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GEOSS Data Sharing Action Plan

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GEOSS DATA SHARING ACTION PLAN

for the Implementation of the GEOSS Data Sharing Principles

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GEOSS DATA SHARING ACTION PLAN

for the Implementation of the GEOSS Data Sharing Principles

EXECUTIVE SUMMARY

Successive GEO Ministerial meetings and Plenaries have taken clear commitments to implement the **GEOSS Data Sharing Principles,** including the undertaking to develop an Action Plan:

- The **10-Year Implementation Plan** says "*The societal benefits of Earth observations cannot be achieved without data sharing*" and then goes on to set out the GEOSS Data Sharing Principles that have been endorsed by all GEO members:
    - There will be **full and open exchange** of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation;
    - All shared data, metadata and products will be made available with minimum time delay and at minimum cost;
    - All shared data, metadata and products being free of charge or no more than cost of reproduction will be encouraged for research and education.
- The **Cape Town Ministerial Summit** in 2007 supported the establishment of a process with the objective to reach a consensus on the implementation of the Data Sharing Principles for GEOSS to be presented to the next GEO Ministerial Summit;
- The GEO-V Plenary created a **GEOSS Data Sharing Task Force** to support the GEO in its objective to reach a consensus at its 2010 Ministerial Summit on the practical steps to implement the Data Sharing Principles;
- The GEO-VI Plenary accepted the **Implementation Guidelines for the GEOSS Data Sharing Principles** that provide the foundation for this proposed Action Plan.

This plan:

- builds upon the crucial concept of **full and open exchange** and on the Implementation Guidelines accepted by the GEO Plenary, which states that data, metadata and products made available through the GEOSS are made accessible with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution;
- notes that the achievement of full and open exchange of, and access to, key datasets will require actions by GEO collectively, by Members and Participating Organizations individually, and by GEOSS tasks and cross-cutting activities;
- recognizes that GEOSS is composed of voluntarily contributed systems and data, which are governed by pre-existing laws, policies and practices that may not, at this time, be fully compatible with the concept of full and open exchange of data, metadata and products;

- acknowledges that GEO welcomes all data contributions into GEOSS, including data with restrictions based on legitimate reasons, with data providers identifying these restrictions when registering data in GEOSS;
- specifies actions to be pursued by:

- GEO collectively to:

1. Create the **GEOSS Data Collection of Open Resources for Everyone** (GEOSS Data-CORE) to address GEO Societal Benefit Areas. The GEOSS Data-CORE is a distributed pool of documented datasets, contributed by the GEO community on the basis of full and open exchange (at no more than the cost of reproduction and distribution) and unrestricted access;
2. Establish a **Task Force within GEO** to:
    a. Monitor the use and impact of resources made available with full and open access;
    b. Promote the efficacy of the Data Sharing Principles in delivering societal benefits;
    c. Evaluate the outcomes of this Action Plan and recommend further actions, including any mechanisms needed to further enhance the ability of the GEOSS architecture to provide access to data, metadata and products.
3. Maintain the **GEOSS Common Infrastructure (GCI)** as the architectural framework essential to implementing the Data Sharing Principles;
4. Integrate implementation of the Data Sharing Principles, as appropriate, into the activities of GEO Work Plan Tasks and GEO Committees;

- GEO Members to:

5. Take **leadership** to establish national coordinating mechanisms to promote and monitor engagement with the implementation of the GEOSS Data Sharing Principles and provide feedback to GEO;
6. Develop **flexible policy frameworks** to ensure that a more open data environment is implemented;

- GEO Members and Participating Organizations to:

7. Maximise the number of documented datasets made available on the basis of full and open access;
    a. When no information about usage rights and restrictions is provided, the presumption within GEOSS will be that the data are fully and openly available with no restrictions on use and dissemination.
8. Promote with data providers within their territories the benefits of full and open access to data.

The 2010 GEO-VII Plenary is invited to adopt this Action Plan for the Implementation of the GEOSS Data Sharing Principles.

1 INTRODUCTION – WHY SHARE DATA FULLY AND OPENLY?

The Earth's atmosphere, oceans and landscapes are changing rapidly, with human activities being a major driver. Monitoring and modelling these changes are critical to enable governments, civil society and the private sector to take informed decisions about climate, energy, food security, natural hazards, health, and other challenges. **Decision makers and managers must have access to the information they need, when they need it, and in a format they can use.**

But assessing and predicting future change is a challenging task. It requires an advanced understanding of the Earth system and how its physical, chemical and biological components interact with one another. It also requires continuous monitoring of the key parameters of the Earth and its environment. **Observing, modelling and understanding are the keys to good decision making.**

Today, our planet is being monitored by land, sea, air and space-based Earth observation systems. But the current system for collecting, storing, analysing and sharing the resulting observations remains fragmented, incomplete or redundant and difficult to integrate. Major observational (and therefore knowledge) gaps remain. **Decision makers around the world need a global, coordinated, comprehensive and sustained environmental information system that supports action to be taken whenever necessary.**

Recognizing the growing need for improved Earth observations, over 130 governments and leading international organizations are collaborating through the Group on Earth Observations, or GEO, to establish a Global Earth Observation System of Systems (GEOSS) by the year 2015.

The Vision for GEOSS, as described in the GEOSS 10-Year Implementation Plan, "*is to realize a future wherein decisions and actions for the benefit of humankind are informed via coordinated, comprehensive and sustained Earth observations and information*".

To achieve this vision, GEO Members and Participating Organisations are contributing the resources from their respective Earth monitoring systems to GEOSS and interlinking these systems so that they work better together. They are developing common technical standards to make it possible to pool information, and they are promoting the full and open sharing and dissemination of their data, metadata and products.

This expanding coalition of countries and organizations is enabling the provision of reliable information and services built on pooled resources and is transforming the ability of governments to manage natural resources, promote the safety and well-being of their citizens, and meet respective treaty obligations. In this way, the GEO community is supporting international efforts to promote sustainable development and the Millennium Development Goals.

This Action Plan and the supporting documentation therefore describe the actions that the GEOSS Data Sharing Task Force recommends the GEO to take to address the complex technical, organisational and political challenges that, if met, will enable the full and open exchange of data, metadata and products, such that the goals of GEO and the resulting societal benefits can be fully realised.

2 BACKGROUND – WHAT IS THE STATUS OF GEOSS DATA SHARING TODAY?

The GEOSS 10-Year Implementation Plan, which all GEO Members have endorsed, explicitly acknowledges the importance of data sharing in achieving the GEOSS vision and anticipated societal benefits when it states that: "*The societal benefits of Earth observations cannot be achieved without data sharing*". The Implementation Plan then sets out the GEOSS Data Sharing Principles:

- There will be full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation;
- All shared data, metadata and products will be made available with minimum time delay and at minimum cost;
- All shared data, metadata and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

As an initial step, a task was established within the GEO Work Plan that "*Invited experts to identify steps required to further the practical application of the agreed GEOSS data sharing principles*". This task, DA-06-01, which is led by CODATA (the Committee on Data for Science and Technology of the International Council for Science), prepared the "White Paper on the GEOSS Data Sharing Principles"[1] and developed a set of draft "Implementation Guidelines for the GEOSS Data Sharing Principles".

To reinforce the principle of data sharing within the GEOSS, the Cape Town Ministerial Summit in 2007 recognised that "*The success of GEOSS will depend on a commitment by all GEO partners to work together to ensure timely, global and open access to data and products*". The Ministerial Declaration also stated that: "*We (the participants) support the establishment of a process with the objective to reach a consensus on the implementation of the Data Sharing Principles for GEOSS to be presented to the next GEO Ministerial Summit*".

In response to the Cape Town Declaration, the GEO-V Plenary therefore endorsed a proposal that a GEOSS Data Sharing Task Force should be established comprising GEO Members and the Task Team (hereafter referenced as "DSTF"). The purpose of the DSTF is to support the GEO in its objective to reach a consensus at its 2010 Ministerial Summit on the practical steps to implement the GEOSS Data Sharing Principles.

Under its Terms of Reference the DSTF was directed, amongst other things, to submit an updated draft of the Implementation Guidelines for the GEOSS Data Sharing Principles to the GEO-VI Plenary in 2009, which was accepted by the Plenary.

[1] http://www.earthobservations.org/documents/dsp/Draft%20White%20Paper%20for%20GEOSS%20Data%20Sharing%20Policies_27Sept08.pdf, subsequently published concurrently as an article, "Toward Implementation of the GEOSS Data Sharing Principles", in the *Journal of Space Law*, Vol. 35, No. 1 (2009) and the *Data Science Journal*, Vol. 8 (2009).

These guidelines are grouped into six focal areas to ensure the successful implementation of the GEOSS Data Sharing Principles[2]:

1. For GEOSS to realize its vision and potential, it is essential to promote the full and open exchange of data, metadata and products in accordance with the Data Sharing Principles. In this context, full and open exchange means that data, metadata and products made available through the GEOSS are made accessible with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution;
2. The full and open exchange of data called for in the Data Sharing Principles should apply to GEOSS data, metadata and products even after such shared information is disseminated to users. Users need to be able to integrate, reuse, and re-disseminate the shared information with minimal restrictions in order to achieve maximum results in the GEOSS societal benefit areas;
3. Many GEO Members and Participating Organizations have various specific restrictions on the dissemination and use of certain data, metadata and products based on international instruments and national policies and legislation. Such restrictions pertain mainly to concerns regarding the protection of: national security, financial viability, proprietary interests, privacy, confidentiality, indigenous rights, and conservation of sensitive ecological, natural, archaeological, or cultural resources. All participants in GEOSS are required to respect such restrictions when providing access to their data, metadata, and products;
4. The pricing of GEOSS data, metadata and products should be based on the premise that the data and information within GEOSS is a public good for public-interest use in the nine societal benefit areas. GEO, together with its GEOSS data providers, should work to set standards for the full and open exchange of data based on this premise, with the only allowable cost for data being either that of reproduction and distribution, or the marginal cost of fulfilling the user request;
5. GEO should promote "minimal time delay" to data within GEOSS, depending on the type of data and application and the need for appropriate quality control, and data should be transmitted on a real-time basis whenever necessary or practicable;
6. GEO should promote research and education uses of GEOSS data, metadata and products.

