope

- SatCen is the GEO Participating Organisation leading the Space and Security Community Activity
- A main interest in the Space and Security domain is related to the detection of changes on the Earth surface
- The pilot will evaluate suitable solutions to this end building on the BigDataEurope and EVER-EST projects’ results

Pilot Objectives

- To provide tools for detecting and characterizing changes
- To explore methods for extracting information on changes at different scales
- To foster extensive exploitation of GEOSS Data Hub

Challenges

- To improve the capacity to access and analyse a huge amount of heterogeneous data to timely provide decision makers with clear and useful information
Pilot Scope
• Focus on 3 hot spot areas: (1) the Arctic/Svalbard region, (2) Antarctica, and (3) the Himalayan glaciers.

Pilot Objectives
• Within these areas, provide a set of remote sensing, in situ and model products for science and education, and feeding into GEOSS and GEO-CRI communities.

Challenges
• Addressing interoperability issues between different data providers, and the existing shortage in accessing in situ data in GEOSS.
Pilot Scope

- Analysis of air pollution trends, urban growth rates and health risk indicators for megacities by integrating EO data with the nextGEOSS infrastructure
- New inputs from Sentinel-3, -5P, CAMS, WDC/RSAT

Pilot Objectives

- Develop a multi-sensor approach to analyse air pollution variability in megacities linked to urban growth rates
- Develop a tool to analyse local trends and health risks using the NextGEOSS infrastructure
- Exploit Copernicus data and services (Sentinel-3, -5P, CAMS)
- Strengthen the link to the health community

Challenges

- Integrate with Copernicus data hubs and processing chains
IP6: Disaster Risk Reduction

Pilot Scope
- Enhance a multi-hazard risk assessment based on the statistical analysis of long time series of data accessible through the NextGEOSS Data Hub.

Pilot Objectives
- Ensure timeliness access and improved discovery to critical DRR input (EO and non-EO) data

Challenges
- Reduce time to discover, collect and download diverse, multisource data;
- Better estimation of hazard events occurrence based on dynamic/static parameters measured over time;
- Generate new research activities – yield new information;
- Refinement of expected hazard algorithms and models.
Pilot Scope

- Make available a set of Land Use/Land Cover (LULC) mapping and change detection tools for urban environments using high and very high resolution optical imagery.

Pilot Objectives

- Integrate DME and DMUK LULC applications and extend its capabilities by addressing requirements from territorial planning institutions in Lisbon and Dubai.

Challenges

- Reduce computational time of running the different features of the application and apply it to different open data satellite imagery streams (Sentinel-2, Landsat).
Pilot Scope
• Use of Sentinel-2 for crop monitoring in collaboration with industry
• Data fusion between Proba-V 100 m and Sentinel-2

Pilot Objectives
• Deploy and run HR processing chain for Vegetation Parameters on public cloud: on-demand & subscription
• Develop dynamic dashboard: integration of time series analysis
• Demonstrations & training for users from Agro and Insurance sector

Challenges
• Convenient & scalable processing of large amounts Sentinel-2
• Data analytics
• Data fusion of Proba-V and Sentinel-2
Pilot Scope
• Pilot based in work developed in ESPRESSO H2020 support action. Smart cities use the ISO 37120 and we will see how that maps on the SDG for EO, as well as pilot how we can integrate smart city sensors in the in-situ EO

Pilot Objectives
• Mapping ISO 37120 and SDG, sensor integration in GC

Challenges
• Sensor standards in Smart Cities and standards in in-situ EO
Pilot Scope

- Constructing gridded data for grid operators
- Process CAMS services to provide time series of gridded data
- **High resolution solar mapping at urban scale**
  - Process and combine CAMS with 10 cm resolution DSM and 30 m DTM to provide geo-localized patches of time series of global tilted irradiation including local horizon

Pilot Objectives

- Constructing gridded data for grid operators
- Enabling access to nation-wide gridded time series of solar radiation
- **High resolution solar mapping at urban scale**
  - Enabling on-the-fly high resolution solar mapping of an urban area

