GROUP ON EARTH OBSERVATIONS

GEO-VIII

16-17 November 2011

Second Evaluation of GEOSS Implementation

Document 6 (Rev1)

As accepted at GEO-VIII

Second Evaluation of GEOSS Implementation

The Plenary is requested to take note of the Report of the Mid-term Evaluation of GEOSS Implementation (Enclosure 1), as complemented by the Report Transmittal Letter from the M&E Working Group co-chairs to the Executive Committee (Enclosure 2). The revised document includes, as Enclosure 3, the Executive Committee managerial response to the Report:

1 INTRODUCTION AND BACKGROUND

The overall approach to GEOSS Monitoring and Evaluation, approved by GEO-VI, is contained in the "GEOSS Monitoring and Evaluation framework Document", and constitutes the basis for the performance of yearly evaluations. The first evaluation, the "mid-term assessment", took place in 2010 and the process will continue until the final evaluation planned in 2015.

For each of these subsequent evaluations a dedicated Evaluation Team will be appointed, with the responsibility of conducting the evaluation and producing the corresponding report.

The purpose of the second evaluation, endorsed by GEO-VII, was to assess the progress towards GEOSS implementation in the areas of Architecture and Data Management (ADM), having as the reference the corresponding GEOSS strategic targets for 2015..

The Evaluation Team members were nominated by GEO principals.

The evaluation process was initiated at the Monitoring and Evaluation meeting, held in Geneva on 17-19 November 2010 and the Evaluation Team provided its final report on June 16, 2011.

2 SECOND EVALUATION OF GEOSS IMPLEMENTATION

The Evaluation Team developed the detailed evaluation plan for the second evaluation and, in accordance with the approved M&E Framework, the plan was reviewed and approved by the M&E Working Group.

The Evaluation Team then proceeded in implementing the Plan, starting with the collection of the information on which to base analysis and assessment, using different sources:

- Review of GEO Documents;
- Assesment of GEO Work Plan tasks;
- Literature Review;
- Key informant Interviews;
- Surveys;
- A test case.

To synthesize and aggregate the results from the analysis of the data collected, the Team adopted the concept of Figures of Merit (FOM), as numerical metrics to describe the progress of GEOSS ADM along several complementary axes, as follow:

- Completeness of Function;
- Sustainability;

- Operational Availability;
- Content Availability;
- Usability;
- Data quality assurance;
- Technical Currency;
- Fit for purpose;
- System Maturity Level.

Before the official issue of the report, the final draft has undergone a factual review by the GEO Secretariat Experts and has been provided to the M&E Working Group that, in its meeting from 1 to 3 June, reviewed the report and wrote the formal transmittal letter to the Executive Committee.

In accordance to the agreed timeline, the Evaluation Team issued the final evaluation report on June 16th . The Team also issued a "Lessons Learned Document" that has been reviewed by the M&E Working Group and is being considered in the course of the design for the third evaluation.

Enclosure 1) contains the Report of the Second Evaluation of GEOSS Implementation, Enclosure 2) the letter with which the M&E Working Group co-chairs transmitted the Report to the Executive Committee.

3 EXECUTIVE COMMITTEE RESPONSE TO THE REPORT OF THE SECOND EVALUATION OF GEOSS IMPLEMENTATION

The Report of the Second evaluation of GEOSS implementation was presented to the Executive Committee at its 22nd meeting in July 2011 and thoroughly discussed. It is the general view of the Executive Committee that the recommendations contained in the Report should be addressed by GEO at the highest level.

The Executive Committee has elaborated, in accordance to the procedure approved by GEO-VI, a managerial response, outlining the lines along which the recommendations should be implemented, (Enclosure 3).

ENCLOSURES

1. Report of the Second Evaluation of GEOSS Implementation;
2. Report Transmittal Letter from the M&E Working Group co-chairs to the Executive Committee;
3. Executive Committee response to the Report of the Second Evaluation of GEOSS Implementation.

ENCLOSURE 1

REPORT OF THE MID-TERM EVALUATION OF GEOSS IMPLEMENTATION

(pdf document attached)

GEOSS

Evaluation of Architecture and Data Management

June 2011

GROUP ON EARTH OBSERVATIONS

June 2011

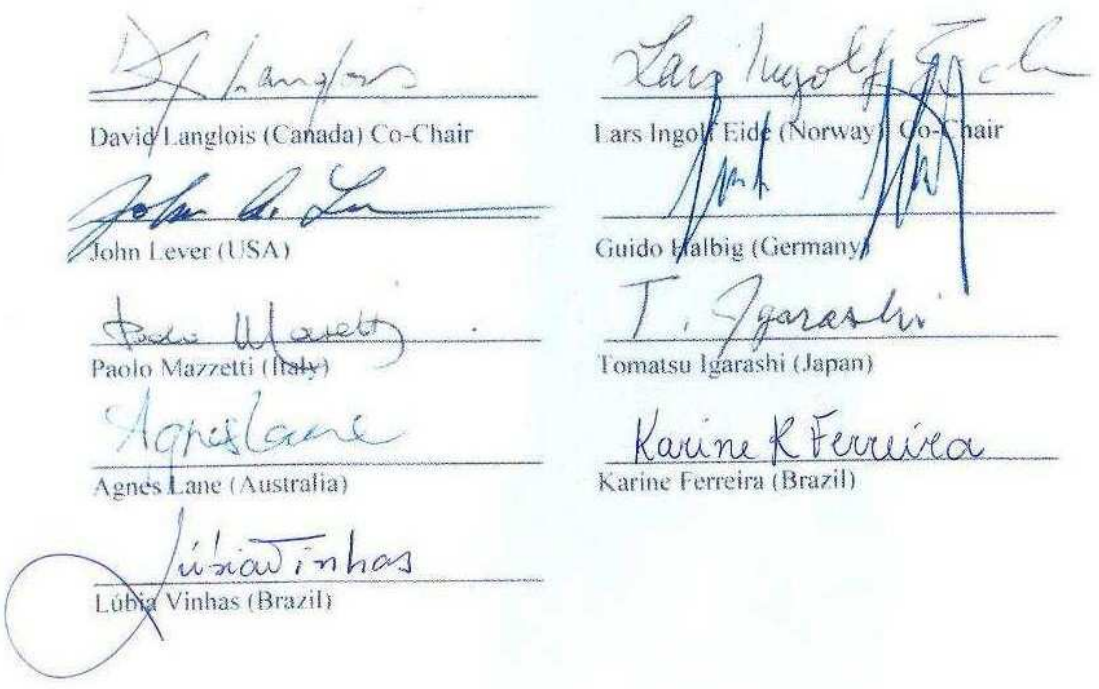
The GEOSS Architecture and Data Management Evaluation was performed under an aggressive schedule in order to be available for the meeting of the GEO Executive Committee in July 2011, in time to be submitted, together with the Executive Committee managerial response, to the GEO VIII Plenary in November 2011 in Istanbul. The Evaluation Team and the GEO Secretariat responded with grace and dedication to meet these demands, and the report that follows is a testimony to their efforts.

The evaluation was the first of five evaluations recommended by the Monitoring and Evaluation Working Group, after the Midterm Evaluation conducted in 2010 and provides an understanding of the state of affairs with respect to GEOSS Architecture and Data Management.

As with many other parts of GEO, the Evaluation Team was comprised of volunteers from Member Agencies and Participating Organizations. In addition to their hard work and expertise, team members were distinguished by their good humour and good will. I think I can speak for them in all sincerity in reporting that we enjoyed the experience and in meeting and working with one another.

Given the importance of evaluation in ensuring the success of GEO and GEOSS, and the positive experience this evaluation has been, I encourage other members of the Earth science community to volunteer for subsequent evaluations.

Sincerely,



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Acknowledgements

The Architecture and Data Management Evaluation Team thanks the GEOSS Monitoring and Evaluation Working Group, especially its co-chairs Craig Larlee (Canada) and Charles Baker (USA), for their support and direction; the GEO Secretariat for hosting us during our meeting in Geneva; Environment Canada for hosting us during our meeting in Ottawa; Giovanni Rum and Hendrik Baeyens of the GEO Secretariat for their invaluable secretariat and technical support; the GEO Community for providing insight into GEOSS Architecture and Data Management; those who deigned to be interviewed and provide us with their insight and observations, those who responded to our surveys; and the National Meteorological Service of Germany for hosting us during our final meeting in Offenbach.

Acronyms

ADM Architecture and Data Management

AIP Architecture Implementation Pilot

CEOS Committee on Earth Observation Satellites

CoP Community of Practice

ESIP Earth Science Information Platform

FOM Figure of Merit

GCI GEOSS Common Interface

GEO Group on Earth Observations

GEOSS Global Earth Observation System of Systems

IEEE International Society of Electrical and Electronics Engineers

ISRSE International Symposium on Remote Sensing of Environment

IT Information Technology

M&E WG Monitoring and Evaluation Working Group

NAVMETOCCOM Naval Meteorology and Oceanographic Command

NOOC Naval Oceanography Operations Command

SBA Societal Benefit Area

SIF Standards and Interoperability Forum

TA Transverse Area

TTM Target / Task Matching

WMO World Meteorological Organization

1. Executive Summary

1.1. Purpose

This report provides the results of a second evaluation of the Global Earth Observation System of Systems (GEOSS). Based on the Mid-Term Evaluation, the Monitoring and Evaluation Working Group recommended the assessment in 2011 of the progress towards GEOSS implementation in the areas of Architecture and Data Management (ADM). The GEO Plenary, while endorsing the Mid-Term Evaluation, accepted this recommendation and established the 2011 Evaluation Team. In particular this report assesses the ADM area for a comprehensive strategy for the "monitoring of performance against defined requirements and intended benefits" as stated in the GEOSS 10-Year Implementation Plan in the 10-Year Implementation Plan Reference Document and the GEOSS Strategic Targets and as further defined in the GEOSS Monitoring and Evaluation Framework Document. This evaluation is the first in a regular cycle of evaluating the implementation of GEOSS by assessing progress made towards achieving strategic targets in Societal Benefit Areas (SBAs) and Transverse Areas (TAs). The primary audience for this evaluation report is the GEO Plenary and Principals of GEO Members and Participating Organizations. The final report will be made available to this audience through the normal channels of distribution of Plenary documents.

This evaluation did not specifically address the possible value added by the GEOSS or other topics relevant to the GEOSS in general. Such topics were partly covered in the Mid-term Evaluation, and the Evaluation Team expects that the value added question will be taken up during the evaluation of the SBA's. However, many key informants expressed views and these have been summarized in the report.

1.2. Overview

The evaluation of the GEOSS Architecture and Data Management (ADM) took place over a period of seven months, from November 2010 to May 2011. The team was comprised of members from Japan, Australia, South Africa, Italy, Germany, Norway, Brazil, the United States and Canada. The evaluation team met in person three times during the seven month period and conducted weekly teleconferences. The principal data gathering instruments included surveys, document reviews, and a set of formal interviews. These data gathering instruments were supported by other analysis as was deemed necessary by the evaluation team. The evaluation team Co-Chairs reported back to the Monitoring and Evaluation Working Group twice during the evaluation, and once again upon the preparation of its findings and recommendations.

1.3. Approach

The following were the principal sources of data and information that were used to answer the evaluation questions. Not all sources were used for every question; however, multiple sources were used wherever possible as a control against the inherent biases of any particular source or method (triangulation).

Review of GEO documents

Documents that were reviewed included all GEO foundational documents, e.g. Ministerial declarations, the *GEOSS 10 year Implementation Plan* and the *10 year Implementation Plan Reference Document*, *the GEOSS Strategic Targets*, all Work Plans and Task Sheets, the *GEOSS Roadmap*, Progress Reports, meeting reports from Plenaries, Executive Committee and other GEO Committees, and other documents as required.

Key informant interviews

Interviews were conducted with a sample of: GEO Secretariat staff (past and current), members of GEO Committees, leads for GEO Tasks, non-lead participants in GEO Tasks, and members of user communities. Interviews were generally used for the qualitative identification of issues and themes rather than as the basis for statistical inference.

Sample surveys of selected communities

Surveys were used as a means for obtaining more representative data than is possible through other means. Web-based surveys were used as a means for obtaining representative data. Although the evaluation team faced severe time and resource limitations, the following three surveys were conducted:

- The main survey, also called ADM survey, was sent to more than 4,000 email addresses provided by the GEO Secretariat;
- The survey was also sent to the participants of the 33rd International Symposium on Remote Sensing of Environment (ISRSE) in Stresa, Italy in May 2009;
- The survey was run through laptops available at the Earth Science Information Platform (ESIP) Conference in Washington DC, USA, in January 2011.

Target/Task Matchup and Task Assessment

As part of the evaluation team's analysis process a "matching" of GEOSS Strategic Targets Outcomes (which will demonstrate success in achieving the Targets - the points following the phrase "This will be demonstrated by..." in the Targets document) vs. Subtasks and Overarching Tasks was undertaken to answer the following question chain from the Question Framework: Are subtasks and overarching tasks (Work Plan) tied to Target outcomes (Strategic Target Document)? (To what extent are the Work Plan tasks reflective of the actions required to achieve the Strategic Targets?) For the Task Assessment (TA) the evaluation focused on the progress made up to 2010 by analyzing GEO VI and GEO VII results. The evaluators who evaluated the "Targets" were also asked to consider Task Assessment. The fundamental question of TA is "To what extent have the tasks/subtasks satisfied the strategic targets?" The evaluators were asked to grade the progress of the nine overarching tasks against the Strategic Targets outcomes and the visions of the Cape Town Declaration.

Literature Review

Team members were asked to search the open scientific literature for technical or policy articles that were relevant to the Architecture and Data Management of

GEOSS. The members reviewed the articles using a review guide from the prior mid-term evaluation. This guide looked for general trends of progress in the implementation of the ADM segment.

Case studies

A test case was undertaken as a means to address questions of ease when accessing a dataset given the current Architecture and Data Management construct of GEOSS. The organization of one of the Evaluation Team members was asked to conduct a test case to evaluate the utility of GEOSS in a simulated, but plausible, application of GEOSS. Members of the organization were asked to envision a particular scenario in which environmental information (e.g. oceanographic, atmospheric) would be needed to support the mission, craft a set of questions/queries to be posed to GEOSS, and then query GEOSS for the desired information. The expected result of the test was used as an indicator of the ability of GEOSS to return the required information and the utility and usability of the GEOSS Common Infrastructure.

In connection with the March 11, 2011, earthquake in Japan, the Evaluation Team asked the Japanese member if decision-makers use GEOSS for any purpose. The GEO home page has a Geohazards Supersite and it is both important and interesting to know how the site and the data are being exploited by the real users.

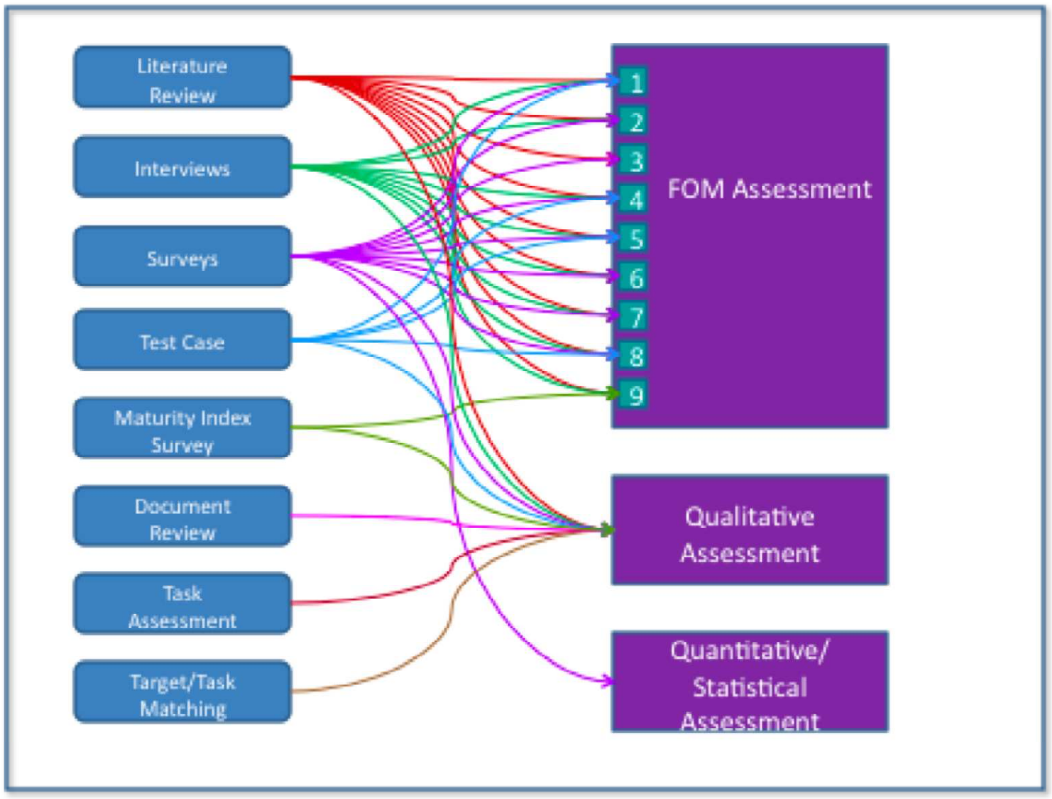
The results from this mini-survey came in too late to be considered for the FOM scores.

Synthesis

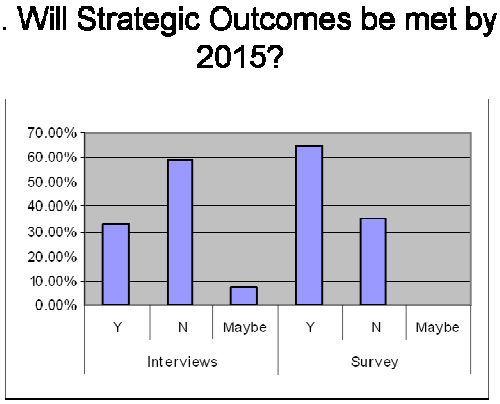
To synthesize and aggregate the indicators from the inquiry vectors described above, the Team adopted the concept of Figures of Merit (FOM) as numerical metrics of the success of the ADM along several complementary axes, as follow:

- Completeness of Function.
- Sustainability.
- Operational Availability.
- Content Availability.
- Usability.
- Data quality assurance.
- Technical Currency.
- Fit for purpose.
- System Maturity Level.

To clarify the approach, the following figure is presented, which represents the logical flow from the inquiry vectors to the activities that produced the information content of this report. To wit, the inquiry vectors collected raw data and information that were used to conduct the FOM Assessment, along with both Qualitative and Quantitative/Statistical Assessments.



1.4. Summary of findings



All subtasks under GEOSS ADM have some relevance to either the Strategic Target Outcomes or the Cape Town Declaration. Generally, the target task alignment is good. Eight of the nine outcomes from the GEOSS Strategic Targets are directly addressed by at least three overarching tasks. The match between tasks and target outcomes varies considerably and the GEOSS ADM tasks would benefit from a structured gap analysis.

Progress made against the outcomes of the overarching tasks seems to be moderate. There are differences in the opinions of some interviewees and the survey respondents on this.

Although there have been individual achievements, the interviewees and the external evaluators appear to have a less positive evaluation of the progress than do the survey respondents.

The moderate progress is substantively different from the ratings of the ADM tasks in the annual Work Plan Progress Reports. In the latter, all but one ADM task were rated with progress very good to excellent in both the 2007-2009 and 2009-2011 Progress reports (the one task was rated as progressing but with need for more effort).

The fifth outcome under Architecture: "Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products" is not directly addressed by any subtask and indirectly by only three subtasks of the 29 tasks and subtasks. This is considered a significant finding, which suggests that there is no concerted activity to do gap analysis and the ADM effort may be proceeding without clear direction.

The high number of answers in the groups "don't know" or "cannot answer" introduces uncertainty into the results. They are also an indication of limited knowledge and experience with GEOSS.

Those who are "experts" see more progress than those who are "users". A test case conducted for the evaluation team by a group of users (subject matter experts in the field of applied oceanography and meteorology) determined that GEOSS "appears to us to be a difficult, time-consuming and non-intuitive system." On the other hand, a response from Japanese earthquake experts to a question asking about the usefulness of the GEOSS Supersite in analyzing the Japanese earthquake of 11 March 2011 elicited praise for the timeliness, accuracy and usefulness of data.

Progress of ADM towards the Strategic Targets outcomes is moderate. Important aspects such as "Completeness of Function", "Operational and Content Availability" and "Usability" are negatively evaluated. Survey results are more positive than interview results. Real use (test case and other evidence) shows negative evaluations and shortcomings in content availability and completeness of function.

The present progress reporting against Tasks, although it uses a standard form, does not allow for a quantitative evaluation of progress. The internal progress reporting appears at times to be more positive than what this evaluation has revealed.

The Architecture Implementation Pilot (AIP) does not seem to be sufficiently open a process to be of value to a larger audience. There are differences between what is reported to the GEO Secretariat against plans and what was found by the evaluation as substantive performance measures, outputs and outcomes.

As a practical tool the GEOSS website seems to be less user-friendly than other web-based search engines, such as Google, Yahoo!, Bing or Dogpile.

The operational availability of the GEOSS datasets was varied. In several instances the database was unavailable for extended periods of time.

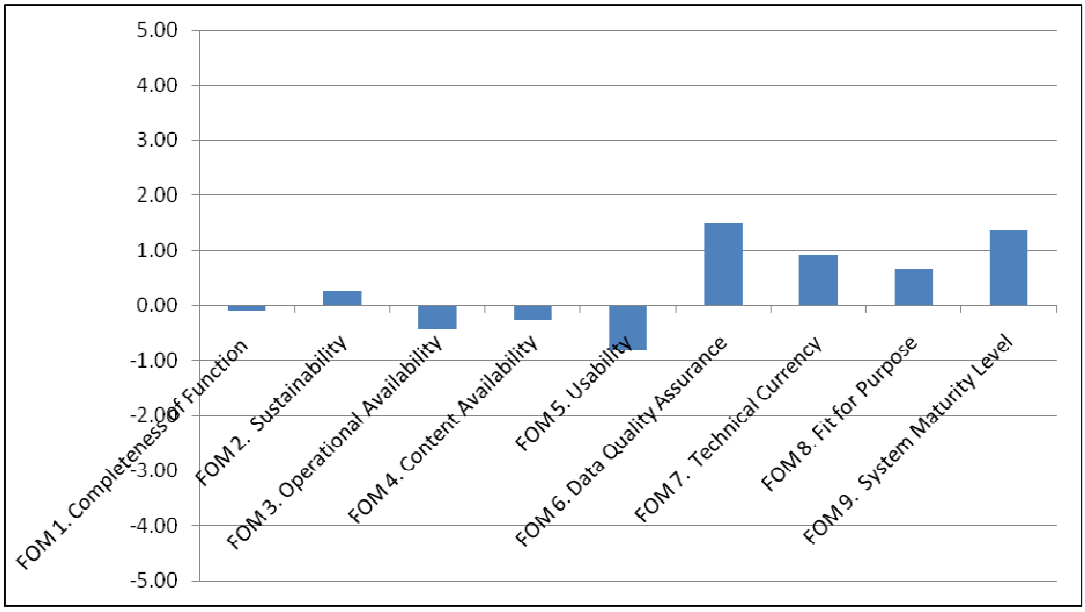
For certain users the Registry has made it easier to find information. Others found it difficult to find information which they themselves had registered.

Technical currency may not be as advanced as some GEOSS community members believe. More work is needed on open standards and open source software.

Data sharing as a GEOSS principle seems to have created a change in mindset, mainly through constant shift of policies by GEO Members and Participating Organizations.

The current opinion of survey respondents of how things are today belies the popular opinion that GEOSS will achieve its targets for 2015. There is a large gap between what is available today and what is necessary to be met in 2015.

Finally, the Figure of Merit analysis yielded the following results (on a scale of -5 (very poor) to 0 (neutral) to +5 (excellent)):



The overall average of FOM is 0.34, implying that the GEOSS ADM implementation is slightly better than neutral in rating.

1.5. Conclusions and Recommendations

CONCLUSION	SUPPORTING FINDINGS	RECOMMENDATIONS
There is no clear evidence that the ADM Strategic Targets will be met by 2015.	Progress of ADM towards the Strategic Targets outcomes is moderate. Important aspects such as "Completeness of Function", "Operational and Content Availability" and "Usability" are negatively evaluated. Survey results are more positive than interview results. Real use (test case and other evidence) shows negative evaluations and shortcomings in content availability and completeness of function.	**Recommendation 1**: GEOSS activities must have clearly defined goals, with performance indicators and measurable tasks, aligned with the ADM Strategic Targets. **Recommendation 2**: Formation of Provider-to-End-User projects with Performance Indicators and clearly defined goals.
The User Interface is difficult to use because it does not follow good human factors engineering practices.	The most telling indicator of the state of use of the GEOSS user interface was from the Test Case. As noted previously, the testers were unable to produce any result from the GEOSS, due to the complexity of the interface and the access mechanisms. The cause of the difficulty of use could range from the interface	**Recommendation 3**: The Evaluation Team recommends that the usability issue be re-evaluated by a Human-Computer Interface (HCI) expert group, as the sole focus of that evaluation, a topic that was beyond the scope or skill set of this Evaluation Team. An HCI

CONCLUSION	SUPPORTING FINDINGS	RECOMMENDATIONS
	itself, the way the GCI returns the results, the way the holdings are managed and accessed, or otherwise. The Evaluation Team believes that prior usability tests may have been inadvertently biased by employing a control group that had extraordinary ability to use the system.	group would evaluate the GEOSS user interface through a set of usability and ergonomics factors, with recommendations that could range from simple tweaks to wholesale redesign.
Although the implementation of the GCI provides a standard infrastructure and platform, there is not a uniform, consistent way that data are registered, stored, and accessed.	Numerous responses in interviews indicated that the GEO data sets are virtually inaccessible, and certainly not at an aggregated top level. The test case also pointed to the difficulty of retrieving data to answer specific questions. The GCI registry consists of pointers to external data sources, and the data in those external data sources can vary widely, with no consistent means of storage or access. There are not any machine-machine services that would permit the user to mine the underlying distributed data repositories. Although the Clearinghouse contains metadata records that are mined from the repositories, again the user cannot get to the final data other than by enacting multiple brute force searches against the end storage areas. What is missing is the capability to access a geographic area (e.g. a rectangle) and retrieve all parameters (along with their coordinates) therein. This type of function is commonly provided in geospatial information systems (such as GIS or Google Earth), albeit on a smaller scale.	**Recommendation 4**: The Evaluation Team recommends that GEO undertake a pilot project to (1) implement a geospatial browser in the GCI that is capable of rendering thematic layers from GEO data holdings, (2) standardize a subset of GEO data holdings accessible through the geospatial browser, (3) develop a way ahead so that the majority of GEO data holdings are accessible in this manner.
Lack of Systems Engineering Rigor	Numerous findings indicated that, although a working GCI was in place, there was not a clear plan to identify and fill gaps, nor was there a high expectation that the adequate architecture would be implemented by 2015. Although there was also significant documented resistance to the overly prescriptive processes of GEO, there still remains an unfilled need to document and follow an unambiguous systems engineering process. Systems Engineering is inclusive of requirements elicitation and management, design, requirements traceability to system/subsystem elements, integration, deployment, and life cycle management.	**Recommendation 5**: A Systems Engineering Working Group be established to revisit the efforts to date and map them to a defined Systems Engineering process, resulting in a plan of action for GEOSS implementation.

CONCLUSION	SUPPORTING FINDINGS	RECOMMENDATIONS
Technology employed by GEOSS is not current.	Although the Evaluation Team was not able to analyze design documents, the interviews produced anecdotal evidence that the GCI is using technology which lags by at least a partial generation. Specific examples of technology that is current, but not employed by the GCI are the semantic web and data brokering. Also, as far as the Evaluation Team was able to discern, current generation implementation techniques such as Open Source Software and Agile Programming were not used. The Team believes that if current generation methodologies were used it could improve the likelihood of attaining an implementation that keeps pace with user requirements.	**Recommendation 6**: The Evaluation Team recommends that current generation technology be targeted for utilization by the Systems Engineering Working Group. The Team also recommends that GEO issue a policy requiring that all software in the GCI be made Open Source and available to GEO member organizations.
Data may exist but it is difficult to find.	Test Case.	**Recommendation 7**: Data retrieval, and the catalogue of archive data with metadata, should be improved to meet user requirements and needs.
There is no formal process by which gaps between Targets and Tasks are addressed.	The fifth outcome under Architecture: "Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products" is not addressed. Target Task matching and interviewees indicated that this outcome from the GEOSS Strategic Targets is not directly addressed by any subtask and indirectly by only three subtasks of the 29 tasks and subtasks. This suggests that there is no concerted activity to do gap analysis and the ADM effort may be proceeding without clear direction.	**Recommendation 8**: The gap analysis/filling, Target/Task matchup software developed by Japan should be modified to meet the requirements. **Recommendation 9**: Project proposals should identify gaps and the impact this will have on funding (as is seen with ESA/EU/GMES).
The present progress reporting against Tasks Sheets, although it uses a standard form, does not allow for a quantitative evaluation of progress	The moderate progress is substantively different from the ratings of the ADM tasks in the annual Work Plan Progress Reports. GEO appears to have no formal process by which progress against qualitative performance measures may be evaluated. The internal progress reporting appears at times to be more positive than what this evaluation has revealed. The progress of the overarching tasks seem to be moderate, however there is a difference of opinion between interviewees and survey respondents on	**Recommendation 10**: GEO implement a progress reporting system for all Tasks that measures progress against milestones, reports important issues and give confirmed or revised plans for further work. The Task Leads should be asked to grade their progress .

CONCLUSION	SUPPORTING FINDINGS	RECOMMENDATIONS
	this. Despite the fact that the interviewees point to some achievements, they, as well as the external evaluators, appear to have a less positive evaluation of the progress than the survey respondents. The ratings of the ADM tasks in the annual Work Plan Progress Reports also seem to be at odds with the interviewees.	
The capabilities of GEOSS are not well communicated to the global community.	The number of survey respondents who reported "don't know" or could not answer specific question about GEOSS. The difference in success reported by the test case and the Japanese use of the GEO Hazards super site.	**Recommendation 11**: GEO create a communications plan which clearly identifies GEOSS, its capabilities, and its data content.
Commercial and intellectual property rights are perceived as a barrier to publishing data in GEOSS	The question "If you are a data provider, do you publish your datasets through GEOSS?" was answered negatively by a large majority of the respondents. The reasons given included "My system is not for public access", "I did not know I could do it", "Too political", "Difficulty in quality control", "My data is proprietary and under copyright" and "I do not know how to make my data set compliant". Approximately 20% said they do not publish their data because of commercial and intellectual property rights.	**Recommendation 12**: Pay attention to the implementation of the GEOSS Data Sharing Action Plan.[1]
GEOSS has both direct and indirect effects	Through numerous interview responses, the Evaluation Team was made aware of primary and secondary effects of GEOSS, including its Architecture and Data Management components. The promotion of the GCI has led to widespread adoption of interoperability standards. The US Geological Survey decision to release all LANDSAT on the web was a direct result of GEOSS, referred to as "a catalyst effect." A general change of mindset has resulted from GEOSS; the need of a global coordination is now widely recognized. Human networks have been organized, contributing to the understanding of the present status and the trend in global scale, and the consideration and exploration of different ideas to respond to the common issues.	The Team has no specific recommendation on this observation.

[1]http://www.earthobservations.org/documents/geo_vii/07_GEOSS%20Data%20Sharing%20Action%20Plan%20Rev2.pdf

2. Introduction

This evaluation of Architecture and Data Management (ADM) is the second in a regular cycle of evaluating the implementation of GEOSS by assessing progress made towards achieving strategic targets in SBAs and TAs. As such, the evaluation is a continuation of the implementation of a comprehensive strategy for the "monitoring of performance against defined requirements and intended benefits."[2]

2.1. Objectives

The evaluation had two objectives:

1. Assess GEOSS progress towards delivering outputs and achieving outcomes under the selected SBAs and TA targets.

2. Evaluate whether the ADM Strategic Targets as currently defined are to be met in 2015.

This evaluation did specifically address the possible value added by the GEOSS or other topics relevant to the GEOSS in general. Such topics were partly covered in the Mid-term Evaluation, and the Evaluation Team expects that the value added question will be taken up during the evaluation of the SBA's. However, many key informants expressed views and these have been summarized in the report

2.1.1. Expected audience / users of the evaluation report

The primary audience for the evaluation report is the Group on Earth Observations (GEO) Plenary and Principals of GEO Members and Participating Organizations.. The final report of the second evaluation will be made available to this audience through the normal channels of distribution of Plenary documents.

The secondary audience of the evaluation report is the various GEO bodies responsible for implementing GEOSS.

2.1.2. Expected use of the evaluation findings

The findings and recommendations of the second evaluation are expected to be used to inform decisions concerning possible changes to GEO governance, planning and reporting processes, or other aspects of the implementation of GEOSS.

[2] As stated in the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan and 10-Year Implementation Plan Reference Document, and as further defined in the GEOSS Monitoring and Evaluation Framework Document.

2.2. Structure of the report

Scope of work and important definitions are given in Chapter 4; Chapter 5 summarizes the tools and approach used by the Evaluation Team; Chapter 6 gives results and findings of the analysis and Chapter 7 gives conclusions and recommendations. Annexes are found in Chapter 8, including memos by Team Members with analysis results. Most text in these memos is found under separate headings in the report: Methodological descriptions are extracted into Chapter 5 and the analysis results into different sections of Chapter 6.

3. Scope and description of activities evaluated

As described in the GEOSS Monitoring and Evaluation Framework Document, the primary focus of the second evaluation was to assess progress towards delivering outputs and achieving outcomes under the TA targets of:

- Architecture
- Data Management.