The guidelines focus extensively on promoting the application and implementation of the GEOSS Data Sharing Principles; they address the issue of cost associated with data access and use and further highlight the importance of contributing data as early as possible once available. The guidelines call upon GEO Members to enable and augment data contributions.

The Action Plan has been developed building upon the Implementation Guidelines and noting that the Data Sharing Principles may remain an abstract goal until all parties (members, contributors, users) can appreciate how they take form concretely. The DSTF is of the view that a demonstration of how the Data Sharing Principles can be implemented would significantly contribute to dissipating uncertainties and concerns. It is through such examples of data access, use, re-use, sharing and dissemination that Members will be able to demonstrate benefits and entice data contributors to voluntarily and enthusiastically adhere to the Data Sharing Principles.

[2] Implementation Guidelines for the GEOSS Data Sharing Principles (as accepted at GEO-VI) http://www.earthobservations.org/documents/geo_vi/07_Implementation%20Guidelines%20for%20the%20GEOSS%20Data%20Sharing%20Principles%20Rev2.pdf

3 VISION – WHERE DO WE WANT TO BE AND BY WHEN?

Data and information contribute to finding solutions to the major challenges that society faces. For information to be effective in supporting solutions there needs to be:

- effective monitoring and observing systems;

- systems for ensuring that the data collected are those that are most needed;

- arrangements and standards for sharing and integrating data;

- interfaces that enable users to access the data they need; and

- frameworks to ensure that data will be made fully and openly available.

The GEOSS 10-year Implementation Plan addresses all of these elements. However, without the last one, the benefits of the other elements (which will often entail very significant costs for GEO Members and Participating Organisations) will be limited. This Data Sharing Action Plan is therefore designed to address this final key element through specific steps to deliver the Data Sharing Principles and Implementation Guidelines.

The GEOSS Strategic Targets, which were accepted by the GEO-VI Plenary, set out a number of Strategic Goals of GEO in support of GEOSS[3]: In the domain of Data Management and in support of these the Strategic Goals, it is stated that before 2015, GEO aims to:

- Provide a shared, easily accessible, timely, sustained stream of comprehensive data of documented quality, as well as metadata and information products, for informed decision-making.

The vision set out in the GEOSS Strategic Targets is that this target will, by 2015, be demonstrated by:

- Increased use of observations through advances in all aspects of life-cycle data management, integration, and data recovery and conversion;
- Removal of important data management deficiencies;
- Enhanced information extraction from historical, current and future source data; and
- Open, reliable, timely, consistent, and free[4] 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 the GEOSS Data Sharing Principles.

The focus of the GEO Societal Benefit Areas (SBA) is overwhelmingly environmental. There is common understanding that environmental stresses and human impacts are becoming more severe. The number of people at risk, and the costs, in human and financial terms, of both chronic and acute environmental events are increasing.

National and international commitments increasingly recognise the right of citizens to have access to environmental information, reflected in RIO Principle 10, the outcome of the 2002 World Summit on Sustainable Development and most recently endorsed in the agreement by the UNEP Governing Council on access to information, participation and environmental justice. Furthermore, as public

[3] GEOSS Strategic Targets (as accepted at GEO-VI)
http://www.earthobservations.org/documents/geo_vi/12_GEOSS%20Strategic%20Targets%20Rev1.pdf

[4] Per discussion with the GEO Target Task Team, the use of the word 'free' in this target was intended to mean at no more than the cost of reproduction and distribution, noting that the cost of reproduction and dissemination of data and information online is near zero and most efficiently available at no cost.

authorities engage in measures that impose costs and restrictions on their populations, it is increasingly important that these measures and their effects are shown to be justified.

Good data sharing practices are an essential contribution towards meeting the general needs of public authorities. Restrictions on data access militate against this, because it is impossible to know for certain what uses would have been made of data, and what benefits would have accrued if they had been fully available. A second requirement is to ensure maximum benefit for the whole economy from public actions. Numerous studies [5] [6] have shown convincingly that the whole economy benefits from open access to data and that these benefits far outweigh any narrow budgetary gains.

The DSTF therefore pictures a world in which a wide variety of environmental observations and associated information products are used routinely and flexibly at local, regional, and global scales in support of the GEO Societal Benefit Areas. Particularly when crisis situations occur, such data and information need to be made accessible to a range of users as quickly and seamlessly as possible. Even in cases where lives are not immediately at stake, timely and effective access to data is essential to achieving the goals set by GEO. At the same time, it is clear that new technologies for data access, new types of value-added data and information, and new uses for Earth observations will continue to develop over time in both the public and private sectors.

The full implementation of the GEOSS Data Sharing Principles is, therefore, an essential step towards maximizing the net societal and economic benefits of the global investment by Members and Participating Organizations in GEOSS.

[5] http://www.earthobservations.org/documents/dsp/Draft%20White%20Paper%20for%20GEOSS%20Data%20Sharing%20Policies_27Sept08.pdf, subsequently published concurrently as an article, "Toward Implementation of the GEOSS Data Sharing Principles", in the *Journal of Space Law*, Vol. 35, No. 1 (2009) and the *Data Science Journal*, Vol. 8 (2009), and references therein.

[6] Uhlir, P. (Ed.) 2009. The socioeconomic effects of public sector information on digital networks. National Research Council. Washington D.C. http://www.nap.edu/openbook.php?record_id=12687&page=R1

4 WHAT ARE THE BENEFITS OF IMPLEMENTING THIS VISION?

Data sharing is an indispensable means to achieve better policies in areas such as health, environment, poverty and other public-interest priorities that are high on the global agenda. By improving data sharing and the subsequent continuous availability of that information, researchers and policy-makers can react with timely and well-informed decision-making to national, regional or global issues of governmental and societal concern.

Similarly, there is now broad international consensus regarding climate change. Responding to these changes, through mitigation and/or adaptation strategies, requires a better understanding of the natural and human-induced factors leading to these changes. The participants in GEO collect most of the data that are relevant to improving understanding and responding appropriately, and therefore need to make the data as broadly available for analysis as possible. This will contribute towards providing greater transparency, leading to increased societal trust in the scientific findings on climate change.

Sharing data through GEOSS can therefore lead to the improvement of national legislation and international policy formation, whilst helping to make citizens more aware of the state of their environment. The potential improvements in this broad subject area include:

1. support of a wide range of activities related to environment policy implementation;
2. enhanced participation by non-governmental organisations and members of the public in public debates and decision-making;
3. more effective design, monitoring and evaluation of environmental policies;
4. support for more integrated policy approaches and policy coordination over different environmental themes and across sectors; and
5. better integration of environmental protection objectives into other policies, through the use of information common to various sectors.

Sharing data is also expected to contribute to improving market competition. Businesses should be able to increase their international activities if they find it easier to obtain and process data for other locations. Businesses and private research institutes should also be able to expand the range of their activities.

For example, a study of the commercial exploitation of Europe's public sector information suggested that the U.S. information market was between two and five times that of the European Union (EU) at that time, and that 35% of this EU market was in geographic information[7]. In light of this estimate, it is reasonable to assume that data sharing would contribute to more vibrant economic activity. This assumption is supported by the private sector's positive reaction to the INSPIRE initiative in Europe, through the Internet consultation and public hearing.

It is also important to emphasize that modern science is increasingly data driven. This is especially true of Earth and environmental sciences, including global change research, which rely to a great extent on the development of comprehensive global data sets. Such research frequently requires the integration, reuse and sharing of data from many sources in order to facilitate a better understanding of the Earth system. Enabling the full and open exchange of data within the GEOSS will greatly aid the global research community in its essential role in social and economic development.

[7] PIRA International (2000) Commercial Exploitation of Europe's Public Sector Information. Letherheads, Surrey: http://ec.europa.eu/information_society/policy/psi/docs/pdfs/pira_study/commercial_final_report.pdf

Many empirical studies of the dissemination of public sector data and information [8] (as well as publicly funded data in academia) have repeatedly demonstrated the value of open access to such information. The lack of restrictions on their reuse provides much greater economic and social returns than proprietary dissemination systems with access costs and reuse restrictions. Real life cases studies, (which are described in more detail in the supporting document: case studies), mirror some of the conclusions of the empirical studies:

- CBERS (China Brazil Earth Resources Satellite): the removal of imagery charges resulted in increased access from 1,000 images/year to 10,000 images/month, with more than 10,000 new users registered in the first year. 98% of users surveyed agreed with the policy of open data access and reported the creation of many new jobs, the creation of new businesses and improved research and teaching;
- The U.S. Geological Survey achieved similarly impressive results following removal of Landsat's charges for internet users, which resulted in more Landsat data (more than 1.1 million images) being processed and distributed in FY 2009 than in the previous 38-year mission history combined;
- The release of the ASTER Global Digital Elevation Model (GDEM) in June, 2009, with a new policy of “free of charge”, provided a clear indication of dramatically increased usage of ASTER data worldwide with over 6.5 million tiles distributed in FY 2009. ASTER GDEM distribution is much greater than all other ASTER product distribution, where the marginal costs of distribution are charged. Representatives of all GEO Societal Benefit Areas, as well as other users, expressed a strong interest in the GDEM;
- The Argo program's public data access policy has enabled the provision of near real-time access to the first continuous global monitoring array of ocean temperature, salinity and velocity for use in oceanographic and climate forecasting models; and
- The Global Biodiversity Information Facility efforts to make scientific biodiversity data available free of charge on a worldwide basis has resulted in the publication online of nearly 200 million biodiversity records from approximately 300 data holders in 54 countries.

