



## D2.1 Methodology and process for evaluation of relevance of specific observation infrastructure

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## **Executive Summary**

EGIDA WP2 aims to actively engage and incorporate Science and Technology communities in developing GEOSS by providing direct support to the GEOSS Science and Technology Roadmap concerning the GEO Task ST-09-01, specifically activities 1c (Assess the requirements for continuity and long-term monitoring) and 1e (Respond to Science and Technology needs and priorities). The work described in this deliverable (D2.1) has been undertaken within EGIDA Work Package 2: Support of GEO Task ST-09-01 and is related to the former task.

Earth system sciences require long-term monitoring by Earth Observation systems and this is the role for the GEOSS. Growing the GEOSS requires the identification of new GEOSS components from outside GEO. This deliverable (D 2.1) has therefore been generated to assess existing methodologies and processes for evaluation of the relevance of specific observation infrastructure to the GEOSS and develop a new one for the science and technology community, in co-ordination with GEO STC and Task ST-09-01. It covers the data processing, product generation and interoperability associated with such systems. Existing processes are assessed and the criteria for a new process aimed at the science and technology community are spelt out, as well as the steps required to nominate, describe, assess and decide on the relevance of proposed new components. Finally, a candidate EO system is identified that is ready to test the proposed process.

Contributing organisations: NERC-BGS, CREAM, DMI, HZG, IIASA



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**EGIDA, Coordinating Earth and Environmental cross-disciplinary projects to promote GEOSS**

FP7 Project nr 265124

## **Acronyms and Abbreviations**

Abbreviation	Name
ADC	(GEO) Architecture and Data Committee
EC	European Commission
EO	Earth Observation
EU	European Union
FP7	Seventh Framework Programme
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GMES	Global Monitoring for Environment and Security
ST-09-01	GEO Task ST-09-01: Catalysing Research and Development (R&D) Funding for GEOSS
ST-09-02	GEO Task ST-09-02: Promoting Awareness and Benefits of GEO in the Science and Technology Community
S&T	Science and Technology
SBA	Societal Benefit Area
STC	(GEO) Science and Technology Committee
T	Task
WP	Work Package



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## 1. Introduction

As with several other deliverables in WP2, the motivation for this methodology results from the fact that a considerable part of Earth Observation infrastructure<sup>1</sup> is developed and deployed in the frame of research projects with little or no perspective for sustained operation, funding in the research domain and often inadequate data integration and interoperability. At the same time, the Earth system sciences often require long-term monitoring by Earth Observation systems. The continued availability of key observation infrastructure is therefore essential for the full exploitation of its scientific and societal benefits. However, many of the Earth Observation system components including those registered as GEOSS components are likely to be discontinued at some time, unless a framework is developed for their sustained operation. As part of that framework, new components of observational infrastructure will be proposed in order to expand the GEOSS, or to replace a discontinued component, and so we need a way to assess the relevance of such components to the goals of GEOSS.

One of the main concerns is the necessity to evaluate the observational infrastructure within the context in which the observation infrastructure will be used (context-based evaluation). This comes from the fact that the observation infrastructure may work well within a specific context and under certain conditions but interoperability may be limited and reduce the range of circumstances within which the component could be used. In addition, the methodology and process may be constrained by technical issues (for the experimentation and exploratory stage for which the process is intended) or by business or legal issues (for the product evaluation and selection stage) and these must also be considered. It is essential that the evaluation criteria be well defined to ensure that the observation infrastructure can be evaluated in the most efficient manner.

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<sup>1</sup> Observation infrastructure in this context includes both datasets and observing systems



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## 2. Methodology

WP2 looked at current mechanisms for candidate Earth Observation systems to be brought into GEOSS and assessed the suitability of such processes for the range of potential observational infrastructures, given the contexts in which they will be used. The GEOSS Component and Service Registry includes a mechanism to register components and have them approved by the GEO Secretariat, to register services and associate them with GEOSS-recognized standards and special arrangements for implementations using non-recognized approaches. It is not specifically focused on observation systems. Then, of course, Member States sometimes offer new systems through Plenary and these are typically welcomed. Finally, Participating Organisations often represent a specific Earth Observation system (e.g. GCOS) and bring it to the table by joining as POs.