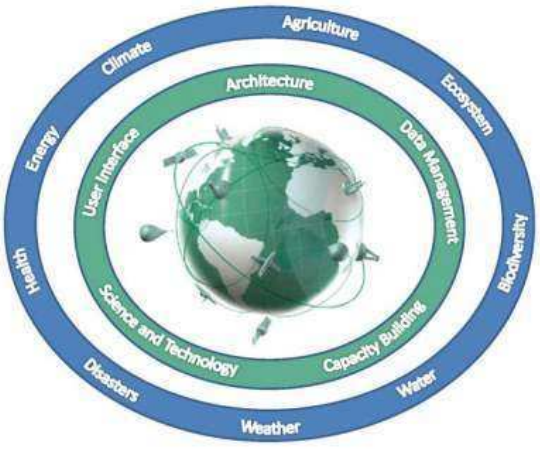


Figure 2: GEOSS works in nine Societal Benefit Areas and five Transverse Areas which support all of the SBAs.
Source: Y. Gevorgyan; GEOSS Evaluation Team

3.1. Definition of Architecture and Data Management

In the discipline of Enterprise Architecture, the term "architecture" refers to an intellectual construct that describes the design and make-up of the enterprise and its component parts (people, processes, documents, systems, data, software applications, products, IT infrastructure).

In the GEOSS evaluation, the term "architecture" refers to the items themselves being described; that is, the architecture equals the acquisition and operational processes, documents, systems, data, software applications, products, and IT infrastructure.

Therefore, the evaluation of the GEOSS Architecture involves the heuristic assignment of value to the aggregate of the following:

- Acquisition processes
    - Specification, development, procurement, modification, deployment, and maintenance
    - Acquisition of the other items in the architecture
- Operational processes
    - Use of IT resources to perform a specific GEO related function

        - Data production, data basing, building information products
- Documents
    - GEOSS specifications, agreements, designs
- Systems
    - Integrated subsets of GEOSS
- Data
    - Any data produced in the operation of GEOSS systems
    - Metadata
- Software applications
    - Custom GEOSS software
    - Commercial software
    - System-level integrative software
- Products
    - Any information-laden content that is produced by or for GEOSS in support of one of the GEO Societal Benefit Areas.
- IT Infrastructure
    - Any other IT items required for the function of GEOSS
    - Communications, networks, etc.

3.2. Figures of Merit (FOM)

The approach to examining the overall wellness, completeness, or *merit* of the GEOSS Architecture and Data Management components centers on the evaluation of nine defined metric indicators, referred to as Figures of Merit, defined as follows:

1. **Completeness of Function.** Represents the degree to which the GEOSS meets the perceived need; i.e. how fully the system is built out. Refers to *capacity* and *capability*.
2. **Sustainability.** Refers to the degree to which the GEOSS contributors would be able to maintain system components, including custom application software, infrastructure, data elements, acquisition processes, operational processes, documentation, subsystems, and products. That is, the extent to which GEO and its participants can provide a systematic capability for life cycle maintenance of the GEOSS.
3. **Operational Availability.** Refers to the degree of robustness of the GEOSS in performing its operations and meeting the GEOSS mission. Typically Operational Availability is represented as a percentage of time system is working and available; in this evaluation, Operational Availability will be inferred from other indicators of availability (e.g. a percentage of links that return usable data.)
4. **Content Availability.** Refers to an indication of the volume and availability of GEOSS content, whether data or information products. Indicators will include percentage of products that are registered for a sampled set of data providers.

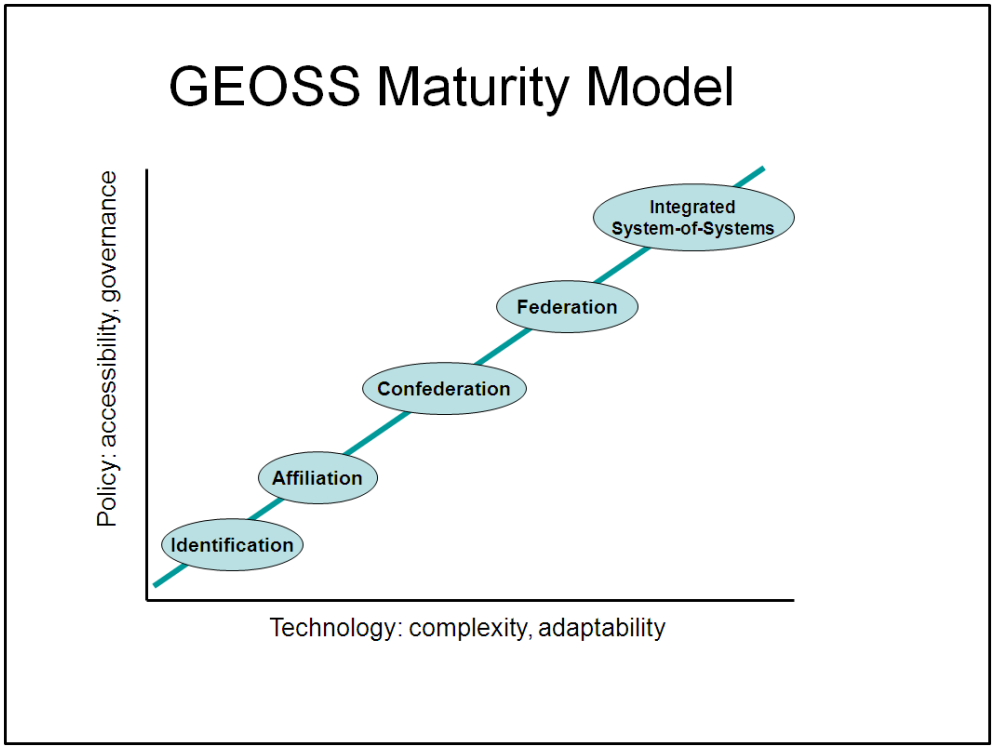
5. **Usability.** An indicator of a typical user's satisfaction in use of the GEOSS. Indicators would include response time, perceived ease of use.
6. **Data quality assurance.** Refers to the perceived level of quality of GEOSS data holdings, as evidenced by the existence of a quality standard *a*nd confidence that the data is current and up to date.
7. **Technical Currency.** An indicator of the extent to which the GEOSS system technology uses state of the art practices and principles.
8. **Fit for purpose.** Indicator of whether the system and its contents meet the needs of the users. This indicator refers to *alignment,* as compared to *completeness* (see FOM #1, Completeness, which measures *capacity* and *capability*). To wit, FOM #1 asks "Does the system do what was intended by the integrators?" and FOM #8 asks, "Does the system do what the user needs?"
9. **System Maturity Level.** An indicator of the degree to which an individual component or the system as a whole exhibits integrated system of system characteristics, as opposed to stovepiped.

3.3. GEOSS Maturity Index

One means of evaluation was the "GEOSS Maturity Index", a linear scale to indicate the degree of integration of a given system into the GEOSS System of Systems. The descriptors are shown following, in increasing order.

- Identification: Organization/system has identified resources and provided basic information for further contact. Little/no direct access to data or services. Web pages and documents predominate. (e.g. Web model)
- Affiliation: Organization/system has branded contributions with a common group identity (GEOSS) for recognition. Information access and technology are limited but diverse. Integration of resource content is difficult. (e.g. Membership model)
- Confederation: Organization/system has adopted a common approach but retained rights of self-governance, access terms, and technology. Information access is enhanced but multiple interfaces predominate. Developers can assemble interfaces to multiple systems in weeks (e.g. Community of Interest model)
- Federation: Organization/system has agreed to adopt common practices, data access principles, terminology, devolving some authority to a common governance body. Information content and services are well-described and some common interfaces and formats are deployed by requirement. Integrators can assemble interfaces to diverse systems in days (e.g. Governmental or professional network model)
- Integrated System-of-Systems: Organization/system has encapsulated systems and offers standardized service interfaces to process/access data with identified and common semantics and common format/syntax. Data access rules are deployed transparently across all systems. Client software can be deployed to access diverse

system interfaces in real-time based on familiar patterns (e.g. Enterprise System model, System-of-Systems model)



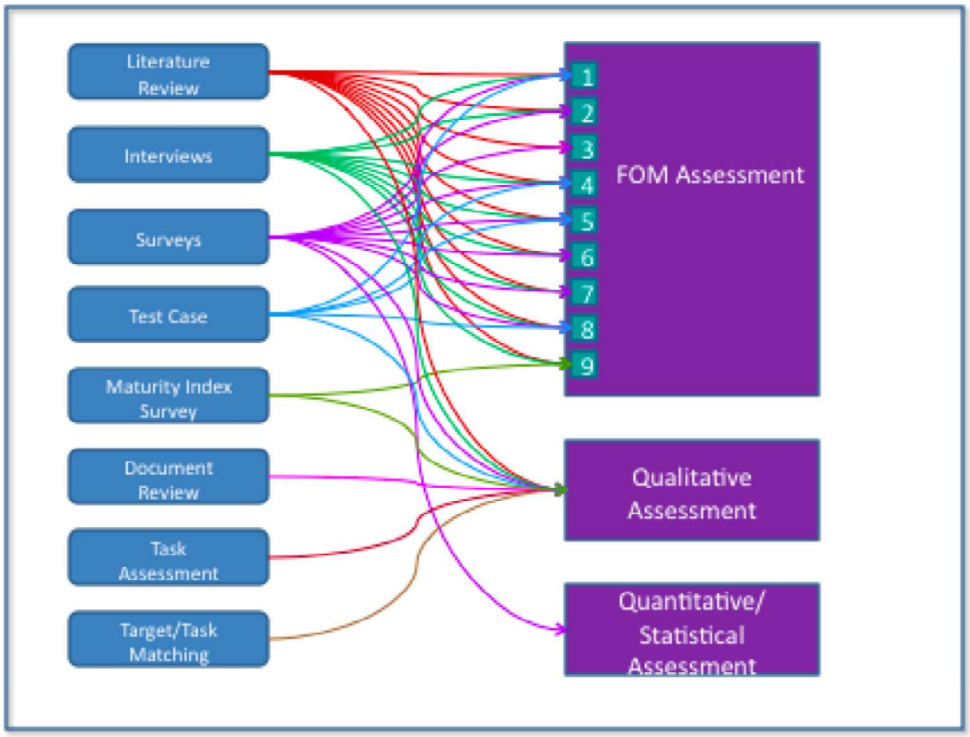
4. Evaluation approach and methodology

The following were the principal sources of data and information that were used to answer the evaluation questions. Not all sources were used for every question; however multiple sources were used wherever possible as a control against the inherent biases of any particular source or method (triangulation).

Data and information collected in support of the evaluation were maintained and made available to all members of the Evaluation Team through an electronic registry.

Information provided through interviews or surveys was secured to ensure confidentiality of informants/participants. If a sample was too small to ensure confidentiality of the respondents that sample was aggregated to a higher level.

The following figure shows the logical flow from the inquiry vectors to the activities



that produced the information content of this report. To wit, the inquiry vectors collected raw data and information that were used to conduct the FOM Assessment, along with both Qualitative and Quantitative/Statistical Assessments.

4.1. Review of GEO documents

Documents reviewed included all GEO foundational documents (Ministerial declarations; the GEOSS 10 year Implementation Plan and the 10 year Implementation Plan Reference Document; Work Plans, Work Plan Progress Reports and relevant Task Sheets; meeting reports from Plenaries, Executive Committee and

other GEO Committees) and other documents as required. Emphasis was placed on progress reports from the Architecture and Data Committee (ADC).

4.2. Literature Review

As part of the GEOSS mid-term evaluation in 2010 bibliographic search tools were used to generate a list of GEOSS-related literature. The resulting list was limited to publications from 2009 and earlier. The list was revisited as part of the GEOSS ADM evaluation and filtered in the titles, abstracts, and text for keywords with relevance to the ADM Evaluation Question Framework to create a list of priority items for analysis.

A new bibliographic search was performed by the Second Evaluation to search for literature with relevance to GEOSS ADM published in 2010 but with poor result. The final list of publications that were reviewed appears in Chapter 8.

The literature review question guide used in the mid-term evaluation was also used for this evaluation of Architecture and Data Management. It included the following five questions:

- Does the literature show evidence of links between the described activities and the goals of GEOSS Architecture and Data Management?
- Does the literature identify any gaps in GEOSS Architecture and Data Management?
- Does the literature indicate attempts to fill identified gaps in GEOSS Architecture and Data Management?
- Does the literature show progress or outcomes from GEOSS Architecture and Data Management activities?
- Does the literature identify any unintended positive or negative outcomes or impacts of GEOSS Architecture and Data Management implementation?

A sixth question was added for the ADM evaluation:

- Does the literature address any of the Figures of Merit (FOM) shown below? If so, indicate a value from -5 (very counter-indicated) to 0 (neutral) to +5 (strongly supported)?

Where appropriate, examples from the literature were cited as evidence to support the Team's evaluation of GEOSS implementation progress.

Team members were assigned several publications to review and were asked to complete a question guide for each source. All completed question guide forms were reviewed and the results are shown in the attached spreadsheet.

4.3. Evaluations, audits, reviews and performance measurements conducted by GEO Members or Participating Organizations

A call was issued to 26 GEO ADM Task Leads requesting any evaluations, audits or reviews relevant to the assessment of Task implementation of which they were aware.

The Task Leads were also requested to provide performance measurement data they had that may have been relevant to the assessment of Task implementation or to the assessment of progress toward the realization of the outcomes associated with the Areas being evaluated. More specifically, the task leads were asked:

> 1) Are there any performance measurement data that may have been relevant to the assessment of Task implementation or to the assessment of progress toward the realization of the outcomes associated with the ADM tasks? If yes, the evaluation team will appreciate to receive information or a copy.
>
> 2) Are you aware of any evaluations, audits or reviews relevant to the assessment of the implementation of the task you are leading or any other ADM tasks? If yes, the evaluation team will appreciate to receive a copy.

In response evaluation team received three undeliverable messages and three real responses.

Only one of the respondents could report a systematic process for progress reporting and evaluation. The WMO Information System (WIS) - AR-09-02B has a fully developed monitoring and evaluation process which ends up in relevant reports to WMO Executive Council and WMO Congress. WMO uses results based management and reporting so these are an integral part of the working process.

4.4. Key informant interviews

An interview protocol was developed and interviews were conducted with a sample of: GEO Secretariat staff, members of GEO Committees, leads for GEO Tasks, non-lead participants in GEO Tasks, and members of user communities. Interviews were used for the qualitative identification of issues and themes rather than as the basis for statistical inference.

Observed opinions about the effectiveness of the GCI and GEOSS varied considerably and were highly correlated with the role of the respondent, as follows:

Users: Personnel who do not necessarily have an advanced scientific or technical background. These respondents often found GEOSS too difficult to navigate, and they typically compared it to one of the ubiquitous components of the Internet (e.g. Google, an e-commerce site, etc.), with the remark that GEOSS is much more difficult to use. A typical response is "I find what I wanted in one Google search, but GEOSS required navigating many layers."

Scientists: Personnel who have advanced scientific or technical training and who are employed in some area of scientific research or production. These respondents were able to navigate the GCI, but their preference was to use the organic scientific databases and portals that are specific to their area of work. These users have great familiarity with specific portals and the GEOSS adds another layer but no additional value.

Managers: Personnel who are a part of the GEO infrastructure. These personnel had very positive responses to the GEOSS/GCI, but it was unclear whether their experience was direct or anecdotal.

4.5. Sample surveys of selected communities

Web-based surveys were used as a means for obtaining representative data. Although the evaluation team faced severe time and resource limitations, three surveys were conducted. These were

1. The main survey (the ADM survey) was sent to more than 4,000 email addresses provided by the GEO Secretariat;

2. A secondary survey, sent to an email list of persons who had attended the 33rd International Symposium on Remote Sensing of Environment (ISRSE) in Stresa, Italy in May 2009;

3. A tertiary survey, using laptop computers, at the Earth Science Information Platform (ESIP) Conference in Washington DC, USA, in January 2011.

The survey had five parts:

1. Introduction, 7 questions
2. Data user, 26 questions
3. Data provider, 18 questions
4. Architecture and Data Management, 36 questions
5. Concluding questions, 5 questions

Parts 1 and 5 were related to the respondents' affiliation with GEO and GEOSS and education, age and employment, respectively. . Parts 2, 3 and 4 were focused on substantive matters.

The survey questions from parts 2, 3 and 4 were assigned to a FOM in a spreadsheet, resulting in a matrix of questions along the vertical axis and FOMs along the horizontal axis. 60 questions were identified as addressing a FOM. The results are shown in the table below.

FOM	1	2	3	4	5	6	7	8	9
Questions assigned to FOM	2.23;3.9; 3.10; 3.12; 4.4; 4.14; 4.26; 4.33	2.12; 2.16;3.4; 3.5; 3.6; 3.7; 3.8; 3.17; 4.2; 4.3; 4.15; 4.27; 4..28; 4.36	2.13; 2.14; 3.16;	2.6; 2.7;2.9; 2.10; 2.11;2.15; 2.17; 3.11; 3.13; 3.14; 3.15; 3.18; 4.30	2.1;2.3; 2.5;2.7; 2.18; 2.19; 2.20; 2.22; 3.1	3.2; 3.3; 4.29: 4.31; 4.32	4.1	2.2;2.4; 4.6;4.7; 4.13; 4.34	4.5
Total	8	14	3	13	9	5	1	6	1

Table 1. Survey questions that address the different FOMs

The responses to most survey questions may be divided into three categories in their characterization of the FOM:

1. Positive evaluation of progress
2. Negative evaluation of progress
3. Don't know or cannot answer

Of the 60 questions that were assigned to FOMs seven were of the type "What kind of data would you like to access through GEOSS?" The remaining 53 questions were of the type "Yes", "No", "Don't Know" or "Cannot Answer" and it was possible to judge some value of merit for responses to these.

In the FOM analysis responses the "Don't know" or "cannot answer" groups were not counted. Thus, if the positive responses outweighed the negative the FOM, target/task matching or target progress assessment were regarded as having positive outcomes or good progress. Conversely, if the negative answers dominated, the progressor outcomes were rated negatively.

4.6. Contact, communication and feedbacks between ADM tasks and SBA tasks

A request was sent to 77 Leads of tasks and sub-tasks under the SBA's and contacts for one of the GEO Communities of Practice asking the following questions:

- What has been your contact with ADM in terms of requests from ADM regarding the needs and wishes of your SBA and any feedbacks from ADM;
    - requests for data from ADM
    - support from ADM;
- What is your experience with use of GEOSS Common Infrastructure (GCI) and its Portal and Clearinghouse?
- Are there issues or experiences regarding ADM that you want to share with the evaluation team?

The response was answers from four tasks or sub-tasks (one sub-task gave answers by two co-PI's) and four undeliverable messages. In the four responses there appeared to be a confusion of ADM and the tasks and the ADC.

4.7. Target / Task Matching and Task Assessment Exercise

Since the evaluation was focused on Architecture/Data Management, for the Target / Task Matching (TTM) we analyzed two overarching tasks, AR-06-11 and DA06-01, and 27 Architecture and Data Management Targets at the level of Sub-tasks. The remaining overarching tasks were not evaluated as there were no clear and unambiguous means as to how to aggregate the results of the subtasks into the overarching tasks; thus there may be inconsistencies in the evaluation.

4.7.1. Target/Task Matching

A matching of GEOSS Strategic Targets Outcomes[3] vis-à-vis Subtasks and Overarching Tasks was undertaken to answer the following question chain from the Question Framework:

- Are subtasks and overarching tasks (work plan) tied to target outcomes (Strategic Target Document)? (To what extent are the Work Plan tasks reflective of the actions required to achieve the Strategic Targets?)
    - Do both documents show a clear connection in descriptive language?
    - Are any targets' outcomes overlooked by overarching tasks or any overarching tasks not represented in target outcomes?
    - Do any key points appear in only one of the documents?

The same exercise was performed for subtasks and overarching tasks against the Cape Town Declaration [4]

Descriptions of the Over-Arching Tasks and Subtasks can be found in the GEO Work Plan[5] and the Task Sheets[6].

The evaluation team considered 27 subtasks and two overarching tasks (AR-06-11 and DA06-01). The two overarching tasks have no related subtasks. The remaining overarching tasks were not evaluated as there were no clear and unambiguous means by which to aggregate the results of subtasks into the overarching tasks; thus there may be inconsistencies in the evaluation.

In this report these 29 will be referred to simply as tasks.

To answer the questions a matrix was established for each of the GEOSS Architecture and Data Management subtasks, with the tasks along the horizontal axis and the strategic targets outcome and visions of the Cape Town Declaration along the vertical. Five external evaluators were then asked to indicate the cells for which they found that the task reflects the outcome. One of the evaluators assessed only Architecture tasks vs. Architecture outcomes, whereas the other four evaluators assessed both Architecture and Data Management tasks against the Architecture and Data management outcomes as well as the Cape Town Declaration.

The reviewers looked for evidence in the texts of indications of how the tasks directly and indirectly address the outcomes. This opened for a certain degree of subjectivity

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[3] http://www.earthobservations.org/documents/geo_vi/12_GEOSS%20Strategic%20Targets%20Rev1.pdf

[4] http://www.earthobservations.org/05_Cape%20Town%20Declaration.pdf

[5] http://www.earthobservations.org/documents/work%20plan/geo_wp0911_rev3_101208.pdf

[6] http://www.grouponearthobservations.org/cdb/geoss_imp.php

and different ratings of certain combinations amongst the reviewers. The following colour coding of the match between task and outcome was used:

1 Green = Task directly addresses outcome = Half or more of reviewers found the task addresses the outcome.

2 Yellow = Task indirectly addresses outcome = Less than half of reviewers found the task addresses the outcome.

3 Red = Outcome not addressed by task = None of the reviewers found that the match between task and outcome was not addressed by the task.

There were nine outcomes included in the evaluation – five under Architecture and four under Data Management[7].

Architecture:

- Deployment, population, and enablement of sustained operations and maintenance of a user-friendly and user-accessible GEOSS Common Infrastructure (GCI), including the core components and functions that link the various resources of GEOSS.
- Coordinated planning and sustained operation of national, regional and global observing and information systems within an interoperability framework.
- Continual improvement in observations and information available to users through the transition of research outcomes and systems into operational use, and through an optimal mix of space-based, airborne and in-situ observing platforms.
- Increased efficiency in the operation of observational systems through convergence among global, regional and national facilities.
- Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products.

Data Management:

- Increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion.
- Open, reliable, timely, consistent, and free access to a core set of essential environmental observations and information products, supported by adequate metadata, by users across all GEOSS Societal Benefit Areas in accordance with GEOSS Data Sharing Principles.
- Removal of important data management deficiencies.

[7] GEOSS Strategic Targets, Document 12 (Rev 1), GEO VI, 17-18 November 2009

- Enhanced information extraction from historical, current and future source data.

4.7.2. Task Assessment

For the Task Assessment (TA) the evaluation focused on the progress made up to 2010 by analyzing GEO VI and GEO VII results. The same five evaluators who evaluated the "Targets" were asked to consider Task Assessment.

The fundamental question of TA is "To what extent have the tasks/subtasks satisfied the strategic targets?" The evaluators were asked to grade the progress of the nine overarching tasks against the strategic targets outcomes and the visions of the Cape Town Declaration, using a scale from 1 to 5, where 1 indicates none or very little accomplishment, and 5 indicates a great amount of accomplishment. It was suggested that they include the following documents as part of the evaluation documentation:

a) GEO VI progress report (http://www.earthobservations.org/documents/geo_vi/05_2009-2011%20Work%20Plan%20Progress%20Report%20Rev1.pdf)

b) GEO VII progress report (http://www.earthobservations.org/documents/geo_vii/05_2009-2011%20Work%20Plan%20Progress%20Report.pdf

c) the task work sheets (http://www.grouponearthobservations.org/cdb/geoss_imp.php)

d) the document "Prototype Assessment Work Plan Progress Towards Strategic Targets" ftp://ftp.earthobservations.org/ExCom/20/08_Prototype%20Assessment%20Work%20Plan%20Progress%20Towards%20Strategic%20Targets.pdf)

4.8. GEOSS Maturity Index

The GEOSS Maturity Index is described in Chapter 3.2 of this report. The Maturity Index was evaluated by emailing all available points of contact from the GEOSS Registry. A total of 240 emails were sent, with a return of 13 usable responses. Out of the total, 23 email bounces, out-of-office replies, or negative indicators were returned, indicating a lack of currency in the GEOSS Registry entries.

The queries asked the recipient to identify the system and then address the maturity index as follows:

What is your maturity level now?

What is your expected maturity level by 2015?

Both of these were to be expressed by selection of one of the index levels. This was followed by four discussion items that are elaborated below.

4.9. Case studies

4.9.1. Test case by the Naval Oceanography Operations Command (NOOC)

A test case was undertaken as a means to address questions of ease when accessing a dataset given the current Architecture and Data Management construct of GEOSS.

The parent organization of one of the Evaluation Team members was asked to conduct a test case to evaluate the utility of GEOSS in a simulated, but plausible, application of GEOSS. Here, the test activity was the Naval Oceanography Operations Command (NOOC), a part of the Naval Meteorology and Oceanography Command (NAVMETOCCOM) of the United States Navy.

Uniformed members of the NOOC were asked to envision a particular scenario in which environmental information (e.g. oceanographic, atmospheric) would be needed to support the mission, craft a set of questions/queries to be posed to GEOSS, and then query GEOSS for the desired information. The expected result of the test was indicators of the ability of GEOSS to return the required information and the utility and usability of the GEOSS Common Infrastructure.

A full account of the Test Case is given in the Appendices and results are described under each FOM in Chapter 5 of this report.

4.9.2. Geohazard Supersite and the Tohoku-oki earthquake

There was a 9.0 magnitude earthquake on 11 March 2011 in East Japan, followed by a tsunami and the Fukushima-Daiichi power plant accident. Using this event as a case study, the GEOSS ADM Evaluation Team devised a survey on the usefulness of GEO's Tohoku-oki Event Supersite (http://supersites.earthobservations.org/sendai.php), which was created very quickly after the Japan Earthquake and Tsunami. Contrary to the GEOSS web pages that were used in the test case described in 4.9.1 the Geohazard Supersite is a highly specialized site and that the survey was directed at experts. The results from this case study came in too late to be considered for the FOM scoring described in Section 5.5.

The response from the consulted experts were mainly positive, stating that the Supersite was the most important clearinghouse for data and information about all aspects of this earthquake and that the Supersite proved a model of international collaboration and dissemination of information that directly impacts what we will be able to learn from it.

It was also noted that much information and data were rapidly made available through the Supersite; however, one respondent noted that this did not apply to all data sources.

Further details of the Geohazards Supersite and Tohoku-oki earthquake can be found in the Appendices.

5. Findings

The evaluation may be used to determine two salient characteristics of the GEOSS:

1. Does the project have the right activities to reach its goals?

2. Does the project carry out the activities the right way, i.e. to meet the activity goal on time and budget?

These questions were asked directly or indirectly in the interviews and the surveys. The evaluation team also asked five external evaluators without ties to any of the ADM tasks, to do an analysis of how the existing tasks are sufficiently addressing the outcomes expected in the Strategic Targets Document and how the tasks are progressing towards these outcomes.

5.1. Possible bias in interviews

The list of interviewees was established by the evaluation team in cooperation with the GEO Secretariat. Factors that may bias the results include:

- Interviewees are mainly from within the GEO related communities in the countries represented on the evaluation team. This means either persons directly involved in GEO and GEOSS or involved with relevant activities within the member organizations. Thus the members that are most likely to have an expressed interest in the progress of GEOSS are overrepresented in the interview population.

- The interviewees may not be representative of the general GEOSS data provider or data user. Among those selected as potential interviewees a significant number did not respond to the request or declined taking part. These persons were mainly from countries not represented on the evaluation team (however some of those who declined to be interviewed were also from those countries represented on the evaluation team). There is a danger that a large part of those identified as good interview candidates but declined or did not respond, have less knowledge of GEOSS than would be expected from their positions..

5.2. Uncertainties in survey response

Bias and uncertainties can be introduced in survey results from many factors.

1. Geographical skewings. The geographical spreading in the main survey was large, all continents were represented and the survey cannot be said to be biased towards countries represented on the evaluation team. The ISRSE and ESIP surveys were biased towards the host country or near-by countries, respectively Italy and Western Europe and the USA. The main survey is the one used in the further analysis.
2. Skewed background of respondents. Of the approximately 280 responses to the main survey there were 65 answers to questions in Section 4 (Architecture and Data Management) whereas Sections 2 (Data Users) and 3 (Data Providers)

received 110 and 70 responses, respectively. Only 45 persons answered the questions if and why they access data through GEOSS. Thus, persons with experience from ADM may be somewhat under represented in the surveys.

3. Of the 80 questions, 67 had the possibility to answer "don't know" or "cannot answer". In the main survey 32 of the 67 questions had a majority answering "don't know" or "cannot answer" and in the ISRSE survey 42 questions were answered this way. In both surveys the largest, both in absolute and relative terms, number of questions that were answered with "don't know" or "cannot answer" were in Part 4 of the survey.
4. There is always a psychological factor in surveys. Some respondents may give what they perceive as the "correct expected" answer. Some questions for consistency check were imbedded in the survey but the psychological factor is still difficult to evaluate. Surveys do not have the same possibility for control questions or elaborations of topics as do interviews. A certain difference may therefore be expected and the interview results are likely to be the more trustworthy.

5.3. Are GEO and GEOSS doing the right things?

Target-Task matchup by external evaluators

The results of the review of tasks and target outcomes from the five external evaluators can be found in Appendices.

Of the 29 tasks all but one was found to directly address at least one outcome, i.e. they show at least one green cell. One task, AR-06-11 Radio Frequency Protection, had no green cells and was evaluated as only indirectly addressing an outcome. However, it should be noted that this task is specifically mentioned in the Cape Town Declaration and the 10-Year Implementation Plan Reference Document.

Thus, none of the tasks are identified as completely without relevance for the outcomes.

Of the nine outcomes all but one are directly addressed by at least three overarching tasks. Indeed, three outcomes are addressed by 3 to 5 tasks, three outcomes by 6 to 8 tasks, and two outcomes by 9 to 11 tasks, a good coverage. The exception is the fifth outcome under Architecture, "Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products". This outcome was found to have only three tasks indirectly associated with it. It should be noted that a finding from the mid-term evaluation of GEOSS was that GEO has not conducted a comprehensive gap analysis (Finding 13) and that conducting one was one of the recommendations (Recommendation 7).

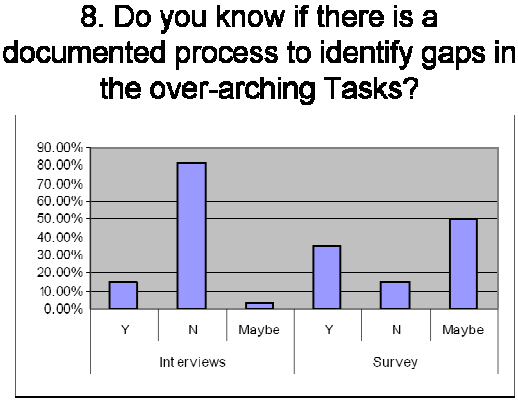
An action team to develop a GEOSS Gap Analysis Strategy was established following the 10th Executive Committee Meeting. The team presented a memo to the 21st Executive Meeting 22-23 March 2011 with a plan to have the Gap Analysis Strategy approved at the GEO VIII Plenary session in November 2011, and final results presented at the GEO-X Ministerial in 2013. The memo to the 21st Executive Meeting states that some gap analysis has occurred, but it is too early for conclusive results.

The five visions of the Cape Town Declaration are directly addressed by only 4 of the 29 tasks. Only one task, DA-06-01 GEOSS Data Sharing Principles, is judged to be a task that addresses all five Cape Town "visions". Another task, AR-09-01d -, Ontology and Taxonomy Development, was judged as addressing four of the five visions.

Interviews

Although neither interviews nor surveys included a direct question about the match between target outcomes and tasks, the answers to several questions help shed light on how key informants perceive this important topic. The responses to interview question 4[8] were mixed, with some cautious optimism. The fact that there is a GCI that is operational was cited as an indicator of future success. The respondents quickly turned to items that are missing from the GEOSS, such as a semantic web structure ontology to underpin the GCI, not enough open access to data, and missing capabilities that would permit full interoperability.

Interviewees were also asked if they are familiar with the current task structure of the GEOSS Work Plan and, if yes, if they find that there are gaps in the existing over-arching tasks and sub-tasks in the ADM Strategic Targets which would cause the expected outcomes not to be met and what might those gaps be?



Respondents reported significant gaps in the tasks and strategic targets. There are a wide variety of tasks that are not being implemented uniformly. Implementation therefore creates gaps in matching tasks to targets. One participant claimed that there had not been a comprehensive gap analysis to enable GCI to deliver what the users say they need. Interviewees also said that SBAs need to take a more holistic view and that cooperation between existing overarching tasks could be improved.

When asked if they believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015 respondents felt that as the global user requirements were not known, the question could not be addressed. There is a need to define what fundamental environmental requirements are and then meet them.

None of the interviewees were aware of a documented process to identify gaps, and evidence of a documented process was perceived as sketchy at best. In case of Data Management, the process was reported to be working, evaluated and managed by the GEO Secretariat and the Leads and Team Members of four Task communities. An alternate approach that was called out is that each Architecture Implementation Pilot (AIP) Phase identifies some gaps in architecture to be filled. It was reported that one

[8] E.g., interview question 4: "Do you agree the ADM Strategic Outcomes will be achieved by 2015? If you do not agree, what is missing to enable this result?"

objective of the May 2010 GEOSS Architecture and Data Management meeting in Pretoria, South Africa was to identify gaps. There is presumably another such meeting to be held in spring 2011 in Geneva.

Gap analysis has been conducted by other Committees (Science and Technology Committee and User Interface Committee). Ostensibly, the results or process may be applicable to ADM.

One option mentioned as a possible avenue to improve the Target/Task matchup was a software that was developed by Japan, located on the /earthobservations.org page. However, the evaluation team explored this tool and found that it needs significant extensions to meet the requirements of a proper target/task matchup and gap analysis. Another suggestion was to follow ESA/EU/GMES, where project proposals are asked to identify gaps and this has impact on the funding. This helps both identification of gaps and the filling.

Also, the use of EuroGEOSS framework was mentioned as a possibility.

