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Deliverable D5.1

Common criteria in the project stakeholder and industry challenges

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1 Introduction

The Task 5.1 has the aim to define better what we are going to do in the other task of this work package; mainly task 2, 3, 4 and 5. This is the deliverable that summarizes this work. Work Package 5 has the objective of supporting the gap analysis by providing use cases that will use or produce GEOSS data.

This is the summary description of the WP 5 industrial challenges:

- Task 2 (Challenge 1) proposes clear experiment based on Surface Solar Irradiance measurements and the gaps in them. ARMINES is leading. This activity starts on August 2015.
- Task 3 (Challenge 2nd) proposes an experiment to combine in-situ and satellite data. The text in the DoA frames the scope to SAR and atmospheric data for CalVal. Sentinel 1 will have a role. S&T is leading. Start on September 2015
- Task 4 (Challenge 3rd) proposes to integrate more in-situ networks in the GEOSS DAB with the scope on CZEN and terrestrial ecosystems. CNR is leading and starts on July 2016.
- Task 5 (Challenge 4th) proposes a private sector challenge. It will consist in a competition. EARSC leads and starts on December 2015
- Task 6 (Challenge 5th) proposes an Interdisciplinary cooperation on the food-water-energy nexus (FWEN)

Next steps need to be done

• Better define the activities that need to be done in challenges 1st, 2nd, 3rd, 4th and 5th in collaboration with the WP leader, CREAF and task's leaders. What are about?
• Try to harmonize and relate them as much as possible
• Define the theme and the EVs used
• Define the outcome. In particular
    • Define if data (and metadata) is going to be produced an its nature
    • Define the extent of the experiment both in bounding box and data content time interval
    • Define how we are going to collaborate in the Open Research Data pilot
• Define the standards that are going to be used. E.g. SOS is clearly mentioned in two tasks
• Define the stakeholders and the mean of dissemination. Particular attention will be put in:
    • Define the connection with ENEON
    • Define the connection with GEO - GEOSS
• Define that is "new" in what we want to do
• For challenges 2, 3, 4 and 5 we re-examine the partners that could be involved. See Section 4

The results of an analysis of the commonalities and differences of the different challenges are presented in Section 3 that presents what is expected what will be possible to achieve in them.

2 Review of the proposed industry challenges

2.1 The industry energy challenge

We will extend an existing portal for the energy community to allow access to data (particularly in-situ) instead of merely metadata and to allow data sharing between companies and organisations. This will put to the test the capacity of cooperation in the SSI community by introducing an unprecedented level of collaboration and eventually help to detect gaps in European EO networks. The pilot deployment will help to set priorities in the energy domain. It will also explore the possibilities to work together with weather/climate networks. Concrete tasks are as follows:

- Gaps in data models: Design standardized data and metadata models suitable for in-situ SSI observations as profiles of OGC Sensor Web Enablement standards. Profiles for XML encodings are defined as Schematron rules. The data and metadata models must take into account spatiotemporal coverage, lineage, data quality, IPR, the existing terminology and units of measure.
- Gaps in in-situ measurements: Extend a catalogue platform with data management functions based on the new (meta)data profiles and the GEOSS recommendations for interoperability

based on 52°North Sensor Web. The platform will allow for (i) visualise sensor locations on a map, (ii) visualise measurements as time series plots and in tabular form, (iii) display sensor metadata at different levels of detail, (iv) upload of data by data owners, and (v) download raw observation data for offline processing. It will support company to prepare, pre-process and integrate their datasets.

- Gaps in collaboration: We will present the platform to domain stakeholders at a stakeholder workshop. This demonstration will be exploited as the basis to concretely define the next steps for research in this area and seek funding opportunities to address gaps in data with an added focus on forecasts and projections. The use case will support Tasks 2.2, 3.2, 3.3, 4.4, 6.2 and 7.2. It will help to identify and validate energy related Essential Variables (EVs) as well as critical observation to latter fill the GEOSS SEE IN Knowledge Base.

Theme (SBA):
Energy

EV used:
Surface Solar Irradiance (SSI), Wind speed.