The GEOSS data sharing philosophy of "full and open exchange" is therefore increasingly accepted as providing added economic, social and research value to the data. The potential benefits of full and open exchange of data and information through GEOSS are expected to be very significant. Improving data access and sharing should significantly increase data utilisation by reducing the cost and reuse restrictions for the users. This should create innovative opportunities for new and existing players in the information sector to improve and expand their activities.

[8] See ref. (ii) in Annex 2 and the references to the studies quoted therein

5 WHAT ARE THE BARRIERS TO IMPLEMENTING THIS VISION?

Various data providers have the perception that the implementation of the full and open exchange of data, metadata and products in GEOSS could pose challenges to their development, resulting in limited revenue, in particular as payments for reuse are not consistent with the accepted Implementation Guidelines for the GEOSS Data Sharing Principles. Further, many providers cannot see a clear articulation of a business model linked to the adoption of the principle of full and open exchange. . Yet in many cases, requiring users to pay for access to data impedes its use, especially if acquiring the necessary funding to purchase data is a long and arduous process. Hence the data provider can at best only realise very limited societal benefits if the product is not attractive to the user.

It is incumbent, therefore, on the GEO Community to demonstrate that the full and open exchange of data can lead to new applications, additional jobs and more open competition as opposed to the old model of data protection.

Legal frameworks in different countries also need to be adapted in order to remove legal barriers that could slow the implementation of the GEOSS Data Sharing Principles. In some cases the principle of full and open exchange of data is currently inconsistent with certain national policies. GEO should therefore encourage national and international bodies to adopt the principle of full and open exchange of data.

Nonetheless, to be able to remove barriers, we first need to fully understand them, including: what are the barriers that inhibit the use of data when costs have to be paid; are the mechanisms for paying for data too cumbersome?

For example, the barriers to data access and use are not simply a matter of pricing policies, but also one of varying policies across data providers and countries, so that negotiating access with each provider is extremely complex and long, thus creating a de facto barrier. Problems regarding the availability, quality, organisation, accessibility and sharing of data and information are common to a large number of policy and information themes and are experienced across the various levels of public authority. Solving these problems requires measures that address exchange, sharing, access and use of interoperable data and services across the various levels of public authority and the different sectors.

It should also be noted that different disciplines, sectors and countries have different legal and socio-cultural approaches to data sharing. A commonly endorsed vision is needed to bridge this gap and to help in overcoming language barriers and the different rate of development of countries across the globe.

The GEOSS Common Infrastructure (GCI) plays a critical role in the implementation of the GEOSS as the primary tool that enables both data providers and users to interact within the GEOSS. The GCI must therefore provide efficient and effective support to the implementation of the GEOSS Data Sharing Principles. This requires the long-term sustained operation of the GCI. However, to date the technical maintenance of the GCI has been provided in accordance with the GEOSS implementation methodology on a voluntary basis.

Resources for the sustained operation of the GCI and the other initiatives set out in this Action Plan thus need to be made available by the GEO Members and Participating Organisations.

6 WHAT ACTIONS NEED TO BE TAKEN?

The Data Sharing Task Force proposes that the 2010 GEO Ministerial Summit adopt the following recommendations for actions to be undertaken to implement the Data Sharing Principles and to enable the development of working procedures for data sharing within GEOSS.

6.1 Actions for GEO

Action 1. Create the GEOSS Data Collection of Open Resources for Everyone (GEOSS Data-CORE) to address GEO Societal Benefit Areas. The GEOSS Data-CORE is a distributed pool of documented datasets, contributed by the GEO community on the basis of full and open exchange (at no more than the cost of reproduction and distribution) and unrestricted access.

The GEOSS Data Sharing Principles use the term "full and open exchange" of data, metadata and products as the guiding strategy. The GEOSS Data Sharing Implementation Guidelines provide the definition of full and open exchange as meaning that data, metadata and products made available through the GEOSS are made accessible with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution.

To promote the implementation of the "full and open exchange" of data, metadata and products, GEO Members and Participating Organisations should therefore commit to the creation of a GEOSS Data-CORE to highlight those documented datasets registered within the GCI that are contributed on the basis of full and open, unrestricted access to the data, metadata and products and are at no more than the cost of reproduction. The concept of the GEOSS Data-CORE is intended to highlight that subset of data and products within the GEOSS that can be fully and openly exchanged **without restrictions**.

The GEOSS Data-CORE is also intended to address all GEO Societal Benefit Areas, with the expectation that this resource will expand over time and contribute to global scale needs. Global, homogeneous and comparable data would therefore be particularly suitable and welcomed for the GEOSS Data-CORE.

Such a collection should be managed/coordinated by the GEOSS Common Infrastructure (GCI) Coordination Team.

To launch this initiative, GEO Members are invited to announce their contributions to the GEOSS Data-CORE in advance of, or at, the Ministerial Summit.

Action 2. Establish a Task Force within GEO to:

a. Monitor the use and impact of resources made available with full and open access.

To demonstrate the value of GEOSS, the impacts of sharing GEOSS data, metadata and products in diverse arenas, including science, education, and development, in a full and open way, should be monitored and documented. The GEO therefore should develop metrics to assess the impact and progress of data sharing. The Task Force should work with the GCI Coordination Team to enable implementation of such metrics.

These metrics should include clear performance indicators and milestones toward progress, as well as indicators that would lead to actions that can accelerate progress in implementing data sharing. Such indicators and milestones should be both unambiguous and achievable, so that progress and success can be measured.

Users who benefit from full and open access to information within GEOSS should be asked to provide in-kind assistance to help document the use and impact of the data, metadata and products received.

Suitable metrics should also be agreed, developed and implemented into the GCI to assess progress in data sharing activity. Metrics should be also used as a feedback for data quality with respect to users.

Pilot projects should also be initiated to demonstrate convincingly that solutions such as a single GEOSS sign-on can preserve data usage metrics and the attribution of data sources.

b. Promote the efficacy of the Data Sharing Principles in delivering societal benefits.

The GEO should develop cross-cutting tools that will support and facilitate GEO participants' best efforts to promote the benefits of the implementation of the GEOSS Data Sharing Principles, including:

- mechanisms to support transparency;
- common definitions and a limited number of recognized and emerging standards to facilitate interoperability;
- communication materials; and
- dissemination of case studies and good practices.

For example, researchers should be asked to describe how they have benefited from full and open access to GEOSS data and any new understanding that arises.

c. Evaluate the outcomes of this Action Plan and recommend further actions, including any mechanisms needed to further enhance the ability of the GEOSS architecture to provide access to data, metadata and products.

The GEO should establish a process to provide support to the required activities resulting from this Action Plan. This process should include a mechanism for working with the Monitoring and Evaluation Working Group to evaluate the outcomes arising from this Action Plan.

It should also foresee the ways and means by which further actions can be recommended to the next Ministerial Summit to further advance GEOSS data sharing.

It is important to note that the existing infrastructure for data delivery in developed countries with ready access to relatively low-cost and high-bandwidth connections typically far exceeds that in developing countries, which have limited or expensive connectivity and which are faced with higher costs of access to or delivery of data. Together with the Committees, GEO needs to work at a technical level to equalize the accessibility of data to users in developing and developed countries through models that do not penalize uses of GEOSS data that specifically address developing country problems, or users based in developing countries.

Action 3. Maintain the GEOSS Common Infrastructure (GCI) as the architectural framework essential to implementing the Data Sharing Principles.

The GCI plays a critical role in the implementation of the GEOSS, enabling both data providers and users to interact within the GEOSS. The GCI, through its sustained operation, is a tool that can provide effective support to the implementation of the GEOSS Data Sharing Principles.

The procedures of registering and maintaining the metadata in the GCI should be simple, or partially automated, as a means of promoting the discovery of resources being offered by data providers and to encourage timely updates.

Based on the explanatory metadata provided, users should be able to readily and easily discover the GEOSS resources, and any details on restrictions applicable to the use of the associated data, products

and information, via the GEO Web Portal [9] in a user friendly manner, enabling them to make informed choices about the data to be used. In particular, users of the GEOSS should also be able to search the GCI to find data or services that:

- fit a particular application, theme, or societal benefit area[s]; and / or
- comply with the Data Sharing Principles of "full and open exchange" that match one or more of the categories of data access conditions.

To meet this challenge GEO will need to agree on descriptions and/or simple categorisations of data access conditions, so that users can easily identify on the one hand data in the GEOSS Data-CORE with full and open unrestricted access, and on the other data in categories that have additional restrictions.

The descriptions, or simple categorisations, of data access conditions should also align with the various "categories of data" that have been described in GEO documents, including the 10-year Implementation Plan, the Implementation Guidelines for the GEOSS Data Sharing Principles and this Action Plan. Hence any categorization approach that is adopted would need to ensure that users could readily identify data falling into the following groups:

- Full and open with unrestricted access (GEOSS Data-CORE);
- Full and open exchange with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution;
- Full and open exchange with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, with minimum cost;
- Other (including custom licences, cost recovery over and above that of reproduction and distribution, and other possible restrictions).