Challenges

- NextGEOSS cloud based solution to reduce computation time!
  - **Constructing gridded data for grid operators**
    - Currently 15s per point. Need to address 1000km x 1000km area of 10 km grid cells (10k cells at the same time)
  - **High resolution solar mapping at urban scale**
    - To access real-time rendering of local solar mapping for an urban area of interest. Currently, 400 s is required for a zone of 100 m x 100 m
ENGAGEMENT & DISSEMINATION
Dissemination

Communication infrastructure

Project Website

nextgeoss.eu

Social Media

Webinars and Training

• Three online training events, one per year
• Face2face and online segment plus interactive webinars

Summits

• Four project events, to be setup as satellites of GEO symposia*, focusing on:
  1. Engagement of communities;
  2. Report on the status of the project’s activities and collaborations;
  3. Assess and report publicly on the project developments, with showcases;
  4. Final NextGEOSS showcase.

* not this year
Other Business and Private Sector

Opening up to the Private Sector
• Contribute to the implementation of GEO’s new strategic plan wrt advancing and facilitating cooperation with the private sector
• Help to develop links between industry and the public sector

Business Innovation Assessment
• Assessment the gap between geospatial services As available today and expected after NextGEOSS
• Stakeholders identification and Consultation

Sustainability Assessment and Recommendations
• Assessment of best mechanisms to support long-term usage of NextGEOSS
Main Project Events

Summits:
• An annual event in the second quarter of each year (4 in total)

Training:
• One online training event per year (3 in total)

+ presence in other events
• Baltic from Space Workshop, 30th March
• 2nd GEO Data Providers Workshop, Florence, 20th & 21st April
• GEO-CRADLE Industry Engagement Workshop, 26 April
• ISRSE-37, South Africa: NextGEOSS session, 11 May
Thank you!

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SPARES
Catalogue and Data Hub
Using CKAN data management system
relying on open source technologies
Data harvesting, annotation and analytics
Data mining and discovery

Cloud Resources
Configurable VMs on cloud infrastructures
Used in deployment of pilot applications
Support to service integration
Workflow monitoring and analytics

Community Feedback Mechanism
Community Feedback Mechanism

Quality of Service
Continuous assessment of QoS on randomly selected products

Pilot Applications – System Testers
Ten pilot activities to demonstrate the system
• Six innovative pilots
• Four business-oriented pilots
DATA

Data Harvesting

Sentinel Collaborative Ground Segments (DLR, NOA)
Land (VITO), Atmosphere (WMO, MeteoSwiss, NILU) and Marine (CLS) data sources
Citizen Observatories
Commercial Providers

Federation of additional data sources

Dedicated CKAN-based harvesting tools for major data providers
relying on OpenSearch and OGC standards

Will incorporate previous initiatives on data harmonisation
COPERNICUS

- European Earth Observation Programme

**Sentinel Satellites:**

- Six missions with 2 satellites each: Sentinels
  - radar
  - optical
  - atmospheric
  - altimeter

**Core Services:**

- Land Monitoring
- Marine Environment Monitoring
- Atmosphere Monitoring
- Emergency Management
- Climate Change
- Security
Earth Observation:

- Gathering of information about Earth via remote sensing technologies supplemented by Earth surveying techniques, encompassing the collection, analysis and presentation of data.

Data Systems:

- Satellite and in situ data collection

Value Adding Systems:

- Information extraction from data
GEO and GEOSS

Organisation of voluntary partnership of governments and organizations
Promotes the use of Earth Observations in decision making processes
Includes:
• 102 nations and the European Commission
• 103 Participating Organizations comprised of international bodies with a mandate in Earth Observations

Global Earth Observation System of Systems
A central part of GEO’s Mission
A set of coordinated, independent EO, information and processing systems

2016 Work Programme
GD-02: GCI Operations
GD-07: GCI Development
GD-03: Global Observing and Information Systems
GD-04: GEOCast
GD-05: GEOSS satellite Earth Observation Resources
GD-06: GEOSS non-space based Earth Observation Resources
GD-11: Communications Networks
AIP - Architecture Implementation Pilot
Thank you!

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