Addressed gap:
Access to in-situ measurements of Surface Solar Irradiance (SSI) will help to detect gaps in EO Networks, namely in **data models, in in-situ measurements, in collaboration**.

Types of Outcome:

- Sensor Observation Service (SOS) platform as a new infrastructure component (OGC-SOS Platform) of the Webservice-Energy SDI,
- Metadata and data models to take into account Energy related specifications and compliant with GEOSS recommendations on interoperability,
- SSI Data easily accessible on the Webservice-Energy SDI.

Data (and metadata) produced:
SSI metadata and data will be provided. More generally renewable energy and environmental resources (solar, wind, temperature, humidity, pressure) will be targeted.
For addressing metadata declaration, several use cases are possible:

- Manual editing of ISO 19139 metadata records into the Webservice-energy catalog.
- Automatic harvest of the SOS platform from the Webservice-energy catalog
- Automatic harvest of the SOS platform from the GEO DAB (Discovery and Access Broker)
- Registration of the SOS platform in the CSR (Catalog and Service Registry)

Each solution will be investigated in order to come up with the most reliable, efficient and consistent approach to support metadata search and discovery.

For addressing data dissemination a solution based on the 52 North SOS platform has been selected. This enables the dissemination of in-situ measurement through an easy to use Web client as well as using standard Web service based mechanism via the access to the GetCapability of the service for additional computational use.

Spatial and temporal extent:
World coverage (-180.0 -90.0 180.0 90) and temporal extent ranging from at least 1 month to up to tens of years with of up to per minute integration period measurements.

Open Research Data pilot collaboration:
Yes in principle with reference to the Guidelines on Data Management in Horizon 2020 document: (http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf). Will depend on licenses in data sources.

Standards that are going to be used:
OGC (Open Geospatial Consortium):

- SOS (Sensor Observation Service)
- O&M (Observations & Measurements)

- SensorML (Sensor Model Language)CSW (Catalog Service for the Web)

ISO (International Standard Organization)

- ISO 19139 (Geographic information Metadata XML schema implementation)

Mean of Dissemination:

- Stakeholders Energy Challenge Workshop to be held along with the Free trainings in solar radiation fourth session in Sophia Antipolis (France) on week 4, January 2016. This workshop is co-organized by MINES ParisTech / ARMINES and Transvalor. This workshop will gather solar radiation practitioners including companies, SME's, researchers and bankers.Publication of domain-specific extensions of client and server components as open source. This will include the release of Open Source code to speed-up the feeding of long (up-to ten years) time series dataset in the 52North SOS platform.
- Participation to the GEOSS AIP-8 (Architecture Implementation Pilot – 8th Phase). The SOS platform will be presented at the twelfth plenary session of the Group on Earth Observations (GEO-XII), hosted by Mexico that will take place in Mexico City, from 11 to 12 November 2015.
- A presentation of the ConnectinGEO SWE (Sensor Web Enablement) solution presented by ARMINES and 52 North has been made under the AIP-8 "Deep Dive" session. A video of this presentation is available here:
    - https://portal.opengeospatial.org/files/?artifact_id=64600
- An article entitled "Interoperable Exchange of Surface Solar Irradiance Observations: A Challenge" (doi:10.1016/j.egypro.2015.07.867) has been published in Energy Procedia journal gathering a selection of presentations made during the European Geosciences Union General Assembly 2015 - Division Energy, Resources and Environment, EGU 2015. In this article we present how implementations of the Sensor Web Enablement framework of the Open Geospatial Consortium are integrated into an existing spatial data infrastructure in order to provide the energy community with visualization and download functionality of in-situ measurements.

Connection to ENEON:

Renewable energy in-situ measurements will be provided under the newly created SOS capacity available on the existing Webservice-energy SDI. This newly created network will benefit from the ENEON methodology developed under the task 3.1 and assess during task 3.2. Links will be made in task 3.3 with Copernicus activities under the former MACC and new CAMS framework to foster satellite/in-situ relations. Providing such new network should enable more participation of the renewable energy community regarding the release of in-situ measurements time-series.