The GEO should therefore study the evolution of intellectual property, licensing and other frameworks, including the possible applicability in GEOSS of approaches such as Creative Commons, and related issues such as legal liability. This could also include examining and recommending the appropriateness and feasibility of adopting, or not, common intellectual property, licensing or other models in the GEOSS context as possible options to support the implementation of the Data Sharing Principles.

The GCI's minimum capability should be to provide information to enable users to understand usage requirements and restrictions indicated by the data provider. Where restrictions are shown, then as appropriate, the GCI should refer the user to the data source or owner to obtain any necessary permission directly. However, in the context of full and open exchange of data and information, the requirement from a data provider of user registration and/or attribution of the data source should not in itself be considered a restriction.

User registration

GEO Members and Participating Organizations should encourage and support the development of coordinated registration of GEOSS users, working with the GCI and other GEOSS elements as needed.

[9] http://www.geoportal.org/web/guest/geo_home

It is recommended that such user registration be the "lightest" implementation possible, requiring the user to register only once and to provide at the time of registration only that information necessary to comply with most data provider "user log-in" requirements.

User registration is useful for monitoring usage of the GEO Web Portal and the data made available through it, providing statistics on user profiles, types of data accessed by different user types, use of services, and other aspects of the GEOSS operations. These metrics are needed on an ongoing basis both to improve GEOSS effectiveness and efficiency, and to inform improvements for the GEOSS.

Data Citation and Data Tagging

The expression "data-tagging" is open to a wide range of interpretations and implementations. In itself, it means no more than attaching information to data to describe some of its characteristics, to meet a particular purpose. Developing data tagging procedures and standards for citation tracking and securing international agreement for their use in the peer-reviewed literature is an issue that is being addressed by a number of bodies at the present time. GEO should work in concert with these groups.

To the extent that application of the GEOSS Data Sharing Principles promotes the publication of data, the need to ensure that data can be used appropriately is amplified. Measures are needed both as a safeguard against misleading use and as a means of supporting the exploitation of the greater availability of data. Crucial to these measures is how tags attached to data items might be used.

Action 4. Integrate implementation of the Data Sharing Principles, as appropriate, into the activities of GEO Work Plan Tasks and GEO Committees.

GEO Task Teams and GEO Committees should look to identify their data sharing opportunities and needs and work to promote harmonization of data sharing procedures within their activities consistent with the Data Sharing Principles.

6.2 Actions for GEO Members

Action 5. Take leadership to establish national coordinating mechanisms to promote and monitor engagement with the implementation of the GEOSS Data Sharing Principles and provide feedback to GEO.

GEO Members should establish a process within their respective countries to identify and take steps to reduce areas where the institutional, legal and technical barriers to full and open exchange of data, metadata and products are constraining the use of such information.

This process should also enable feedback to be provided to the GEO.

Action 6. Develop flexible policy frameworks to ensure that a more open data environment is implemented.

GEO Members should establish flexible policy frameworks wherein their country's agency leadership and program managers can take the practical steps, some of which are identified in this Action Plan, to ensure that a more open data environment is implemented.

Governmental data providers should seek to make their datasets available in accordance with the principle of full and open exchange. GEO Members should also seek to implement and promote the Implementation Guidelines as best practices at the national and institutional levels.

6.3 Actions for GEO Members and Participating Organizations

Action 7. Maximize the number of datasets made available on the basis of full and open access.

GEO Members and Participating Organisations should ensure that they register their Earth Observation resources in the GEOSS. In particular, adequately detailed metadata should be provided and registered by GEO Members and Participating Organisations, with no costs or restrictions attached to the use of this metadata to facilitate data and service discovery, assessment, and integration for decision support. This metadata should include detailed information about usage rights and all usage requirements and restrictions, with external links to any associated licensing agreements.

When no information about usage rights and restrictions is provided, the presumption within GEOSS will be that the data are fully and openly available with no restrictions on use and dissemination. The GCI web pages will make this presumption clear to both data providers and users.

If useful and appropriate for informing data providers and users, the GEOSS could point to machine-readable licenses or waivers of usage rights to facilitate automated access and reduce the burden on users to complete one or more license agreements.

Where GEO Members, or Participating Organisations, provide grants for work leading to the access and use of Earth observation data produced under the grant, clear data access and data exchange rights should be stipulated in the grant agreement that are, wherever possible, in accordance with the principle of full and open exchange of that data, and these access and exchange rights should be specified in the associated metadata.

Action 8. Promote with data providers within their territories the benefits of full and open access to data.

GEO Members and Participating Organizations should undertake actions to promote the benefits of full and open access to GEOSS data through a process that directly engages data providers, including their respective contributions and perspectives. This process should also identify and recognise the societal and economic benefits that will arise.

Such actions should maximize the number of datasets contributed to the GEOSS Data-CORE, enabling global-scale datasets to be developed through the integration of national and regional contributions via interoperability arrangements.

GEO Members and Participating Organizations should also be encouraged to raise awareness among their stakeholder constituencies and to continue their efforts toward participatory decision-making.

The participation and engagement of the representatives of key stakeholder groups should be ensured on a continuous basis. The categories of major stakeholders include the data producers and users in government, academia, and industry; the public policy and funding organizations with purview over the relevant data activities; and the general public. While the involvement of the data providers is obviously crucial to the GEOSS, the long-term and sustained involvement of all the other stakeholder groups is also important.

It is important to underscore the fact that GEOSS is composed of voluntarily contributed systems and data, which are governed by pre-existing laws, policies and practices that may not, at this time, be fully compatible with the Data Sharing Principles. Datasets with restrictions based on legitimate reasons also can be contributed into GEOSS and GEO welcomes all data contributions into the GEOSS. When registering data in GEOSS, if any restrictions arise from relevant international instruments and national policies and legislation, then data providers should identify those that may be applicable to the use of the data or products submitted.

ANNEX 1

IMPLEMENTATION GUIDELINES FOR THE GEOSS DATA SHARING PRINCIPLES

Available at:

http://www.earthobservations.org/documents/geo_vi/07_Implementation%20Guidelines%20for%20the%20GEOSS%20Data%20Sharing%20Principles%20Rev2.pdf

Annex 2

The Benefits of Data Sharing Through GEOSS

ANNEX 2

THE BENEFITS OF DATA SHARING THROUGH GEOSS[i]

1 INTRODUCTION

One of the major challenges of GEOSS is to provide access to the vast array of historical data series and continuously collected environmental data and information to enable their integration with other information by a broad spectrum of potential users in the nine societal benefit areas (SBEs). The discussion that follows expands on the benefits, summarized in the Action Plan, of 'Full and Open' (see Glossary) exchange of data and information in line with the consensus Data Sharing Principles (DSPs).

The economic and social benefits of Full and Open availability of publicly generated data and information may be assessed at several levels—in terms of the relative economic efficiency of the dissemination function, in better capturing the value of the information, and in promoting the network effects and related positive externalities associated with its open availability on digital networks. The open communication of the results of public-sector data collection efforts and the maximum diffusion and dissemination of that information is in the public interest. The value of this information lies in its use.

Many empirical studies of the dissemination of public sector data and information (as well as publicly funded data in academia) have repeatedly demonstrated the value of open access to such information online[ii] The lack of restrictions on their reuse provides much greater economic and social returns than proprietary dissemination systems with access costs and reuse restrictions. Real life cases studies mirror some of the conclusions of the empirical studies:

- CBERS (China Brazil Earth Resources Satellite) removal of imagery charges resulted in increased access from 1,000 images/year to 10,000 images/month with more than 10,000 new users registered in the first year. 98% of users surveyed agreed with the policy of open data access and reported the creation of many new jobs, the creation of new SMEs and improved research and teaching;
- The U.S. Geological Survey achieved similarly impressive results following removal of Landsat's charges for internet users which resulted in more Landsat data (more than 1.1 million images) being processed and distributed in FY 2009 than in the whole 38 year mission history combined;
- The ASTER Global Digital Elevation Model (GDEM) saw a reversal in fortunes following the introduction of charges in January 2006 with a substantial reduction in data distribution. A reversal in policy to no charge in June 2009 again provided a clear indication of dramatically increased usage of ASTER data worldwide (with over 6.5 million tiles distributed in FY 2009). Strong interest for the DEM was received by representatives of all GEO Societal Benefit Areas as well as other users;

- The Argo program's public data access policy has enabled the provision of near real-time access to the first continuous global monitoring array of ocean temperature, salinity and velocity for use in oceanographic and climate forecasting models;
- GBIF's aims to make scientific biodiversity data the common property of everyone has resulted in the publication online of nearly 200 million biodiversity records from 300 data publishers in 54 countries.

The data sharing ethos therefore is increasingly accepted as providing added economic and social value to the data. The potential benefits of exchanging data and information through GEOSS are expected to be significant, as discussed in more detail below. Improving the data access and sharing system should significantly increase data value by reducing the cost and reuse restrictions for the users and the various returns on investment for the producers.

All kinds of data are candidates for sharing through GEOSS. Unique data sets, even fragmented ones, can be especially important. Some countries and agencies already have data sharing plans in place, but basic environmental data from other sources and institutions are also amenable to sharing. Although many sectors can benefit from sharing data, the general public in particular will benefit from the increased transparency and availability of information that makes full use of the rapidly evolving information and communication technologies. There also appears to be significant motivation for improving the cost-effectiveness of national monitoring efforts through further harmonisation.