Surveys

In general survey respondents find that the expected outcomes from GEOSS ADM strategic outcomes have been clearly articulated and are aligned with stakeholder views of GEOSS priorities. There is a fair agreement between tasks and strategic target outcomes. The majority agree that the planned activities, i.e. the over/arching tasks and sub/tasks, are necessary and sufficient to achieve the expected outcomes for ADM. In the case that ongoing activities and tasks are not necessary for achievement of the expected outcomes, they do still add value to the ADM Strategic Targets. However, the respondents are neutral on the issue on whether all necessary tasks and activities to achieve the outcomes have been defined.

On the issue of gap analysis 2/3 of the respondents were not aware of any process to identify and fill gaps for the ADM Strategic Targets outcomes and a very slight majority (really a neutral response) indicated they did not believe this will exist by 2015.

Findings

Despite the apparent lack of formal and structured gap analysis, all subtasks under GEOSS Architecture and Data Management have some relevance to and address either Strategic Target Outcomes or the Cape Town Declaration. However, the match between tasks and target outcomes varies considerably and several tasks would benefit from a structured gap analysis.

Recommendation

Perform proper formal and structured gap analysis and define remaining activities necessary to achieve strategic targets outcomes.

5.4. And are they doing it the right way?

Task Assessment by external evaluators

The results of the review of tasks and target outcomes from the five external evaluators can be found in the Appendices. For task vis-à-vis outcomes the grades (average of evaluators) range from 1.3 to 4.0 whereas the average for each task over all outcomes ranges from 1.8 to 3.2. Data Management seems to score slightly higher than Architecture but the significance of this is probably low. The lowest task scores are found for AR-06-11 Radio Frequencies and DA-09-03 Global Data Sets.

For Tasks vs. Cape Town Declaration the grades vary from 1.3 to 4.3 for tasks vs. visions" and between 2.1 and 3.0 when averaged over all visions. Task AR-09-02 Interoperable Systems for GEOSS shows the highest average score and DA-06-01 GEOSS Data Sharing Principles has the highest individual score, against the vision "Continued cooperation and dialogue will establish GEOSS as a powerful means to support informed decision making".

It is emphasized that the low number of evaluators resulted in significant uncertainties in the average grades.

Interviews

The interviewees were asked if they believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015 and which expected outcomes they feel have been realized.

Most respondents pointed to concrete examples of system artefacts that have been implemented and demonstrated, such as:

- Availability of the GCI.
- Interoperability among provided components using standards promoted by the Standards and Interoperability Forum (SIF).
- Registry population (although participation has proved challenging).
- Data Centers, working towards common IT platforms.
- Data Quality standards and processes, through the IEEE/CEOS.
- GEONETCAST

Some secondary effects were called out, notably, that the USGS decision to release all LANDSAT on web was a direct result of GEOSS, "a catalyst effect."

On the other hand, there was a general feeling that the global user requirements were not known and that GEOSS ADM must get beyond the demonstration phase and become fully operational to achieve this quality. A hard push is needed.

Much of GEOSS is usable today, but not enough is in place. One concern had to do with getting observations and archives on-line for users who are not familiar with earth observations. There is a perceived unfulfilled need to employ general internet techniques that persons are used to using (e.g. Google, web services). GEOSS seems to be lacking an emphasis on end users.

Other concerns were related to the validation of data points and the lack of consistency among global data, and especially that GEOSS will not achieve common and universal use of units.

Respondents felt that leaders will use the GEO portal for their information needs. However specialists will still go to their own sources.

Some interviewees pointed out that there was a recent proposal to the ADM Task Group to establish an interoperability working consortium in the belief that such a working consortium would improve the discoverability in the GCI. This would require rethinking as to how to manage and use metadata since, in the usability testing undertaken by the evaluation team, there were too many false positives. The adoption of the Data Core may help attain success but this would require validation.

Surveys

On the direct question whether implementation of ADM for GEOSS is on track to meet the Strategic Targets by 2015 of those persons who answered with yes or no, almost 2/3 of them gave a positive answer. This is consistent with the positive answers to most questions of the type "Do you agree that by 2015 …. will be in place or operational?", indicating that the majority of survey respondents believe progress is satisfactory. The lack of gap analysis is a significant exception to this.

Feedback from ADM task Leads

The request to 26 ADM Task Leads asking if earlier reviews, audits, evaluations or performance measurement data exist resulted in one – 1 – response confirming that there is a process in place. This is sub-task AR-09-02b WMO Information System (WIS), which has implemented a fully developed monitoring and evaluation process that ends up in relevant reports to the WMO Executive Council and the WMO Congress. There may be other sub-tasks that have similar processes implemented but these were not communicated to the evaluation team.

Findings

All in all the progress of the overarching tasks seem to be moderate, however there is a difference of opinion between interviewees and survey respondents on this. Despite the fact that the interviewees point to some achievements, they, as well as the external evaluators, appear to have a less positive evaluation of the progress than the survey respondents. The ratings of the ADM tasks in the annual Work Plan Progress Reports also seem to be at odds with the interviewees, where all but one ADM task were rated with progress very good to excellent in both the 2007-2009 and 2009-2011 Progress Reports[9].

GEO appears to have no formal process by which progress against qualitative performance measures may be evaluated.

The high number of answers in the groups "Don't know" or "cannot answer" introduces uncertainty in the results. They are also an indication of limited knowledge and experience with GEOSS.

[9] The one task was rated as progressing but with need for more effort.

Recommendations

GEO implement a progress reporting system for all Tasks that measures progress against milestones, reports important issues and give confirmed or revised plans for further work. The Task Leads should be asked to grade their progress .

5.5. Figures of Merit (FOM)

The information sources, i.e. interviews, surveys, literature review, test cases and information from Tasks and Sub-tasks, were evaluated and rated with respect to each FOM. The rating was on a scale from -5 (very counter-indicating evidence) to 0 (neutral) to +5 (strongly supporting evidence) and the results are shown in the following nine sections (6.5.1 – 6.5.9 and summarized in Section 6.5.10.

5.5.1. Completeness of function

Represents the degree to which the GEOSS meets the perceived need; i.e. how fully the system is built out. In other words, what capacity and capability does GEOSS have? Does the system do what was intended by the integrators?

Interviews

The respondents that said they were familiar with the GEOSS Work Plan and task structure (Question 7) reported significant gaps in the tasks and strategic targets. There are a wide variety of tasks that are not being implemented uniformly. Implementation therefore creates gaps in matching tasks to targets. There is a need for SBAs to take a more holistic look at data sources. A second issue concerns the technical sophistication of the GCI implementation; to wit, GCI has no elements for Web 2.0 type interfaces. There is no "broker system" to bring SBAs into a common nomenclature.

In registering services there is no common language, so the registrar has no way of knowing of the content or status of other areas; this makes it difficult to be interoperable among SBAs. Also, existing over-arching tasks may not cooperate with each other enough.

A further concern had to do with getting observations and archives on-line for users who are not familiar with earth observations. There is a perceived unfulfilled need to employ general internet techniques that they are used to using (e.g. Google, web services). GEOSS seems to be lacking an emphasis on end users.

To the question about a documented process to identify gaps (Question 8) the general answer was no. Evidence of a documented process was sketchy at best.

One possible option is in the Target/Task matchup software that was developed by Japan, located on the /earthobservations.org page. Also, there is some possibility of use of EuroGEOSS framework. However, this would require some extension of functionality.

Some interviewees found that the Portal does not provide access to its functionality through an accessible interface and identified some missing elements, including (Question 29):

- The Map Viewer is inadequate and would not meet the needs of what would be considered the target user of the Portal. This seems like a missed opportunity to get people exposed to data in a simple to use exploratory interface.
- Query based on temporal constraints are not implemented or difficult to express. Data access is still not implemented.
- It's difficult to know what can be done through the system.
- At least, should be accessible to real data for GEOSS DataCORE rather than just metadata.

Suggested rating of the FOM with respect to interview results: - 1

Survey

This FOM was addressed by eight questions in the survey. Seven of these were answered in a positive way and one neutral-negative. Five of the questions, all answered positively, were related to the situation in 2015. The majority of respondents that did not answer "Don't know" found that the current deployment of GCI exceeds or meets the requirements. There is a slight majority that finds that the present over-arching tasks and sub-tasks are insufficient to meet the ADM Strategic Targets Outcomes.

Suggested rating of the FOM with respect to survey results: +1

Literature review

A total of 15 papers that were reviewed and could be evaluated and scored for this FOM, with an average score of 1.6.

Test Case

The test case is relevant to this FOM. The team performing the test case accessed GEOSS by way of the GEOSS portal and attempted to discern what supporting information could address or partially address any of the postulated questions. As the team members were not able to successfully retrieve supporting information from GEOSS, the functions of GEOSS cannot be said to be complete.

Suggested rating of the FOM with respect to test case results: -2.

5.5.2. Sustainability

Refers to the degree to which the GEOSS contributors would be able to maintain system components, including custom application software, infrastructure, data elements, acquisition processes, operational processes, documentation, subsystems, and products. That is, the extent to which GEO and its participants can provide a systematic capability for life cycle maintenance of the GEOSS.

Interviews

This FOM was not directly addressed by any of the interview questions but the answers to questions about challenges that have arisen or are being faced by GEOSS (Questions 10 and 19) give insight into the opinion of the key informants.

There are particularly two issues that will have influence on the sustainability of GEOSS: Policy issues and political issues but the interview results are not clear as to what extent the GEOSS contributors would be able to maintain system components.

Policy: For the ADM to be successful the majority of the interviewees state that data must be accessible free of charge. That is not the case, given the different data policies of member states. One challenge was represented as a coordination of data at a national level when the data itself is spread across myriad organizations. A related issue is the challenge in the sustainability of the GCI (content); the latter requires connection to metadata catalogues that are actively being maintained. It was noted that there was a data sharing task force, briefed at last plenary, which resulted in a task force to mitigate implementation issues for the data sharing plan.

Political: A challenge derives from the volunteer nature of GEOSS. Physical deliverables (to include IT entities) require coordination. There are many proliferating tasks and organizations; thus the structural unity of GEOSS is becoming ever more confusing. These politico-socio issues are nearly intractable, while the technical challenges are entirely solvable. The issues are those of management, whether formalized or informal. The tension between the success of GEOSS and the nation's own systems posed a challenge; that is, the tension with national interests.

Suggested rating of the FOM with respect to interview results: 0.

Survey

This FOM was addressed by 13 questions in the survey. Eleven of these 13 questions were answered in a positive way and one neutral-negative. Six of the questions, all but one of which were answered positively, were related to the situation in 2015. The question with a negative response asked the respondents if they believe that by 2015 a comprehensive analysis and gap filling will exist. On the question if the respondent's organization is prepared to fund a centralized system or capability allowing users to search or order data, the overall response must be said to be neutral.

Suggested rating of the FOM with respect to survey results: 0.

Literature review

A total of 15 papers that were reviewed and could be evaluated and scored for this FOM, with an average score of 0.8.

Test Case

The test case is not relevant to this FOM.

5.5.3. Operational Availability

Operational availability refers to the degree of robustness of the GEOSS in performing its operations and meeting the GEOSS mission. Typically Operational Availability is represented as a percentage of time system is working and available. In this evaluation, Operational Availability will be inferred from other indicators of availability (e.g. a percentage of links that return usable data.).

Interviews

There were no interview questions related to this FOM.

Survey

This FOM was addressed by three questions in the survey. Two of these were answered in a positive. The question "If you are a data provider, do you publish your datasets through GEOSS?" was answered negatively by a large majority of the respondents. The reasons given included "My system is not for public access", "I did not know I could do it", "Too political", "Difficulty in quality control", "My data is proprietary and under copyright" and "I do not know how to make my data set compliant". Approximately 20% said they do not publish their data because of commercial and intellectual property rights.

Suggested rating of the FOM with respect to survey results: -1.

Literature review

A total of 16 papers that were reviewed and could be evaluated and scored for this FOM, with an average score of 1.7.

Test Case

The test case did not directly address operational availability as defined here.

Evidence from SBA Tasks and other sources.

The leads of SBA tasks and subtasks were asked about their experience for use of GCI. One individual sent feedback, and answered "I tried to access the portal around the 2nd of April and the server was down. This happened during a workshop when I was trying to disseminate knowledge about the GEO Portal."

Team members also experienced the message "web site not available" on more than one occasion.

Suggested rating of the FOM with respect to "other evidence": -2.

5.5.4. Content Availability

Refers to an indication of the volume and availability of GEOSS content, whether data or information products. Indicators will include the percentage of products that are registered for a sampled set of data providers.

Interviews

The interviewees were asked three questions that related to this FOM.

When asked "Do you agree that GEOSS allows increased use of observations through the ADM Strategic Targets? If you do not agree, why not?" (interview question 6) the interviewees answered a qualified "yes", noting that the term "use" has multiple levels of meaning; that is, differing classes of potential users will use the GEOSS at different levels of effectiveness, depending on their relative understanding of their needs and the ability of the system to satisfy them. Some users understand GEOSS well and are integrated into the system, while others have a very limited understanding and may not even know that anyone is interested in their observational requirements. It was also noted that there needs to be a more integrated use of the GEOSS portal and clearinghouse, and a tangible demonstration of some successful cases, for example Integrated System of Drought Monitoring.

A second question (Question 24) was "How easy and efficient is it to enter your data/services in the Registry?" The respondents found that it was reasonably easy to enter data/services in the Registry, but with some exceptions. There seems to be a general feeling that it is not very different from other resources on the web. An account is needed, this is common, and users can then register their data sets. However, the efficiency was questioned, as 'Efficiency' is a subjective term, and some interviewees found it difficult to register without help from experts of the Registry or without themselves being expert in standards. Finally, some interviewees said they deliver data and tools through systems that are or will be integrated with GEOSS, like EUMETSAT and WMO.

The last question related to this FOM was "How easy and efficient is it to find items in the Registry that meet your needs?" (Question 25). While moderately favourable, the response was mixed. Some interviewees found it reasonably easy to locate items in the Registry– although the schism between "services" and "components" is likely to make it unclear to many potential end users where they should begin. Others found it fairly easy but that the efficiency needs improvement. Standards seem to be well covered.

Other feedback from the interviews was that it got easier to find items over the two years after the Registry became available, and that stability improved during usability testing. However, discoverability remains an issue, and search algorithms need some improvements. The user must hit search term exactly, as opposed to the approximate matching used by mass market search engines

Finally, several interviewees found it difficult to locate data that they knew had been registered: "When you go to the Portal, sometimes you can't find things that you know are in there." It is as if the search function does not yield complete results. The evaluation was told that this was a problem a year ago and remains. The existing list (http://geossregistries.info/holdings.htm) was made by a report from each provider. These reports are not well organized. Some providers select all SBAs, some of which are not well addressed in reality. Other problems also concern registration. For example, when a user tries to find data covering Switzerland, the user will get the result of global OCEAN data even though there is no ocean in the country.

Suggested rating of the FOM with respect to interview results: 2.

Survey

This FOM was addressed by ten survey questions whereof six had a positive outcome, meaning that the majority of the respondents that held an opinion that questions like "Do you agree that by 2015 access to cross-cutting data sets, such as land cover and land use information, will be improved?" gave a positive answer.

However, all six questions with a positive outcome related to the expected situation in 2015. Rating of the present population (Q2.7) was poor to good and the majority of respondents with an opinion believe that the content does not represent members' data holdings. The questions related to data sets that have been registered or are available for registration were both rated with a negative outcome, as the majority of answers indicate zero or one data sets. 13 respondents answered they have registered six or more data sets, whereas 28 respondents claim they hold six or more data sets that could be registered, indicating that there are still many data sets available for registration.

Suggested rating of the FOM with respect to survey results: 1.

Literature Review

A total of 14 papers that were reviewed and could be evaluated and scored for this FOM, with an average score of 1.7.

Test Case

The test case is highly relevant to this FOM. The team performing the test case accessed GEOSS by way of the GEOSS portal and attempted to discern what supporting information could address or partially address any of the postulated questions.

The team members were not able to successfully retrieve supporting information from GEOSS, citing complexity and numerous cascading levels of indirection as the obstacles that prevented its successful use. The team concluded that GEOSS is a massive collection of system elements (i.e. links to distributed holdings), but it does not provide a means of access that can be negotiated, except by perhaps the most expert users. Other available means of data are normally selected due to accessibility.

Suggested rating of the FOM with respect to test case results: -3.

Evidence from SBA Tasks.

The Task Leads of SBA Tasks were asked about experience with use of GCI, its Portal and its Clearinghouse. Two of the responses basically said there was no experience. One response described the contributions to GCI and the Architecture Implementation Pilot (AIP) rather than giving a direct answer to the question. The fourth answer was "The Portal looks more like an advertising post than a real information dissemination means. If I click on 'Italy', 'disasters', and ask for 'data provision', I get items such as 'ALOS on the Antarctica' which is clearly out of

scope. It seems like there's an effort in place to show that there's 'much' to see and browse through, but actually my feeling after browsing it for a while is that of 'information overflow', including side bars that invite you to 'take a look also at'. This is not good."

This answer is in agreement with the result of the Test case.

Team members also had the same experience when trying to access data they were familiar with.

Overall rating

Suggested rating of the FOM with: respect to "other evidence": -3.

5.5.5. Usability

Usability refers to an indication of a typical user's satisfaction in use of the GEOSS. Indicators would include response time, perceived ease of use.

Interviews

While not directly targeting Usability, Question 18, concerning whether GEOSS sufficiently leverages current thinking in technology, elicited some relevant responses. First, one person noted that the interface is not flexible. A second person indicated that the implementation was suitable for experts, but did not address the needs of potential GEOSS users who are not experts. Several respondents referenced other technologies that, if used, would enable more usable access, including the semantic web and brokering techniques.

Question 19, "What are the greatest challenges…" drew out similar responses, including a detailed description of one user's attempts to use GEOSS to retrieve Sea Surface Temperatures. In this case, the user entered "SST" into the portal (sea surface temperature). Multiple pages of hits ensued. He was not clear how to use this mass of response. He clicked on one such and it took him to a summary of one particular data set. Therein, the full description was 1000s of lines – useless. Eventually, he located a URL in the description that took him to the data. The respondent reported feeling "underwhelmed" with the user experience.

Question 23 on the current implementation of the GCI had a few similar responses; it is difficult to get to any actual data.

Question 26 on how easy and efficient is to search the Clearinghouse, was directly related to Usability. Again, the users stated that it is easy to perform a search, but difficult or impossible to get to usable data. One person said he liked the federated search capabilities exposed through the Portal.

For question 28 on what is missing that would provide a friendly user interface, Responses to this question varied significantly from "not friendly" to "quite user friendly."

Question 29 was even more pointed, asking what is missing in the portal to provide access to its functionalities. One person called the Map Viewer (a capability of the

portal) “useless”. One person commented on the lack of temporal search capability. One stated that data, vice only metadata, should be accessible. Finally, one user said that it is difficult to even know what can be done through the system.

Additionally, some responses along the same lines were received from the Societal Benefit Area Task leads, when asked “What is your experience with use of GEOSS Common Infrastructure (GCI) and its Portal and Clearinghouse?” One person replied that “the Portal looks more like an advertising post than a real information dissemination means.” He went on to relay how his attempts to access the portal returned results completely unrelated to the query terms. In contrast, the Energy SBA reported that they had worked closely with the ADC on the Architecture Implementation Pilots, and that the GCI was effectively supporting their SBA’s requirements.

Suggested rating of the FOM with respect to interview results: -3

Survey

This FOM was addressed by seven survey questions, of which five had a positive response. Of the positive responses, the questions dealing with portal access and interfaces were more frequently answered with the descriptors “average” or “satisfactory”. Two questions about access were answered negatively. One response stated that the GCI makes it easier to find datasets.

Suggested rating of the FOM with respect to survey results: +2

Literature Review

A total of eight papers were reviewed and scored for this FOM, with an average estimated value of 1.75.

Test Case

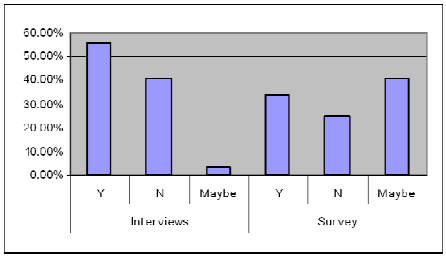
The test case is highly relevant to this FOM. As described previously, the team performing the test case accessed GEOSS by way of the GEOSS portal and attempted to discern what supporting information could address or partially address any of the postulated questions. A telling quote from the testers’ notes reported that “GEOSS appears to us to be a difficult, time-consuming and non-intuitive system. Using our questions as a guide, we were unable to answer even the most basic questions.”

Successive re-attempts to access GEOSS data holdings to address directed questions had the same result, even when the testers were subject matter experts in the field of applied oceanography or meteorology. As noted, the testers stated a strong preference for commercially available datasets and access mechanisms. Although the test might return different results for a long-standing GEOSS user, the results that count are the ones measured, and this is reflected in the result posted.

Suggested rating of the FOM with respect to test case results: -4.

5.5.6. Data quality assurance

22. Will GEOSS data be of an appropriate quality by 2015 to meet user needs?



Data quality assurance refers to the perceived level of quality of GEOSS data holdings, as evidenced by e.g. existence of a quality standard (GEOSS documents) and confidence that the data is current and up to date.

Interviews

For Question 5, concerning data policy, one response stated that national data policies were restrictive to the point of preventing attainment of the Strategic Targets.

Question 10 asked about challenges in GEOSS implementation, and one response again referenced restrictive data sharing policies. On the other hand, Question 11, on realized outcomes, pointed to success stories in which certain data sets had been fully populated and shared.

Question 15, on the three most important GEOSS accomplishments, elicited very favourable responses concerning content, including:

- Establishing the registries and portal content
- GEOSS Data Core
- Data policy
- Most of existing important data and information portals; International Disaster Charter, Sentinel Asia, DIAS, etc. have been integrated.

Similarly, for the same question, several content/data related accomplishments were cited:

- Created understanding that all aspects of data management are important and have put focus on this.
- Evolution of LANDSAT data set to open access.
- Architecture and Data Management plans.
- Data Sharing Task Force results

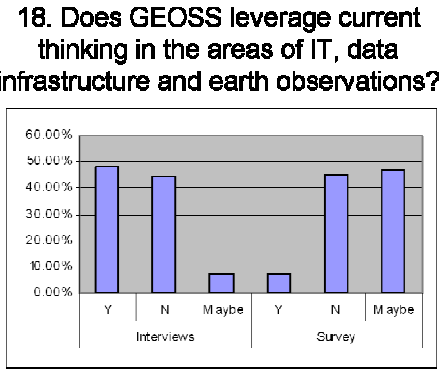
On Question 16, the challenges to GEOSS included the following:

- Ignorance of data standards.
- Data Sharing Policy agreement

On Question 17, it was noted that financial pressure has limited the amount of data sharing.

In Question 18, again on GEOSS challenges, a technical deficiency was noted concerning the availability of an ontology/data model to define the data to be shared

to allow fully global analysis of data. An unfulfilled requirement exists for standardized data models / ontologies and shared vocabularies.



Suggested rating of the FOM with respect to interview results: 2.0

Survey

This FOM was addressed by five survey questions. Of these, four had moderate to strong positive responses, and there was one strong negative response. In particular, the question "Are there important data management deficiencies in GEOSS" was weighted toward "yes" or "don't know", with minimal "no" responses. However, several of the other questions had a response spread heavily weighted to the positive. It is worth noting that the majority of the positively answered questions referred to the user's expectation of the system in 2015, vice the current capabilities.

Suggested rating of the FOM with respect to survey results: 2.0

Literature Review

A total of 14 papers were reviewed and scored for this FOM, with an average estimated value of 0.5.

Test Case

The test case is not relevant to this FOM.

5.5.7. Technical Currency

Technical currency is an indicator of the extent to which the GEOSS system technology uses state of the art practices and principles.

Interviews

The interview instrument contained one question that directly addressed technical currency. The responses to this question about the use of current technology were mixed, with many persons stating that, while GEOSS was making some progress, there remains much that is not being done and/or that could be done. The responses include the following.

- Interviewee believes that GEOSS ADM is not actually achieving interoperability. He believes that although there are currently no solutions to achieving interoperability, there are people/groups working on this internationally, and solutions are becoming available.
- The interviewee does not support the portal concept which he considers a "bottom up" approach. He thinks that an overarching framework is required. GEOSS is based on distributed systems and standards, which is current

thinking. GEOSS needs to continue to evolve the architecture: open standards, open source.

- The GCI uses older technical concepts, vice current thinking, such as the semantic web.
- GCI is not flexible; it is not much more than a catalog/library. GCI does not have a broker function, which is where the field is going. GCI does not address long term interoperability needs.
- Some recent information technology solutions (such as the brokering approach experimented in the AIPs) would provide a greater flexibility for interconnecting heterogeneous systems such as existing and planned Community of Practice systems. This might help to address related interoperability issues.
- If the goal is to make this data immediately relevant to those working across the societal benefit areas, GEOSS needs to be able to provide them with IT capabilities that are more in line with what they have come to expect in their personal and work lives – registries and to some extent, the Portal are in some ways manifestations of "Business as usual."
- GEOSS needs to do more to address needs of users from disciplines other than earth observations. Specifically, information should be accessible and represented on an easy to use map (cf. Google Earth.) A similar capability was developed and demonstrated in the AIP.

Given the mixed nature of the responses, a neutral score is indicated.

Suggested rating of the FOM with respect to interview results: 0.0.

Survey

The survey instrument contained a single question that alluded to technical currency, "Do you believe that the GEOSS Architecture implementation sufficiently leverages current thinking in the fields of information technology, data infrastructures and earth observations?" The response was 47% "yes", 23% "no", and 29% "don't know."

Suggested rating of the FOM with respect to survey results: 1.0

Literature Review

A total of 15 papers were reviewed and scored for this FOM, with an average estimated value of 1.73.

Test Case

The test case is not relevant to this FOM; that is, it does not represent any attribute of technical currency.

5.5.8. Fit for purpose

Indicator of whether the system and its contents meet the needs of the users? This indicator refers to alignment and asks, "Does the system do what the user needs?"

Interviews

The issue of what the user needs is clouded by the perception that the user needs are not well known. There were two questions that asked about a process for determining capability gaps and filling them. For these questions, the respondents generally said that either there was no such process, it was sketchy or not known, or was ad-hoc.

Concerning the question of whether GEOSS promotes increased use of observations, the question received a qualified "yes", noting that the term "use" has multiple levels of meaning; that is, differing classes of potential users will use the GEOSS at different levels of effectiveness, depending on their relative understanding of their needs and the ability of the system to satisfy them. Some users understand GEOSS well and are integrated into the system, while others have a very limited understanding and may not even know that anyone is interested in their observational requirements.

Further, respondents reported significant gaps in the tasks and strategic targets. There are a wide variety of tasks that are not being implemented uniformly. Implementation therefore creates gaps in matching tasks to targets. There is a need for SBAs to take a more holistic look at data sources. A further concern had to do with getting observations and archives on-line for users who aren't familiar with earth observations. There is a perceived unfulfilled need to employ general internet techniques that they are used to using (e.g. Google, web services). One person stated that *GEOSS seems to be lacking an emphasis on end users.*

On a positive note, most respondents pointed to concrete examples of system artefacts that have been implemented and demonstrated. To wit:

- Availability of the GCI.
- Interoperability among provided components using standards promoted by the Standards and Interoperability Forum (SIF).
- Registry population, although participation has proved challenging.
- Data Centers, working towards common IT platforms.
- Data Quality standards and processes, through the IEEE/CEOS.
- Communications:
    - GEONETCAST
    - GCONET: Use of internet systems of large research facilities and high speed links
    - Mobile communications: Outreach to developing countries; architecture and pilot implementations.

Some secondary effects were called out, notably, that the USGS decision to release all LANDSAT on web was a direct result of GEOSS, "a catalyst effect."

The third item of note from the interviews is the general change of mindset resulting from GEOSS. For example, interviewees mentioned that the data sharing principle

was agreed, GCI concept was built up, and the objective themes of IGOS have been transferred into GEO Tasks. The need of a global coordination is now widely recognized; involvement of Communities of Practice is a beneficial effect. For example, data archive on flood and drought was demonstrated in Asia Water-Cycle WS and GOSAT and PALSAR data coordination in Global Carbon Cycle are typical outcomes.

The change to a belief in the feasibility of a GEOSS was noted as a beneficial outcome.

Suggested rating of the FOM with respect to interview results: +3.0

Survey

Two of the questions in the survey instrument asked whether the *anticipated* result of the GEOSS would meet user needs or are relevant, and for both of them, the response was resoundingly positive. An additional question asked whether the planned activities would yield the anticipated results, and the response was slightly positive. A fourth question asked whether increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion will exist by 2015? As in the other such questions, the response was positive. Thus, the survey indicated that GEOSS participants were optimistic that GEOSS would deliver capabilities that would meet their needs, *in the future*.

On the other hand, the one relevant question for the present asked whether the user accessed existing national, regional and global observing and information systems through the GEOSS, and the response was 69% negative.

Given that the only positive responses were for a future state, the consensus is more to the negative.

Suggested rating of the FOM with respect to survey results: -1.0.

Literature Review

A total of 17 papers were reviewed and scored for this FOM, with an average estimated value of 1.70.

Test Case

The test case is difficult to apply to the FOM, since the result of the test case was that the user could not obtain *any* results, so it is impossible to judge whether the content would be suitable for the user's needs. However, the inability to access anything would imply at least a slightly negative result.

Suggested rating of the FOM with respect to test case results: -1.0.

5.5.9. System Maturity Level

This FOM was the subject of a separate survey, the results of which are described in more detail in section 6.6.

Interviews

One question referenced the Maturity Level, however few interviewees responded. For those who did respond, their rating was 3.8 on a scale of 1-5, equating to 2.0 on the FOM scale of -5 to +5.

Survey

The survey instrument contained one question that touched on system maturity: "Is implementation of the Architecture and Data Management for GEOSS guided by a clear plan to 2015?" The responses were "yes" 37; "no" 13; "don't know" 50. That this question is tangential to the issue of system maturity limits its impact on the overall scoring.

Under this heading, a more relevant metric is the e-mail survey that is described in section 4.8 and the results of which are reported separately in Section 6.6. The returned value of 3.21 (on a scale of 1-5) translates to a value of 0.51 on the -5 to 5 scale used elsewhere in this report below.

Suggested rating of the FOM with respect to survey results: 0.5.

Literature Review

A total of 15 papers were reviewed and scored for this FOM, with an average estimated value of 1.53.

Test Case

The test case is not relevant to this FOM.

5.5.10. Findings and recommendations based on aggregate FOM

The ratings of each FOM with respect to the information sources are summarized in Table 3, along with the calculated averages.

	Inverview	Survey	Lit. Review	Test Case	Other evidence	
FOM 1. Completeness of Function	-1.00	1.00	1.60	-2.00		-0.10
FOM 2. Sustainability	0.00	0.00	0.80	-		0.27
FOM 3. Operational Availability	-	-1.00	1.70	-	-2.00	-0.43
FOM 4. Content Availability	2.00	1.00	1.70	-3.00	-3.00	-0.26
FOM 5. Usability	-3.00	2.00	1.75	-4.00		-0.81
FOM 6. Data Quality Assurance	2.00	2.00	0.50	-		1.50
FOM 7. Technical Currency	0.00	1.00	1.73	-		0.91
FOM 8. Fit for Purpose	3.00	-1.00	1.70	-1.00		0.68
FOM 9. System Maturity Level	2.00	0.53	1.53	-		1.35
				Aggregate FOM		**0.34**

Table 3. Individual and average ratings of the FOMs with respect to information sources

Finding

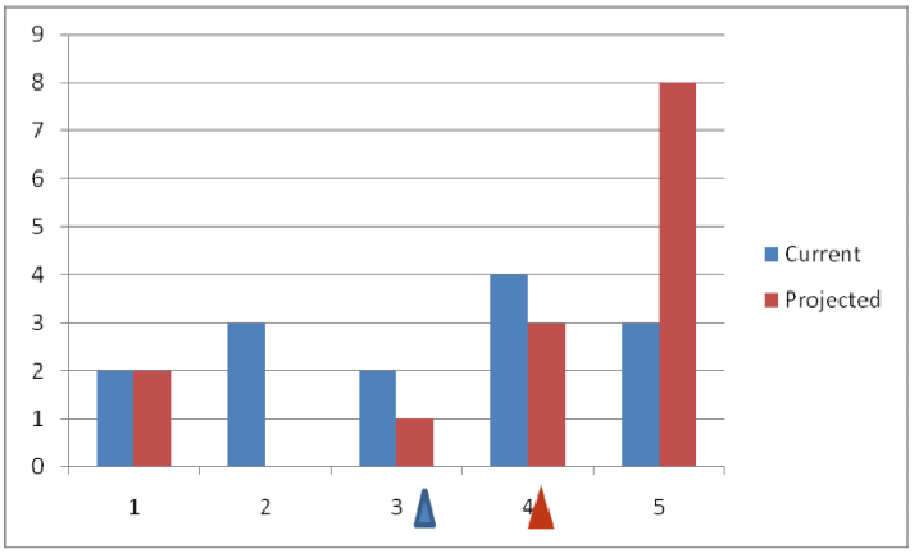
Progress of ADM towards the Strategic Targets outcomes is weak. The important aspects like Completeness of Function, Operational and Content Availability and Usability are negatively evaluated. In view of the information value chain, the activities at the origination of information (vice consumption) were evaluated much less positively. Survey results are more positive than interview results. Real use (test case and other evidence) shows negative evaluations and great shortcomings in content availability and completeness of function.

5.6. Maturity Index

Separate Survey for Maturity Index.

The Maturity Index was evaluated by emailing all available points of contact from the GEOSS Registry. A total of 240 emails were sent, with a return of 13 usable responses.

The distribution of the responses is indicated in the following figure (where 1=Identification, through 5=Integrated System of Systems).



The Mean value of current maturity index = 3.21

The Mean value of projected maturity index = 4.07

The returned value of 3.21 (on a scale of 1-5) translates to a value of 0.51 on the -5 to 5 scale used elsewhere in this report.