There are a perhaps couple of other relevant mechanisms, one being the Architecture Implementation Pilot process whereby new elements of the Infrastructure are proposed and if selected piloted; at the moment, this tends to be focused on the GCI but it could perhaps be used to develop other parts of the system. The other is the process used to populate the GEOSS Data-CORE with appropriate datasets, which could be used to bring in the observations from an EO system that is currently outside the GEOSS but is focused on the datasets rather than the observation systems.

None of these mechanisms are focused on Earth Observation systems that individual scientists might develop and run that could be a contribution to the development of GEOSS from the science and technology community. So a separate approach could be justified. A possible methodology and process were developed within the WP2 team that was then consulted on in detail through a dedicated WP2 Workshop held in Madrid in January 2012. This workshop followed consultations in the margins of GEO, for example at the Beijing and Istanbul Plenary meetings in 2010 and 2011 and through a Linked-in Group and email discussions. These consultations involved organisations from a range of aspects of Earth Observation including data users and data providers who are directly involved in GEO, to give a broad view of considerations relating to evaluation processes.



### 3. Observation Infrastructure

GEOSS already contains a considerable number of specific observation infrastructures (<http://www.geosregistries.info>) but, although the list is vast and continuing to expand, it is far from complete. Observing systems already within GEOSS cover all 9 Societal Benefit Areas (SBAs): Agriculture, Biodiversity, Climate, Weather, Disasters, Ecosystems, Energy, Health and Water. However, coverage is uneven; there are more concerned with Disasters, Climate and Water, for example, than there are with Agriculture or Health.

Examples of current observing systems, many of which are already registered: EOS (NASA-NOAA), GCOS (Climate), GTOS (Terrestrial), GOOS (Ocean), AWOS (Automated Weather), CeNCOOS (Central and Northern Californian Ocean), SeaCOOS (South East U.S. Atlantic Coastal Ocean), Arctic ROOS (Arctic Regional Ocean), IOOS (U.S. Integrated Ocean), GLOS (Great Lakes), AOOS (Alaska Ocean), EuroGOOS (European Global Ocean), SCCOOS (Southern Californian Coastal Ocean), NANOOS (Northwest Association of Networked Ocean), ASOS (Automated Surface), IGOS (Integrated Global), GGOS (Global Geophysics), SeaDataNet (Pan-European for Ocean and Marine), COCOS (Coordination Action of Carbon), AEGOS (African-European Georesources), GCOOS (Gulf of Mexico Coastal Ocean), ICOS (Integrated Carbon), GOMOOS (Gulf of Maine Ocean), PacIOOS (Pacific Islands Ocean), IBI-ROOS (Iberia-Biscay-Ireland Regional Operational Oceanographic), GLOOS (Global Sea-Level), SOOS (Southern Ocean), CariCOOS (Caribbean Coastal Ocean), WHYCOS (World Hydrological Cycle)

To further populate the registry there is a need to identify the candidate observation infrastructure and encourage submission to the GEOSS registry. However, the desire to further populate the registry must be balanced by an evaluation process through which GEO can assess, for example: the quality of data provided by the observational infrastructure; the adequacy of documentation on product generation any assurances of product repeatability and continuity; and interoperability of the observation infrastructure with the existing components.



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At the same time, there must be a clear incentive for the observation infrastructure to want to become registered with clear benefits to the both the observation infrastructure and to the wider scientific community. Possible benefits might include wider recognition for and access to the observational infrastructure in question, its integration with other infrastructure to increase its utility for science and the possibility that a funding agency may develop an interest in securing the continuity of the observations that it makes.