Connection with GEO – GEOSS:

The connection with GEO GEOSS is done via the AIP activity, in which MINES ParisTech / ARMINES is a recognized key actor of the Energy SBA. The Webservice-energy SDI is a recognized GEOSS Community Portal since 2008. The SDI includes a catalog that is registered into the DAB as one of the 52 top providers. The catalog offers more than 1200 metadata records including GEOSS Data CORE resources harvested on a weekly basis (http://reporting.geodab.eu/DAB-Report-2015-09-18.html).

Stakeholder Profile:

SMEs in Renewable Energy Business - Big Players in Energy/Electricity – Researchers - Bankers - Weather & Climate Networks.

2.2 In-situ data compatible to satellite mission data challenge

In this task we will investigate in what way in-situ, satellite and airborne measured data are compatible by analyzing the results and conclusions of relevant related projects. This should lead to the finding of functional gaps. Two types of analyses will be done:

1. For the essential atmospheric variables the GAIA- CLIM project aims at exposing the functional gaps. In this task we will use the intermediate results and methodology used in this projects and try to project it to other themes and climatic variables.

2. Based on experience in projects related to intercomparison of data we will investigate the problems that were found and take a look at the initiatives taken to harmonize the data and data formats and look at availability and accessibility.

Relevant projects

Horizon 2020 GAIA-CLIM: "Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring" will establish sound methods for the characterization of satellite-based Earth Observation data by surface-based and sub-orbital measurement platforms - spanning Atmosphere, Ocean and Land observations.
http://www.gaia-clim.eu/
http://www.nersc.no/project/horizon-2020-gaia-clim

FP7 NORS: "Demonstration Network Of ground-based Remote Sensing Observations in support of the GMES Atmospheric Service" principal objective was to improve the quality and validation of the products delivered by the Copernicus Atmospheric Service (CAS), previously known as GAS (GMES Atmospheric Service), using independent ground based remote sensing data from the international Network for the Detection of Atmospheric Composition Change (NDACC). This project included the creation of a validation server, where you can compare the remote sensing data with in-situ data.

http://nors.aeronomie.be

FP7 QA4ECV : "Quality Assurance for Essential Climate Variables" (2014-2017) aims at establishing quality assurance for the essential climate variables. The project is very practical in the sense a validation server is created to be able to validate the measured observations. Analysis of this study and intermediate results can reveal requirements on data format and metadata conventions needed for inter-comparison of the data.

http://www.qa4ecv.eu/

Theme (SBA):
The selected SBA's are climate and land. For the climate theme the focus will be on the atmospheric (NORS, GAIA-CLIM and QA4ECV project) and climatic (ice sheet growth measured with Sentinel-1) Copernicus services.
For the land theme results from the QA4ECV project will be used.

EV used:
EV's that can be measured with SAR data (e.g. change detection of crop growth or ice sheets) and atmospheric data (trace gases)

Addressed gap:
Analysis 1: Gaps in intercomparability **in-situ measurements related to satellite**-based data.
Analysis 2: **Accessibility** of detailed in-situ data. **Standardization** of data.

Types of Outcome:
- Identification of problems when using in-situ data,
- Suggestions on how to find functional gaps when using in-situ data compared to satellite data. Evaluation of the methods used for GAIA –CLIM.
- Proposals for extensions of EO networks.

New focuses derived from gap analysis for in-situ and/or satellite networks Standardization of EO data access and organization

Data (and metadata) produced:
This is related to Task 4.4 of ConnectinGEO and will depend on the results found.

Spatial and temporal extent:
Global and long term measurements.

*Open Research Data pilot collaboration:*N/A

Standards that are going to be used:
This is an output of the task

Mean of Dissemination
Remote Sensing Private Sector Workshop, feedback to the relevant projects (GAIA-CLIM, QA4ECV)

Connection to ENEON:
Enable a better relation remote sensing / in-situ sector
Finding gaps in existing in-situ or airborne measured data.

Connection with GEO – GEOSS:
Provide feedback about missing data

Stakeholder Profile
EO service and data providers, addressed observation networks.