2 SOCIETAL DRIVERS

Data sharing is an indispensable means to reaching important policy objectives relating to health, environment, poverty, energy, disaster management and other public-interest priorities that have been high on the global agenda for the last few decades. By improving data sharing, and the subsequent continuous availability of that information, decision-makers, policy-makers and researchers can react with timely and well-informed responses to national, regional, or global issues that threaten the environment, human health, or safety.

An example that quickly comes to mind is the tragic tsunami of 26 December 2004, which killed several hundred thousand people in South Asia. A more rapid response based on shared seismic, shoreline topography, bathymetry, population, meteorology, and land-use data could potentially have saved many thousands of lives. Disaster reduction is but one of the global concerns that demand greater sharing of data from activities under the GEOSS umbrella.

Similarly, there is now broad international consensus regarding climate change, based in part on human activities and resulting in some warming of the global climate over the coming decades. Responding to these changes, through mitigation and adaptation, requires a better understanding of the natural and human-induced factors leading to those changes. The participants in GEOSS collect most of the data that are relevant to improving understanding and responding appropriately, and therefore need to make the data as broadly available for analysis as possible.

3 IMPROVEMENTS IN THE DEVELOPMENT AND IMPLEMENTATION OF LAWS AND POLICIES

Another important benefit of data sharing through GEOSS concerns the improvement of national legislation and regulation, international policy formation, and helping to make citizens more aware of the state of their environment. The potential improvements in this broad subject area include:

- support of a wide range of activities related to environment policy implementation;
- enhanced participation by non-governmental organisations and members of the public in public debates and decision making;

- easier predictive evaluation of environmental policy, an already established practise for many major policy initiatives;
- more effective monitoring and evaluation of environmental policies;
- support for more integrated policy approaches and policy coordination over different environmental themes and across sectors; and
- better integration of environmental protection objectives into other policies, through the use of information common to various sectors.

Implementation of the Environmental Impact Assessment (EIA) Directive (Directive 85/337/EEC) and the Directive on Strategic Environmental Assessment (SEA) (Directive 2001/42/EC) provides one example of the potential benefits to be gained through Full and Open data sharing. A recent report published by the Joint Research Centre of the European Commission[iii] found that:

- data acquisition costs represent between 5% and 10% of the total cost to produce an EIA or SEA;
- 59% of practitioners face difficulties finding data; and
- 53% of practitioners face difficulties accessing and integrating data.

The results of these findings were that practitioners needed more time to prepare EIA/SEA reports and were less certain of the impacts. The increase in costs and time caused by problems connected with the use of spatial data was between 10% and 20% which, based upon an average study cost of €40,000, could lead to conservative savings in the order of €150 million per annum in the countries of the European Union.

4 ENHANCING PRIVATE SECTOR COMPETITION AND INNOVATION

The data collected by a private-sector entity has the same economic public-good characteristics that similar public-sector data sets have. The presumption for data sources emanating from the private sector, however, is that they are proprietary, subject to commercial terms and conditions. Nevertheless, at least some data from private-sector entities can meet the data sharing policy conditions of GEOSS, which is why some Affiliated Organizations of GEO are private and commercial.

To meet the full range of user needs identified as priorities by GEO, private-sector (or hybrid public-private) systems should be encouraged to contribute to the data and information made available to users under GEOSS. Providing usable subsets of data (e.g. de-resolved or unprocessed), products, and services absent reuse or re-dissemination restrictions from private or public-private data systems will help demonstrate the value of the data to existing and potential users, as well as provide incentives for governments, participating organizations, or other entities to contribute new elements to GEOSS. Other possible benefits for the private sector include the better and more accurate analysis of different markets by commercial data users and the creation of new products and services by value-added data providers and others.

If cross-global data were easier to identify and obtain, private sector companies also would find it easier to compete outside the boundaries of their home market. Thus, sharing data within GEOSS is likely to make some contribution to improving market competition. There are many sectors in the economy that could embrace data sharing, including the oil and gas industry; the communications industry; the fishing industry; farming and forestry; mining, drilling, dredging and quarrying; surveying; architecture; and engineering, among others. Businesses should be able to increase their international activity if they find it easier to obtain and process data for other locations. Indeed, there is widespread recognition of the huge changes in applications and in functionality that can be achieved by the application of information technology to various geographical and other data sources. Businesses and research institutes will be able to expand the range of their activities. There are many

examples of geographic information applications, such as Upmystreet in the UK, a commercial product which provides a variety of separate local data sources in order to provide users, with a one-stop shop, the access to a wide range of information about geographical localities. In light of the strong evidence provided by the reports cited above in the Introduction, it is reasonable to assume that data sharing would contribute to more vibrant economic activity. This assumption is also supported by the private sector's positive reaction to the INSPIRE initiative in Europe, through the Internet consultation and public hearing.

5 RESEARCH AND EDUCATION BENEFITS

Modern science is increasingly data driven. This is especially true of Earth and environmental sciences, including global change research, which rely to a great extent on the development of comprehensive global data sets [GEOSS, 2005]. Such research frequently also requires the integration, reuse, and sharing of data from many sources [NRC, 1999]. Countries and public agencies have policies that provide special status to the research and education sectors, recognizing their essential role in social and economic development. Such policies (e.g., free-of-charge satellite data provided by ESA for research) typically provide various forms of preferential treatment, incentives, subsidies, and cost allowances to researchers, educators, and students, particularly those who are funded by the public sector. However, even the private sector may offer discounts for their products and services to these groups.

The GEOSS Data Sharing Principles encourage GEOSS data providers to make their data and information available to such users free of charge or at no more than cost of reproduction. The presumption is that users in these sectors will produce socially and economically beneficial results based on such privileged access conditions, as long as the easy access is accompanied by a concomitant absence of reuse or re-dissemination restrictions. Furthermore, there are many international research programs and related data activities that provide free-of-charge and unrestricted or Full and Open access to such research data. Such international cooperative research policies and practices have parallel examples at the national level of many countries, research programs, and disciplines. In many cases, data sharing is promoted by both official research policy (e.g., through terms and conditions of public research grants) and by the norms of many academic discipline communities [NRC, 1997; Reichman & Uhlir, 2003].

Open access to, and sharing of data from, publicly-funded research offer many research and educational advantages over a closed, proprietary system that places high barriers to both access and subsequent re-use. Open access to such data:

- reinforces open scientific inquiry,
- encourages diversity of analysis and opinion,
- promotes new research and new types of research,
- enables the application of automated knowledge discovery tools online,
- allows the verification of previous results,
- makes possible the testing of new or alternative hypotheses and methods of analysis,
- establishes a broader base set of data than any one researcher can hope to collect, thereby providing a greater baseline of factual information for the research community,
- supports studies on data collection methods and measurement,
- facilitates the education of new researchers,
- enables the exploration of topics not envisioned by the initial investigators,

- permits the creation of new data sets, information, and knowledge when data from multiple sources are combined,
- helps transfer factual information to and promote development and capacity building in developing countries,
- promotes interdisciplinary, inter-sectoral, inter-institutional, and international research, and
- generally helps to maximize the research potential of new digital technologies and networks, thereby providing greater returns from the public investment in data collection and research [NRC, 1997; NRC, 1999; NRC 2003; Arzberger et al., 2004; Uhlir & Schröder, 2007].

6 DEVELOPING COUNTRY BENEFITS

With regard to preferential policies for users in the developing world it is important to note the differences that exist between data delivery infrastructures within developed and developing countries. Developed countries typically have ready access to relatively low-cost and high-bandwidth connections. Developing countries however typically have limited or expensive connectivity and are therefore faced with higher costs of access to, or delivery of, data.

GEO therefore needs to work at a technical level to help equalize the accessibility of data to users in developing and developed countries through models that do not penalize uses of GEOSS data that specifically address developing country problems, or more generally users based in developing countries. An acceptance and implementation of the basic concepts underlying the GEOSS data sharing principles would give an enormous boost to the ability of developing countries to play a much more prominent role in the GEO. To achieve this, the ever increasing volumes of openly available data in the nine societal benefit areas should begin to flow through GEOSS as soon as possible. Capacity building issues should therefore be more fully considered by the GEO Members and Participating Organizations, especially from the perspective of how data providers can be both encouraged and rewarded for making their data readily available and accessible free-of-charge.

7 BROAD STAKEHOLDER PARTICIPATION NEEDED TO REALIZE THE BENEFITS OF DATA SHARING

One of the main challenges of any data sharing policy is ensuring the participation of the representatives of key stakeholder groups, who need to remain engaged on a continuous basis. The categories of major stakeholders include the data producers and users in government, academia, and industry; the public policy and funding organizations with purview over the relevant data activities; and the general public. While the involvement of the data providers is obviously crucial to obtain the GEOSS, the long-term and sustained involvement of all the other stakeholder groups is also important. The Member States and Participating Organizations should therefore be encouraged to raise awareness among their stakeholder constituencies and to continue their efforts toward participatory decision-making.

This commitment of all the stakeholders is intrinsically linked to the issue of sustainability. Operating a data collection system and then managing and making the data available requires the long-term investment of financial and human resources. As these resources are scarce and their use needs to be justified, not only for internal budget allocation within a public agency, but also towards central government and the general public, ensuring sustainability can be a struggle. Therefore it is important that funding mechanisms are elaborated and implemented in the Member States and Participating Organizations and that duplication of efforts is avoided, in order to use resources as efficiently and equitably as possible. Securing the continuous availability of resources entails involving the national policy decision makers of all the Member States and the relevant decision makers for Participating Organizations, and ensuring their understanding and endorsement of the value of GEOSS.