Maturity levels

Using the five maturity "levels" of Identification, Affiliation, Confederation, Federation, and Integrated System-of-Systems the respondents were asked "what factors indicate that your system meets the maturity level that you indicated?"

Identification: My organization/system has identified resources and provided basic information for further contact. Little/no direct access to data or services. Web pages and documents predominate. (e.g. Web model) (2 respondents)

The respondents for Identification cited that some resources were identified for contact, and that the web page model was the primary one in use.

Affiliation: My organization/system has branded contributions with a common group identity (GEOSS) for recognition. Information access and technology are limited but diverse. Integration of resource content is difficult. (e.g. Membership model) (3 respondents)

The respondents for Affiliation cited a variety of projects with different outputs & variety of visions to share/disseminate data. Some referenced the ability for users to query and download remote sensing images and information products. Some cited availability of standardized services, including Open Geospatial Consortium (OGC), weather services, and the Open Data Access Protocol (OpenDAP).

Confederation: My organization/system has adopted a common approach but retained rights of self-governance, access terms, and technology. Information access is enhanced but multiple interfaces predominate. Developers can assemble interfaces to multiple systems in weeks (e.g. Community of Interest model) (2 respondents)

The respondents for Confederation only cited minimal capabilities, including the use of standardized interfaces, formats and metadata, and that data are made freely accessible. These responses were actually indicative of less capability than the 2 responses, who cited the use of an SOA model.

Federation: My organization/system has agreed to adopt common practices, data access principles, terminology, devolving some authority to a common governance body. Information content and services are well-described and some common interfaces and formats are deployed by requirement. Integrators can assemble interfaces to diverse systems in days (e.g. Governmental or professional network model). (3 respondents)

The respondents for Federation cited use of common infrastructure among the participating organizations, portal access with standardized parameter names, common data federation schema (Darwin Core, ABCD), a set of communications protocols (DiGIR, BioCASe, TAPIR), and metadata standards (ISO19115 and INSPIRE). This group also referenced OGC standards (Web Mapping Service). They also indicated the application of governance structures and availability of skilled personnel. One entrant cited volume: 264 million records from some 11,000 data sources (datasets) from 316 publishers.

Integrated System-of-Systems: My organization/system has encapsulated systems and offers standardized service interfaces to process/access data with identified and common semantics and common format/syntax. Data access rules are deployed transparently across all systems. Client software can be deployed to access diverse system interfaces in real-time based on familiar patterns (e.g. Enterprise System model, System-of-Systems model). (3 respondents)

The respondents for Integrated System-of-Systems cited the use of a broad set of standards, including OGC CSW Core, OGC CSW ISO AP, OGC CSW ebRIM CIM and EO Extension Packages, OAI-PMH, and OpenSearch (with Geo and Time extensions). One represented as a distributed catalogue service, federating a set of catalogue, inventory, harvest and access services. One noted the availability of client applications for accessing the broker, including an ad hoc client available through a web site. One claimed Integrated System-of-Systems status by merit of being an integrated component of the GCI.

Enabling Higher Levels of Maturity

Respondents indicated that higher levels of maturity could be facilitated primarily by interoperability practices such as common data access principles, terminology, and a common governance body for data sharing. Specifically, they cited the need for well-described Information content and services and common interfaces and formats. Also, several respondents stated a need for OGC compliant services (e.g. Web Mapping Service, Web Feature Service, etc.) Other items included more discovery metadata, common vocabularies and semantic metadata, and Web Processing Services to allow service chains to be created by users. One respondent indicated that anticipated new funding would result in broader deployment of interoperability standards by non-federal partners.

Several respondents noted that broadened visibility through education, advertisement, and showing the benefits of GEOSS would enable higher levels of maturity. Some asked for technical support, including the means to be connected to other parts of GEOSS and access to GEOSS resources and expertise. One respondent said that GEOSS should develop compelling end-user interfaces, not a single search interface, and not just geographic. One respondent said that they intended to develop new standards for data handling/querying. It was also noted that the existing standards are often overly broad and require considerable profiling, specialization or restriction to achieve true interoperability. GEO could help define and promulgate specific profiles that are appropriate to information communities with similar data types. Multiple respondents said that funding or resources would help.

Obstacles

All respondents cited lack of or insufficient funding/resources/time as an obstacle to their attaining higher levels of maturity. One respondent cited motivation, meaning “I do not know what your system could provide that I do not already have, and I do not have confidence that you can provide anything better than what I am currently doing.”

Another stated it this way, “partners [tend] to prefer to support local stakeholders needs with ad hoc interfaces rather than giving up some autonomy to achieve federated or system-of-systems status.”

Some cited lack of common vocabulary and semantic metadata and lack of a common user-identification system. Another concern was a lack of agreement among members on standards. One member cited the poor fit of OGC standards with their data types.

5.7. Communication between ADM tasks and SBA tasks

Judging from the four received responses from task or sub-task leads, the contact between ADM tasks and SBA tasks has been limited. One task lead said they believed that the request to submit standards and protocols to GEOSS had come through ADM and two could not report contact. The fourth had fed data set wishes into the system, but the request to submit such a list did not come directly from ADM.

The SBA tasks and sub-tasks report very limited experience with use of GCI. One response said there had not been active use of GCI, one said GCI had been used to report progress, one had negative experience (see Section 5.5.4) , and the fourth reported contributions rather than use of GCI.

There were two answers to the question of other issues and experiences regarding ADM that they wanted to share. One said that interactions had been minimal due to lack of funding and it also made a remark about a steep learning curve due “the alphabet soup of groups and interactions which our tasks’ co-leads have not entirely overcome”.

The fourth response was more serious in character, although not directly addressing ADM. It complained that a report that is going to be used as a basis for AIP-4 had not included several parameters that had been flagged by the SBA and its Community of Practice (CoP). There was fear that this may hurt the perception of GEOSS amongst experts in the field of this particular SBA (Energy).

5.8. Review of GEO Documents: Progress against plans as reported

The following four GEO Documents were reviewed for evidence on progress reporting of ADM tasks.

- GCI Report and recommendations for Long Term Operations. Document 6, GEO-VI 17-18 November 2009
- GCI Coordination Team report. Document 8, GEO-VII, 3-4 November 2010
- Report of the Architecture and Data Committee, Document 17, GEO-VI, 17-18 November 2003
- Report of the Architecture and Data Committee, Document 17, GEO-VI, 3-4 November 2009

Below follow summaries of progress reported for some important aspects of GEOSS – GEOSS Common Infrastructure (GCI), and Architecture

Implementation Pilots (AIPs), The Standards Interoperability Forum (SIF) and Quality for earth observation.

GCI

- Progress since GEO-VI (2009) includes the establishment of the GCI Coordination Team (GCI-CT), whose achievement has been the evaluation and selection of a single GEO web portal and a single GEOSS Clearinghouse.
- The GCI-CT was also tasked with formulating recommendations vis-à-vis a "reserve fund". This has not yet been completed. The GCI-CT has plans to undertake further analysis before it can make a recommendation. The GCI-CT will examine:
    - What GCI needs cannot be met by existing resources through to 2015
    - Legal and policy constraints
    - Exploration of other funding arrangements
- On the topic of the Component and Service Registry (CSR), the GCI-CT was tasked to assist in increasing resources registered in the GCI. The GEO-VI ADC report states "population of the GEOSS registries must be intensively encouraged. It is imperative that the number of components and services registered be significantly increased". As at Sept 2010, more than 240 EO systems, 13500 services, and 12,400 data sets have been registered. There is no information on how this compares with 2009, or how the GCI-CT plan to improve the registration of components (see GCI Implementation Guideline 11).

AIPs

- The GEO-VI ADC document reports that plans for 2010 include the implementation of AIP-3 for “further refinement of GEOSS architecture implementation". While the GEO-VII ADC report does not specifically mention AIP-3, it does report that AIPs continue to develop and test new components. AIPs are demonstrating and fostering interoperability and common practices. Technology is generally available but not yet fully refined to meet the needs of all GEOSS communities. More research is required e.g. to harmonize data models for remote sensing and Spatial Data Infrastructures.
- The GEO-VII ADC document also reports that some progress has been achieved in the implementation of common architecture solutions for several SBAs (details not provided).
- The latest status of AIP-3 is available via the Task Sheet for Task AR-09-01b (GEOSS Architecture Implementation Pilot), which reports that AIP-3 Development was conducted from March to October 2010. Results of the development were captured as series of Demonstrations to be used for display at the Beijing Summit. Several AIP-3 Engineering Reports are now available.
- Progress for this activity has followed GCI Implementation Guideline 09:

    > The Architecture and Implementation Pilots process is retained, reinforced and fully integrated into the strategy to develop and enhance the GCI in a cyclic fashion. The GCI Coordinating Team facilitates the interface between the AIP and the GCI component providers.

The Standards Interoperability Forum (SIF)

- The GEO-VI ADC document reports that plans for 2010 include "regular engagement of the SIF to facilitate interoperability". This is in line with GCI Implementation Guideline 13 which states "... d) Looks to consolidate the preferred standards for GEOSS to maximize inter-operability within the GCI under the guidance of the ADC / SIF."
- The GEO-VII ADC document does not provide information on achievements of the SIF for 2010, but lists plans for 2011 which include:
    - The Standards Interoperability Forum (SIF) is preparing a white paper on GEOSS interoperability.
    - SIF is generating materials and web-based training to assist with registration of standards, services and best practices.
    - SIF is developing guidelines and best practices for realizing convergence of standards in the Standards and Interoperability Registry.
    - SIF will recommend ways of improving the effectiveness of the Best Practices Wiki.

Quality for earth observation

- The GEO-VI ADC document reports that plans for 2010 include addressing major areas of data management including quality for earth observations. It is assumed that this refers to quality management of all components registered in the GCI, addressed by GCI Implementation Guideline 06, and by task DA-09-01a. There is no mention of this priority in the GEO-VII ADC document, and the related task sheet also provides no progress update.

Other plans for 2010, for which no progress report has been provided include:

- Fostering of sensor and modeling networks
- Registration of cross-cutting observations
- Data management and datasets

6. Findings and Recommendations

6.1. Findings

Finding

All subtasks under GEOSS ADM have some relevance to either the Strategic Target Outcomes or the Cape Town Declaration. Generally, the target task alignment is good. Eight of the nine outcomes from the GEOSS Strategic Targets are directly addressed by at least three overarching tasks. The match between tasks and target outcomes varies considerably and the GEOSS ADM tasks would benefit from a structured gap analysis.

Finding

Progress made against the outcomes of the overarching tasks seems to be moderate. There are differences in the opinions of some interviewees and the survey respondents on this.

Finding

Although there have been individual achievements, the interviewees and the external evaluators appear to have a less positive evaluation of the progress than do the survey respondents.

Finding

The moderate progress is substantively different from the ratings of the ADM tasks in the annual Work Plan Progress Reports. In the latter, all but one ADM task were rated with progress very good to excellent in both the 2007-2009 and 2009-2011 Progress Reports (the one task was rated as progressing but with need for more effort).

Finding

One outcome from the GEOSS Strategic Targets is not directly addressed by any subtask and indirectly by only three subtasks of the 29 tasks and subtasks. This is considered a significant finding, which suggests that there is no concerted activity to do gap analysis and the ADM effort may be proceeding without clear direction.

Finding

The high number of answers in the groups “don’t know” or “cannot answer” introduces uncertainty into the results. They are also an indication of limited knowledge and experience with GEOSS.

Finding

Those who are “experts” see more progress than those who are “users”. A test case conducted for the evaluation team by a group of users (subject matter experts in the field of applied oceanography and meteorology) determined that GEOSS “appears to

us to be a difficult, time-consuming and non-intuitive system." A response to a question asking about the usefulness of the GEOSS Supersite in analyzing the Japanese earthquake of 11 March 2011 elicited praise for the timeliness, accuracy and usefulness of data.

Finding

Progress of ADM towards the Strategic Targets outcomes is moderate. Important aspects such as "Completeness of Function", "Operational and Content Availability" and "Usability" are negatively evaluated. Survey results are more positive than interview results. Real use (test case and other evidence) shows negative evaluations and shortcomings in content availability and completeness of function.

Finding

The present progress reporting against Tasks, although it uses a standard form, does not allow for a quantitative evaluation of progress The internal progress reporting appears at times to be more positive than what this evaluation has revealed.

Finding

The Architecture Implementation Pilot (AIP) does not seem to be sufficiently open a process to be of value to a larger audience. There are differences between what is reported to the GEO Secretariat against plans and what was found by the evaluation as substantive performance measures, outputs and outcomes.

Finding

As a practical tool GEOSS seems to be less user-friendly than other web-based search engines, such as Google, Yahoo!, Bing or Dogpile.

Finding

The operational availability of the GEOSS datasets was varied. In several instances the database was unavailable for extended periods of time.

Finding

For certain users the Registry has made it easier to find information. Others found it difficult to find information which they themselves had registered.

Finding

Technical currency may not be as advanced as some GEOSS community members believe. More work is needed on open standards and open source software.

Finding

Data sharing as a GEOSS principle seems to have created a change in mindset, demonstrably through constant shift of policies by GEO Members and Participating Organizations. **Finding**

The current opinion of survey respondents of how things are today belies the popular opinion that GEOSS will achieve its targets for 2015. There is a large gap between what is available today and what is necessary to be met in 2015.

Finding

The overall average of FOM is 0.34, implying that the GEOSS ADM implementation is slightly better than neutral in rating.

6.2. Recommendations

Recommendation 1

The Evaluation Team recommends that the GEOSS activities must have clearly defined goals, with performance indicators and measurable tasks, aligned with the ADM Strategic Targets.

Recommendation 2

The Evaluation Team recommends the formation of Provider-to-End-User projects with Performance Indicators and clearly defined goals.

Recommendation 3

The Evaluation Team recommends that the usability issue be re-evaluated by a Human-Computer Interface (HCI) expert group, as the sole focus of that evaluation, a topic that was beyond the scope or skill set of this Evaluation Team. An HCI group would evaluate the GEOSS user interface through a set of usability and ergonomics factors, with recommendations that could range from simple tweaks to wholesale redesign.

Recommendation 4

The Evaluation Team recommends that GEO undertake a pilot project to (1) implement a geospatial browser in the GCI that is capable of rendering thematic layers from GEO data holdings, (2) standardize a subset of GEO data holdings accessible through the geospatial browser, (3) develop a way ahead so that the majority of GEO data holdings are accessible in this manner.

Recommendation 5

The Evaluation Team recommends that a Systems Engineering Working Group be established to revisit the efforts to date and map them to a defined Systems Engineering process, resulting in a plan of action for GEOSS implementation.

Recommendation 6

The Evaluation Team recommends that current generation technology be targeted for utilization by the Systems Engineering Working Group. The Team also recommends that GEO issue a policy requiring that all software in the GCI be made Open Source and available to GEO member organizations.

Recommendation 7

The Evaluation Team recommends that data retrieval, and the catalogue of archive data with metadata, should be improved to meet user requirements and needs.

Recommendation 8

The Evaluation Team recommends that the gap analysis/filling, Target/Task matchup software developed by Japan should be modified to meet the requirements.

Recommendation 9

The Evaluation Team recommends that the project proposals should identify gaps and the impact this will have on funding (as is seen with ESA/EU/GMES).

Recommendation 10

The Evaluation Team recommends that the GEO implement a progress reporting system for all Tasks that measures progress against milestones, reports important issues and give confirmed or revised plans for further work. The Task Leads should be asked to grade their progress .

Recommendation 11

The Evaluation Team recommends that the GEO create a communications plan which clearly identifies GEOSS, its capabilities, and its data content.

Recommendation 12

The Evaluation Team recommends that the GEO pay attention to the implementation of the GEOSS Data Sharing Action Plan.

7. Documents consulted

7.1. GEO Documents

Ad hoc GEO. (February 16, 2005). GEOSS 10-Year Implementation Plan. Third Earth Observation Summit, Brussels. Retrieved from http://www.earthobservations.org/documents/10-Year%20Implementation%20Plan.pdf

Ad hoc GEO. (February 2005). GEOSS 10-Year Implementation Plan Reference Document. Third Earth Observation Summit, Brussels. Retrieved from http://www.earthobservations.org/documents/10-Year%20Plan%20Reference%20Document.pdf

GCI Report and recommedations for Long Term Operations. Document 6, GEO-VI 17-18 November 2009

GCI Coordination Team report. Document 8, GEO-VII, 3-4 November 2010. http://www.earthobservations.org/documents/geo_vii/08_GCI%20Coordination%20Team%20Report.pdf

Report of the Architecture and Data Committee, Document 17, GEO-VI, 17-18 November 2009 http://www.earthobservations.org/documents/geo_vi/17_Report%20of%20the%20Architecture%20and%20Data%20Committee.pdf.

Report of the Architecture and Data Committee, Document 17, GEO-VI, 3-4 November 2010. http://www.earthobservations.org/documents/geo_vii/13_Report%20of%20the%20Architecture%20and%20Data%20Committee%20(ADC).pdf

GEO Ministers. (November 30, 2007). Cape Town Declaration. Cape Town Ministerial Summit. Retrieved from http://www.earthobservations.org/05_Cape%20Town%20Declaration.pdf.

GEO Monitoring and Evaluation Working Group. (November 17-18, 2009). GEOSS Monitoring and Evaluation. GEO-VI, Washington. Retrieved from

http://www.earthobservations.org/documents/geo_vi/13_%20GEOSS%20Monitoring%20and%20Evaluation.pdf.

GEO Secretariat. The First 100 Steps to GEOSS. Annex of Early Achievements to the Report on Progress 2007. Cape Town Ministerial Summit. Retrieved from http://www.earthobservations.org/documents/the_first_100_steps_to_geoss.pdf

GEO Secretariat. (December 10, 2009). 2009-2011 Work Plan Annual Update. GEO-VI, Washington. Retrieved from

http://www.earthobservations.org/documents/work%20plan/geo_wp0911_rev2_091210.pdf

GEO Secretariat. (November 3-4, 2010) 2009-2011 Work Plan Annual Update. GEO-VII, Beijing 3-4 November 2010 Retrieved from

http://www.earthobservations.org/documents/geo_vii/09_2009-2011%20Work%20Plan%20Annual%20Update.pdf

GEO Secretariat. (November 19-20, 2008). 2007-2009 Work Plan Progress Report. GEO-V, Bucharest. Retrieved from http://www.earthobservations.org/documents/geo_v/08_2007-

2009%20Work%20Plan%20Progress%20Report.pdf.

GEO Secretariat. (November 3-4, 2009). 2009-2011 Work Plan Progress Report. GEO-VI, Washington. Retrieved from http://www.earthobservations.org/documents/geo_vi/05_2009-2011%20Work%20Plan%20Progress%20Report%20Rev1.pdf

GEO Secretariat. (November 3-4, 2010). 2009-2011 Work Plan Progress Report. GEO-VII, Document 5, Beijing. Retrieved from

http://www.earthobservations.org/documents/geo_vii/05_2009-2011%20Work%20Plan%20Progress%20Report.pdf

GEO Secretariat (November 3-4, 2011) Mid-term Evaluation of GEOSS Implementation. Document 6, GEO-VII, Beijing. Retrieved from

http://www.earthobservations.org/documents/geo_vii/06_Mid-Term%20Evaluation%20of%20GEOSS%20Implementation%20Rev1.pdf

GEO Secretariat (November 3-4, 2011) Report on Progress. Beijing Ministerial Summit. Oberve, Share, iform. Retrieved from http://www.earthobservations.org/documents/ministerial/beijing/MS2_The%20GEO%20Report%20on%20Progress.pdf

GEO Secretariat(March 22-23, 2011) Development of a GEOSS Gap Analysis Strategy. Document 13, 21st Executive Committee http://www.geosec.org/documents/committees/stc/201104_16thSTC/13_Development%20of%20a%20GEOSS%20%20Gap%20Analysis%20Strategy.pdf

Other relevant documents from the following web-sites:

ADC Terms of Reference	http://www.earthobservations.org/documents/committees/adc/tor_adc.pdf	
GCI Terms of Reference	ftp://ftp.earthobservations.org/ExCom/18/08_GCI%20Coordination%20Team%20-Terms%20of%20Reference.pdf	
ADC strategy (2010)	ftp://ftp.earthobservations.org/ADC/meeting14_01-03_Sep_2010/Presentation/Day2/	

	ADC%20strategy.ADC.14th%20v1.pdf	
ADC Home	http://www.earthobservations.org/ag_adc.shtml	
ADC meetings website	ftp://ftp.earthobservations.org/ADC/	
GCI page on the GEO Website	http://www.earthobservations.org/gci_gci.shtml	Documents - GCI consolidated Requirements (12-3-2009) - The GCI Concept of Operations - Strategic Guidance for Current and Potential Contributors to GEOSS - Tactical Guidance for Current and Potential Contributors to GEOSS
GCI coordination team report to GEO VII	ftp://ftp.earthobservations.org/GEO-VII/08_GCI%20Coordination%20Team%20Report.pdf	
Architecture Implementation Pilot website	http://www.ogcnetwork.net/AIpilot	Pilot activities to actually describe and demonstrate how GEOSS can be used by users in different SBA's. Four cycles of projects.

7.2. General literature

Ahn B.Y., Joh M.S., Myung H.J., 2008 A study on development of metadata and ontology standardization strategy for korean earth observation data. Proceedings of the 2008 2nd International Conference on Future Generation Communication and Networking, FGCN 2008, Vol. 2

Anonymous. (2009). *Report Of The Seventeenth Session Of The GCOS Steering Committee.* (GCOS – 137, WMO/TD No. 1516). Geneva: World Meteorological Organization.

Bai Y., Di L., Wei Y. (2009). A taxonomy of geospatial services for global service discovery and interope-rability. *Computers and Geosciences. 35* (4), pp. 783-790.

Bambacus M., Yang C., Evans J., Li Z., Li W., Huang Q. (2008). Sharing earth science information to support the global earth observing system of systems (geoss). Papers of the International Geos-cience and Remote Sensing Symposium (IGARSS 2008) *1*, pp. I-141 - I-144.

Butterfield M.L., Pearlman J.S., Vickroy S.C. (2008). A system-of-systems engineering GEOSS: Architec-tural approach. *IEEE Systems Journal. 2* (3), pp. 321-332.

Christian E.J. (2008). GEOSS architecture principles and the GEOSS clearinghouse. *IEEE Systems Journal. 2* (3), pp. 333-337.

CODATA Secretariat, 2009 The importance of data sharing within the Global Earth Observation System of Systems. Committee on Data for Scince and Technology (CODATA) Newsletter

Durbha S.S., King R.L., Younan N.H., 2008 An Information Semantics Approach for Knowledge Management and Interoperability for the Global Earth Observation System of Systems. IEEE Systems Journal, Vol. 3, No. 2

Fontaine K.S. (2007). Architecture and data management challenges in GEOSS and IEOS. IEEE Aero-space Conference Proceedings. 4161329.

GIGAS Consortium, NNNN GIGAS Technology Watch Report Architecture Technical Note

Hassan M.M., Huh E.-N., 2008 An efficient grid based metadata processing and sharing. International Conference on Advanced Communication Technology, ICACT, Vol. 3

Husar R.B., Hoijarvi K., Falke S.R., Robinson E.M., Percivall G.S. (2008). DataFed: An architecture for federating atmospheric data for GEOSS. *IEEE Systems Journal. 2* (3), pp. 366-373.

Khalsa S.J.S., Nativi S., Shibasaki R., Ahern T., Thomas D. (2007). The GEOSS interoperability process pilot project. Papers of the International Geoscience and Remote Sensing Symposium (IGARSS 2007). pp. 293-296.

Khalsa S.J.S., Nativi S., Geller G.N. (2009). The GEOSS Interoperability Process Pilot Project (IP3). *IEEE Transactions on Geoscience and Remote Sensing. 47* (1), pp. 80-91.

Lefevre, R.J, et al, 2010 The Role of Science and Technology in GEOSS. Aerospace Conference, 2010 IEEE, 15 Apr 2010

Leibovici D., Hobona G., Stock K., Jackson M., 2009 Qualifying geospatial workflow models for adaptive controlled validity and accuracy

Liebig V., Aschbacher J., Briggs S., Kohlhammer G., Zobl R. (2007). Global monitoring for enviornment and security: The second European flagship in space. *European Space Agency Bulletin.* (130), pp. 10-16.

Mandl D., Sohlberg R., Justice C., Ungar S., Ames T., Frye S., Chien S., Cappelaere P., Tran D., 2007 Experiments with user centric GEOSS architectures. International Geoscience and Remote Sensing Symposium (IGARSS)

Mandl D., Sohlberg R., Justice C., Ungar S., Ames T., Frye S., Chien S., Tran D., Cappelaere P., Derezinski L., Paules G., Sullivan D., Di L., Kolitz S., 2007 Sensor webs with a service-oriented architecture for on-demand science products. Proceedings of SPIE - The International Society for Optical Engineering, Vol. 6684

Mandl D., Sohlberg R., Justice C., Ungar S., Ames T., Frye S., Chien S., Tran D., Cappelaere P., Sullivan D., Ambrosia V., 2008 A space-based sensor web for disaster management. International Geoscience and Remote Sensing Symposium (IGARSS)

Martin J.N. (2008). Using architecture modeling to assess the societal benefits of the global earth obser-vation system-of-systems. *IEEE Systems Journal. 2* (3), pp. 304-311.

Mason P. J. (ed.) (2009). *Progress Report on the Implementation of the Global Observing* System for Climate in Support of the UNFCCC 2004-2008. (GCOS-129, WMO
TD/No. 1489, GOOS-173, GTOS-70). Geneva: World Meteorological Organization

Nativi S., Bigagli L., Mazzetti P., Boldrini E., Papeschi F., 2009 GI-cat: A mediation solution for building a clearinghouse catalog service. Proceedings of the International Conference on Advanced Geographic Information Systems and Web Services, GEOWS 2009

Pearlman, J., S.Holt, C.Waldman, 2008 Creation and Operation of a Global Earth Observation System of Systems. PROCEEDINGS, OCEANS 2008
10.1109/OCEANS.2008.5151839

Percivall G., 2006 OpenGIS international standards for GEOSS interoperability arrangements. International Geoscience and Remote Sensing Symposium (IGARSS)

Percivall G. (December 8, 2009). Directing the Evolution of GEOSS Technical Architecture. *Earthzine*. Retrieved from
http://www.earthzine.org/2009/12/08/directing-the-evolution-of-
geoss-technical-architecture/.

Rank R., 2008 Enterprise IT support for NOAA archives. International Geoscience and Remote Sensing Symposium (IGARSS)

Rösner S. (2010). WMO Commission for Climatology 14th intersessional period Rapporteur on GEOSS Final Report. WMO Commission for Climatology.

Sekiguchi S., Tanaka Y., Kojima I., Yamamoto N., Yokoyama S., Tanimura Y., Nakamura R., Iwao K., Tsuchida S., 2008 Design principles and IT overviews of the GEO grid. IEEE Systems Journal. Vol. 2, No. 3

Uhlir P.F., Chen R.S., Gabrynowicz J.I., Janssen K. (2009). Toward Implementation of the Global Earth Observation System of Systems Data Sharing Principles. *Data Science Journal 8*.

Werle D., Ball D. (2009). *Canadian Activities Contributing to GEO- A Summary Survey and Report of Re-sults*. (GoC Order No. 28/700 6998 – Standing Offer No. 9 F028-04-4003/05). Canadian Space Agency.

Wolf, L. And M. Williams, 2007 GEONETCast-Delivering Environmental Data to Users Worldwide (September 2007). IEEE Systems Journal. Vol. 2 No. 2

Yang P., Evans J., Cola M., Marley S., Alameh N., Bambacus M., 2007 The emerging concepts and applications of the spatial web portal. Photogrammetric Engineering and Remote Sensing. Vol. 73, No.6

Yasukawa, M. Et al, 2008 PVES: Powered Visualizer for Earth Environmental Science. IEEE Systems Journal. Vol. 2, No. 3

Zillman J.W. (October 2009). GCOS in the GEOSS Targets Statement and Work Plan. (GCOS SC-XVII Doc. 11.1). Submitted to GCOS Steering Committee Seventeenth Session.

8. Appendices

8.1. Literature Review

The literature review question guide used in the mid-term evaluation was also used this time. It included the following five questions:

- Q1. Does the literature show evidence of links between the described activities and the goals of GEOSS Architecture and Data Management?
- Q2. Does the literature identify any gaps in GEOSS Architecture and Data Management?
- Q3. Does the literature indicate attempts to fill identified gaps in GEOSS Architecture and Data Management?
- Q4. Does the literature show progress or outcomes from GEOSS Architecture and Data Management activities?
- Q5. Does the literature identify any unintended positive or negative outcomes or impacts of GEOSS Architecture and Data Management implementation?

A sixth question was added for the ADM evaluation:

- Q6. Does the literature address any of the Figures of Merit (FOM) shown below? If so, indicate a value from -5 (very counter-indicated) to 0 (neutral) to +5 (strongly supported)?

8.1.1. Results

Of the 35 selected publications 31 were reviewed regarding the five first questions above. The last question, related to FOM, was added after the reviewing had commenced and was therefore addressed by only 27 reviews.

				Figure of Merit (FOM)								
ID Number	First Author	Does literature address FOM?		1 Completeness of function	2 Sustainability	3 Operational Availability	4 Content Availability	5 Usability	6 Data Quality Assurance	7 Technical Currency	8 Fit for purpose	9 System Maturity Level
3	Werle, D.											
5	Rösner, S.	Y		1	-1	0	1	0	0	0	0	1
6	Butterfield M.L.	N										
7	Bai Y., Di L., Wei Y.	N		0	0	1	0		0	3	2	2
11	Husar R.B.	Y*		2	1	1	2	2	3	2	2	2
22	Khalsa S.J.S.	N										
27	Uhlir P.F.											
28	Martin I.N.											
29	Percivall G.	Y		2	1	2	2		1	1	3	2
38	CODATA Secretariat	?										
39	Zillman, J.W.											
40	Anonymous	Y		0	1	0	0	0	0	0	0	1
45	Christian E.J.	N										
59	Liebig V.	N										
66	Sekiguchi S.	Y*		2	0	1	1	2	0		1	2
73	Yang P.											
79	Durbha S.S.	Y										
83	Ahn B.Y.	Y		2	0	2	2	1	0	1	1	2
88	Bambacus M.	Y				0				2	3	
108	Fontaine K.S.											
113	Hassan M.M.	Y		1	1	2	2		1	0	3	1
129	Khalsa S.J.S.	Y		1	0	0	0	1	0	1	1	1
136	Leibovici D.	N										
139	Mandl D.	Y*		4	1	4	3	4	1	3	3	3
140	Mandl D.	Y		4	1	4	3	4	1	3	3	3
141	Mandl D.	N										
146	Nativi S.	Y								2	3	
155	Percivall G.	Y		3	3	3				3	4	3
158	Rank R.	N										
213	Mason, P. J. (ed)	N										
217	Wolf, L.	Y		2	2	4	4		0		0	0
218	Yasukawa, M.	Y		0	0	1	2		0	5	0	0
219	Pearlman, J.	Y		0	2	2	2		0	0	0	0
220	Lefevre, R.J.	N										
221	GIGAS Consortium											
	% addressing FOM	63	Average (of answers)	1.6	0.8	1.6875	1.7142857	1.75	0.5	1.733333	1.705882	1.533333
	* Comments on FOM added by LIE after cursory reading											

Table 8.1 below summarizes results of the review with respect to the five basic questions.

Table 8.1 - Percent of 31 reviewed publications with positive outcome regarding the five first (basic) questions.

	Q1.Links to ADM	Q2. Gap identification	Q3. Filling gaps	Q4. Progress	Q5: Unintended outcomes
% of publication addressing question	90	45	52	39	12

For Question 6, the rating spanned from -1 to +5, i.e. from weakly counter-supported to strongly supported, whereas Table 8.2 shows the average rating for each FOM. The average is of the reviews where a grade was given. Blanks are not included.

Table 8.2. Average rating of support of publications to FOM

	FOM								
	1	2	3	4	5	6	7	8	9
Average grade	1.6	0.8	1.7	1.7	1.8	0.5	1.7	1.7	1.5

8.1.2. Discussion

The results of the literature review are only indicative of how GEOSS ADM appears in the open and grey literature. As the publications were reviewed by different team members there is an unknown degree of subjectivity in the evaluations and two evaluators may not always end up with the same result. There may also have been a slight difference in how the team members interpreted the questions and in their approach to answering them.

Although the literature search was made on terms related to GEOSS and ADM three publications, or 10%, were found not to show evidence of links between the described activities and GEOSS ADM. These papers 1) use GEOSS as an example; 2) describe activities in other programmes and only mention GEOSS without relation to its ADM goals; or 3) address only science aspects of GEOSS.

About half of the publications address identification and filling of gaps, many of these only indirectly. Twelve publications, or approximately 40%, show evidence of progress or outcomes. It seems that a large part of the reviewed publications contain descriptions of planned or ongoing activities rather than results.

Four of the publications, or 12%, indicate unintended outcomes of GEOSS and GEOSS ADM.

None of the publications were written with the FOM in mind. Still, of the 27 publications that were reviewed with respect to the FOM, seventeen, or 63%, could be said to address the FOM. It is difficult to draw any firm conclusions from the material but with one exception, the publications seem to be either neutral or show moderate support to the FOM. The exception, which is marked slightly counter-indicative for *FOM 2 – sustainability*, describes the relationship between GEOSS and WMO and some slight tension that may jeopardize the sustainability of GEOSS ADM.

8.1.3. Conclusion/finding

The reviewed literature shows moderate support to the FOM and progress in GEOSS ADM. The only negative unintended outcome that has appeared is related to tension between GEOSS and one member organization. This tension was addressed in the mid-term evaluation report.

8.2. Key informant Interviews

Interviews were conducted with 31 persons. The interview methodology used the same interview questionnaire (Section 8.7) for all interviews, and all interviewees received the questionnaire in advance of the interview being conducted. The interviews were conducted in person or by telephone. The interviews were conducted in:

Country	Number of persons interviewed
Australia	4
Brazil	3
Canada	5
Italy	1
Japan	4
Norway	5
United States	10

The interview consisted of 32 questions. Twelve questions required a Yes/No answer. Three asked for an opinion rated from Very Good, Good, Neutral, Poor, to Very Poor and Unsure. Seventeen questions asked for a narrative response.