2.3 In-situ network integration into the GCI challenge

This task will help the integration of existing EO networks in ENEON to the GEO Discovery and Access Broker (DAB) for complete integration to GEOSS. E.g. ENEON will help CZEN to integrate to GEOSS, as it provides particular strengths to deliver GEOSS priority areas of environmental factors for human wellbeing, predicting climate change, managing water resources, and managing terrestrial ecosystems.

Theme (SBA):
Cross-cutting

EV used:
All

Addressed gap:
Lack of interoperability for discovery, access and use of data from new systems (ENEON networks) with the GEOSS Common Infrastructure (GCI).

Types of Outcome:
Enhancement of the GEO DAB with the development of new interoperability arrangements to enable the GCI to interact with new systems from ENEON.

Data (and metadata) produced:
N/A

Spatial and temporal extent:
N/A

Open Research Data pilot collaboration:
N/A

Standards that are going to be used:
The complete list of standards supported by the GEO DAB is available at http://www.geodab.org.

Mean of Dissemination
Results of this task (e.g. integration of new systems with the GEO DAB) will be presented in conferences and in relevant GEOSS-related meetings and workshops.

Connection to ENEON:

ENEON is working in the level of dialog and cooperation and facilitates that; later, the GEO DAB will become the practical infrastructure that connects the data produced by the networks to GEOSS.

Connection with GEO – GEOSS:
This is the whole purpose of this task: to connect data services to GEOSS through the GEO DAB.

Stakeholder Profile:
Data providers, the GEOSS Web Portal, GEOSS users and GEOSS Client Application developers.

2.4 Remote Sensing Private sector challenge

In this task EARSC will launch the competition "European EO product of the year" which encourages the use of open data from GEOSS (Global Earth Observation System of Systems)

European Earth observation companies understand how important it is to be creative, innovative, and inventive in order to react to the rapid evolution in the sector. The exponential increase in data available from all sources promises radical change and the EARSC industry competition will recognize this. For the first year, under the umbrella of the ConnectinGEO project, it will reward a company which has developed the most innovative product integrating an element of open data ideally discoverable through the GEOSS broker services.

Companies are invited to show their interest before 27th November 2015 to secretariat@earsc.org. During the 1st week of December a first WEBEX will be organized where companies may be briefed on which types of data are available through the GEOSS – GCI Factsheet (Recipe) and making use of the GEOSS Discover Access Broker (Search & Discovery API). Partners in the ConnectinGEO H2020 project will inform via WEBEX to potential entrants on the possibilities which are presented.

The competition will run over a 6 month period (December 2015-May 2016) during which time they may adapt an existing product, develop a new product or simply promote one they have already in their catalogue. Companies will be asked to provide a short summary of the results (Report should not exceed 2 pages) which will be used as statement for the jury.

This year's award will be announced during the EARSC annual cocktail where the winner of the EARSC "European Earth Observation company of the year" is also revealed.

Criteria: eligibility requirements & metrics

Any commercial product integrating an element of open data resources (ideally data discoverable by GEOSS Discover Access Broker). Note: Copernicus data is eligible.
Report on the findings (not exceed 2 pages).

Explain what type of innovation product the company offers using open data and the degree to which the product depends on the open data.
Describe the challenge: What problem this product will solve/what solution will this provide?
Companies should explain the circumstances surrounding the development of this new product.

Expected impact and clients to address

Timing:

Interest: 27th November 2015
1st WEBEX: 1st week December 2015
Intermediate WEBEX: guiding the companies in February 2016
Dead-line entries: 15th May 2016
Selection: the files will be judged by the jury to select the overall product winner (Period May15th-May 31st) Announcement: EARSC cocktail late June 2016 in Brussels

Theme (SBA):
Cross-cutting

EV used:
All

Addressed gap:
Lack of involvement of companies (ie private sector) in the activities of GEO. Sustain research results through commercial exploitation not yet applied.

Types of Outcome:
More sustainable research results as new algorithms and products are translated into commercial products.

Data (and metadata) produced:
Depending on what the participants develop.

Spatial and temporal extent:
Depending on what the participants develop.

Open Research Data pilot collaboration:
Companies are requested to develop the most innovative product open data ideally discoverable through the GEOSS broker services.