The motives of GEOSS participants are varied and may be driven by diverse objectives and perceived benefits. From the perspective of creating stable relationships that can sustain the GEOSS network, which incentive works best depends entirely on the context of each participant's involvement. Value is thus subjective and the network must be flexible enough to facilitate all forms of value exchange so that a participant's initial interests are met. The interdependence and reciprocity between the participant's and the network's interests needs to be sustained, if not increased.

Motivating a Member State or Participating Organization to share its data to serve an external, global need requires a corresponding incentive. Access to—and being a local distributor of—a global data set provides one such incentive. The participant also gains prestige as the source for a regional or global product. Additionally, the local, regional, and global data sets provide raw material for higher level value-added products. Because all forms of exchange involve local costs, value-added activities are particularly important. They provide the means to offset the costs while raising members' participation above the local level.

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[i] Much of this section, except as otherwise noted, is based on the *CODATA White Paper on the GEOSS Data Sharing Principles*, which was prepared under GEO Task DA-06-01. The *CODATA White Paper* was completed and published as a peer-reviewed article simultaneously in two journals: Paul F. Uhlir, Robert S. Chen, Joanne Irene Gabrynowicz, and Katleen Janssen, "The GEOSS Data Sharing Principles," in *Journal of Space Law* and *Data Science Journal* (2009), under a Creative Commons 3.0 Attribution license.

[ii] The following studies have substantiated this value proposition: U.S. National Committee for CODATA, *The Socioeconomic Effects of Public Sector Information on Digital Networks: Toward a Better Understanding of Different Access and Reuse Policies*, Paul F. Uhlir, ed., National Academies Press, 2009, available at http://www.nap.edu/catalog.php?record_id=12687; Ed Mayo and Tom Steinberg, *The Power of Information: An Independent Review*, 2007 available at: http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/power_information.pdf; Pilar Garcia Almirall, Montse Moix Bergadà, and Pau Queraltó Ros, *The Socio-Economic Impact of the Spatial Data Infrastructure of Catalonia*, Max Craglia, ed., 2008, available at http://inspire.jrc.ec.europa.eu/reports/Study_reports/catalonia_impact_study_report.pdf; Makx Dekkers, Femke Polman, Robbin te Velde, and Marc de Vries, *MEPSIR, Measuring European Public Sector Information Resources*, 2006, available at http://www.epsiplus.net/reports/mepsir_measuring_european_public_sector_resources_report; Peter Weiss, *Borders in Cyberspace: Conflicting Public Sector Information Policies and Their Economic Impacts*, 2002, available at http://www.epsiplus.net/reports/borders_in_cyberspace; Garry Sears, *Canadian Geospatial Data Policy Study*, KPMG, 2001, executive summary available at: http://www.geoconnections.org/programsCommittees/proCom_policy/keyDocs/KPMG/KPMG_E.pdf [19]; National Research Council, *A Question of Balance: Private Rights and the Public Interest*, National Academies Press, 1999, available at http://www.nap.edu/catalog.php?record_id=9692; Pira International Ltd., University of East Anglia, and KnowledgeView Ltd., *Commercial Exploitation of Europe's Public Sector Information*, 2000, http://www.ekt.gr/cordis/news/eu/2001/01-01-19econtent/econtent_study2.pdf; National Research Council, *Bits of Power: Issues in Global Access to Scientific Data*, National Academy Press, 1997, available at http://www.nap.edu/catalog.php?record_id=5504.

[iii] http://ies.jrc.ec.europa.eu/uploads/SDI/publications/JRC_technical%20report_2009%20EIA-SEA%20survey.pdf

Annex 3

Considerations and Actions for the GEO Community to Improve the Data Sharing Culture and to Populate and Promote the Use of the GEOSS Common Infrastructure and GEOSS Data-CORE

ANNEX 3

CONSIDERATIONS AND ACTIONS FOR THE GEO COMMUNITY TO IMPROVE THE DATA SHARING CULTURE AND TO POPULATE AND PROMOTE THE USE OF THE GEOSS COMMON INFRASTRUCTURE AND GEOSS DATA-CORE

1 INTRODUCTION

The Action Plan, a document being put forward for GEO agreement contains a number of generic actions. This document outlines in more detail what actions need to be taken within the GEO community and how they relate to tasks already underway. It does not address the technical details for the GEOSS Common Infrastructure (GCI). Those are outlined in the Supporting Document "Considerations Arising form the Data Sharing Action Plan for the GEOSS Common Infrastructure."

2 THE ACTIONS

- The main actions outlined in section 6 of the Action Plan are:
- Create the GEOSS Data-CORE and maintain the GCI as the architectural framework for implementing the Data Sharing Principles;
- Establish a task force to monitor, promote, and evaluate progress and benefits;
- Integrate the Principles and raise the awareness and benefits into all responsibilities of GEO;
- Set up Member State level coordination to maximise the number of data sets available;
- Undertake studies or research on user needs and outstanding issues including technical, operational or cultural changes needed to achieve greater data sharing.

3 CORE ACTIONS

3.1 Analysis of User Requirements

As the GCI becomes operational, the focus must be on the contents (data and services) to be delivered through it. There needs to be an:

- analysis of user requirements,
    - Performing a critical assessment of the initial contributions to the GEOSS Data-CORE to identify gaps with user requirements;
    - Liaising with GEO Committees and relevant tasks to ensure user requirements are reflected into the setting and communicating priorities to extend the GEOSS Data-CORE;
- identifying priority parameters and gap analysis, and
- identifying priorities for data harmonisation or interoperability arrangements).

A data management Strategy is being developed by the Architecture and Data Committee (ADC) during 2010. User requirements for content, new data collection, harmonisation of existing resources, and, interoperability arrangements need to be justified on the basis of clearly identified requirements.

Other important initiatives to gather user requirements have been launched by the User Interface Committee (UIC). They are a database on user types, user applications and user requirements in each of the Societal Benefit Areas (SBAs) and a meta-analysis to identify critical Earth observations priorities common to many SBAs. This latter activity (*Task US-09-01a*) was completed for 5 SBAs and a synthesis report across all 9 SBAs will be completed in 2010.[1] Early indications are that approximately 100 parameters can be identified that are critical across several SBAs such as land cover, temperature, precipitation, elevation and so on. Following this synthesis across all SBAs, a gap analysis regarding the current and future availability of the "priority Earth observation parameters"[2] will be conducted.

The GEOSS Data-CORE should include datasets identified as SBA priorities. All GEO Committees, task leaders, and Communities of Practice (COP) should be involved in this process. There is a need to build on existing mechanisms and tasks to strengthen them where needed, rather than duplicating efforts.

One COP that has mobilised to define its requirements is the biodiversity community. It had an opportunity that arose out of 2010 being designated as the Year of Biodiversity. The requirements expressed through the GEO BON project led to a document being tabled at the Washington Plenary on the GEO Baseline Initiative[3]. It "is a coordinated effort to call on GEO Members, Participating Organizations and the public to assemble shared, inter-operable products that will be used to establish a baseline for the year 2010 of bio-environmental conditions, as well as indicators of ecosystem functioning and services. The first step will support the development of interoperable datasets of imagery and derived products…An important aspect of the initiative is to ensure that the data are inter-operable and accessible, which will enhance their use by reducing pre-processing time, cost and redundancies".

3.2 Supporting Implementation

Establishing a mechanism to support the GEO community in implementing the Data Sharing Principles and contributing to the GEOSS Data-CORE is key to success. This could be the existing Data Sharing Task Force, the GEO Secretariat, or another mechanism. There are a number of possible activities for this body:

- Regularly monitoring and reporting on progress in the development and use of the GEOSS Data-CORE;
- Identifying appropriate metrics and putting in place a programme to measure the benefits deriving from the use of the GEOSS Data-CORE;
- Organising coordinated national focal points responsible for data sharing, who may meet and discuss barriers and issues in dedicated forums;
- Engaging in dialogue with data providers of priority datasets to incentive contribution to GEOSS Data-CORE, identifying barriers preventing contributions, and communicating them to the GEO Members and Participating Organisations.

[1] http://earthobservations.org/documents/geo_vi/18_Report%20of%20the%20User%20Interface%20Committee.pdf

[2] http://www.earthobservations.org/documents/committees/uic/201003_14thUIC/07_us0901a_status.pdf

[3] http://earthobservations.org/documents/geo_vi/10_The%20GEO%202010%20Baseline%20Inititative.pdf

- Identifying actions to raise the profile in the GEO community and scientific community at-large of the GEOSS Data-CORE (e.g. the program "making public data public" could be considered)
- Engaging scientists and the public in a dialogue about missing data and observations to address clearly societal and environmental problems
- Gathering user feedback on the GEOSS Data-CORE and ensuring that technical and organisational issues are addressed.
- Encouraging funding agencies (e.g. the U.S. National Science Foundation, the European Commission) to award research grants conditional on contributing the outcome of research (data, services, models) to the GEOSS Data-CORE.