After analysis and summarization, the responses indicate a general awareness of the Architecture and Data Management aspects of GEOSS. However, 60% of those interviewed believe that the Strategic Targets for ADM will not be met by 2015.This issue may be of concern to GEO, its governance, and the expectations of member organizations.

8.2.1. Yes / No Questions

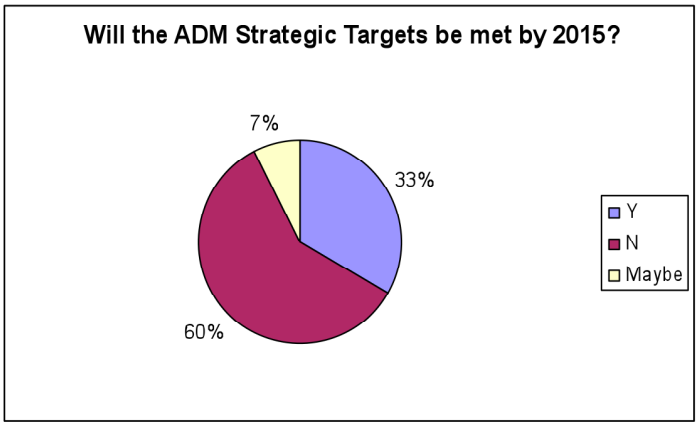
Of those interviewed, 30 respondents indicated they had heard of GEOSS and were familiar with it. One respondent said they had heard of GEOSS but were not familiar with it so this answer was counted as a “no”.

89% of those interviewed have been involved with GEOSS at some point. Most of this involvement has been in the technical work of GEOSS; however some respondents indicated their involvement in the Tasks or in committees.

Interviewees were asked about their knowledge of the Strategic Targets for the GEOSS ADM. Although 55% indicated some knowledge of the ADM Strategic Targets, 45% have no knowledge of the ADM STs.

60% of those interviewed believe that the STs will not be met by 2015. 33% believe the STs will be met, and the remaining 7% were unsure.

85% of respondents do not find that national policies and/or legislation inhibit their ability to meet the ADM Strategic Targets.



60% of respondents agree that GEOSS allows increased use of observations through the ADM Strategic Targets.

55% of respondents indicated that they are familiar with the current Task structure of the GEOSS Work Plan.

48% of respondents believe that the GEOSS ADM sufficiently leverages current thinking in the fields of information technology, data infrastructure and earth observations.

56% of respondents believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015.

48% of respondents are familiar with GEOSS Common Infrastructure (GCI).

8.2.2. Opinion Questions

Respondents were asked three questions in which they could express an opinion on rating the overall progress for Architecture and Data Management at this point in their development and implementation, using a scale of 1 to 5, where 1 meant “Very Good” and 5 meant “Very Poor”.

Architecture. Respondents were slightly positive in their opinion of overall progress for the implementation of GEOSS Architecture. The average response was 2.9 (+/- 0.46 with 95% confidence level) with a standard deviation of 1.14.

Data Management. Respondents were slightly negative in their opinion of overall progress for the implementation of GEOSS Data Management. The average response was 3.3 (+/- 0.55 with 95% confidence level) with a standard deviation of 1.37.

Respondents were slightly negative in their opinion of cooperation of members and participating organizations in the implementation of GEOSS Architecture and Data Management. The average response was 3.1 (+/- 0.62 with 95% confidence level) with a standard deviation of 1.54.

8.2.3. Summary of GEOSS ADM Interview Results

Question 4.

Do you agree the ADM Strategic Outcomes will be achieved by 2015?

If you do not agree, what is missing to enable this result?

Responses were mixed, with some cautious optimism. The fact that there is a GCI that is operational was cited as an indicator of future success. The respondents quickly turned to items that are missing from the GEOSS, such as a semantic web structure ontology to underpin the GCI, not enough open access to data, and missing capabilities that would permit full interoperability. One participant claimed that there had not been a comprehensive gap analysis to enable GCI to deliver what the users say they need.

Question 5.

Are there any national policies/legislation, under which your organization operates, that inhibits your ability to meet the ADM Strategic Targets?

If yes, please elaborate

Respondents cited countries' data sharing policies as being restrictive to the point of preventing attainment of the Strategic Targets. Also, limited budgets were noted as inhibitors.

Question 6.

Do you agree that GEOSS allows increased use of observations through the ADM Strategic Targets?

If you do not agree, why not?

This question received a qualified "yes", noting that the term "use" has multiple levels of meaning; that is, differing classes of potential users will use the GEOSS at different levels of effectiveness, depending on their relative understanding of their needs and the ability of the system to satisfy them. Some users understand GEOSS well and are integrated into the system, while others have a very limited understanding and may not even know that anyone is interested in their observational requirements. It was also noted that there needs to be a more integrated use of the GEOSS portal and clearinghouse, and a tangible demonstration of some successful cases, for example Integrated System of Drought Monitoring.

Question 7.

Are you familiar with the current "Task" structure of the GEOSS Work Plan?

If yes, do you find that there are gaps in the existing over-arching tasks and sub-tasks in the ADM Strategic Targets which would cause the expected outcomes not to be met and what might those gaps be?

Respondents reported significant gaps in the tasks and strategic targets. There are a wide variety of tasks that are not being implemented uniformly. Implementation therefore creates gaps in matching tasks to targets. There is a need for SBAs to take a more holistic look at data sources. A second issue concerns the technical sophistication of the GCI implementation; to wit, GCI has no elements for Web 2.0 type interfaces. There is no "broker system" to bring SBAs into a common nomenclature.

In registering services there is no common language, so the registrar has no way of knowing of the content or status of other areas; this makes it difficult to be interoperable among SBAs. Also, existing over-arching tasks may not cooperate with each other enough.

A further concern had to do with getting observations and archives on-line for users who aren't familiar with earth observations. There is a perceived unfulfilled need to employ general internet techniques that they are used to using (e.g. Google, web services). GEOSS seems to be lacking an emphasis on end users.

Question 8.

Do you know if there is a documented process to identify gaps?

If yes, do you know where it can be found?

No. Evidence of a documented process was sketchy at best. It was reported that one objective of the May 2010 GEOSS Architecture and Data Management meeting in Pretoria, South Africa was to identify gaps. There is presumably another such meeting to be held in spring 2011 in Geneva.

One possible option is in the Target/Task matchup software that was developed by Japan, located on the /earthobservations.org page. Also, there is some possibility of use of EuroGEOSS framework.

Question 9.

Whether formally documented or not, can you describe the process by which gaps are identified and filled?

Any such process was at best ad hoc, possibly through the communities of practice. In case of Data Management, the process was reported to be working, evaluated and managed by Geo secretariat and the Leads and Team Members of four Task communities. An alternate approach that was called out is that each Architecture Implementation Pilot (AIP) Phase identifies some gaps in architecture to be filled.

One response stated that any development strategy for system of systems must be tailored. The comment recommended an evolutionary development process; to wit, Agile Development, Pilots, evaluations, awareness, and "progressive operationalization."

It was reported that a gap analysis has been conducted by other Committees (Science and Technology Committee and User Interface Committee). Ostensibly, the results or process may be applicable to A/DM. Although not for GEOSS, in ESA/EU/GMES, project proposals are asked to identify gaps and this has impact on the funding. This helps both identification of gaps and the filling.

Question 10.
What challenges have arisen during implementation of the ADM Strategic Targets and how have these been addressed?

<u>Resources.</u>
Lack of funding for technology and infrastructure issues sufficient to support services was noted as a standing problem. Even though GEO comprises voluntary activities, to implement and promote those, a funding mechanism supported by each government will be required. A good example is a new FP7 call last year targeting GCI implementation with other SBAs. This will accelerate the existing activities which are currently completely voluntary activities and also encourage further participation to GEOSS implementation.

<u>Policy.</u>
For the ADM to be successful data must be accessible free of charge. That is not the case, given the different data policies of member states. One challenge was represented as a coordination of data at a national level when the data itself is spread across myriad organizations. A related issue is the challenge in the sustainability of the GCI (content); the latter requires connection to metadata catalogs that are actively being maintained. It was noted that there was a data sharing task force, briefed at last plenary, which resulted in a task force to mitigate implementation issues for the data sharing plan.

<u>Political.</u>
A challenge derives from the volunteer nature of GEOSS. Physical deliverables (to include IT entities) require coordination. There are many

proliferating tasks and organizations; thus the structural unity of GEOSS is becoming ever more confusing. These politico-socio issues are nearly intractable, while the technical challenges are entirely solvable. The issues are those of management, whether formalized or informal. The tension between the success of GEOSS and the nation's own systems posed a challenge; that is, the tension with national interests.

Implementation.
The early implementation of GEOSS had larger number of Targets, disseminated from the Secretariat. It was recognized that the scope of the Targets made this challenging for GEO. As a result the GEO started distilling the Targets to a series of high level tasks. Even though GEO narrowed the number of targets, there were still a large number of sub-tasks. The GEO process allowed countries to offer a number of tasks that weren't associated with targets. This was good for buy-in, but made it hard to understand the task/target matchups. For example: The process was started by the ADC when the committee released three prototype portals and GCI for testing (for a year, 2009). A challenge was getting participants to respond (for testing and feedback). Out of 150 people, only one person responded.

Getting agencies, especially space agencies, to recognize the Agile Development process is a challenge. Implementation of GEOSS is a different process than for satellite development and launch for example. One respondent suggested promoting the awareness of community to evolutionary development process, used in the AIP.

One challenge represents as a need for a stronger involvement of the research community; the involvement is too dominated by bureaucrats. This seems to be the case nationally as well as internationally

In general, the implementation challenge can be characterized as the difficulty of the interconnection of heterogeneous systems addressed through the System of Systems engineering process (standardization, special interoperability agreements)

Question 11.
Which expected outcomes from GEOSS have been realized (fully or partially) to date?

Most respondents pointed to concrete examples of system artifacts that have been implemented and demonstrated. To wit:

- *Availability of the GCI.*
- *Interoperability among provided components using standards promoted by the Standards and Interoperability Forum (SIF).*
- *Registry population, although participation has proved challenging.*
- *Data Centers, working towards common IT platforms.*
- *Data Quality standards and processes, through the IEEE/CEOS.*
- *Communications:*

- *GEONETCAST*
- *GCONET: Use of internet systems of large research facilities and high speed links*
- *Mobile communications: Outreach to developing countries; architecture and pilot implementations.*

Some secondary effects were called out, notably, that the USGS decision to release all LANDSAT on web was a direct result of GEOSS, "a catalyst effect."

The third item of note is the general change of mindset resulting from GEOSS. For example, the data sharing principle was agreed, GCI concept was built up, and the objective themes of IGOS have been transferred into GEO Tasks. The need of a global coordination is now widely recognized; involvement of Communities of Practice is a beneficial effect. For example, data archive on flood and drought was demonstrated in Asia Water-Cycle WS and GOSAT and PALSAR data coordination in Global Carbon Cycle are typical outcomes.

The change to a belief in the feasibility of a GEOSS was noted as a beneficial outcome.

Question 12.

Are there any methods, processes, tools, etc. that were found to be particularly important to realizing progress in the ADM Strategic Targets?

One respondent said that this is not really the important issue, but rather the issue is the willingness to share. GEO must develop compelling reasons to bring otherwise antagonistic players to the table.

Judging from the European experience, the methods, processes, tools etc used by the marine and atmospheric communities seem to work better than those used by the land community

Several facilitation methods were discussed:

- *ADC co-chairs met monthly to review progress.*
- *Committee meetings.*
- *Extended discussions on Strategic Targets; analysis of the targets.*
- *Allocating expert leads to the targets.*
- *Strategic Plan to address targets. However, we don't have formal tools to assess progress toward targets.*

- *The "Sherpa" process, a means to mentor the task leads; however, it hasn't been as active recently.*

For other SBAs, a relevant question is how to monitor the tasks that aren't directly related to ADC. There's no effective monitoring of overarching tasks. GEOSS needs a tool to transfer requirements to those building those capabilities. The management structure of GEOSS needs to be reviewed.

The Architecture Implementation Pilot (AIP) methodology is good, but lack of funding makes it difficult to implement it properly. Involved parties usually bring to the AIP what they have developed in other contexts without the possibility of dedicating efforts to tailor them to the AIP and GEOSS objectives.

Sensor Web and Model Web technologies which are part of Interoperable Systems (AR-09-02) will be keys in GEOSS. Additional specific items cited:

- *Ontology retrieval system*
- *In situ data*
- *Historical data*
- *Quality control and meta-data*
- *Evolutionary development process w/ leadership by the SBAs. ADM is applied in the SBAs.*
- *Geoinformatics: technology of information systems, applied to geospatial information.*

The expected theoretical functions of GCI should work in practice.

Question 13.

Are there any methods, processes, tools, etc. that were found not to be helpful or which ought to be avoided in implementing the ADM Strategic Targets?

Meeting process – Rapid talking and an over reliance on acronyms doesn't allow new comers to easily adapt and it is especially difficult for those who do not have English as their first language. The most significant item noted was the proliferation of organizations, committees, task teams, etc. that must be inter-coordinated. Ref the N-squared principle; the effectiveness of a team is inversely proportional to the square of the number of members. Additionally, there is too much discussion on legal matter, even though Data Sharing is one of the GEOSS achievements.

Reliance on volunteer workforce - Don't expect people to volunteer to test anything. Use "embarrassment factor". This, along with isolation and

boredom, worked in Pretoria.

We spend a lot of time and money showing our wares to ourselves (e.g. Plenary). Need to be presenting to end users, those who would get value from systems. Excess cost was incurred at Plenary. GEO should consider a "GEOSS users forum" at the size of the plenary.

Q.14.a: Using the scale below where 1 means "Very Good" and 5 means "Very Poor" how do you rate overall progress for Architecture at this point in its development and implementation?

Average response was 2.8.

Q.14.b: And for Data Management?

Average response was 3.0.

Additional commentary:
There are successes that can be cited, but GEO is a few years behind that which was projected in 10 year work plan. There is a lot more to do and a lot more decisions in the short term. GEOSS should be able to progress faster in the next 4-5 years.

GEOSS has been good with designs and plans, but progress has been very much lagging. The challenge is that GEO is a holding company that depends on members to adopt and execute the plans.

Question 15.
What, in your opinion, are the three most important accomplishments of GEOSS Architecture and Data Management to date?

Infrastructure

- *The GCI components*
  - *GEO portal*
  - *Registries*
  - *Clearinghouse*
- *Defining architecture based on open spatial standards; development of GCI Consolidated Requirements*
- *Communications capabilities*

Content

- *Establishing the registries and portal content*
- *GEOSS Data Core*
- *Data policy*
- *Most of existing important data and information portals; International Disaster Charter, Sentinel Asia, DIAS, etc. have been integrated.*

Demonstration/operations

- *Created understanding that all aspects of data management are important and have put focus on this.*
- *Execution of Architecture Implementation Pilot (AIP) process w/ OGC. Pilots that demonstrate architecture and use of GCI/interoperability arrangements by SBAs.*
- *Networking is the most important accomplishment but this is more on the personal level, otherwise there has been production of documents of uneven quality for use.*
    - *Created environment for network building; access to important data, particularly marine data, through GMES*
    - *Work with NOAA and EUMETSAT re GEONET.*
- *Evolution of LANDSAT data set to open access.*
- *Bringing together the diverse collection of technical interests and developing an architecture to accumulate diversity. 10 years is not a long time to accomplish results that will have multi-decade viability.*
- *Membership and contributions from diverse domains; many important voluntary contributions*
- *Architecture and Data Management plans.*
- *Data Sharing Task Force results*

"It's too early to find any accomplishment. Accomplishment shall be defined as concrete societal benefits achieved."

Question 16.

What, in your opinion, are the three greatest challenges that GEOSS Architecture and Data Management has overcome to date?

General categories that were reported:

Cultural

- *Lack of communication among nations.*
- *Resistance to cooperation among countries.*
- *I have not seen important data providers releasing the details of how their data are or can be distributed.*
- *Natural resistance of changing from individual institutional architectures onto a global architecture for data management.*
- *Commercial data policies.*

- *Demonstration of the scientific value of GEOSS*
- *Filling of cultural gap between IT experts and geo-scientists, e.g. through the involvement of both communities in the development of pilot projects*
- *Lack of understanding of what's required to implement architectural principles. Folks were not astute as to what the standards meant.*

Technical

- *Mapping versus using earth observations. Big gap.*
- *Usability has not been adequately addressed – how to ensure that you'll get the data to the people who will produce the societal benefits; i.e. decision makers. ADM is not being focused on delivery systems. GEONETCAST is a good system, but it is unclear whether it is getting information to the right end users. It's not "sexy" to build information delivery systems. Decision makers won't go to the portal or the GCI.*
- *Also, the use of the semantic web has not been undertaken. What we have now, based on common standards, doesn't appear to be enough.*
- *How to choose the right system/program to back. Is GEOSS going to do Data Management enterprise-wide?*
- *Interconnection of heterogeneous systems*

Procedural

- *Creation of the GCI; specifically the programmatics – a volunteer organization*
- *Getting task progress to be uniform, and focused on specific tasks that were required.*
- *Attracting talented committed people to the effort.*
- *Organizational "storming and norming"*
    - *Work plan, committees.*
- *Ignorance of data standards.*
- *Building a strong community of technical leads from around the world to execute on the GEOSS GCI*
- *Broad agreement on interoperability principles and standards, working together to create new standards that are needed that don't yet exist*
- *Pushing the ball forward on sensor web interoperability*
- *Getting people to the meetings.*
- *Data Sharing Policy agreement*
- *Accomplishment of GEO portal to work in reality, agreed by members. Sustained and coordinated operation framework committed by stakeholders such as United Nations and no volunteer basis.*

Question 17

How do you rate the cooperation of members and participating organizations in the implementation of GEOSS Architecture and Data Management?

The average rating on the scale (1.Very Good//3.Neutral//5.Very Poor) was 2.7.

The cooperation is very good within some member organizations and their contributions to GEOSS, e.g. WMO and WIS. There appears to be still some hesitation among the members. Some want to be in GEO, but not have their data in GEOSS.

Financial pressure has limited the amount of data sharing, but legislation has changed in EU that would allow for data sharing (e.g. ESA Sentinel data.)

Question 18.

Do you believe that the GEOSS Architecture and Data Management implementation sufficiently leverages current thinking in the fields of information technology, data infrastructure and earth observations?

The responses to this question about the use of current technology were mixed, with many persons stating that, while GEOSS was making some progress, there remains much that is not being done and/or that could be done:

- *Interviewee believes that GEOSS ADM is not actually achieving interoperability. He believes that although there are currently no solutions to achieving interoperability, there are people/groups working on this internationally, and solutions are becoming available.*

- *The interviewee does not support the portal concept which he considers a "bottom up" approach. He thinks that an overarching framework is required. GEOSS is based on distributed systems and standards, which is current thinking. GEOSS needs to continue to evolve the architecture: open standards, open source.*

- *The GCI uses older technical concepts, vice current thinking, such as the semantic web.*

- *GCI is not flexible; it is not much more than a catalog/library. GCI does not have a broker function, which is where the field is going. GCI does not address long term interoperability needs.*

- *Some recent information technology solutions (such as the brokering approach experimented in the AIPs) would provide a greater flexibility for interconnecting heterogeneous systems such as existing and planned Community-of-Practices systems. This might help to address related*

interoperability issues.

- *If the goal is to make this data immediately relevant to those working across the societal benefit areas, GEOSS needs to be able to provide them with IT capabilities that are more in line with what they have come to expect in their personal and work lives – registries and to some extent, the Portal are in some ways manifestations of "Business as usual" in our community… which is probably a good thing from the standpoint of the experts but does not serve us well in terms of growing the community of users and demonstrating value of the offering and effort.*

- *GEOSS needs to do more to address needs of users from disciplines other than earth observations. Specifically, information should be accessible and represented on easy to use map (cf. Google Earth.) A similar capability was developed and demonstrated in AIP.*

Question 19.

What, in your opinion, are the three greatest challenges facing implementation of GEOSS Architecture and Data Management today?

As in Question 16, responses clustered around three general categories:

<u>Cultural</u>

- *GEO is a volunteer organization, sustained by voluntary funding. There needs to be more structure (tasking/funding) to build executable plans.*
- *Organizational sustainability.*
- *Demonstration of success stories. Communication of GEOSS concepts, needs, and priorities.*
- *Aligning of major intergovernmental organizations.*
- *Achieving better engagement with organizations such as the Open Geospatial Consortium (OGC) and the Natural Environment Research Council (NERC). Cooperation with other observation bodies (GTOS, GOOS, GCOS, GOS, et al).*
- *Policy decisions around data release by GEOSS – Intellectual Property, licensing, no cost access. (Legal discussions to technical implementations).*
- *Building a community of users beyond the technical providers of data.*
- *Shrinking resources available to support efforts.*
- *Development of international interoperable exchange standards.*
- *The voluntary aspect: will all member states contribute? Data may be withheld for several reasons, real or imaginary: For research purposes by scientists (not-until-I –have-published syndrome), national security, fear to expose poor data quality, others.*

Technical

- *Defining an appropriate ontology (application schema) to define the data we are sharing to allow fully global analysis of data*
    - *Standardizing data models / ontologies and shared vocabularies.*
- *Easy access. In a voluntary based GEOSS, this is needed to have people use it. If GEOSS is to become mandatory, governments will require easy use to avoid spending too many resources on this.*
- *The interviewee related an actual attempt at using the GCI to retrieve data. He entered "SST" into the portal (sea surface temperature). Pages of hits ensued. He was not clear how to use this mass of response. He clicked on one such and it took him to a summary of one particular data set. Therein, the full description was 1000s of lines – useless. Eventually, he located a URL in the description that took him to the data.*
    - *Missing:*
        - *1. The high level summary/search;*
        - *2. Seamless link to inventory of the data set.*
            - *Need a common inventory protocol.*
    - *The respondent was "underwhelmed" as a result.*
- *Lexicon of terms. Need a controlled vocabulary. A core set of language needs to be the same everywhere so that other things can be different.*
- *Model interoperability*
- *Mature from collection of systems to a system-of-systems.*
- *Implementation of data sharing principles.*
- *Architectural principles and plans – evolution to fit technology*
    - *E.g. social network, mobile computing.*
- *Quality control, especially in situ data*
- *Retrieval across transversal areas*
- *Registration of data sets*
- *Delivering real time data*
- *Broadband access to developing countries*

Procedural

- *Understanding the role of R&D vs. operational programs*
- *Involve scientists/data users more than bureaucrats*
- *To get operational and interoperable, i.e. making real technical deliverables that will be used and not only project tasks. Data policies remain to be a challenge.*
- *Standardization. There are initiatives on global (GEOSS), regional (in Europe Inspire) and national levels. An organization cannot support all, this will be too expensive. GEOSS needs to define what shall be achieved and describe how to achieve this. Establish a clear framework with progress plan and communicate the message*
- *Avoid inventing the wheel again regarding standards. There are so many standards out there. On the European scene, but partly also on*

the global scale, these are about to be coordinated and unified. There is a danger that GEOSS may introduce new ones, this must be avoided. There is also a need for common controlled vocabularies, to assure that all are "speaking the same language".

Question 20.

Have there been any unintended positive outcomes of GEOSS Architecture and Data Management to date?

- *Awareness of EO and need for easy access*
- *GEOSS ADM has contributed to making data more accessible*
  - *Better understanding of complexities of legacy data systems*
    - *How to use metadata for future use.*
  - *Narrowed the gap in our ability to share data in the global enterprise.*

- *Yes, as a result of putting the architecture out for a test period, obtained a very good benefit. In usability testing, the participants were asked if they would use the GCI in the future. The answers were mostly yes. There were many testers who were outside the GEO. The number of organizations that volunteered to do additional work showed interest.*
- *Better understanding of international standards (ISO) in the US.*

- *Fully open data accessibility of Landsat data from USGS*
- *Global 30m land cover activities plan in different countries and their coordination.*

- *Human networks have been organized, contributing to the understanding of the present status and the trend in global scale, and the consideration and exploration of different ideas to respond to the common issues.*

Question 21.

Have there been any unintended negative impacts of GEOSS Architecture and Data Management to date?

- *Expectations were created, particularly in developing countries, that data would be freely available, at least faster than is realistic. There is also a tendency for some members to be draw benefits from GEOSS ADM rather than contributing.*

- *Scientists are important data providers but may feel a competition with*

GEOSS and may become reluctant to contribute

- *One respondent felt that GEOSS has not progressed sufficiently to reveal negative impacts.*

- *The strong focus on making data, models and services etc. available through GEOSS may have shifted some funding from research to service based projects, which in turn may have contributed to negative views on GEOSS/GMES by some scientists. It is important to convey the importance of data exchange and availability to society, i.e. a message of holistic approach to earth observations.*

- *Impacts from the relationship of GEOSS to other organizations required much socializing and compromising. This created strained relationships with leadership of other organizations.*

- *Lack of participation in GCI is calling the benefits of GEO into question. The reality is if nobody participates, nobody uses it.*

- *The quality and pixel sixe of earth observation data may be required to be improved by 2015. I feel this issue may not be discussed enough*

- *A very negative impact of ADC activity was seen in CEOS Cal/Val for ASTER GDEM. ASTER GDEM team opened their data to GEO community for validation before the official release. The team opened those validation results to the public before the release without notice to the data provider. I hear rumor that because that organization is composed of some commercial competitors about DEM and that they did a negative campaign. Maybe it is not true. The dataset should be validated and should be shared those results to the public, but we need to follow a minimum rule as scientists to ensure voluntary mechanism. This kind of violation of the rule will cause a negative impact to other data provider to GEO.*

Question 22.

Do you believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015?

If NO, please explain why:

Respondents felt that the global user requirements were not known, and thus the question couldn't be addressed. There is a need to define what fundamental environmental requirements are and then meet them.

GEOSS ADM must get beyond the demonstration phase and become fully operational to achieve this quality. A hard push is needed.

There was a recent proposal to the ADM to establish an interoperability

working consortium. That type of work would improve the discoverability in the GCI. This would require a lot of rethinking of how we manage and use metadata. In the usability testing, there were too many false positives. Adoption of the Data Core will help attain success.

Much of GEOSS is usable today, but not enough is in place. However, the respondent felt that leaders will use GEO portal for their information needs. Specialists will still go to their own sources.

Each data point might be validated but there is no consistency among global data.

There is a slight concern that one will not achieve common and universal use of units.

Question 23.
Are you familiar with GEOSS Common Infrastructure (GCI)?

If yes, what is your opinion of the current deployment of GCI?

The respondents that were familiar with the GCI had generally unfavorable comments:

- *The GCI is unsustainable. Responsibility and funding is currently with a couple of organizations with no scope for others to influence future technological directions or learn from current technology implementations in order to deploy their own services.*

- *It works but more efforts are needed to make it fully operational.*
- *The system seems technically advanced but it appeared difficult to get below the national level when searching geographically.*
- *Searching for a specific data set (German flood data) was not successful but this could have been caused by slow response time.*
- *The current deployment is poor, mainly because data providers are still in the process of registering or being convinced to register.*
- *Its initial rollout was inadequate because it did not allow for evolution of the system/holdings.*
- *So far, GCI is a large catalog without provision of (promised) added value services.*
- *It is just a yellow page. No direct link to REAL data.*
- *Public announcement of the GCI may not be enough.*

Question 24.
How easy and efficient is it to enter your data/services in the Registry?

The respondents found that it was reasonably easy and efficient to enter

data/services in the Registry, with some exceptions.

- *It is not very different from other resources on the web. An account is needed, this is common, and users can then register their data sets. It is easy, indeed, but I am not sure about efficiency. 'Efficiency' is a subjective term.*
- *Quite easy if you are an expert in standards*
- *It's difficult to register if not explained by experts of the Registry.*
- *We deliver data and systems but this through other systems that are or will be integrated with GEOSS, like Eurometsat and WMO. GEOSS must relate to this; otherwise GEOSS will fail*

Question 25.
How easy and efficient is it to find items in the Registry that meet your needs?

While moderately favorable, the response was mixed:

- *Reasonably easy – although the schism between "services" and "components" is likely to make it unclear to many potential end users where they should begin.*
- *Fairly easy and efficient. Standards are well covered*
- *It is easy but efficiency needs improvement*
- *It got easier over the two years after availability of Registry. Improved during usability testing. Discoverability remains an issue. Could be improved. So hard to find data that you know has been registered.*
- *When you go to the Portal, sometimes you can't find things that you know are in there. Search function does not yield complete results. This was a problem a year ago and remains.*
- *Look and feel is good. Search algorithms need some improvements. Must hit search term exactly, as opposed to the approximate matching used by mass market search engines.*
- *Initial understanding is difficult.*

- *Not so easy. Existing list http://geossregistries.info/holdings.htm was made by report from each provider which are really not well organized. Some providers select all SBAs some of which are not well addressed in reality. Other problems also concern registration. For example, when user tries to find data covering Switzerland, user will get the result of global OCEAN data even though there is no ocean in the country.*

Question 26.
How easy and efficient is it to search the Clearinghouse for data?

As in other questions, the responses were mixed:

- *This is a straight metadata search, which is easy; however, it is dependent on the quality of metadata entered by GEOSS participants.*
- *Easy to search for data and get access to the relevant site but can be difficult or impossible to download the data. Some sites one is pointed to are unavailable or closed. The Clearinghouse must be filled with more data.*
- *Difficult is a better description, perhaps because there was little information when we tried.*
- *It is easy but efficiency needs improvement*
- *Initially it was extremely difficult. Now, this is the same as searching for components and services; transparent. The user doesn't know where the search is going.*
- *Through the GEO-Portal, it is very easy. I like the federated search capabilities exposed through the Portal. Through the Clearinghouse itself – we have problems connecting from inside EPA because it is available over a non-standard port.*
- *It's not easy and speedy.*

Question 27.

Apart from the GCI, what additional venues for member countries to discuss and perhaps agree upon methods for greater data system interoperability and leverage common international metadata standards would you suggest?

Initially, one respondent noted that question is not correctly formulated - GCI doesn't do this. ADC/SIF is the main GEOSS means for discussion of interoperability and metadata.

Other examples cited:

- *International Ocean Commission.*
- *International Hydrography Organization.*
- *World Meteorological Organization*
- *US Integrated Ocean Observing System and similar.*
- *Open Geospatial Consortium*
- *Committee on Earth Observing Satellites*
- *International Organization for Standards Technical Committees: ISO TC 211*
- *There are many smaller regional or technically limited networks or venues where parties can discuss and cooperate, e.g. for the Arctic and within the international meteorological and oceanographic communities. Such venues have a tendency to be more open and including than the large global and overarching venues and have e.g. produced valuable standards*
- *GEOSS has 4 committees and a data sharing task force. The members of the GCI Coordination Team are also members of these, providing synergy. But Capacity Building and Science/Technology are not*

liaising with the GCI CT. More coordination is needed. Also, the S&T community may not be aware of the GCI. Same for the capacity building world.

- *Some of the GEOSS tasks and projects address this.*
- *Big need for "community portals." The charter for GCI is to be a single point of entry to all people. Community portals provide communities with opportunity to have specific to their needs. Community portals need to be endorsed by GEOSS community perhaps through a task force.*
- *Data broker kind of project coordinated under the EuroGEOSS will be required in each region and global scale.*

Question 28.
If you think the portal interface is not friendly, what is missing?

Responses to this question varied significantly from "not friendly" to "quite user friendly."

- *I do think the interface is not very friendly. For example, it would be better if the services themselves (register a component, search the components registry) were not mixed with technical information like the Find Out More section on the right side. If there are services, users should be guided straight to them.*
- *It has gotten a lot friendlier. Recommendations had been proposed from the usability testing. These should be revisited after the release of the next version.*
- *Portal site is quite user friendly.*
- *Needs links to tools, community portals, or other clients (e.g. Matlab).*
- *Slow*
- *Needs: Help desk, user support, tips, instruction demo, direct access to key ECVs.*

Question 29.
If you think the portal does not provide access to its functionalities through an accessible interface, what is missing?

- *This was documented in the usability testing report.*
- *The Map Viewer is useless to what I would consider to be the target user of the Portal. This seems like a missed opportunity to get people exposed to data in a simple to use exploratory interface.*
- *Query based on temporal constraints are not implemented or difficult to express. Data access is still not implemented.*
- *It's difficult to know what can be done through the system.*
- *At least, should be accessible to real data for GEOSS DataCORE rather than just metadata.*

Question 30.

Would you prefer to access the GEOSS via one or multiple portals and clearinghouses?

- *Using multiple portals introduces a lot of technology risk. It may be preferable to use a federated catalogue that accesses the same clearing house with the same technology, providing two-way replication.*
- *Recent GCI tests showed different results from different technologies.*
- *One is acceptable.*
- *Whether using portals or clearinghouses, people will still prefer to use familiar systems. If separate portals/clearinghouses are introduced or developed, they must be significantly better than existing ones. There will always be a danger that systems used today will not be exist ten years from now and this should always be in the back of the heads of those choosing portals*
- *Multiple. For specific communities or SBAs, users need direct access to the area of interest. Directed access would be easier, and would entail a better, narrowed search engine. This would lead to better search results with fewer false positives.*
- *One. With the caveat being that search capabilities using the catalog APIs should be available from many different places*
- *Multiple (e.g. thematic portals, different portals for different user profiles, etc.)*
- *One is better because it's easy to do.*

Question 31.

Are you responsible for any of the systems in the GEOS Registry?

Respondent provided training a system for developing countries. System is ready to be operational and is mature.
EPA Air Quality Database and GEO Gateway.
Whether referencing NOAA or NGDC – Federation.
EPA Geodata Catalog Service – Federation
EPA Geospatial Data Download – Confederation

If YES, please try to rate the maturity of your system according to the Maturity Index at the end of this guide.

A few of the interviewees responded to this question, returning an average value of 3.8 on a scale of 1-5.

Question 32.