Standards that are going to be used:
Catalog service for the Web (CSW) and data access standards.

Mean of Dissemination

- EARSC media tools (EARSC website, EARSCportal, EOmag) and distribution to our network or companies (membership) but also stakeholders competition announcement
- Webex
- EARSC cocktail (Winner announcement)

Connection to ENEON:
The ENEON is a key component to bring the private sector into contact with research networks.

Connection with GEO – GEOSS:

Any commercial product integrating an element of open data resources (ideally data discoverable by GEOSS Discover Access Broker) is eligible.

GEOSS Common Infrastructure (GCI) and GEO web portal (GWP)

Stakeholder Profile
EO Service providers including satellite operators, value adding companies and GI companies.

2.5 Interdisciplinary cooperation on the food-water-energy nexus (FWEN)

At the first ENEON Workshop, this task was discussed. There were three themes proposals:

1. Urban coasts under climate change and sea level rise
2. Resilient communities
3. Food-water-energy nexus.

The participants selected the food-water-energy nexus (FWEN) as the theme for the task.

Under this theme, the task will apply the ConnectinGEO methodology to indicators related to this FWEN and explore to what extent ENEON provides an environment that supports a transdisciplinary nexus approach to a complex and societally highly relevant issue. Specifically, the task will conduct the following activities:

- Use the observation inventory and the gap analysis to identify potential stakeholders who can benefit from collaboration across disciplines and domains represented in ENEON and develop a compelling argument for the prioritization of FWEN-related observations and products based on results from the work packages.

- Determine stakeholders, develop plans for further research and investigate regional, national and international funding opportunities to cover the gaps identified.
- Analyze the cost saving potential of collaborations across previously segregated disciplines and domains

In addressing the FWEN under global and climate change, the task will specifically consider indicators related to food, water and energy security. The recent very rapid changes in the phosphate and nitrogen cycle (Figure x) associated with food production will also be considered. Taking into account that the rapidly increasing energy usage during the last roughly 100 years enabled the population growth that is now threatening food and water security, the task will actually have to consider the Energy-Population-Food-Water-Nexus (EPFWN). The nexus approach will help to understanding the interdependencies between energy usage and availability, population growth, global change, food security, water security, and the global boundaries. Specific questions to be consider are:

- How can collaboration and coordination through ENEON help to inform about the FWEN and impacts in Europe?
- Which SDGs relate to the FWEN and which are the relevant indicators?
- Can ENEON help to quantify the indicators for these SDGs?
- What ENEON products could support policy making that takes a nexus perspective?