3.3 Changing the culture through awareness-raising and benefit-selling

To ensure there is an uptake of the Data Sharing Principles, the benefits of full and open access and the value of the GEOSS Data-CORE need to be communicated both within the GEO community and in the broader scientific and decision-making spheres. To encourage organisations to join the GEO community several activities have been identified including:

- Globally: launch a global campaign showing successes of data sharing and collaborative working (e.g. Haiti Earthquake); advertising important and valuable contributions; communicating in global publications the value added of GEO and its Data Sharing Principles; demonstrating the value of GEOSS in solving societal problems; having countries announce major contributions at Summit meetings; writing editorials for all major science journals, promoting the use of existing community portals implementing the Data Sharing Principles;
- In SBA and research context: organize thematic workshops around an SBA that highlight the importance of implementing the Data Sharing Principles and using the GEOSS Data-CORE to address SBA research. Support the integration of the GCI with social networks and mash-ups as ways to provide, use, and feed back on environmental and Earth observation data; create a feedback capability and encourage researchers and scientists to describe how they have used full and open access data and what benefits and new understanding have come about through their use;
- In governmental context: make Ministers aware of which datasets are needed most urgently for decisions on good environmental management and adaptation to climate change as well as other policy priorities; provide some simple tangible steps to be fulfilled to contribute to the GEOSS Data-CORE; provide evidence that expanding the GEOSS Data-CORE will contribute to the GEOSS quality assurance strategy (data quality increases with use and feedback);
- Among data providers: define and implement a mechanism to give visibility and attribution credit to any provider that makes its data available according to the Data Sharing Principles. For example, provide exclusive benefits for datasets that follow the Principles such as priority listing in search queries, conference presentations based on use of shared data get best time slots, etc. Consider the establishment of a GEOSS Yearly Award recognizing the contributions made to GEOSS and to the addressing of SBA priorities. In this way all GEO members will be challenged to make significant contributions;
- With the private sector: involve private sector (Google, Microsoft, others) and the gaming industry to make applications using scientific and environmental data so that school children, students, decision-makers, and the public at-large become increasing familiar with science and scientific models, and more informed participants in the policy debates.

These activities will need to develop with the tasks already underway under the aegis of the GEO Committees, such as *Task ST-09-02: Promoting Awareness and Benefits of GEO in the Science and Technology Community*, and *US-09-02a: Socioeconomic Benefits of GEO and GEOSS*.

3.4 Research requirements

Four main areas of research needed to support the implementation of the GEOSS Data Sharing Principles have been identified, including:

- User requirements for content (data and services) and the priorities of the GEOSS Data-CORE need to be investigated. This activity would link to those of the UIC reported in Section 1, and those of the Science and Technology Committee (STC) in Task ST 09-01 in which a survey is planned of task leaders to assess the science and technology components;
- Issues such as licensing; data tagging; chaining of services cascading different types of restrictions as data is combined; semantic interoperability; multi-disciplinary interoperability; ways in which users can report back on fitness-for-purpose, etc. are areas which need research. Links with the activities of the ADC and GCI Task Force would be particularly important;
- There will be a need to step up research into appropriate methodologies for spatial temporal analysis of datasets at multiple scales and temporal resolutions. Research assessing the value to the scientific community of the increasing volume of data contributed by volunteers and the public through social networks and related developments (citizens as sensors or citizen science) will also need to be increased;
- Assessing the added value of GEOSS, the GEOSS Data Sharing Principles, and the GEOSS Data-CORE for the SBAs and the broader scientific community (e.g. better understanding of the complex relationships between human action and environmental phenomena) will be needed. This research area would link with the activities of both STC and UIC Committees and related tasks (e.g., ST-09-02, US-09-02a).

Annex 4

Considerations Arising from the Data Sharing Action Plan for the GEOSS Common Infrastructure

ANNEX 4

CONSIDERATIONS ARISING FROM THE DATA SHARING ACTION PLAN FOR THE GEOSS COMMON INFRASTRUCTURE

1 OBJECTIVES

The purpose of this document is to highlight a number of key issues that may require future decisions and actions by GEO Members to support the implementation of the Data Sharing Principles, the Implementation Guidelines and the Action Plan through the evolution of the GEOSS architecture and the GEOSS Common Infrastructure (GCI). It is essential that the GCI provide mechanisms to support the full and open exchange of data, metadata and products within the GEOSS, while also enabling users to discover and access data that have been registered in the GEOSS with restrictions as seamlessly as possible. The GEOSS Data Sharing Implementation Guidelines provide the definition of full and open exchange as meaning that data, metadata and products made available through the GEOSS are made accessible with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution.

2 CURRENT SITUATION WITH THE GCI

At present, the GCI does not distinguish between data that are registered in the GEOSS with regards to the various possible use, reuse, and distribution restrictions. The Architecture Implementation Pilot Phase 3 (AIP-3) is considering and experimenting with a number of different use cases with regard to data with no restrictions or a limited set of restrictions.

3 ISSUES ARISING FROM THE IMPLEMENTATION OF THE DATA SHARING PRINCIPLES

As stated in section 6 of the Action Plan and discussed further in this document, the key issues identified for the implementation of the Data Sharing Principles in relation to the GCI are:

- To enable users to discover the quality and any restrictions applicable to the use of data, including any usage restrictions that may apply to value-added products produced by GEOSS systems from data obtained from or through GEOSS;
- To implement an agreed categorization of data access conditions;
- To support the accessibility of GEOSS data and information in decision making in the GEO SBAs, especially resources made available through the GEOSS Data-CORE;
- To examine processes for the simplification and automation of digital rights management where possible for both data providers and data users;

- To develop processes to ensure appropriate handling of various data access conditions, such as provision of attribution information when attribution is required. These processes could include pointing to information on machine-readable licenses, waivers of usage rights and other legal instruments that may enable improved interoperability;
- To enable users to search GEOSS to find data or products that meet specific criteria with regard to usage rights or data access conditions;
- To establish requirements for data use metrics that would enable assessment of the impacts of open access on data usage and utility in GEOSS SBAs.

4 FURTHER CONSIDERATIONS

The GEO-VI Plenary provided a mandate for the DSTF to address the different policy needs of various GEO Members, while acknowledging that the full and open exchange of data without restrictions is to be clearly encouraged. In support of this mandate, the DSTF has considered selected issues related to data restrictions/licenses, reuse/redistribution of data, data tagging, and user management.

4.1 Data Access Conditions and Licenses

The Implementation Guidelines confirm that: "GEO welcomes all data contributions into the GEOSS. When registering data in GEOSS, the contributor should present any restrictions arising from relevant international instruments and national policies and legislation, and the duration of each restriction, that is applicable to the exchange of the data, metadata, and products submitted." In support of this implementation guideline, it is proposed that GEO identify a set of categories of data access conditions.

The descriptions, or simple categorisations, of data access conditions should also align with the various "categories of data" that have been described in GEO documents, including the 10-year Implementation Plan, the Implementation Guidelines for the GEOSS Data Sharing Principles and this Action Plan. Hence any categorization approach that is adopted would need to ensure that users could readily identify data falling into the following groups:

- Full and open with unrestricted access (GEOSS Data-CORE);
- Full and open with unrestricted access plus attribution requirement;
- Full and open exchange[1];
- Other (including custom licences, cost recovery over and above that of reproduction and distribution, and other possible restrictions).

When no information about usage rights and restrictions is provided, the presumption within GEOSS will be that the data are fully and openly available with no restrictions on use and dissemination. The GCI web pages will make this clear to both data providers and users. If useful and appropriate for informing data providers and users, the GEOSS could point to machine-readable licenses or waivers of usage rights to facilitate automated access and reduce the burden on users to complete one or more license agreements. There could be multiple licenses or waiver types in each of the categories, such as various licenses developed by Creative Commons and by the Open Data Commons.

1 As defined in the Implementation Guidelines: "with minimal time delay and with as few restrictions as possible, on a non-discriminatory basis, at minimum cost for no more than the cost of reproduction and distribution."

The Architecture Implementation Pilot Phase 3 (AIP-3) is studying and experimenting with some of the above mentioned categories. This work will identify approaches to encoding in metadata necessary information about data access conditions, including applicable restrictions, specific license or waiver information, and attribution information. Further, the AIP-3 work will help to define how data users can be made aware, through the GEO Portal, of these access conditions, and how data users can perform search and discovery on GEOSS data using search criteria based on data access information encoded in the metadata.

Although the GCI should have a clear role in communicating data access conditions to data users, the GCI should *not* assume responsibility for ensuring that data access conditions are adhered to by data users. Instead, the GCI should, when appropriate, put data users in direct contact with data providers to obtain any needed permissions or agree to specific licensing or usage requirements. This is also the case for the recovery of costs. Although this may require extra steps on the part of data users and data providers, **it is important that the GCI not assume any legal liabilities that could result from users who do not comply with applicable data restrictions or conditions**.

4.2 Data Reuse, Redistribution, Merging, and Layering

It is common for data to be used and distributed many successive times, from user to user, and for derivative data sets and products to be produced by layering data, as in maps, or merging data from different providers. In each of these cases, appropriate metadata regarding data access conditions, usage rights, attribution, etc. needs to be carried forward in an appropriate manner. Because different input datasets may have different data access conditions, the GCI will need to implement mechanisms to determine the set of conditions and restrictions that may apply to any integrated, merged, or value-added data or products, consistent with the rights of the providers of the input data. The simplest case is when all of the inputs are free of charge and open with no restrictions, which enables maximum flexibility in data integration, reuse, and redissemination.

The AIP-3 is studying and experimenting with these issues. The ISO 19115 metadata standard is currently being used as the framework for encoding data access conditions and licenses, and it may be possible to suggest enhancement of the standard to meet GCI needs. This work is addressing the logic of dealing with multiple data access conditions simultaneously, including multiple instances of attribution. Metadata will be used to support for machine-to-machine data access and processing. For data visualization and display (e.g., maps), users need to be made aware of any access conditions and requirements (e.g., attribution) applicable to the visualization or product.