Is there anything else you would like to mention in regards to the implementation progress of GEOSS Architecture and Data Management that we have not talked about during this interview?

The general goal of GEOSS, data sharing through standardization, is excellent but could work better. Politicians and bureaucrats do not always understand the meaning of or see the benefits from operability and standardization. The voluntary nature of GEOSS is a challenge and contributes to some of the problems described earlier in this interview.

Maybe one (of several) ways to obtain more focus on GEOSS would be if national and regional funding agencies required reference to how projects involving data collection and data management systems had a reference to the link in GEOSS.

GEOSS is perceived as too top down and dominated by politicians and bureaucrats, with too little involvement from grass root organizations with operative responsibilities and from research. Some of the operability issues are taken care of by member organizations like WMO, but they could have shown stronger involvement; e.g. WMO does not look to GEOSS when developing the WMO Information System WIS.

The overall aims of GEOSS are admirable and desirable, however actual implementation could be better handled through an open source community approach, resulting in more open communications and open access to a wider number of people and expertise.

Principals may not understand the views of the GCI designers. Nobody is saying that "GCI is our product."

GEOSS in general would benefit from more external communication and establishing better contacts with the outside world, including industry. They are important potential data contributors. There is a gap between the policy makers and the technical people that may give the impression of a top-down process. This is a challenge particularly for ADM, as few policy makers understand the complexity of ADM.

GEO and GEOSS give the impression of a top down process, driven by people with limited knowledge and hands-on experience of data handling and sharing. There may be a fear that this is something that will be forced upon operational organizations and research entities.

Status is much further along in metadata catalogs than service registry catalogs. Much more work remains to be done.

We have 3 clearinghouses now. The challenge is that these three aren't interoperable and are not sharing metadata. If sub-elements develop that aren't interoperable, then it creates future work. ADM is difficult and broad and requires workers who are generalists. Finding right people is huge challenge. As we broaden architecture beyond GCI, the Task Force approach may not be the optimal way that to recognize the components that make up the system of systems.

There is very little communication among overarching tasks. In case of a global dataset task, each task provides global data such as DEM, land cover, but no one discussed the consistency among those datasets such as to use same coastal line. The GEO community needs consistent and validated global datasets which would be one of the GEO added-value contributions to Earth Observation community.

GEOSS is executing a viable approach and it will be successful. Politically, it is the right thing to do, and is worth the investment.

8.3. Surveys

8.3.1. Survey questions and Figures of Merit (FOM)

Only the ADM and the ISRSE surveys have been included in the survey-FOM analysis, as the ESIP survey had too few responses. Priority was given to the ADM, i.e. main, survey.

The survey had five parts:

1. Introduction
2. Data user
3. Data provider
4. Architecture and Data Management
5. Concluding questions

Parts 1 and 5 were related to the respondents' affiliation with GEO and GEOSS and education, age and employment, respectively. These parts did not address the Figures of Merit (FOM).

Each of the remaining 80 survey questions were assigned to a FOM in a spreadsheet, resulting in a matrix of questions along the vertical axis and FOMs along the horizontal axis. 60 questions were identified as addressing a FOM. The results are shown in Table 8.3.

Table 8.3. Survey questions that address the different FOMs

FOM	1	2	3	4	5	6	7	8	9
Questions assigned to FOM	2.23;3.9; 3.10; 3.12; 4.4; 4.14; 4.26; 4.33	2.12; 2.16;3.4; 3.5; 3.6; 3.7; 3.8; 3.17; 4.2; 4.3; 4.15; 4.27; 4..28; 4.36	2.13; 2.14; 3.16;	2.6; 2.7;2.9; 2.10; 2.11; 2.15; 2.17; 3.11; 3.13; 3.14; 3.15; 3.18; 4.30	2.1;2.3; 2.5;2.7; 2.18; 2.19; 2.20; 2.22; 3.1	3.2; 3.3; 4.29: 4.31; 4.32	4.1	2.2;2.4; 4.6;4.7; 4.13; 4.34	4.5
Total	8	14	3	13	9	5	1	6	1

The responses to most survey questions can be divided into three categories in their characterization of the FOM:

- Positive evaluation of progress
- Negative evaluation of progress
- Don't know or cannot answer

Of the 60 questions that were assigned to FOMs seven were found to be irrelevant to the above classification, as they were of the type "What kind of data would you like to access through GEOSS". Thus, it was possible to judge some sort of merit for 53 questions.

The majority of responses were in category 3 above – don't know or cannot answer. In the ADM survey 32 questions had the majority of answers in this category and in the ISRSE survey 41 questions were dominated by "Don't know" or "Cannot answer".

In the analysis responses in the third class were not counted. Thus, if the positive responses outweighed the negative the FOM was regarded as having good progress and the cell in the question-FOM matrix was marked green. Conversely, if the negative answers dominated the cell was marked red, indicating poor progress.

In some cases the positive and negative response were equal or differed by only a few percentage points. In these cases the response was classed as neutral and the cell marked yellow.

The results for the main survey are shown in the attached spreadsheets and summarized in Table 8.4.

Table 8.4. The number of positive and negative survey question outcomes for each FOM and survey

	FOM								
	1	2	3	4	5	6	7	8	9
Number of relevant questions	8	13	3	10	7	5	1	5	1
Number of positive answers, ADM+ISRSE	7	11	2	6	5	4	1	4	1

8.3.2. Findings and conclusion

The majority of survey questions indicates positive evaluation of GEOSS ADM in relation to the Figures of Merit (FOM). The larger ADM survey is generally more positive than the ISRSE survey but the statistical significance of this conclusion is probably low, due to the low respondents in the ISRSE survey.

It is not possible to claim that any of the FOMs show more positive answers than the rest.

A major finding is that in both surveys is that the majority of the questions were answered by “don’t know” or “cannot answer”. This is a strong indication that GEOSS has so far had a limited impact on the provision and use of earth observations.

SURVEY'S QUESTIONS	FOM 1	FOM 2	FOM 3	FOM 4	FOM 5	FOM 6	FOM 7	FOM 8	FOM 9
1.1. Are you familiar with GEO or GEOSS?									
1.2. The list below represents the Strategic Targets in GEOSS. Even if you are unfamiliar with GEO or GEOSS, which of the following categories describe fields in which you are personally involved?									
1.3. In which country do you conduct the largest part of your activities related to the GEOSS Strategic Area(s) you identified in Question 2?									
1.4. Which of these terms best describes your primary activity in the GEOSS Strategic Area(s) you identified in Question 2?									
1.5. Which of these terms best describes the body through which you are involved in the GEOSS Strategic Area(s) you identified in Question 2?									
1.6. How are your current activities funded in the GEOSS Strategic Target Area(s) you identified in Question 2?									
1.7. What is your primary relationship to GEOSS?									
2.1. Do you agree that GEOSS data is easily discovered or linked to?					Yes. 30, No 44, Don't know 26: negative				
2.2. Do you access existing national, regional and global observing and information systems through the GEOSS?								Yes 29; no 66; don't know 5; negative	
2.3. If you access existing national, regional and global observing and information systems through the GEOSS, why? (select all that apply)					Single point 55, funct 45, other 16. Not relevant				
2.4. If you access existing national, regional and global observing and information systems through the GEOSS, which of the following adds value to your search?								Not relevant	
2.5. If you do not access existing national, regional and global observing and information systems through the GEOSS, why not? (select all that apply)					Not acc 29; direct acc better 35; direct acc easier 32: negative				
2.6. What would you like to access through the GEOSS?				Not relevant					
2.7. If you are a data user, how do you rate the current GEOSS data population?				6 of 8 data sets have poor with highest response; negative					
2.8. How would you prefer to access the GEOSS? (click one).					Single 62, multiple 8, different dedicated 26, other				
2.9. Do you believe that the data and service registries with GEOSS to-date represent the collections held in member data systems?				Yes 19, no 33, don't know 48; negative					
2.10. How many of your organization's Earth-Observation (EO) systems, data sets, and services have been registered with GEOSS?				0-1: 32; 2 - 5: 9; 6 or more: 13; Dont' know: 47; negative					
2.11. In total, how many of your organization's EO systems, data sets, and services are there available for registration with GEOSS?				0-1: 22; 2-5: 9; 6 or more: 29; don't know: 40; negative					
2.12. Is your organization prepared to fund a centralized system or capability allowing users to search and order data?		yes 35; no 34; don't know 32; neutral							

SURVEY'S QUESTIONS	FOM 1	FOM 2	FOM 3	FOM 4	FOM 5	FOM 6	FOM 7	FOM 8	FOM 9
2.13. If you manage a national, regional and/or global observing and information system, did you link your system to the GEOSS?			Yes 39; no 33; don't know 8; positive						
2.14. If you are a data provider, do you publish your datasets through the GEOSS?			Yes 6; no 45; don't know 29; negative						
2.15. Are the datasets you publish from:				Not relevant					
2.16. If you do not publish datasets, why not? (select all that apply)		Not relevant							
2.17. What would you like to publish through the GEOSS? (select all that apply)				Not relevant					
2.18. Please rate the current portal access.					Few excellent, mostly average or don't know, some poor-bad, positive				
2.19. Do the search interfaces render the GEOSS Portal data and service holdings:					Easy 1, satisfactory 33, difficult 16, don't know 50, positive				
2.20. Does the Best Practices WIKI have information that makes your use of GEOSS easier?					Yes 13, No 12, Don't know 76; neutral				
2.21. Are you familiar with the GEOSS Common Infrastructure (GCI) ?									
2.22. Do you agree that the GCI makes it easier to find existing data sets?					Yes 29, no 10, Don't know 60; positive				
2.23. What is your opinion of the current deployment of the GEOSS Common Infrastructure?	Exceeds req 3, meets 15, partially meets 29, does not meet 5, don't know 47; positive								
2.25. Should the GCI allow local control of information repositories?									
2.26. Should the GCI allow central control of information repositories?									
2.27. Will the GCI "data aggregation services" allow GEOSS to meet its strategic targets for 2015?									
3.1. How was your experience with the registration at the GEOSS Portal?					Easy 12, satisfactory 33, difficult 7, Cannot answer 45; positive				
3.2. Does the Standards and Interoperability Registry allow you to find standards to enable your system to interoperate in GEOSS?						Yes 40; no 19; don't know 51; positive			
3.3. Do you believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015?						Yes 34; no 25; don't know 41; positive			
3.4. Do you agree that by 2015 identification of effective national coordination mechanisms across both observation-provider and observation-user communities will exist in your own country?		Yes 46; no 17; don't know 37; positive							

SURVEY'S QUESTIONS	FOM 1	FOM 2	FOM 3	FOM 4	FOM 5	FOM 6	FOM 7	FOM 8	FOM 9
3.5. Do you agree that by 2015 there will be a framework to ensure data continuity, including the smooth transition from research to operational systems?		Yes 45; no 25; don't know 30; positive							
3.6. Do you agree that the adoption and advocacy of a comprehensive approach to global Earth observation systems will be accomplished by 2015?		Yes 43; no 30; don't know 27; positive							
3.7. Do you agree that by 2015 there will be increased efficiency in the operation of observational systems through convergence among global, regional and national facilities?		Yes 64; no 15; don't know 21; positive							
3.8. Do you agree that by 2015 a comprehensive gap analysis and gap filling, including issues pertaining to operational redundancy and succession planning for systems and products, will exist?		Yes 33; no 35; don't know 32; negative/neutral							
3.9. Do you agree that by 2015 GEOSS will allow the preparation of global and regional information?	Yes 48, no 18, don't know 33, positive								
3.10. Do you agree that a full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation, will be in place by 2015?	Yes 47, No 29 don't know 24. positive								
3.11. Do you agree that by 2015 access to cross-cutting data sets, such as land cover and land use information, will be improved?				Yes 69; no 3; don't know 28: positive					
3.12. Do you agree that improved access to essential socio-economic information will be available by 2015?	Yes 58, No 11, don't know 31. positive								
3.13. Do you agree that data will be made available in accordance with GEOSS Data Sharing Principles by 2015?				Yes 42; no 12; don't know 45: positive					
3.14. Do you agree that all shared data, metadata and products will be made available at minimum cost by 2015?				Yes 40; no 30; don't know 30: positive					
3.15. Will enhanced information extraction from historical, current and future source data be available by 2015?				Yes 51; no 18; don't know 31: positive					
3.16. Do you agree that all shared data, metadata and products will be made available with minimum time delay by 2015?			Yes 42, no 23; don't know 35; positive						
3.17. Do you agree that emerging information sources, including communities that may be global and not formally associated with any particular GEO Member or Participating Organization, will be a part of GEOSS by 2015?		Yes 43; no 13; don't know 43; positive							
3.18. Do you agree that all shared data, metadata and products will be provided free of charge, or at no more than the cost of reproduction, by 2015?				Yes 42; no 31; don't know 27: positive					
4.1. Do you believe that the GEOSS Architecture implementation sufficiently leverages current thinking in the fields of information technology, data infrastructures and earth observations?							Yes 59; no 23; don't know 18; postive		

SURVEY'S QUESTIONS	FOM 1	FOM 2	FOM 3	FOM 4	FOM 5	FOM 6	FOM 7	FOM 8	FOM 9
4.2. Do you think that the current GEOSS architecture is sustainable?		Yes 45; no 23; don't know 32; positive							
4.3. Do you think that the current GEOSS architecture allows for the provision of long-term, continuous data?		Yes 52; no 23; don't know 26; positive							
4.4. Is implementation of the Architecture and Data Management for GEOSS on track to meet the Strategic Targets for 2015?	yes 35, No 19, don't know 45. Postive								
4.5. Is implementation of the Architecture and Data Management for GEOSS guided by a clear plan to 2015?									Yes 37; no 13; don't know 50; positive
4.6. Do the expected outcomes of the Architecture and Data Management Strategic Targets for GEOSS respond to real needs?								Yes 52; no 16; don't know 3; positive	
4.7. Are the expected outcomes of the Architecture and Data Management Strategic Targets for GEOSS relevant?								Yes 62; no 5; don't know 33; positive	
4.8. Is there a clear rationale for the selection of the expected outcomes for Architecture and Data Management in the GEOSS Strategic Targets?									
4.9. Are the expected outcomes of the Architecture and Data Management Strategic Targets aligned with stakeholder views of GEOSS priorities?									
4.10. Have expected outcomes for the Architecture and Data Management Strategic Targets within GEOSS been clearly articulated?									
4.11. Do you have a clear understanding of what is required to demonstrate achievement of the expected outcomes for the Architecture and Data Management Strategic Targets?									
4.12. Are processes in place to obtain the data required to demonstrate achievement of the expected outcomes for the Architecture and Data Management Strategic Targets?									
4.13. Are the planned activities and outputs necessary and sufficient to achieve the expected outcomes for the Architecture and Data Management Strategic Targets?								Yes 34; no 12; don't know 54; positive	
4.14. Have all over-arching tasks and sub-tasks necessary to the achievement of the expected outcomes for the Architecture and Data Management Strategic Targets been defined?	yes 27, no 29, don't know 44. Neutral -negative								
4.15. Have all activities and outputs within over-arching tasks and sub-tasks necessary to the achievement of the expected outcomes for the Architecture and Data Management Strategic Targets been defined?									
4.16. Where over-arching tasks, sub-tasks, activities or outputs have been identified as not necessary to the achievement of the expected outcomes, do they add value to the Architecture and Data Management Strategic Targets?									
4.17. Is the workplan for the Architecture and Data Management Strategic Targets revised in light of new information on gaps and status of implementation?									
4.18. Are you aware of a process in place to identify and fill gaps for the Architecture and Data Management Strategic Targets?									
4.19. Are the work plan tasks and sub-tasks for the Architecture and Data Management Strategic Targets proceeding as planned?									
4.20. Do the work plan progress reports indicate adequate progress for the majority of tasks for the Architecture and Data Management Strategic Targets?									
4.21. Do the activities described in the Architecture and Data Management Strategic Targets progress report match those expected in the work plan?									
4.22. Will the expected outcomes for the Architecture and Data Management Strategic Targets be met by 2015?									

SURVEY'S QUESTIONS	FOM 1	FOM 2	FOM 3	FOM 4	FOM 5	FOM 6	FOM 7	FOM 8	FOM 9
4.23. Have there been any significant unintended positive outcomes for the Architecture and Data Management Strategic Targets?									
4.24. Have there been any significant unintended negative outcomes for the Architecture and Data Management Strategic Targets?									
4.25. Are there any lessons learned during implementation to date for the Architecture and Data Management Strategic Targets that might be transferable to other Strategic Target areas?		Yes 32; no 12; don't know 56; positive							
4.26. Do you think that GEOSS implementation will enable a coordinated and integrated network of Earth observing and information systems?	Yes 73, no 13, don't know 13. positive								
4.27. Do you believe that operational support for component systems by GEO Members and Participating Organizations will exist by 2015?		Yes 53; no 23; don't know 25; positive							
4.28. Do you agree that by 2015 the national radio-frequency administration agencies will be better informed about the long-term use and protection of all parts of the radio frequency spectrum needed for its space-based and surface-based components?		Yse 46; no 9; don't know 44; positive							
4.29. Do you agree that by 2015 the promotion of consistent standards and practices for observations across all earth systems by means of the GEOSS Common Infrastructure (GCI) will be a reality?						Yes 49; no 27; don't know 24; positive			
4.30. Do you agree that by 2015 GEOSS will allow access to global and regional information among Member and Participating Organization communities?				Yes 65; no 12; don't know 24 positive					
4.31. Do you agree that by 2015 key gaps in global geodetic infrastructure required for the maintenance and development of the global geodetic reference frames will be reduced?						Yes 65; no 12; don't know 24; positive			
4.32. Are there important data management deficiencies in GEOSS?						Yes 45; no 8; don't know 47; negative			
4.33. Will open, reliable, timely, consistent, and free access to a core set of essential environmental observations and information products, supported by adequate metadata, by users across all GEOSS Societal Benefit Areas in accordance with GEOSS Data Sharing Principles exist by 2015?	Yes 46, no 25, don't know 30. Positive								
4.34. Do you agree that increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion will exist by 2015?								Yes 68; no 12; don't know 21; positive	
4.35. Do you agree that best practices, identified in the appropriate GCI registry, for observation, collection and access to data and information, including best practices for data quality assurance, for both observing system data and information products will exist by 2015?									
4.36. Do you agree that a coordinated, life-cycle data management process to support improved simulation, modeling, and prediction capabilities for each Societal Benefit Area and across multiple Societal Benefit Areas will exist by 2015		Yes 51; no 25; don't know 25; positive							
5.1. What is your university degree?									
5.2. How old are you?									
5.3. Are you male or female?									
5.4. Who is your employer?									
5.4. Who is your employer? (Other, please specify:)									
5.5. How long have you worked in the GEOSS environment?									

8.4. Target / Task Matching and Task Assessment Exercise

As part of the evaluation team's analysis process a "matching" of GEOSS Strategic Targets Outcomes[10] vs. Subtasks and Overarching Tasks was undertaken to answer the following question chain from the Question Framework:

- Are subtasks and overarching tasks (work plan) tied to target outcomes (Strategic Target Document)? (To what extent are the Work Plan tasks reflective of the actions required to achieve the Strategic Targets?)
  - Do both documents show a clear connection in descriptive language?
  - Are any targets' outcomes overlooked by overarching tasks or any overarching tasks not represented in target outcomes?
  - Do any key points appear in only one of the documents?

The same exercise was performed for subtasks and overarching tasks against the Cape Town Declaration[11]. Descriptions of the Overarching Tasks and Subtasks can be found in the GEO Work Plan[12] and the Task Sheets[13].

In the following we will consider 27 subtasks and two overarching tasks, AR-06-11 and DA06-01. The two overarching tasks have no related subtasks. The reason the remaining overarching tasks are not evaluated is that there were no clear and unambiguous means as to how to aggregate the results of subtasks into the overarching tasks; thus there may be inconsistencies in the evaluation.

In the remaining part of this section these 29 will be referred to simply as tasks.

To answer the questions a matrix was established for each of the GEOSS Architecture and Data Management subtasks, with the tasks along the horizontal axis and the strategic targets outcome and visions of the Cape Town Declaration along the vertical. Five external evaluators were then asked to tick off the cells for which they found that the task reflects the outcome. One of the evaluators assessed only Architecture tasks vs. Architecture outcomes, whereas the other four assessed both Architecture and Data Management tasks against the Architecture and Data management outcomes as well as the Cape Town.

The reviewers looked for evidence in the texts of indications of how the tasks directly and indirectly address the outcomes. This opened for a certain degree of subjectivity and different ratings of certain combinations amongst the reviewers. The following colour coding of the match between task and outcome has been used:

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[10] http://www.earthobservations.org/documents/geo_vi/12_GEOSS%20Strategic%20Targets%20Rev1.pdf

[11] http://www.earthobservations.org/05_Cape%20Town%20Declaration.pdf

[12] http://www.earthobservations.org/documents/work%20plan/geo_wp0911_rev3_101208.pdf

[13] http://www.grouponearthobservations.org/cdb/geoss_imp.php

4 Green = Task directly addresses outcome = Half or more of reviewers found the task to address the outcome

5 Yellow = Task indirectly addresses outcome = Less than half of reviewers found the task to address the outcome

6 Red = Outcome not addressed by task = None of the reviewers found match between task and outcome

There were nine outcomes included in the evaluation – five under Architecture and four under Data Management.

To get valuation statistics with at least four evaluators for each, the summary below is done with Architecture tasks vs. Architecture outcomes and Data Management tasks vs. Data Management outcomes only.

8.4.1. Target/Task Matching - Results

For the Task Assessment (TA) we focused on the progress made up to 2010 by analyzing GEO VI and GEO VII results. The same five evaluators were asked to consider

The fundamental question of TA is "To what extent have the tasks/subtasks satisfied the strategic targets?" The evaluators were asked to grade the progress of the nine overarching tasks against the strategic targets outcomes and the visions of the Cape Town Declaration, using a scale from 1 to 5, where 1 indicates none or very little accomplishment, and 5 indicates a great amount of accomplishment. It was suggested that they include the following documents as part of the evaluation documentation:

a) GEO VI progress report (http://www.earthobservations.org/documents/geo_vi/05_2009-2011%20Work%20Plan%20Progress%20Report%20Rev1.pdf)

b) GEO VII progress report (http://www.earthobservations.org/documents/geo_vii/05_2009-2011%20Work%20Plan%20Progress%20Report.pdf

c) the task work sheets (http://www.grouponearthobservations.org/cdb/geoss_imp.php)

d) the document "Prototype Assessment Work Plan Progress Towards Strategic Targets" ftp://ftp.earthobservations.org/ExCom/20/08_Prototype%20Assessment%20Work%20Plan%20Progress%20Towards%20Strategic%20Targets.pdf)

Tasks vs. outcomes

Of the 29 tasks all but one was found to directly address at least one outcome, i.e. they show at least one green cell. One task, AR-06-11 Radio Frequency Protection, had no green cells and was evaluated as barely addressing an outcome.

Thus, none of the tasks are identified as completely without relevance for the outcomes.

Of the nine outcomes all but one are directly addressed by at least three overarching task. Indeed, three are addressed by 3-5 tasks, three by 6-8 and two by 9-11, a good coverage. The exception is the fifth outcome under Architecture, ”Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products”, which was found not be directly addressed by any subtask and indirectly by only three subtasks of the 29 tasks and subtasks.

Tasks vs. Cape Town Declaration

The five visions of the Cape Town Declaration are directly addressed by only 4 of the 29 tasks, ranging from 1 to 3 for each one of the visions. Task DA-06-01 GEOSS Data Sharing Principles, is judged to be a task that address all five Cape Town ”visions”, and AR-09-01d, Ontology and Taxonomy Development, as addressing four of the five visions.

Here it should be noted that the task that did not address any strategic target outcome, AR-6-11, Radio Frequency Protection, show a link to the Cape Town vision ”Coordination at national, regional and global levels, continued investments, scientific and technological advances and innovative approaches to financing will be vital for upgrading and expanding and expanding Earth observations and building the capacity of individuals, institutions and systems, particularly in developing countries”, and, although not shown here, to the 10-Year Implementation Plan Reference Document.

8.4.2. Task Assessment - Results

Not all of the five evaluators graded all overarching tasks against each outcome and so again results are reported only for Architecture tasks vs. Architecture outcomes and similar for Data Management.

Details can be found in the attached spreadsheet. It is emphasized that the low number of evaluators result in significant uncertainties in the average grades.

Tasks vs. outcomes

For task vs. outcomes the grades (average of evaluators) range from 1.3 to 4.0 whereas the average for each task overall outcomes range from 1.8 to 3.2. Data

Management seems to score slightly higher than Architecture but the significance of this is probably low. The lowest task scores are found for AR-06-11 Radio Frequencies and DA-09-03 Global Data Sets.

Tasks vs. Cape Town Declaration

The grades vary from 1.3 to 4.3 for tasks vs. visions" and between 2.1 and 3.0 when averaged over all visions. Task AR-09-02 Interoperable Systems for GEOSS shows the highest average score and DA-06-01 GEOSS Data Sharing Principles has the highest individual score, against the vision "Continued cooperation and dialogue will establish GEOSS as a powerful means to support informed decision making".

8.4.3. Discussion/Conclusions/Findings

All subtasks under GEOSS Architecture and Data Management are relevant and address either Strategic Target Outcomes or the Cape Town Declaration.

All but one Strategic Target Outcome is addressed by a task. This is the Architecture outcome "Comprehensive gap analysis and gap filling, integrated across all Societal Benefit Areas, including issues pertaining to operational redundancy and succession planning (especially with respect to space missions) for systems and products". It should be noted that a finding from the mid-term evaluation of GEOSS was that GEO has not conducted a comprehensive gap analysis (Finding 13) and that conducting one was one of the recommendations (Recommendation 7).

The GEO Secretariat experts regularly rate the performance of tasks and present task status in the Work Plan Progress Report. The Work Plan Progress Report is submitted annually at the GEO Plenary sessions. For this evaluation, the Team analyzed reports from the Sixth and Seventh Plenary Sessions of GEO (Document 5 to GEO-VI, November 2009, and Document 5 GEO-VII, November 2010). The Secretariat gives tasks a rating of green, yellow, or red. Green represents tasks the Secretariat has judged progress to be "very good" to "excellent". Yellow represents tasks that are progressing but more effort is required. Red represents tasks that the Secretariat has judged progress as insufficient or that the task is inactive.

The Secretariat has consistently rated overall progress of the overarching ADM tasks to be "very good" to "excellent" except AR-09-03 "Advocating for Sustained Observing Systems" in the Work Plan Progress Report to GEO-VII (2010), which was then rated yellow or "more effort is required".

The general impression from this assessment performed in 2011 by the evaluation team is that the overarching tasks seem to be progressing only in a mediocre manner. This is a less positive evaluation of Task progress that what is found in the 2009 – 2011 Work Plan Progress Reports presented to the plenary in 2009 and 2010. One reason for this discrepancy in evaluation of progress may be that in the Work Plan Progress Reports the progress is measured against the original work plan for the tasks and based on the Task Sheets, whereas the TA evaluates progress towards the Strategic Targets Outcomes.

It may be that the basic difference in finding between the ADM evaluation and the Work Plan Progress Reports is that the Progress Reports are saying that they are "Doing things right" whereas the ADM Evaluation asks are you "Doing the right things?"

8.5. Test Case Report

A test case was undertaken as a means to address questions of ease when accessing a dataset given the current Architecture and Data Management construct of GEOSS.

The parent organization of one of the Evaluation Team members was asked to conduct a test case to evaluate the utility of GEOSS in a simulated, but plausible, application of GEOSS. Here, the test activity was the Naval Oceanography Operations Command (NOOC), a part of the Naval Meteorology and Oceanography Command (NAVMETOCCOM) of the United States Navy.

Uniformed members of the NOOC were asked to envision a particular scenario in which environmental information (e.g. oceanographic, atmospheric) would be needed to support the mission, craft a set of questions/queries to be posed to GEOSS, and then query GEOSS for the desired information. The expected result of the test was indicators of the ability of GEOSS to return the required information and the utility and usability of the GEOSS Common Infrastructure.

The NOOC members selected a scenario of humanitarian relief in the country of Haiti, in the case of natural disaster response. The team devised a number of questions of a general nature that would be expected, some of which are relevant to the scope of the GEOSS. Some examples follow:

- How large is the country? What areas were damaged and how badly? What areas are inaccessible by normal means?
- What is the terrain? Is there potential for mudslides? How much vegetation is there?
- What is the population and the distribution among men/women/children?
- What is the estimated death total and where are the most casualties?
- What type of agriculture is there and how much is damaged?
- How much food is available? What fishing/farming is conducted? Is there any food assistance from neighbouring countries?
- What type of water system exists and what is the damage or contamination? Are people able to get fresh water?
- Are there any piers/landings? What type? What is the orientation/configuration?
- Are the waterways clear? How deep is the water normally? What is the bottom type?

- What roadways exist and what is their condition?

- What areas are available for landing aircraft and what is the runway configuration?

The team members accessed GEOSS by way of the GEOSS portal and attempted to discern what supporting information could address or partially address any of the postulated questions.

The team members were not able to successfully retrieve supporting information from GEOSS, citing complexity and numerous cascading levels of indirection as the obstacles that prevented its successful use. Verbiage from the testers follows:

- "We have tested the GEOSS to the best of our capabilities. GEOSS appears to us to be a difficult, time-consuming and non-intuitive system. Using our questions as a guide, we were unable to answer even the most basic questions. For example, What are the average temperatures for any given month in Haiti? A search on the Climate - Haiti section of the portal reveals only more options.

- Choosing Climate - Haiti gives you 193 possible links to choose from, many of those links are of companies and their services, not climate information.

- On the other hand, a simple Google search reveals the answer in one click. I know this is a simple example. However, the GEOSS without proper user training is simply too cumbersome. As you know, applications that are not intuitive or user-friendly are tossed to the side for more familiar applications.

- In our (limited) testing a Google search was more efficient and effective than GEOSS."

Conclusion: GEOSS is a massive collection of system elements (i.e. links to distributed holdings), but it does not provide a means of access that can be negotiated, except by perhaps the most expert users. Other available means of data are normally selected due to accessibility.

8.6. GEOSS Supersite

The evaluation team sent the following question to one of its members.

One question that begs to be asked, and perhaps you know or could find out. In the recent natural disaster in Japan, did ANY decision-makers use GEOSS for any purpose? The GEO home page now has a GEO Geohazards Supersite but it is both important and interesting to know how the site and the data are being exploited by the real users, not only the faithful "congregation". If we had some evidence either way, it would make our report timely and relevant.

The response from this evaluation team member and others is indicative of the usefulness of GEOSS.

A Review of GEO's Geohazard Supersites

Case Study on Japan Earthquake and Tsunami

There was a 9.0 magnitude earthquake on 11 March 2011 in East Japan, followed by a tsunami and the Fukushima-Daiichi power plant accident. Using this event as a case study, the GEOSS ADM Evaluation Team devised a survey on the usefulness of GEO's Tohoku-oki Event Supersite.

GEO's Tohoku-oki Event Supersite

GEO's Tohoku-oki Event Supersite was created very quickly as one of Supersites of the Task: http://supersites.earthobservations.org/sendai.php after the Japan Earthquake and Tsunami.

Purpose of the GEO Supersites

The GEO Supersite webpage is designed for scientific use. This includes understanding the tectonic process and event response. Outreach and education are expected as feedback or suggestions for improvement. The website is also expected to argue for open data provision in the future using user's experience on this case.

Data and Information

The supersite has topics covering issues such as SAR, Focal Mechanism, GPS, Ground Motion, Source Slip, Seismicity, Visible and Links. Much data and results from EO satellites, GPS, in-situ, and model outputs are provided by many providers worldwide. Raw data and information are introduced as they are provided and are not reviewed, validated, or edited prior to insertion into the database. Therefore, a user should have an expert ability and scientific knowledge if they are to use the data and information for their specific purposes.

Links to Disaster Prevention

Within Japan there are links to the responsible authority for disaster observations; Japan Meteorological Agency (JMA) and the Headquarters for Earthquake Research Promotion of MEXT. The headquarters is responsible for survey, observation and research, and to develop comprehensive policies, survey and observation plans. In the event of an emergency, such as occurred with the earthquake and subsequent tsunami, the government emergency disaster headquarters is the head and there may be no contact with them at all.

Applicability for Users

In response to the inquiry by the Evaluation Team on the question on the applicability of the supersite for users, the followings are comments by the Task Lead.

1. They just completed a draft strategic plan for the Space component of the Supersites. It is at: http://supersites.earthobservations.org/SpaceComponentStrategicPlan_FA.pdf It is expected to set up a Japan natural laboratory for geo-hazard with complete satellite imagery.

2. Regarding the Tohoku-oki Supersite, there is no protocol in place on how and when space agencies contribute data. Their infrastructure via ESA's virtual archive allows for very rapid data upload and download. The ESA and TerraSAR-X data were available just a few hours after image acquisition.
3. Some feedback comments regarding the Supersite are received from specialists on the earthquake hazard and the Supersite was useful for their work.

Practical Data Use

1. The Supersite aims at research and education on disaster mitigation and on facilitating the understanding of the disaster occurrence mechanism and simulation. The Supersite can be also useful for disaster risk assesment, mitigation, prevention and preparedness of secondary or induced earthquakes (in post-disaster phase or forthcoming earthquakes in pre-disaster phase). For the disaster area itself, emergency response is the most urgent issue for search and rescue and evacuation of the victims. In this case observation data and information for early decision making on safety measures and disaster management is critical. Much satellite observation data is disseminated for free to the appropriate disaster management authorities through coordination with the government emergency disaster measure headquarters and relevant ministries and agencies. In the case of the earthquake and tsunami on 11 March 2011, by invoking the International Disaster Charter and Sentinel Asia, over twenty satellite emergency observations were made. This series of emergency observations was only possible because of a pre-arranged virtual constellation of multiple satellites (by courtesy of satellite owners worldwide). These national and international mutually supporting frameworks were the systems most responsible for providing supporting data to the emergency management authorities.