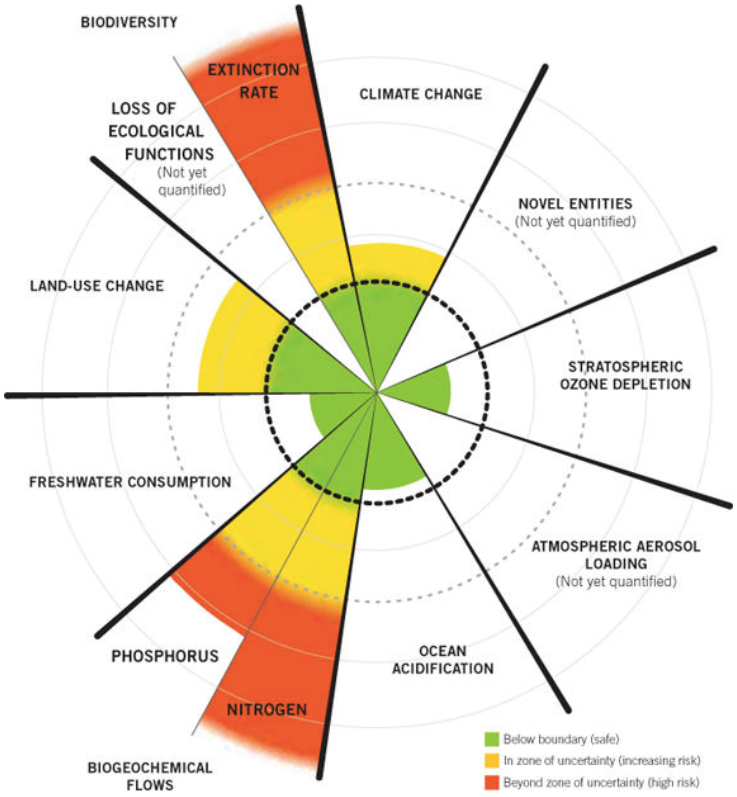

Figure x: Global boundaries of the "safe operating space for humanity" and the extent to which these boundaries have been crossed. Note that the biogeochemical flows for nitrogen and phosphorus have crossed the boundaries by far and are threatening both the Earth's life-support system and food and water security. From Rockstrom and Klun (2015).

Relevant SBAs: Agriculture, Water, Energy

EV used:
The EVs to be used will be determined using the ConnectinGEO methodology. The societal goals and targets will be extracted from the Sustainable Development Goals (SDGs) accepted by the United Nations. Based on the associated indicators, a specific set of EVs for the FWEN will be established. To the extent possible, these EVs will be extracted from the SBA-specific EVs.

Addressed gap:
The main gaps to be addressed in this challenge include the lack of collaborations across disciplines and domains, and a gap in GEOSS related to theme-based approaches to data and product discovery. A particular gap is that linking industry and science communities. Another gap relates to links between different observing networks required to address a complex issue such as the FWEN.

Types of Outcome:
The main outcome will be a report characterizing the gaps that hamper the use of GEOSS in addressing complex issues and proposing actions to address these gaps. The report will identify the stakeholders of the FWEN who would be impacted by the identified gaps and who would benefit from actions addressing the gaps. The aim is to quantify the societal benefits and to estimate the benefit-to-cost ratio. A particular focus will be on the potential contributions of ENEON in closing the gaps. The report will also describe the EVs relevant for the FWEN and assess to what spatial and temporal extent data for these EVs is available through ENEON.

Data (and metadata) produced:
An attempt will be made to identify at least one product that directly relates to the FWEN and that could be produced based on data provided by ENEON members. Prime candidates are quantification of SDG-related indicators that are relevant to the FWEN. The EVs related datasets will be identified and an inventory of these datasets will be compiled.

Spatial and temporal extent:
It is planned to focus on Europe as the test region. Temporally, the project period is the main timeslot to be considered. However, for the quantification of indicators, it may also be consider to extend the time window into the past.

Open Research Data pilot collaboration:
N/A

Standards that are going to be used:
N/A

Mean of Dissemination
The result of the challenge will be presented at the second ENEON plenary workshop in October 2016. The challenge will be documented in a report to the EC, and the scientifically relevant parts will be published in scientific papers.

Connection to ENEON:
ENEON is a key component bringing together the networks required to address metrics-related aspects of the FWEN. Moreover, the goal is to identify related gaps in ENEON and to propose actions for a remedy of these gaps.

Connection with GEO – GEOSS:
In the post-2015 period, GEOSS has a dedicated focus on supporting the SDGs. The challenge directly relates to this goal and will provided important feedback to what extent GEOSS is prepared to inform complex societal issues associated with the SDGs.

Stakeholder Profile
The stakeholders for this challenge include those monitoring the indicators for SDGs related to the FWEN, and those engaged in planning actions to make progress towards these SDGs. The EO networks providing data for EVs required to quantify the indicators are also stakeholders of the FWEN. Researchers studying the FWEN as well as funding agencies at national and international levels providing financial resources for EO networks, research, and monitoring relevant to the FWEN belong to the stakeholders, too. In particular, funding agencies will be interested in cost savings and increased efficiency that may result from the actions proposed by the challenge.

3 Analysis of the commonalities in the challenges

The challenges are relatively heterogeneous but there are some commonalities and gaps that can be detected so we can know what we can expect and the limitations of the approach. This summary has been done by concentrating the different aspects reported by the challenges in a table and analyzing it. (See Annex A Summary table).

Relevant SBAs:
Many challenges will depend on climate and weather. Two challenges will focus on energy (1st and 5th) and two in land use and agriculture (2nd and 5th). Two of them will consider all the SBAs (3rd and 4th).