#### **4. Relevance of Specific Observation Infrastructure**

In assessing the relevance of a candidate system, it is important to start by asking whether there is a need within the GEO framework for the observation infrastructure. This is immediately challenging; what is relevant for one person, organisation or SBA may not be relevant for another. Each SBA and Community of Practice would need to be approached with information on the candidate observation infrastructure to assess if it meets scientific priorities and user needs in their topic. A product designed for a specific purpose in one SBA might be useful to other SBAs, perhaps after some modification. GEO would need to develop a set of criteria by which to judge the relevance. Some important criteria might be:

- Scientific and technical excellence
- Potential impacts within SBAs
- Fit to established Earth Observation scientific priorities (see D2.7)
- Availability of resources to support the infrastructure
- To which SBA or Task is the observation infrastructure most applicable?
- Does the observation infrastructure meet the needs of that SBA?
- Is there a potential for the observation infrastructure to add value elsewhere?
- Is the effort involved in bringing the observation infrastructure in worth the value?



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## 5. Other Evaluation Criteria

As well as assessing the observations' ability to meet GEO requirements in one or more SBA, during the evaluation phase there are a set of criteria that must be met to ensure the quality and appropriateness of the data products to meet the standards for GEOSS. Some of the main criteria are the following.

### **5.1. Data Processing**

Have any data standards been applied and/or met during processing? What kind of quality assurance has been performed? Does the processing stream involve elements that are specific to an organisation? Does this raise any related legal or IPR issues?

### **5.2. Product Generation**

Is there documentation on product generation and is the documentation complete? Can the product be easily repeated? What happens if the data source is terminated? Can the same methodology for product generation be used on an alternative source?

### **5.3. Interoperability**

Does the product meet recognised standards applied in GEO?

### **5.4. Continuity**

Is the product secure? What is its lifespan? Is its collection and generation well-funded and within a stable management structure? Is there another source of data available to make the product if the current data source fails? Is a replacement source scheduled to ensure that the product can be maintained after its current shelf-life?



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## 6. Process for Evaluation

One can envisage a number of stages in a process to evaluate the relevance of observational infrastructure to GEOSS. Once a scientist or organisation identifies a candidate observation infrastructure (identification phase), then they need to provide enough information on the system to support its evaluation (information collection phase). In a screening or analysis phase this information would be judged against the criteria established for relevance to GEOSS. Some of these criteria concern science and applications and others are more to do with standards (assessment phase). It is quite possible that the assessment would need to be distributed across several GEO bodies; for example, an SBA to assess relevance to their EO priorities, a Community of Practice for user testing and one or more Board for more generic criteria. There could also be others who needed to be consulted in order to support an assessment, such as GEO Members and POs, and an expert opinion may be sought if necessary.

In the decision phase, the results of the assessment would be collated and a view expressed on relevance within the most appropriate GEO body; for a minor system, of local relevance, this might be even a Task or could be a Board, whereas a major system of global significance would perhaps be better handled by making a recommendation to Plenary for decision there. Feedback would then be sent to the nominator and to those within GEO responsible for bringing the system into GEOSS.

This process has strong parallels to that identified in D2.7 on communicating EO science priorities within GEO. It would lend itself to a web based nomination service in the same way and the process might look very similar to that spelt out in D2.7. One key difference is that, unlike science priorities, there is no pressing reason to make this process conform to a specific timetable. Whereas strategizing is typically done on a cyclical basis, a new observation system could be ready for integration into GEOSS at any time. Consequently this process is likely to be open ended and without deadlines.



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## 7. Candidate Observing System

EGIDA Partner HZG is involved with the Regional Coastal Observing System, which is currently in its integration phase and combines different types of data and sensors (satellite, in situ, ship-borne measurements (installed on ferries), buoys, HF radar, model-data, etc.). A big challenge for this system is how to move it from a research into a more sustainable operational mode, which can then contribute to GEOSS. HZG have spoken to responsible data managers, and they would be interested in contributing this observing system as a candidate to test the procedure.

## 8. Summary

Current processes in GEO for nominating GEOSS components are described and a new process proposed for the nomination of components of Earth Observation infrastructure by individuals within the science community. This includes an assessment of the criteria that such nominations might be judged against as well as the bodies within GEO likely to be involved in such assessments. A nomination system is likely to be open-ended and operate without deadlines and is amenable to implementation through a web service. A candidate system is identified that is willing to be used to test any such system.