2. Prioritization is also an important issue for data acquisition, processing and data dissemination. Because of the path which each satellite takes as it goes over the disaster area, the observation capability of each satellite is different, but may overlap its peer. This creates a potential repetition of data, which must then be sorted into a common operating picture using limited resources. In the early phase of disaster management, search and rescue should be done first, with the validation of the event, and the simulation of future risk and the rehabilitation of the disaster area following as secondary items.

Other Responses, observations, and comments

The responses below were edited for clarity, spelling and grammar.

Response 1:

Thank you for working with Supersite, which makes it easier us to obtain the information associated with this earthquake.

I have been updating only my Japanese website because this is needed urgently for our Japanese colleagues, media, and some general public who are really interested in the aftershocks and subsequent large earthquakes.

I saw many wonderful results for the Sendai earthquake on the GEO Supersite. It's really a good idea for the construction of the site. I suggest leaving some space for suggestions/comments on the webpage, so that we can discuss the progress or advantages/shortcomings of every result.

The Supersite for this earthquake proved to be the most important clearinghouse for data and information about all aspects of this earthquake. It has been astounding to see at what pace information has become available (GPS/InSAR etc. data, slip models, tsunami and coastal inundation information etc.) that allowed for rapid understanding of many aspects of the event and the early response of the international research community. This event has had tragic consequences, but the Supersite proved a model of international collaboration and dissemination of information that directly impacts what we will be able to learn from it.

This should be a model for future event responses, but also for sharing of information and data about areas at risk before a disaster forces us to do so.

Response 2:

I noticed the request for feedback on the use of data at the Sendai supersite.

I am an undergraduate geoscience student and currently enrolled in a course entitled "Plate Tectonics".

We have been having discussions of, and debates about, subduction zone tectonics, rheology, mechanics and more based on data on the supersite daily since the earthquake occurred.

Our professor emailed us all the link last Sunday night.

Many fellow students have noticed how rapidly we were given access to this information, and thoroughly appreciate that. Having access to essentially real-time data about a globally significant event has piqued everyone's interest in learning more about tectonism.

Response 3:

Regarding the Tohoku-oki Supersite a number of things could have been done better.

There is no protocol in place on how and when JAXA contributes data.

The lack of a protocol resulted in unnecessary time delays. Our infrastructure via ESA's virtual archive (on the cloud) allows for very rapid data upload and download. The ESA and TerraSAR-X data were available just a few hours after image acquisition whereas for ALOS there was a delay of a few days. This was particularly unfortunate for the first post-seismic ALOS imagery for which very rapid data analysis was important.

8.7. Interview protocols

GEOSS MIDTERM EVALUATION INTERVIEW GUIDE

As I've explained, an Evaluation Team has been tasked with conducting the second GEOSS evaluation. The purpose of this interview is to obtain your views on planning, implementation, and progress that have been made thus far regarding GEOSS Architecture and Data Management.

The guide I am using contains a series of interview questions. I want to remind you that you are not required to answer any questions that you cannot or choose not to address. Just let me know that you would like to skip the question and I will move onto the next one on my list. Any information you provide will remain anonymous and none of your responses will be associated with you in our midterm evaluation report.

Our analysis of evaluation interviews for Architecture and Data Manegement will examine trends and patterns of opinion. Once we complete all our interviews and other data collection, our evaluation report will be presented to the GEO Monitoring and Evaluation Working Group.

In order to keep track of what has been said, I will be taking notes as we talk. All interview notes will be destroyed at the end of the evaluation. If there is ever any information that you would prefer I did not document in my notes, please just let me know.

Do you have any questions before we begin?

1. Have you heard about GEOSS and are you familiar with it?

YES☐ NO☐

2. Have you been involved with GEOSS?

YES☐ NO☐

If yes, please elaborate on involvement (Transverse or Societal Benefit Areas, role, responsibilities etc)

_____
_____
_____
_____
_____
_____

3. The purpose of GEOSS is to enable a coordinated and integrated network of Earth observing and information systems. Key components of the network are the Architecture and Data Management (ADM) structures and their Strategic Targets.

Do you consider yourself familiar with the content of the *GEOSS Strategic Targets (GEO-VI, Document 12) for Architecture and Data Management*?

YES☐ NO☐

If unfamiliar with the document, we can skip to Question 14

4. Do you agree the ADM Strategic Outcomes will be achieved by 2015?

YES☐ NO☐

If you do not agree, what is missing to enable this result?

_____
_____
_____
_____

5. Are there any national policies/legislation, under which your organization operates, that inhibit your ability to meet the ADM Strategic Targets?

YES☐ ☐ NO

If yes, please elaborate

_____
_____
_____
_____
_____

6. Do you agree that GEOSS allows increased use of observations through the ADM Strategic Targets?

YES☐ ☐ NO

If you do not agree, why not?

_____
_____
_____
_____
_____

7. Are you familiar with the current "Task" structure of the GEOSS Work Plan?

YES☐ NO☐

If yes, do you find that there are gaps in the existing over-arching tasks and sub-tasks in the ADM Strategic Targets which would cause the expected outcomes not to be met and what might those gaps be?

_____
_____
_____
_____
_____

8. Do you know if there is a documented process to identify gaps?

YES☐ NO☐

If yes, do you know where it can be found?

_____
_____

9. Whether formally documented or not, can you describe the process by which gaps are identified and filled?

_____
_____

10. What challenges have arisen during implementation of the ADM Strategic Targets and how have these been addressed?

11. Which expected outcomes from GEOSS have been realized (fully or partially) to date?

12. Are there any methods, processes, tools, etc. that were found to be particularly important to realizing progress in the ADM Strategic Targets?

13. Are there any methods, processes, tools, etc. that were found not to be helpful or which ought to be avoided in implementing the ADM Strategic Targets?

14. Using the scale below where 1 means “Very Good” and 5 means “Very Poor” how do you rate overall progress for *Architecture* at this point in its development and implementation?

Very Good		Neutral		Very Poor	Unsure
1	2	3	4	5	6

And *for Data Management?*

Very Good		Neutral		Very Poor	Unsure
1	2	3	4	5	6

15. What, in your opinion, are the three most important ***accomplishments*** of GEOSS *Architecture and Data Management* to date?

_____
_____
_____
_____
_____

16. What, in your opinion, are the three greatest ***challenges*** that GEOSS *Architecture and Data Management* has overcome to date?

_____
_____
_____
_____
_____

17. How do you rate the cooperation of members and participating organizations in the implementation of GEOSS *Architecture and Data Management*?

Very Good		Neutral		Very Poor	Unsure
1	2	3	4	5	6

18. Do you believe that the GEOSS *Architecture and Data Management* implementation sufficiently leverages current thinking in the fields of information technology, data infrastrucure and earth obervations?

YES☐ NO☐

If not, please elaborate:

_____
_____
_____
_____

19. What, in your opinion, are the three greatest ***challenges*** facing implementation of GEOSS *Architecture and Data Management* today?

_____
_____
_____
_____
_____

20. Have there been any unintended ***positive outcomes*** of GEOSS *Architecture and Data Management* to date?

_____
_____
_____
_____
_____

21. Have there been any unintended ***negative impacts*** of GEOSS *Architecture and Data Management* to date?

_____
_____
_____
_____
_____

22. Do you believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015?

☐ YES ☐ NO

If NO, please explain why:

_____
_____
_____
_____
_____

About the use of GEOSS. If you do not consider yourself a data user or are unfamiliar with how to access or register GEOSS data/systems/models, we jump to Question 32.

23. Are you familiar with GEOSS Common Infrastructure (GCI)?

YES☐ NO☐

If yes, what is your opinion of the current deployment of GCI?:

_____
_____
_____
_____

24. How easy and efficient is it to enter your data/services in the Registry?

_____
_____
_____
_____

25. How easy and efficient is it to find items in the Registry that meet your needs?

_____
_____
_____
_____

26. How easy and efficient is it to search the Clearinghouse for data?

_____
_____
_____
_____

27. Apart from the GCI, what additional venues for member countries to discuss and perhaps agree upon methods for greater data system interoperability and leverage common international metadata standards would you suggest?

_____
_____
_____
_____

28. If you think the portal interface is not friendly, what is missing?

_____
_____
_____
_____

29. If you think the portal does not provide access to its functionalities through an accessible interface, what is missing?

_____
_____
_____
_____

30. Would you prefer to access the GEOSS via one or multiple portals and clearinghouses?

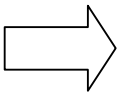
_____
_____
_____
_____

31. Are you responsible for any of the systems in the GEOS Registry?

☐ YES ☐ NO

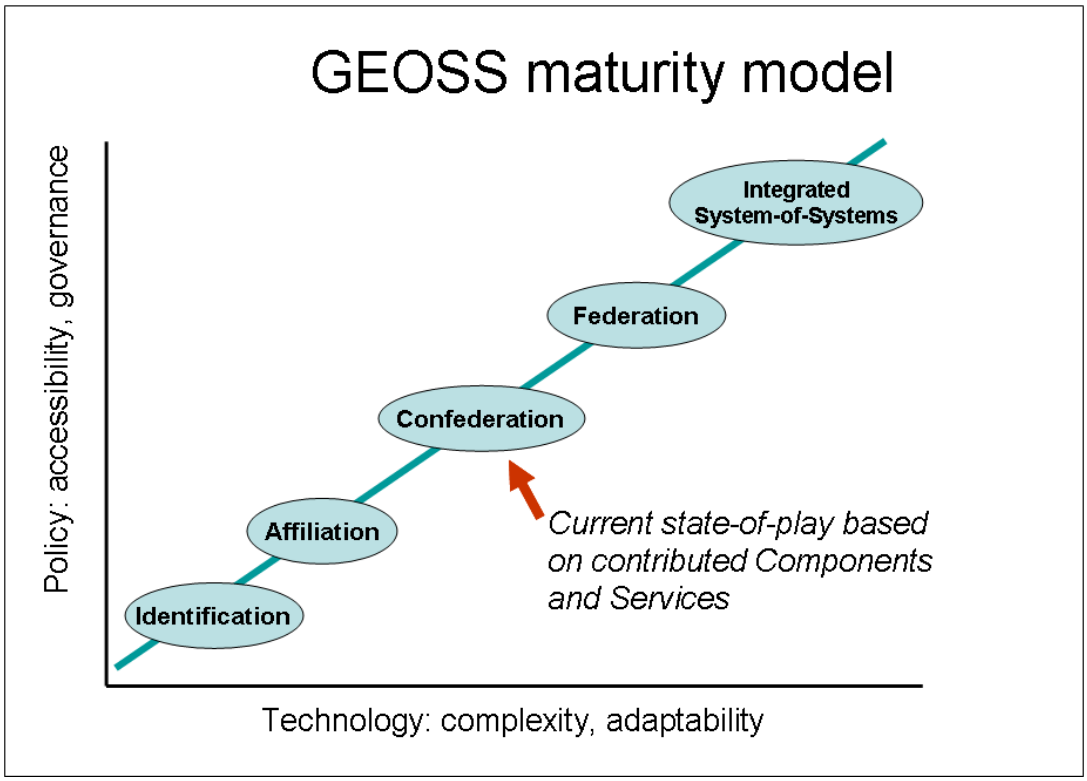
If YES, please try to rate the maturity of your system according to the Maturity Index at the end of this guide. We will also like to know what ou belive can contribute the higher levels of maturity, including assistance from GEO, how your experience was registrering the system and on its interoperability.

_____
_____
_____
_____
_____



32. Is there anything else you would like to mention in regards to the implementation progress of GEOSS *Architecture and Data Management* that we have not talked about during this interview?

_____
_____
_____
_____



- **Identification**: My organization/system has identified resources and provided basic information for further contact. Little/no direct access to data or services. Web pages and documents predominate. *(e.g. Web model)*

- **Affiliation**: My organization/system has branded contributions with a common group identity (GEOSS) for recognition. Information access and technology are limited but diverse. Integration of resource content is difficult. *(e.g. Membership model)*

- **Confederation**: My organization/system has adopted a common approach but retained rights of self-governance, access terms, and technology. Information access is enhanced but multiple interfaces predominate. Developers can assemble interfaces to multiple systems in weeks *(e.g. Community of Interest model)*

- **Federation**: My organization/system has agreed to adopt common practices, data access principles, terminology, devolving some authority to a common governance body. Information content and services are well-described and some common interfaces and formats are deployed by requirement. Integrators can assemble interfaces to diverse systems in days *(e.g. Governmental or professional network model)*

- **Integrated System-of-Systems**: My organization/system has encapsulated systems and offers standardized service interfaces to process/access data with identified and common semantics and common format/syntax. Data access rules are deployed transparently across all systems. Client software can be deployed to access diverse system interfaces in real-time based on familiar patterns *(e.g. Enterprise System model, System-of-Systems model)*

8.8. Main Survey Analysis

The survey was emailed to more than 4,000 persons in January 2011. The survey remained open for three weeks during which time 268 persons responded. The survey contained five sections. Section 1 asked general questions about the backgrounds of respondents, their organizations, and their locations. Section 2 asked general questions about GEOSS. Section 3 asked questions of data providers. Section 4 asked questions of data users. Section 5 asked questions concerning age, sex, and education.

GEOSS Architecture and Data Management

Section 1.

1. Are you familiar with GEO or GEOSS?

Response	Chart	Percentage	Count
Yes		84%	184
No		16%	35
		Total Responses	**219**

2. The list below represents the Strategic Targets in GEOSS. Even if you are unfamiliar with GEO or GEOSS, which of the following categories describe fields in which you are personally involved?

Response	Chart	Percentage	Count
Agriculture		29%	64
Biodiversity		36%	79
Climate		43%	96
Disasters		33%	72
Energy		16%	35
Health		16%	36
Water		34%	76
Weather		20%	45
Earth Observation Architecture		24%	53
Earth Observation Data Management		51%	112
Earth Observation Capacity Building		33%	73
Earth Observation Science and Technology		56%	124
Earth Observation User		28%	62

Engagement		
Other, please specify:	15%	34
	Total Responses	**221**

2. The list below represents the Strategic Targets in GEOSS. Even if you are unfamiliar with GEO or GEOSS, which of the following categories describe fields in which you are personally involved? (Other, please specify:)

#	Response
1.	aquaculture & fisheries
2.	data policy
3.	Education
4.	in-situ earth observations
5.	forestry
6.	Geospatial Standards and Policy
7.	Seismology
8.	Internationally coordinated glacier monitoring
9.	ecosystems
10.	geo information Sciences
11.	air quality
12.	navigational system development.
13.	GEOLOGICAL RISK
14.	GEOLOGICAL RISK
15.	vegetation
16.	Remote Sensing
17.	Data Management & Collection
18.	Forestry
19.	Urban Planning
20.	safety
21.	Geo-marketing
22.	Land Information datasets
23.	Land Use
24.	Land use mapping
25.	biodiversity informatics, biological metadata
26.	More or less in all of the above mentionned
27.	geospatial information technology

28.	carbon sequestration
29.	Remote sensing law
30.	Multidisciplinary interoperability
31.	environment
32.	Geomorphology
33.	Mapping GIS
34.	Urban, Roads etc
35.	Logistics

3. In which country do you conduct the largest part of your activities related to the GEOSS Strategic Area(s) you identified in Question 2?

Response	Chart	Percentage	Count
I don't conduct activities related to GEOSS in any country		5%	12
Afghanistan		0%	0
Albania		0%	0
Algeria		0%	1
Andorra		0%	0
Angola		0%	0
Antarctica		0%	0
Antigua and Barbuda		0%	0
Argentina		0%	0
Armenia		0%	0
Australia		3%	7
Austria		0%	1
Azerbaijan		0%	0
Bahamas		0%	0
Bahrain		0%	1
Bangladesh		0%	1
Barbados		0%	0
Belarus		0%	0
Belgium		1%	3
Belize		0%	0
Benin		0%	1

Bermuda	0%	0
Bhutan	0%	0
Bolivia	0%	1
Bosnia and Herzegovina	0%	0
Botswana	0%	0
Brazil	4%	9
Brunei	0%	0
Bulgaria	1%	2
Burkina Faso	0%	0
Burma	0%	0
Burundi	0%	0
Cambodia	0%	0
Cameroon	1%	2
Canada	2%	5
Cape Verde	0%	0
Central African Republic	0%	0
Chad	0%	0
Chile	0%	0
China	0%	1
Colombia	2%	4
Comoros	0%	0
Congo, Democratic Republic	0%	0
Congo, Republic of the	0%	0
Costa Rica	0%	1
Cote d'Ivoire	0%	0
Croatia	0%	0
Cuba	0%	0
Cyprus	1%	2
Czech Republic	0%	1
Denmark	0%	0
Djibouti	0%	0
Dominica	0%	0
Dominican Republic	0%	0
East Timor	0%	0
Ecuador	0%	0

Egypt	0%	0
El Salvador	0%	0
Equatorial Guinea	0%	0
Eritrea	0%	0
Estonia	0%	0
Ethiopia	0%	1
Fiji	0%	0
Finland	0%	1
France	3%	6
Gabon	0%	0
Gambia	0%	0
Georgia	0%	0
Germany	4%	9
Ghana	1%	2
Greece	1%	3
Greenland	0%	0
Grenada	0%	0
Guatemala	0%	0
Guinea	0%	1
Guinea-Bissau	0%	0
Guyana	0%	0
Haiti	0%	0
Honduras	0%	0
Hong Kong	0%	0
Hungary	0%	0
Iceland	0%	0
India	2%	4
Indonesia	0%	0
Iran	0%	0
Iraq	0%	0
Ireland	0%	0
Israel	0%	1
Italy	3%	7
Jamaica	0%	0
Japan	3%	7

Jordan	0%	0
Kazakhstan	0%	0
Kenya	1%	3
Kiribati	0%	0
Korea, North	0%	0
Korea, South	0%	0
Kuwait	0%	0
Kyrgyzstan	0%	0
Laos	0%	0
Latvia	0%	0
Lebanon	0%	0
Lesotho	0%	0
Liberia	0%	0
Libya	0%	0
Liechtenstein	0%	0
Lithuania	0%	0
Luxembourg	0%	0
Macedonia	0%	0
Madagascar	0%	0
Malawi	1%	2
Malaysia	0%	1
Maldives	0%	0
Mali	0%	0
Malta	0%	0
Marshall Islands	0%	0
Mauritania	0%	0
Mauritius	0%	0
Mexico	1%	2
Micronesia	0%	0
Moldova	0%	0
Mongolia	0%	0
Morocco	0%	1
Monaco	0%	0
Mozambique	0%	0
Namibia	0%	0

Nauru	0%	0
Nepal	1%	2
Netherlands	1%	2
New Zealand	2%	4
Nicaragua	0%	0
Niger	0%	0
Nigeria	5%	10
Norway	2%	5
Oman	0%	0
Pakistan	1%	3
Panama	0%	1
Papua New Guinea	0%	0
Paraguay	0%	0
Peru	1%	2
Philippines	0%	0
Poland	0%	0
Portugal	1%	3
Qatar	0%	0
Romania	0%	1
Russia	0%	1
Rwanda	0%	0
Samoa	0%	0
San Marino	0%	0
Sao Tome	0%	0
Saudi Arabia	0%	1
Senegal	1%	2
Serbia and Montenegro	0%	0
Seychelles	0%	0
Sierra Leone	0%	0
Singapore	0%	0
Slovakia	0%	0
Slovenia	1%	2
Solomon Islands	0%	0
Somalia	0%	0
South Africa	5%	10

Spain	2%	5
Sri Lanka	0%	1
Sudan	1%	2
Suriname	0%	0
Swaziland	1%	2
Sweden	0%	0
Switzerland	1%	3
Syria	0%	0
Taiwan	0%	0
Tajikistan	0%	0
Tanzania	2%	5
Thailand	1%	2
Togo	0%	0
Tonga	0%	0
Trinidad and Tobago	0%	0
Tunisia	0%	1
Turkey	1%	2
Turkmenistan	0%	0
Uganda	1%	2
Ukraine	0%	0
United Arab Emirates	0%	0
United Kingdom	1%	2
United States	12%	27
Uruguay	0%	0
Uzbekistan	0%	1
Vanuatu	0%	0
Venezuela	0%	1
Vietnam	2%	4
Yemen	0%	1
Zambia	1%	3
Zimbabwe	0%	0
	Total Responses	**219**

4. Which of these terms best describes your primary activity in the GEOSS Strategic Area(s) you identified in Question 2?

Response	Chart	Percentage	Count
I do not conduct any activities in a GEOSS Strategic Area area		7%	16
Science / Research		61%	134
Research Administration		11%	24
Public Administration		11%	25
Policy		11%	24
Information Technologies		38%	82
Education and Outreach		24%	53
Decision Support		31%	68
Other, please specify:		4%	9
		Total Responses	**218**

4. Which of these terms best describes your primary activity in the GEOSS Strategic Area(s) you identified in Question 2? (Other, please specify:)

#	Response
1.	consultancy
2.	Intergovernmental coordination
3.	Global Food Supply Monitoring
4.	Operational Monitoring
5.	Remote Sensing
6.	Land use mapping and planning.
7.	Landforms
8.	Building and supporting sustainable infrastructure
9.	legal regulation
10.	Consultancy

5. Which of these terms best describes the body through which you are involved in the GEOSS Strategic Area(s) you identified in Question 2?

Response	Chart	Percentage	Count
I am not involved in any GEOSS Strategic Area		7%	15
State / Province / Territorial or		10%	21

Local Government			
Private Entity		11%	25
Non-Governmental Organization		19%	41
National Government		36%	79
Intergovernmental Body		16%	36
Individual		8%	18
Academic Institution		28%	62
Other, please specify:		5%	11
		Total Responses	**220**

5. Which of these terms best describes the body through which you are involved in the GEOSS Strategic Area(s) you identified in Question 2? (Other, please specify:)

#	Response
1.	Research Institute
2.	research institution
3.	World Glacier Monitoring Service
4.	IEEE
5.	former government involvement
6.	Several bodies including international projects
7.	CGIAR
8.	GBIF
9.	Space law
10.	JAXA
11.	Research Institution

6. How are your current activities funded in the GEOSS Strategic Target Area(s) you identified in Question 2?

Response	Chart	Percentage	Count
Entirely public funds		43%	92
Entirely private funds		8%	18
Mostly public funds		21%	44
Mostly private funds		6%	12
A mix of public and private		17%	37

Other, please specify:		6%	12
		Total Responses	**212**

6. How are your current activities funded in the GEOSS Strategic Target Area(s) you identified in Question 2? (Other, please specify:)

#	Response
1.	donations from NOAA
2.	None
3.	Donor Support
4.	Academic Supports
5.	Scholarship for Doctoral Thesis in Economics of Innovation (Space Science/Earth Observation)
6.	Currently unfunded
7.	Not funded.
8.	No funds
9.	government funds
10.	Government funds
11.	Government and External Donors

7. What is your primary relationship to GEOSS?

Response	Chart	Percentage	Count
GEO / GEOSS Participant		37%	81
GEOSS User		28%	61
GEOSS Data Provider		19%	42
No Role		28%	61
Other, please specify:		5%	10
		Total Responses	**218**

7. What is your primary relationship to GEOSS? (Other, please specify:)

#	Response
1.	representative of affiliated organization
2.	in charge for the Global Terrestrial Network for Glaciers (GTN-G) within GCOS/GTOS

3.	GEO focal point
4.	EEA, Scientific Committee Member
5.	OCCASIONAL INVOLVEMENT
6.	GBIF Rep for NZ
7.	NZ GEO Steering Group Member
8.	Space law teaching
9.	GEOSS GCI tester
10.	Not sure

Section 2.

1. Do you agree that GEOSS data is easily discovered or linked to?

Response	Chart	Percentage	Count
Yes		30%	35
No		44%	52
Don't know		26%	30
		Total Responses	**117**

2. Do you access existing national, regional and global observing and information systems through the GEOSS?

Response	Chart	Percentage	Count
Yes		29%	33
No		66%	75
Don't know		5%	6
		Total Responses	**114**

3. If you access existing national, regional and global observing and information systems through the GEOSS, why? (select all that apply)

Response	Chart	Percentage	Count
A single point of access to multiple information		55%	24
Functionalities provided by GEOSS		45%	20

(e.g. discovery, access)			
Other, please specify		16%	7
		Total Responses	**44**

3. If you access existing national, regional and global observing and information systems through the GEOSS, why? (select all that apply) (Other, please specify)

#	Response
1.	I don't (see 2)
2.	testing
3.	can overview many GEOSS activities
4.	curiosity about the architecture
5.	For Academic Purposes
6.	we are a data provider

4. If you access existing national, regional and global observing and information systems through the GEOSS, which of the following adds value to your search? (click all that apply)

Response	Chart	Percentage	Count
Access to resources only available through GEOSS		16%	7
Resources available at a lower cost		24%	11
Faster search		44%	20
Access to multiple resources through one single point-of-access		67%	30
Other, please specify:		7%	3
		Total Responses	**45**

4. If you access existing national, regional and global observing and information systems through the GEOSS, which of the following adds value to your search? (click all that apply) (Other, please specify:)

#	Response
1.	no depends of internet
2.	I don't (see 2)

5. If you do not access existing national, regional and global observing and information systems through the GEOSS, why not? (select all that apply)

Response	Chart	Percentage	Count
They are not accessible		29%	24
Direct access is better (more reliable, faster)		35%	29
Direct access is easier		32%	26
Other, please specify:		27%	22
		Total Responses	**82**

5. If you do not access existing national, regional and global observing and information systems through the GEOSS, why not? (select all that apply) (Other, please specify:)

#	Response
1.	didn-t know i could
2.	seismology has its information system globally organised
3.	We input not extract
4.	I am not familiar with GEOSS
5.	GEOSS needs FGDC standards also.
6.	used to direct access
7.	No need in the past
8.	NOT CLEAR WHAT IS AVAILABLE AND HOW
9.	no longer involved
10.	Haven't tried yet
11.	Wasn't very sure ot it
12.	we are a data provider
13.	never heard of it
14.	Conducting research
15.	We use GMES/ERS
16.	Accessing NASA (WIST)
17.	via GBIF
18.	not very useful

19.	never try
20.	Only work with Lv1 data
21.	I am not able to access it

6. What would you like to access through the GEOSS? (click all that apply)

Response	Chart	Percentage	Count
in-situ datasets		48%	50
Remote sensing datasets		80%	83
Airborne datasets		45%	47
Data archives and repositories		58%	60
Real-time and near-real-time data from sensor/ sensor networks		51%	53
Environmental models		52%	54
Processing/transformation services		38%	39
Information Products (maps, etc.)		62%	65
Other, please specify:		9%	9
		Total Responses	**104**

6. What would you like to access through the GEOSS? (click all that apply) (Other, please specify:)

#	Response
1.	I dont need access directly through GEOSS, bur helping discovery
2.	weather numerical models
3.	ideas on use of satellite data
4.	WATER RELATED DATA
5.	access to data catalogs or original source, no rehosting of data
6.	models for water management
7.	Thematic maps, Thematic Population Images (Landscan)
8.	GIS (Vector) data
9.	Training

7. If you are a data user, how do you rate the current GEOSS data population?

	Bad	Poor	Average	Good	Excellent	Don't know	Total
In-situ datasets?	3 (5%)	14 (22%)	9 (14%)	7 (11%)	1 (2%)	30 (47%)	64
Remote sensing datasets?	3 (4%)	7 (10%)	15 (21%)	17 (24%)	6 (9%)	22 (31%)	70
Airborne datasets?	4 (6%)	12 (18%)	12 (18%)	6 (9%)	2 (3%)	30 (45%)	66
Data archives and repositories?	2 (3%)	13 (19%)	9 (13%)	12 (17%)	1 (1%)	32 (46%)	69
Real-time and near-real-time data from sensor/ sensor networks?	5 (7%)	12 (17%)	8 (12%)	9 (13%)	4 (6%)	31 (45%)	69
Environmental models?	4 (6%)	13 (20%)	6 (9%)	9 (14%)	0 (0%)	33 (51%)	65
Processing/transformation services?	2 (3%)	12 (19%)	6 (9%)	9 (14%)	0 (0%)	35 (55%)	64
Information Products (maps, etc.)	2 (3%)	9 (13%)	12 (18%)	14 (21%)	5 (7%)	26 (38%)	68

8. How would you prefer to access the GEOSS? (click one).

Response	Chart	Percentage	Count
Through a single GEOSS Portal		62%	63
Through multiple portals		8%	8
Through different dedicated/thematic portals		26%	27
Other, please specify:		4%	4
		Total Responses	**102**

8. How would you prefer to access the GEOSS? (click one). (Other, please specify:)

#	Response
1.	multi-stage discovery
2.	Search Engine
3.	web service architecture
4.	Through (my) applications

9. Do you believe that the data and service registries with GEOSS to-date represent the collections held in member data systems?

Response	Chart	Percentage	Count
Yes		18%	18
No		33%	33
Don't know		48%	48
		Total Responses	**99**

10. How many of your organization's Earth-Observation (EO) systems, data sets, and services have been registered with GEOSS? (0-1; 2-5; 6 or more; don't know)

Response	Chart	Percentage	Count
0 to 1		32%	32
2 to 5		9%	9
6 or more		13%	13
Don't know		47%	47
		Total Responses	**101**

11. In total, how many of your organization's EO systems, data sets, and services are there available for registration with GEOSS?

Response	Chart	Percentage	Count
0 to 1		22%	21
2 to 5		9%	9
6 or more		29%	28
Don't know		40%	39
		Total Responses	**97**

12. Is your organization prepared to fund a centralized system or capability allowing users to search and order data?

Response	Chart	Percentage	Count
Yes		35%	34
No		34%	33

Don't know		32%	31
		Total Responses	**98**

13. If you manage a national, regional and/or global observing and information system, did you link your system to the GEOSS?

Response	Chart	Percentage	Count
Yes		39%	34
No		33%	29
Don't know		28%	24
		Total Responses	**87**

14. If you are a data provider, do you publish your datasets through the GEOSS?

Response	Chart	Percentage	Count
Yes		26%	23
No		45%	39
Don't know		29%	25
		Total Responses	**87**

15. Are the datasets you publish from:

Response	Chart	Percentage	Count
Research activities (projects, initiatives)		54%	53
Operational observations		39%	38
I don’t publish datasets		26%	25
Other, please specify:		6%	6
		Total Responses	**98**

15. Are the datasets you publish from: (Other, please specify:)

#	Response
1.	we are publishing the WRF weather numerical model for Central America
2.	mandated by UN to collect

3.	OS System has been planned
4.	Administrative reports
5.	remote sensing

16. If you do not publish datasets, why not? (select all that apply)

Response	Chart	Percentage	Count
I am not interested		4%	2
My system is not for public access		27%	14
I do not agree with the GEOSS data sharing principles		4%	2
I did not know that I could do it		27%	14
I do not know how to link it		14%	7
My data sets are not compliant with the GEOSS interoperability standards		12%	6
I do not know how to make my data sets compliant		22%	11
I cannot provide the requested metadata for describing datasets		6%	3
I provide my datasets through services other than GEOSS		25%	13
Other, please specify:		14%	7
		Total Responses	**51**

16. If you do not publish datasets, why not? (select all that apply) (Other, please specify:)

#	Response
1.	Do not generate data sets
2.	Data will be release to public in 2012 (contractual obligation)
3.	as per our departmental policy data are published
4.	We would need our client's approval to publish any collected dataset
5.	geoss seems ineffective
6.	there's never been a request and we're unsure of the type of data required by users. Lack of understanding of how to contribute towards GEOSS

17. What would you like to publish through the GEOSS? (select all that apply)

Response	Chart	Percentage	Count
in-situ datasets		32%	26
Remote sensing datasets		44%	35
Airborne datasets		18%	14
Data archives and repositories		39%	31
Real-time and near-real-time data from sensor/ sensor networks		25%	20
Environmental models		29%	23
Processing/transformation services		29%	23
Information Products (maps, etc.)		62%	50
Other, please specify:		5%	4
		Total Responses	**80**

17. What would you like to publish through the GEOSS? (select all that apply)
(Other, please specify:)

#	Response
1.	Don't generate such material
2.	to be discussed in my organization
3.	open source software
4.	depends on the country regulation. in most cases we do not have the technology and capability to sumit real-time or near-real-time data.

18. Please rate the current portal access.

	Bad	Poor	Average	Good	Excellent	Don't know	Total
Datasets search	4 (5%)	5 (6%)	17 (20%)	20 (23%)	3 (3%)	37 (43%)	86
Results presentation	2 (2%)	9 (11%)	14 (16%)	23 (27%)	2 (2%)	35 (41%)	85
Dataset access	3 (3%)	8 (9%)	16 (19%)	22 (26%)	1 (1%)	36 (42%)	86
Keyboard shortcuts	2 (2%)	6 (7%)	11 (13%)	9 (11%)	1 (1%)	56 (66%)	85
Character re-size	2 (2%)	4 (5%)	7 (8%)	13 (15%)	2 (2%)	56 (67%)	84

19. Do the search interfaces render the GEOSS Portal data and service holdings:

Response	Chart	Percentage	Count
Easy		1%	1
Satisfactory		33%	30
Difficult		16%	14
Cannot answer		50%	45
Other, please specify:		0%	0
		Total Responses	**90**

19. Do the search interfaces render the GEOSS Portal data and service holdings: (Other, please specify:)

#	Response

20. Does the Best Practices WIKI have information that makes your use of GEOSS easier?

Response	Chart	Percentage	Count
Yes		13%	12
No		12%	11
Don't know		76%	71
		Total Responses	**94**

21. Are you familiar with the GEOSS Common Infrastructure (GCI) ?

Response	Chart	Percentage	Count
Yes		39%	38
No		61%	59
		Total Responses	**97**

22. Do you agree that the GCI makes it easier to find existing data sets?

Response	Chart	Percentage	Count
Yes		29%	27
No		5%	5

If no, why not?		5%	5
Don't know		60%	55
		Total Responses	**92**

22. Do you agree that the GCI makes it easier to find existing data sets? (If no, why not?)

#	Response
1.	not really effective, so I can't say "yes"
2.	ranking system does not exist
3.	just scratching the surface
4.	no real data access

23. What is your opinion of the current deployment of the GEOSS Common Infrastructure?

Response	Chart	Percentage	Count
Exceeds requirements		3%	3
Meets Requirements		15%	14
Partially meets requirements		29%	27
Does not meet requirements		5%	5
Don't know		47%	44
		Total Responses	**93**

25. Should the GCI allow local control of information repositories?

Response	Chart	Percentage	Count
Yes		40%	35
No		2%	2
If no, why not?		7%	6
Don't know		51%	44
		Total Responses	**87**

25. Should the GCI allow local control of information repositories? (If no, why not?)

#	Response
1.	Need central control
2.	undermines original repositories
3.	REDUCES RELIABILITY
4.	standards problem
5.	unknown data quality
6.	Should be open to all

26. Should the GCI allow central control of information repositories?

Response	Chart	Percentage	Count
Yes		38%	34
No		15%	13
If no, why not?		1%	1
Don't know		46%	41
		Total Responses	**89**

26. Should the GCI allow central control of information repositories? (If no, why not?)

#	Response
1.	It is not your data.

27. Will the GCI "data aggregation services" allow GEOSS to meet its strategic targets for 2015?

Response	Chart	Percentage	Count
Yes		24%	22
No		9%	8
If no, why not?		0%	0
Don't know		68%	63
		Total Responses	**93**

27. Will the GCI "data aggregation services" allow GEOSS to meet its strategic targets for 2015? (If no, why not?)

#	Response

Section 3.