EVs used:
The 2nd and 5th will consider the emerging agriculture EVs and also will deal with energy new EVs. 5th will work on water EVs.

Addressed gaps:
Data access and data semantics harmonization are two common gaps addressed by several of the challenges. The first and last will also address lack of collaboration. It is unclear if gaps in Earth observations variables and techniques will be addressed. Perhaps in the 1st anf 5th.

Types of Outcomes:
Foreseen outcomes are heterogeneous: in the 1st outcomes are SOS services and Metadata, in the 2nd harmonization in in-situ – RS, in the 3rd a better DAB, in the 4th the industry as a stakeholder and in the 5th gaps, remedies and costs for combining themes.

Data (and metadata) produced:
Data and metadata will be only produced in the 1st challenge.

Spatial and temporal extent:
Planned extend is Europe on the world.

Open Research Data pilot collaboration:
1st and 4rt will consider participation in Open Research Data pilot.

Standards that are going to be used:
Catalogue CSW, O&M and SOS will be the most used standards.

Mean of Dissemination:
Workshops in ConnetinGEO project framework or organized by others. Other means of dissemination are the DAB, the EARSC email lists, and scientific papers.

Connection to ENEON:
The connection with the ENEON network has not yet been recognized by the responsible of the tasks.

Connection with GEO – GEOSS:
Mostly by means of the DAB and the SDG.

Stakeholder Profile:
Stakeholder collectives depend on the challenge and are heterogeneous. This will ensure a good impact in different collectives.

4 Partners involved in each task

- The industry energy challenge **ARMINES, 52N**
- In-situ data compatible to satellite mission data challenge **S&T**
- In-situ network integration into the GCI challenge **CNR**
- Remote Sensing Private sector challenge **CREAF, EARSC, S&T**
- Interdisciplinary cooperation on the FWEN **CREAF, 52N, IIASA, IMT, Tiwah**

Annex A Summary table

		Theme (SBA)	EV used	Addressed gap	Types of Outcome	Data (and metadata) produced	Spatial and temporal extent	Open Research Data pilot collaboration	Standards that are going to be used	Mean of Dissemination	Connection to ENEON	Connection with GEO – GEOSS	Stakeholder Profile
2.1	The industry energy challenge	Energy	Surface Solar Irradiance (SSI) Wind speed.	Data models, in in-situ measurements, in collaboration	SOS, Metadata	SSI data and metadata	World, years	Yes in principle	SOS, O&M, SensorML 19115	Stakeholders workshop, AIP-8, Scientific papers	MACC, CAMS	Energy SBA AIP8 GEOSS-DAB	SMEs in Renewable Energy Business Big Players in Energy/Electricity Researchers Weather & Climate Networks.
2.2	In-situ data compatible to satellite mission data challenge	Climate, Land	Crop growth or ice sheets, traces of gases	Compatibility of in-situ and RS data access and data standards	Gaps in in-situ RS EO in-situ extension proposal	N/A	World, long term	N/A	N/A	Workshops, Other project connection			EO service and data providers Addressed observation networks.
2.3	In-situ network integration into the GCI challenge	All	All	Data access in GEOSS	Better DAB	N/A	N/A	N/A	Catalogue, SOS, etc.	Integrated in the GEOSS DAB, Workshop		GEOSS-DAB	Data providers GEOSS Web Portal, GEOSS users GEOSS Client Application developers.
2.4	Remote Sensing Private sector challenge	All	All	Private involvement	Research moves to industry		N/A	Use of GEOSS DATA core data	Catalogue and data access	EARSC email lists and communication	Companies in the ENEON	GEOSS-DAB	EO Service providers including RS operators value adding companies and GI companies.
2.5	Interdisciplinary cooperation on the food-water-energy Nexus	Agriculture, Water, Energy	New Agriculture and energy. Emerging Water	Lack of Collaborations	Gaps, remedies and costs		Europe	N/A	N/A	Scientific Papers	Work Group	The SDGs	SDG. Food, energy Agriculture networks