1. How was your experience with the registration at the GEOSS Portal?

Response	Chart	Percentage	Count
Easy		12%	8
Satisfactory		33%	23
Difficult		7%	5
Cannot answer		45%	31
Other, please specify:		3%	2
		Total Responses	**69**

1. How was your experience with the registration at the GEOSS Portal? (Other, please specify:)

#	Response
1.	we are not yet fully registred

2. Does the Standards and Interoperability Registry allow you to find standards to enable your system to interoperate in GEOSS?

Response	Chart	Percentage	Count
Yes		40%	27
No		9%	6
Don't know		51%	34
		Total Responses	**67**

3. Do you believe that the data contained in GEOSS will be of a quality appropriate to meet user needs by 2015?

Response	Chart	Percentage	Count
Yes		34%	23
No		25%	17
Don't know		41%	28

	Total Responses	**68**

4. Do you agree that by 2015 identification of effective national coordination mechanisms across both observation-provider and observation-user communities will exist in your own country?

Response	Chart	Percentage	Count
Yes		46%	30
No		17%	11
Don't know		37%	24
		Total Responses	**65**

5. Do you agree that by 2015 there will be a framework to ensure data continuity, including the smooth transition from research to operational systems?

Response	Chart	Percentage	Count
Yes		45%	29
No		25%	16
Don't know		30%	19
		Total Responses	**64**

6. Do you agree that the adoption and advocacy of a comprehensive approach to global Earth observation systems will be accomplished by 2015?

Response	Chart	Percentage	Count
Yes		43%	29
No		30%	20
Don't know		27%	18
		Total Responses	**67**

7. Do you agree that by 2015 there will be increased efficiency in the operation of observational systems through convergence among global, regional and national facilities?

Response	Chart	Percentage	Count

Yes		64%	43
No		15%	10
Don't know		21%	14
		Total Responses	**67**

8. Do you agree that by 2015 a comprehensive gap analysis and gap filling, including issues pertaining to operational redundancy and succession planning for systems and products, will exist?

Response	Chart	Percentage	Count
Yes		33%	21
No		35%	22
Don't know		32%	20
		Total Responses	**63**

9. Do you agree that by 2015 GEOSS will allow the preparation of global and regional information?

Response	Chart	Percentage	Count
Yes		48%	32
No		18%	12
Don't know		33%	22
		Total Responses	**66**

10. Do you agree that a full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation, will be in place by 2015?

Response	Chart	Percentage	Count
Yes		47%	31
No		9%	6
If no, why not?		20%	13
Don't know		24%	16
		Total Responses	**66**

10. Do you agree that a full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation, will be in place by 2015? (If no, why not?)

#	Response
1.	not universally
2.	Lack of resources
3.	Non-cooperation by member nations
4.	Too political
5.	Open data policy not accepted by all GEO countries
6.	top down initiative driven by non-experts
7.	Technical and financial issues
8.	difficulty in quality control
9.	Overambitious by 2015
10.	Becasue proprietary data licensing and copyright will be a show-stopper
11.	too complex
12.	Political will not there.
13.	not by 2015

11. Do you agree that by 2015 access to cross-cutting data sets, such as land cover and land use information, will be improved?

Response	Chart	Percentage	Count
Yes		69%	45
No		3%	2
Don't know		28%	18
		Total Responses	**65**

12. Do you agree that improved access to essential socio-economic information will be available by 2015?

Response	Chart	Percentage	Count
Yes		58%	38
No		11%	7
Don't know		31%	20
		Total Responses	**65**

13. Do you agree that data will be made available in accordance with GEOSS Data Sharing Principles by 2015?

Response	Chart	Percentage	Count
Yes		42%	27
No		12%	8
Don't know		45%	29
		Total Responses	**64**

14. Do you agree that all shared data, metadata and products will be made available at minimum cost by 2015?

Response	Chart	Percentage	Count
Yes		40%	27
No		15%	10
If no, why not?		15%	10
Don't know		30%	20
		Total Responses	**67**

14. Do you agree that all shared data, metadata and products will be made available at minimum cost by 2015? (If no, why not?)

#	Response
1.	ESA
2.	Only some will be
3.	Too many interests
4.	inconsistent data policies
5.	major data will be available, but all data will not be available
6.	cutbacks in national funding
7.	Institutions will hold on to their own data.
8.	Because (unrealistic) national interests to generate revenue with this data will prevent this.
9.	what that mean 'minimum cost'?
10.	obtaining all is not possible

15. Will enhanced information extraction from historical, current and future source data be available by 2015?

Response	Chart	Percentage	Count
Yes		51%	33
No		18%	12
Don't know		31%	20
		Total Responses	**65**

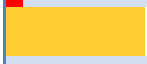
16. Do you agree that all shared data, metadata and products will be made available with minimum time delay by 2015?

Response	Chart	Percentage	Count
Yes		42%	27
No		9%	6
If no, why not?		14%	9
Don't know		35%	23
		Total Responses	**65**

16. Do you agree that all shared data, metadata and products will be made available with minimum time delay by 2015? (If no, why not?)

#	Response
1.	Costs
2.	What do you mean by "all"?
3.	inconsistent data policies
4.	governmental funding models
5.	depending on data volume
6.	Overambitious by 2015
7.	Because data producers are reluctant to integrate open service interfaces to their core data sets. It is still regarded as an additional, disconnected experiment.
8.	what that mean 'minimum time deley'?
9.	not all

17. Do you agree that emerging information sources, including communities that may be global and not formally associated with any particular GEO Member or Participating Organization, will be a part of GEOSS by 2015?

Response	Chart	Percentage	Count
Yes		43%	29
No		7%	5
If no, why not?		6%	4
Don't know		43%	29
		Total Responses	**67**

17. Do you agree that emerging information sources, including communities that may be global and not formally associated with any particular GEO Member or Participating Organization, will be a part of GEOSS by 2015? (If no, why not?)

#	Response
1.	We have all takers that we will get
2.	Overambitious by 2015
3.	There is no need/reason and for crowd sourcing communities like OpenStreetMap to join. Instead there is fundamental mistrust.

18. Do you agree that all shared data, metadata and products will be provided free of charge, or at no more than the cost of reproduction, by 2015?

Response	Chart	Percentage	Count
Yes		42%	28
No		18%	12
If no, why not?		13%	9
Don't know		27%	18
		Total Responses	**67**

18. Do you agree that all shared data, metadata and products will be provided free of charge, or at no more than the cost of reproduction, by 2015? (If no, why not?)

#	Response
1.	depens of the legislation of each of the countries
2.	Greed

3.	What do you mean by "all"?
4.	too many issues
5.	there would be exception
6.	I sure hope so, but Overambitious by 2015
7.	see reasons above
8.	legacy IPR constrains
9.	GEOSS data should be free

Section 4.

1. Do you believe that the GEOSS Architecture implementation sufficiently leverages current thinking in the fields of information technology, data infrastructures and earth observations?

Response	Chart	Percentage	Count
Yes		59%	36
No		23%	14
Don't know		18%	11
		Total Responses	**61**

2. Do you think that the current GEOSS architecture is sustainable?

Response	Chart	Percentage	Count
Yes		45%	29
No		23%	15
Don't know		32%	21
		Total Responses	**65**

3. Do you think that the current GEOSS architecture allows for the provision of long-term, continuous data?

Response	Chart	Percentage	Count
Yes		52%	34
No		23%	15
Don't know		26%	17
		Total Responses	**66**

4. Is implementation of the Architecture and Data Management for GEOSS on track to meet the Strategic Targets for 2015?

Response	Chart	Percentage	Count
Yes		35%	22
No		19%	12
Don't know		45%	28

	Total Responses	**62**

5. Is implementation of the Architecture and Data Management for GEOSS guided by a clear plan to 2015?

Response	Chart	Percentage	Count
Yes		37%	22
No		13%	8
Don't know		50%	30
		Total Responses	**60**

6. Do the expected outcomes of the Architecture and Data Management Strategic Targets for GEOSS respond to real needs?

Response	Chart	Percentage	Count
Yes		52%	33
No		16%	10
Don't know		32%	20
		Total Responses	**63**

7. Are the expected outcomes of the Architecture and Data Management Strategic Targets fro GEOSS relevant?

Response	Chart	Percentage	Count
Yes		62%	37
No		5%	3
Don't know		33%	20
		Total Responses	**60**

8. Is there a clear rationale for the selection of the expected outcomes for Architecture and Data Management in the GEOSS Strategic Targets?

Response	Chart	Percentage	Count
Yes		48%	29
No		7%	4

Don't know		45%	27
		Total Responses	**60**

9. Are the expected outcomes of the Architecture and Data Management Strategic Targets aligned with stakeholder views of GEOSS priorities?

Response	Chart	Percentage	Count
Yes		37%	22
No		5%	3
Don't know		58%	35
		Total Responses	**60**

10. Have expected outcomes for the Architecture and Data Management Strategic Targets within GEOSS been clearly articulated?

Response	Chart	Percentage	Count
Yes		44%	26
No		19%	11
Don't know		37%	22
		Total Responses	**59**

11. Do you have a clear understanding of what is required to demonstrate achievement of the expected outcomes for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		41%	24
No		38%	22
Don't know		21%	12
		Total Responses	**58**

12. Are processes in place to obtain the data required to demonstrate achievement of the expected outcomes for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count

Yes		33%	19
No		14%	8
Don't know		53%	30
		Total Responses	**57**

13. Are the planned activities and outputs necessary and sufficient to achieve the expected outcomes for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		34%	19
No		12%	7
Don't know		54%	30
		Total Responses	**56**

14. Have all over-arching tasks and sub-tasks necessary to the achievement of the expected outcomes for the Architecture and Data Management Strategic Targets been defined?

Response	Chart	Percentage	Count
Yes		27%	15
No		29%	16
Don't know		44%	24
		Total Responses	**55**

15. Have all activities and outputs within over-arching tasks and sub-tasks necessary to the achievement of the expected outcomes for the Architecture and Data Management Strategic Targets been defined?

Response	Chart	Percentage	Count
Yes		22%	12
No		22%	12
Don't know		56%	31
		Total Responses	**55**

16. Where over-arching tasks, sub-tasks, activities or outputs have been identified as not necessary to the achievement of the expected outcomes, do they add value to the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		25%	13
No		2%	1
Don't know		74%	39
		Total Responses	**53**

17. Is the workplan for the Architecture and Data Management Strategic Targets revised in light of new information on gaps and status of implementation?

Response	Chart	Percentage	Count
Yes		35%	19
No		15%	8
Don't know		50%	27
		Total Responses	**54**

18. Are you aware of a process in place to identify and fill gaps for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		33%	18
No		67%	36
		Total Responses	**54**

19. Are the work plan tasks and sub-tasks for the Architecture and Data Management Strategic Targets proceeding as planned?

Response	Chart	Percentage	Count
Yes		28%	15
No		11%	6
Don't know		61%	33
		Total Responses	**54**

20. Do the work plan progress reports indicate adequate progress for the majority of tasks for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		27%	14
No		13%	7
Don't know		60%	31
		Total Responses	**52**

21. Do the activities described in the Architecture and Data Management Strategic Targets progress report match those expected in the work plan?

Response	Chart	Percentage	Count
Yes		28%	15
No		6%	3
Don't know		67%	36
		Total Responses	**54**

22. Will the expected outcomes for the Architecture and Data Management Strategic Targets be met by 2015?

Response	Chart	Percentage	Count
Yes		19%	10
No		17%	9
Don't know		63%	33
		Total Responses	**52**

23. Have there been any significant unintended positive outcomes for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		6%	3
No		0%	0
Don't know		94%	49
		Total Responses	**52**

23. Have there been any significant unintended positive outcomes for the Architecture and Data Management Strategic Targets? (Yes)

#	Response
1.	global information sharing

23. Have there been any significant unintended positive outcomes for the Architecture and Data Management Strategic Targets? (No)

#	Response

24. Have there been any significant unintended negative outcomes for the Architecture and Data Management Strategic Targets?

Response	Chart	Percentage	Count
Yes		6%	3
No		2%	1
Don't know		92%	49
		Total Responses	**53**

24. Have there been any significant unintended negative outcomes for the Architecture and Data Management Strategic Targets? (Yes)

#	Response
1.	Still too difficult too communicate, so people tend to discount the progress that has been made.
2.	language difficulty

24. Have there been any significant unintended negative outcomes for the Architecture and Data Management Strategic Targets? (No)

#	Response

25. Are there any lessons learned during implementation to date for the Architecture and Data Management Strategic Targets that might be transferable to other Strategic Target areas?

Response	Chart	Percentage	Count
Yes		32%	16
No		12%	6
Don't know		56%	28
		Total Responses	**50**

26. Do you think that GEOSS implementation will enable a coordinated and integrated network of Earth observing and information systems?

Response	Chart	Percentage	Count
Yes		73%	38
No		13%	7
Don't know		13%	7
		Total Responses	**52**

27. Do you believe that operational support for component systems by GEO Members and Participating Organizations will exist by 2015?

Response	Chart	Percentage	Count
Yes		53%	28
No		23%	12
Don't know		25%	13
		Total Responses	**53**

28. Do you agree that by 2015 the national radio-frequency administration agencies will be better informed about the long-term use and protection of all parts of the radio frequency spectrum needed for its space-based and surface-based components?

Response	Chart	Percentage	Count
Yes		46%	25
No		9%	5
Don't know		44%	24
		Total Responses	**54**

29. Do you agree that by 2015 the promotion of consistent standards and practices for observations across all earth systems by means of the GEOSS Common Infrastructure (GCI) will be a reality?

Response	Chart	Percentage	Count
Yes		49%	27
No		27%	15
Don't know		24%	13
		Total Responses	**55**

30. Do you agree that by 2015 GEOSS will allow access to global and regional information among Member and Participating Organization communities?

Response	Chart	Percentage	Count
Yes		65%	33
No		12%	6
Don't know		24%	12
		Total Responses	**51**

31. Do you agree that by 2015 key gaps in global geodetic infrastructure required for the maintenance and development of the global geodetic reference frames will be reduced?

Response	Chart	Percentage	Count
Yes		49%	26
No		9%	5
Don't know		42%	22
		Total Responses	**53**

32. Are there important data management deficiencies in GEOSS?

Response	Chart	Percentage	Count
Yes		45%	24
No		8%	4
Don't know		47%	25

	Total Responses	**53**

33. Will open, reliable, timely, consistent, and free access to a core set of essential environmental observations and information products, supported by adequate metadata, by users across all GEOSS Societal Benefit Areas in accordance with GEOSS Data Sharing Principles exist by 2015?

Response	Chart	Percentage	Count
Yes		46%	25
No		19%	10
If no, why not?		6%	3
Don't know		30%	16
		Total Responses	**54**

33. Will open, reliable, timely, consistent, and free access to a core set of essential environmental observations and information products, supported by adequate metadata, by users across all GEOSS Societal Benefit Areas in accordance with GEOSS Data Sharing Principles exist by 2015? (If no, why not?)

#	Response
1.	politics and national budgets
2.	difficulty in quality control
3.	I have some doubts on "supported by adequate metadata" goal

34. Do you agree that increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion will exist by 2015?

Response	Chart	Percentage	Count
Yes		68%	36
No		8%	4
If no, why not?		4%	2
Don't know		21%	11
		Total Responses	**53**

34. Do you agree that increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion will exist by 2015? (If no, why not?)

#	Response
1.	see above
2.	sustainable funding mechanism

35. Do you agree that best practices, identified in the appropriate GCI registry, for observation, collection and access to data and information, including best practices for data quality assurance, for both observing system data and information products will exist by 2015?

Response	Chart	Percentage	Count
Yes		58%	31
No		13%	7
If no, why not?		0%	0
Don't know		28%	15
		Total Responses	**53**

35. Do you agree that best practices, identified in the appropriate GCI registry, for observation, collection and access to data and information, including best practices for data quality assurance, for both observing system data and information products will exist by 2015? (If no, why not?)

#	Response

36. Do you agree that a coordinated, life-cycle data management process to support improved simulation, modeling, and prediction capabilities for each Societal Benefit Area and across multiple Societal Benefit Areas will exist by 2015

Response	Chart	Percentage	Count
Yes		51%	27
No		21%	11
If no, why not?		4%	2
Don't know		25%	13
		Total Responses	**53**

36. Do you agree that a coordinated, life-cycle data management process to support improved simulation, modeling, and prediction capabilities for each Societal Benefit Area and across multiple Societal Benefit Areas will exist by 2015 (If no, why not?)

#	Response
1.	no spare resources
2.	Lack of application of standards, semantic heterogeneity, error propagation when chaining web services

Section 5.

1. What is your university degree?

Response	Chart	Percentage	Count
I do not have a university degree		3%	3
Bachelors		9%	10
Masters		39%	45
PhD		45%	52
Other, please specify:		4%	5
		Total Responses	**115**

1. What is your university degree? (Other, please specify:)

#	Response
1.	J.D. and Masters
2.	P.hd. student/Geoinformation sciences
3.	Postgraduate Diploma in GIS and Remote Sensing, PGD or maitrise in Geotechniques and Hydrotechnics
4.	Especialización
5.	specialist in Environmental Law

2. How old are you?

Response	Chart	Percentage	Count
Less than 30		7%	8
Less than 40		25%	29
Less than 50		28%	32

Less than 60		27%	31
Less than 70		9%	10
Over 70		5%	6
		Total Responses	**116**

3. Are you:

Response	Chart	Percentage	Count
Female		16%	18
Male		84%	97
		Total Responses	**115**

4. Who is your employer?

Response	Chart	Percentage	Count
Private sector		14%	16
Private sector - education		3%	4
Private sector - research		5%	6
Public sector - government		33%	38
Public sector - education		11%	13
Public sector - research		24%	28
Unemployed		1%	1
Retired		3%	4
Other, please specify:		4%	5
		Total Responses	**115**

4. Who is your employer? (Other, please specify:)

#	Response
1.	intergovernmental
2.	United Nations
3.	Self-Employed (Private Sector)
4.	international organization
5.	International organisation

5. How long have you worked in the GEOSS environment?

Response	Chart	Percentage	Count
Less than 5 years		40%	46
Less than 10 years		20%	23
Less than 15 years		7%	8
Less than 20 years		3%	3
Less than 25 years		4%	5
More than 25 years		11%	12
I don't work in this area		15%	17
		Total Responses	**114**

ENCLOSURE 2

REPORT TRANSMITTAL LETTER FROM THE M&E WORKING GROUP CO-CHAIRS TO THE EXECUTIVE COMMITTEE

Dear Members of the Executive Committee,

The Monitoring and Evaluation Working Group (M&E-WG) is pleased to forward to you the second Evaluation of GEOSS Implementation.

At the nineteenth meeting of the Executive Committee in July 2010, the M&E-WG presented the Report of the Midterm Evaluation of GEOSS Implementation and proposed that the Second Evaluation of GEOSS focus upon progress towards achieving the Architecture and Data Management Targets. After the approval by the Executive Committee and with the assistance of the GEO Secretariat, the M&E-WG asked all GEO Members and Participating Organizations to nominate members to the Second Evaluation Team.

In November 2010, the nominated Evaluation Team was constituted and began the evaluation. The M&E-WG provided a summary plan for the second evaluation, and from that point onward, the Evaluation Team conducted the evaluation without interference of any kind from GEO institutions.

The M&E-WG wishes to call the Executive Committee's attention to several aspects of the attached Report:

Unlike the Midterm Evaluation, which addressed GEOSS as a whole, the Second Evaluation assesses only two of the fourteen Targets. We consider progress against these two targets as key to the successful implementation of GEOSS.

The M&E-WG reviewed the process by which the Evaluation Team conducted the evaluation and prepared the report, and we believe that the approach taken by the Evaluation Team is consistent with what the Executive Committee expected from the Second Evaluation.

The Evaluation Team introduced new data sources and new methodologies to analyze and synthesize them. For data sources, they also used a test case and a maturity index survey. For the analysis, they employed nine "Figures of Merit", each addressing a different aspect of progress.

The M&E-WG notes the overall finding of the Evaluation Team that "there is no clear evidence that the ADM targets will be met by 2015". However, we note that other entities within GEO are also concerned that prominent activities within Architecture and Data Management, namely those related to GCI and Data Sharing Principles, are not making adequate progress. The Evaluation Report suggests specific measures to address the underlying causes.

One recommendation, for which the M&E-WG has a partial responsibility, is to improve the progress reporting of the Tasks. The M&E-WG will work with the Secretariat to implement this recommendation.

Findings of problem areas and recommendations for corrective action should be taken in a spirit of collaborative effort toward a set of common goals. The M&E-WG believes that a vibrant and successful GEOSS depends upon an ongoing process of identifying problems and taking corrective actions.

We recommend that the Executive Committee, with support from the GEO Secretariat, prepare a Management Response to the Report. Such a response should indicate whether the Executive Committee agrees, partially agrees, or disagrees with each of the Key Findings and Recommendations, along with any corrective actions being undertaken.

The M&E-WG continues to review the scope of the planned evaluations. At the July 2010 Executive Committee, the M&E-WG presented a revised schedule of evaluations which envisioned an assessment of one Transverse Area and three Societal Benefit Areas (SBAs) each year during the period of 2012-2014, and a comprehensive evaluation in 2015. However, the lessons learned from the two completed evaluations offer strong evidence that this revised plan may also be unattainable. Consequently, we propose, with your concurrence, to further revise the schedule to reduce overall workload and to give priority to the SBAs. In 2012, we propose to evaluate three SBAs (Agriculture, Biodiversity, and Ecosystems). While at this pace we will be unable to accomplish individual evaluations of all fourteen Strategic Targets by 2014, we expect that the subset of the Targets evaluated will be representative of the progress achieved in GEOSS. We continue to assume an overall evaluation in 2015.

We wish to highlight that a key factor for a successful evaluation remains GEO's ability to recruit a adequately resourced Evaluation Team. Our experience in 2011 was that some of the individuals nominated for the Team didn't receive the anticipated support of their respective agencies. In some cases, the Evaluation Team members didn't have funds to travel, or were forced to significantly reduce their time commitment to the evaluation, and in one instance, a member of the Team had to withdraw his participation at mid-point. We rely on the Executive Committee to make a concerted effort to ensure that GEO Members and Participating Organizations seriously commit to supporting the GEOSS evaluation and provide Team members who are adequately resourced.

Regards,

Craig F. Larlee, Co-chair (Canada)

Charles S. Baker, Co-chair (USA)

24 June 2011

ENCLOSURE 3

THE GEO EXECUTIVE COMMITTEE MANAGERIAL RESPONSE

TO THE REPORT OF THE SECOND (2011) GEOSS EVALUATION

The Second GEOSS Evaluation took place from November 2010 to June 2011. As proposed by the Monitoring and Evaluation Working Group and endorsed by GEO-VII Plenary, the Second Evaluation looked in detailed at the progress towards GEOSS Implementation in the areas of Architecture and Data Management.

The report produced by the Evaluation Team, "GEOSS Evaluation of Architecture and Data Management, June 2011", was presented to the 22nd Meeting of the GEO Executive Committee (EXCOM), EXCOM-22 Document 10, and thoroughly discussed.

In accordance with the procedure approved by GEO-VI, the Executive Committee took note of the Report and undertook to prepare a managerial response to be submitted, together with the Report itself, to the GEO-VIII Plenary. As the focus of the 2011 Evaluation was on the GEOSS Architecture and Data Management, EXCOM asked the Architecture and Data Committee (ADC) to prepare a response at its September meeting to the findings and recommendations made by the Evaluation Team and then submit this to EXCOM. (A copy of the response prepared by the ADC is appended to this report.)

In welcoming the findings and recommendations made by the Evaluation Team, the GEO Executive Committee also wishes to place on record its appreciation of the efforts being made by all parties to implement the GEOSS Architecture and Data Management and in particular, EXCOM recognises the commitment of the GEOSS Common Infrastructure (GCI) Providers to the implementation and operation of the GCI. It is the general view of the Executive Committee that the recommendations contained in the Report should be addressed by GEO at the highest level.

The GEO Executive Committee also takes note of the response from the ADC and in particular the actions that are being taken through the "Sprint to Plenary" to address many of the issues identified in the Evaluation Report.

More detailed responses from EXCOM to the conclusions and recommendations of the Evaluation Team, together with the response of the ADC, are given in the following Annex.

ANNEX

CONCLUSIONS OF THE 2011 EVALUATION AND RELATED RECOMMENDATIONS

Conclusion 1: There is no clear evidence that the ADM Strategic Targets will be met by 2015.

Recommendation 1: GEOSS activities must have clearly defined goals, with performance indicators and measurable tasks, aligned with the ADM Strategic Targets.

ADC Response: *A revision of all GEO Task documentation (annual action plans) that realize the 2012-2015 work plan should include elements that enable declaration and tracking of milestones and measures of success. Proposed tasks already are linked to their role in meeting the Strategic Targets.*

EXCOM remarks: The strategic target document was adopted at the GEO-VI Plenary and provides the means to clearly link Work Plan tasks with the strategic targets and their outcomes.

Recommendation 2: Formation of Provider-to-End-User projects with Performance Indicators and clearly defined goals.

ADC Response: *The focus of topical or SBA Tasks in the future must include EO data publication and use, consistent with the interoperability goals of GEOSS, and engage the spectrum of participants from provider through to end-user, with an eye towards use outside the immediate scientific field. This is a broader issue for the joint committees to address where such publishing requirements for all science/data must be adopted and tracked.*

EXCOM remarks: Whilst EXCOM can broadly support this recommendation, EXCOM believes that GEO must limit the investments it makes in monitoring performance indicators. Such indicators and any associated evaluation process must be "lite".

Conclusion 2: The User Interface is difficult to use because it does not follow good human factors engineering practices.

Recommendation 3: The Evaluation Team recommends that the usability issue be re-evaluated by a Human-Computer Interface (HCI) expert group, as the sole focus of that evaluation, a topic that was beyond the scope or skill set of this Evaluation Team. An HCI group would evaluate the GEOSS user interface through a set of usability and ergonomics factors, with recommendations that could range from simple tweaks to wholesale redesign.

ADC Response: *UIC-sponsored annual user usability tests have been conducted on the GCI interfaces and capabilities that have resulted in updates to the GCI. HCI expert consultation would be welcome on the emerging user interface that will be developed as a result of the Sprint-to-Plenary activities, evaluating the evolution of GEOSS capabilities.*

EXCOM remarks: Given the finite resources available to GEO Members, EXCOM would prefer that available efforts are directed to strengthening support of the tasks set out in the 2012-2015 Work Plan, rather than creating new expert groups.

Conclusion 3: Although the implementation of the GCI provides a standard infrastructure and platform, there is not a uniform, consistent way that data are registered, stored, and accessed.

Recommendation 4: The Evaluation Team recommends that GEO undertake a pilot project to (1) implement a geospatial browser in the GCI that is capable of rendering thematic layers from GEO data

holdings, (2) standardize a subset of GEO data holdings accessible through the geospatial browser, (3) develop a way ahead so that the majority of GEO data holdings are accessible in this manner.

ADC Response: *The focus of the Sprint-to-Plenary effort is to streamline access to EO data. The user interface will include the capabilities of finding data based on a common EO vocabulary of observable properties, reaching into inventories of EO data, a geospatial browser to rendering select data resources, and identifying suitable helper applications to exploit EO data. This provides access to the majority of GEO data holdings that conform to data service practices and standards identified in the GEOSS documentation. These capabilities will be demonstrated in the 2011 Plenary and Exhibition.*

EXCOM remarks: EXCOM takes note that the issues identified during the 2011 evaluation are being addressed within the scope of the "Sprint to Plenary".

Conclusion 4: Lack of Systems Engineering Rigour

Recommendation 5: A Systems Engineering Working Group should be established to revisit the efforts to date and map them to a defined Systems Engineering process, resulting in a plan of action for GEOSS implementation.

ADC Response: *The ADC has overseen the systems engineering activities for GEOSS, coordinating the implementation and outreach of subordinate activities: Architecture and Implementation Pilot, Sprint to Plenary, and GCI Coordination Team. The proposed work plan includes a design and coordination Task (IN-05) to continue this engineering work under the new Infrastructure area.*

EXCOM remarks: Given the finite resources available to GEO Members, EXCOM would prefer that available efforts are directed to strengthening support of the tasks set out in the 2012-2015 Work Plan, rather than creating new expert groups. EXCOM therefore takes note that it is currently proposed to address this issue through the task IN-05 in the 2012-2015 Work Plan.

Conclusion 5: Technology employed by GEOSS is not current.

Recommendation 6: The Evaluation Team recommends that current generation technology be targeted for utilization by the Systems Engineering Working Group. The Team also recommends that GEO issue a policy requiring that all software in the GCI be made Open Source and available to GEO member organizations.

ADC Response: *Standards-based services and interfaces have been deployed within the GCI. Current generation technology and standards are being deployed in the GCI and by providers in direct result of the 2011 Sprint to Plenary effort. This includes Web 2.0 and 3.0 (semantic) capabilities, rapid application development (RAD), enabling 'mash-ups', and support of open search query APIs. All GCI software has been made available as open source.*

EXCOM remarks: EXCOM notes the statement from the ADC that standards-based services and interfaces are already used in the GCI. EXCOM acknowledges that the challenge of transitioning to new technologies will remain an ongoing action for GEO, even after the GEO-VIII Plenary. This will require continued work, which should be addressed through a proper structuring of the necessary tasks in the 2012-2015 Work Plan, including designing the process for the evolution of the GCI architecture.

Conclusion 6: Data may exist but it is difficult to find.

Recommendation 7: Data retrieval, and the catalogue of archive data with metadata, should be improved to meet user requirements and needs.

ADC Response: *Usability has been regularly re-assessed and improvements to the catalogue have been made in response. Improved end-user usability and the ability to search inventories (archive) are also being demonstrated for the Sprint to Plenary efforts and subsequent operational enhancements. A user request and comment system has been in-place to track and assign enhancements and bug fixes identified by users.*

EXCOM remarks: EXCOM takes note that the issues identified during the 2011 evaluation are being addressed within the scope of the "Sprint to Plenary".

Conclusion 7: There is no formal process by which gaps between Targets and Tasks are addressed.

Recommendation 8: The gap analysis/filling, Target/Task matchup software developed by Japan should be modified to meet the requirements.

ADC Response: *Target/Task matchup from Japan has been applied to the existing ADC Tasks and will be applied to the new work plan as well. ADC recognizes the importance of gap analysis in the work plan.*

EXCOM remarks: EXCOM takes note of the ADC response, which shows that this recommendation is being addressed.

Recommendation 9: Project proposals should identify gaps and the impact this will have on funding (as is seen with ESA/EU/GMES).

ADC Response: *This recommendation requires some consideration. However, there are no project proposals, per se, in the context of the Architecture and Data domain. But offerings from contributors that could address this recommendation are under consideration.*

EXCOM remarks: EXCOM recognises that gap analysis is important. However, the focus of gap analysis should be on the post-2015 GEO process.

Conclusion 8: The present progress reporting against Tasks Sheets, although it uses a standard form, does not allow for a quantitative evaluation of progress

Recommendation 10: GEO implement a progress reporting system for all Tasks that measures progress against milestones, reports important issues and give confirmed or revised plans for further work. The Task Leads should be asked to grade their progress.

ADC Response: *This is a valuable recommendation for all GEO Tasks and should be incorporated in the new 2012-2015 work plan documentation and the actual annual working documents (action plans) for each Task.*

EXCOM remarks: The Executive Committee concurs with the recommendation.

Conclusion 9: The capabilities of GEOSS are not well communicated to the global community.

Recommendation 11: GEO create a communications plan which clearly identifies GEOSS, its capabilities, and its data content.

ADC Response: *Improved communication is a necessary precondition to adoption. ADC supports this idea that seeks to collaborate with all entities of GEO to improve outreach and clarity on deploying a useful GEOSS infrastructure.*

EXCOM remarks: The Executive Committee concurs with the recommendation.

Conclusion 10: Commercial and intellectual property rights are perceived as a barrier to publishing data in GEOSS

Recommendation 12: Pay attention to the implementation of the GEOSS Data Sharing Action Plan.

ADC Response: *ADC-affiliated tasks have been supporting the recommendations of the Data Sharing Task Force. Critical tracking elements for data policies, access, and pricing have been introduced into the GCI to enable discovery of data resources such as GEOSS Data-CORE. Broader GEO awareness of data sharing principles and actions within the SBA Tasks is necessary to achieve a more open and accessible GEOSS.*

EXCOM remarks: EXCOM fully supports the GEOSS Data Sharing Action Plan, which was adopted at the GEO-VII Plenary. At its 21st meeting in March 2011, EXCOM instructed the current Data Sharing Task Force to make the implementation of the GEOSS Data-CORE its highest priority. EXCOM was pleased to note the progress reported by the Data Sharing Task Force on the GEOSS Data-CORE at its 22nd meeting.