4.3 Data Tagging

As stated in the Action Plan, 'The expression "data-tagging" is open to a wide range of interpretations and implementations, but in itself it means no more than attaching information to data to describe some of its characteristics, to meet a particular purpose. Developing data tagging procedures and standards for citation tracking and securing international agreement for their use in the peer-reviewed literature is an issue that is being addressed by a number of bodies at the present time. GEO should work in concert with these groups.'

The growth of electronic publishing of data, and changing requirements and expectations of the users of data, present a range of challenges for data tagging, including:

- how to incentivise the publication of data which might be useful over a range of applications;
- how to ensure the traceability of data used in research, applications, and decision making;
- how to encourage maximum responsible use of data (e.g., through social networking media);

- how to utilize data tagging to improve metrics on data use and impact in GEOSS Societal Benefit Areas.

In considering and implementing data tagging, the kind of questions that need to be considered include:

- definition of terms: what is data-tagging, how is it used?
- is data-tagging a topic to be considered on its own or is it part of a wider group of issues related to citation and reuse?
- what work on it is already under way, distinguishing between academic and operational activity, and identifying the leading fora - particularly the international framework. What gaps need to be filled?
- what are the mechanisms that can achieve the desirable outcomes – e.g., shared good practice, new standards, or intergovernmental agreements?

To the extent that application of the GEOSS Data Sharing Principles promotes the publication of data, the need to ensure that data can be used appropriately is amplified. Measures are needed both as a safeguard against misleading use and as a means of supporting the exploitation of the greater availability of data. Crucial to these measures is how tags attached to data items might be used.

GEOSS elements, including the GCI, could try to support appropriate attribution of sources, and labelling and documentation of data products (e.g., maps) and integrated datasets that utilize data with one or more source attributions, which may include machine-readable licenses, e.g., by displaying the source or license logo and associated attribution information.

4.4 User Management

Many GEOSS data providers currently require users to register and log in to gain access to their data. Since a key objective of GEOSS is to facilitate access to and integration of many different types and sources of data, it is highly desirable for the GCI to support both a one-time registration process for users and a "single sign-on" approach. One-time registration would enable users to create a unique GEOSS user name or ID, provide any necessary user profile information in a secure manner, and then use this GEOSS user name or ID in all subsequent interactions with GEOSS and its components. Single sign-on would allow users to use their GEOSS user name or ID to log in once to access multiple GEOSS data sources and services for a defined period of time. Implementation of these two complementary functions should be as light an impact as possible on the user, requiring the user to provide at the time of registration only that information necessary to comply with most data provider "user log-in" requirements.

The AIP-3 is studying and experimenting with these functions. Certain existing standards for accomplishing these functions are being considered, but there could be impacts on some data providers. Those data providers that have no registration or login requirements would not be directly affected. Those data providers that do have registration and login requirements may need to adjust their GEOSS registered resources to be interoperable with what may be implemented based on lessons learned from AIP-3. The goal is to have as light an impact as possible on GEOSS data providers, as well.

4.5 User Types and Data Use Categories

The User Interface Committee (UIC) is currently engaged in the development and deployment of the User Requirements Registry (URR). This registry will support the identification of user types and the categories of data usage that users will belong to. A user type taxonomy is in development to support a common understanding of user types. These may be useful in helping to implement certain data

conditions, data restrictions, and cost recovery requirements, e.g., those that give preferential treatment to research and education uses or users from developing countries.

4.6 Data Use Metrics

Data use metrics should be acquired and maintained in the GCI to help GEO understand what data are being used, how they are being integrated, reused, and redisseminated, and what impact they are having in GEOSS Societal Benefit Areas and other applications. These metrics will inform future efforts for both the evolution of the GCI and the GEOSS architecture, as well as efforts to increase the accessibility and usability of GEOSS data. A key need is to demonstrate the value of full and open sharing of data and in particular the impact of data access conditions and restrictions—or their absence—on data usage and impact.

The Data Sharing Task Force welcomes comments and feedback from the GEO Community on the issues raised above and any other matters that GEO Members and Participating Organizations believe the DSTF should take into account to support the implementation of the Action Plan through the GEOSS Common Infrastructure.

Annex 5.1

Argo – Part of the Integrated Global Observation Strategy

ANNEX 5.1

ARGO – PART OF THE INTEGRATED GLOBAL OBSERVATION STRATEGY

1 BACKGROUND

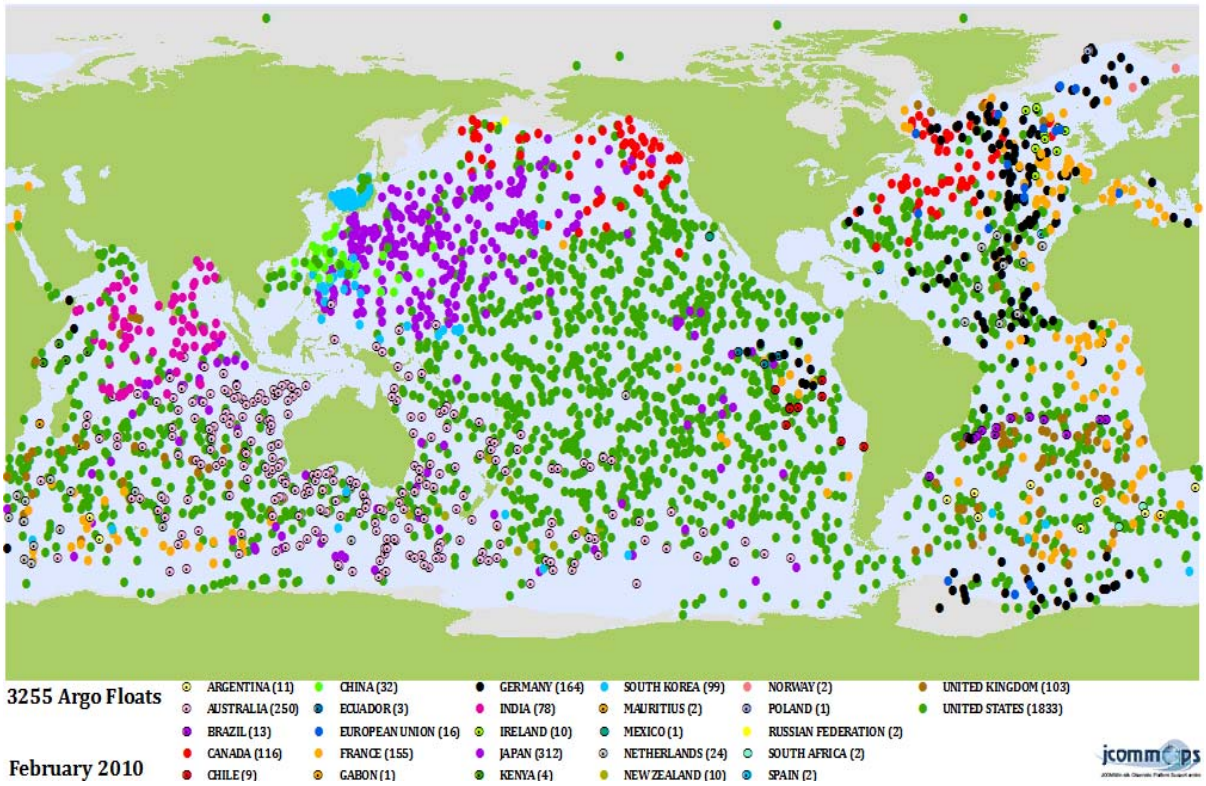
Argo is a new method of collecting information from the upper ocean using a global array of 3,000 free-drifting profiling floats that measure the temperature and salinity of the upper 2,000 meters of the ocean. This allows, for the first time, continuous monitoring of the temperature, salinity, and velocity of the upper ocean, with all data being relayed and made publicly available within hours of collection. Argo data complement other in-situ observations (many restricted to shipping routes) and data from earth-observing satellites. The main Argo data uses are in operational ocean and climate forecasting and in oceanographic and climate research.

2 PREVIOUS SITUATION

The lack of sustained observations (without temporal or spatial biases) of the oceans has hindered the development and validation of models of ocean circulation, oceanic processes (e.g., heat storage) and, subsequently, climate models. An example comes from a recent analysis which concluded that the currents transporting heat northwards in the Atlantic and influencing western European climate had weakened by 30% in the past decade. This result had to be based on just five research measurements spread over 40 years. Was this change part of a trend that might lead to a major change in the Atlantic circulation, or due to natural variability that will reverse in the future, or is it an artifact of the limited observations?

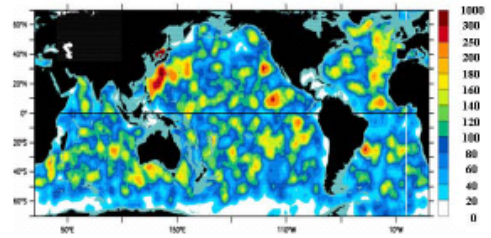
3 CHANGE IN SITUATION

In 1999, to combat this lack of data, an innovative step was taken by scientists to greatly improve the collection of observations inside the ocean through increased sampling of old and new quantities and increased coverage in terms of time and area. Argo deployments began in 2000 and by November 2007 the array attained its initial implementation goal of approximately 3000 operating floats, homogeneously distributed throughout the world's oceans. Although the designed density of coverage has not been attained, particularly in high latitudes, the global and temporal distribution of Argo data is unprecedented.

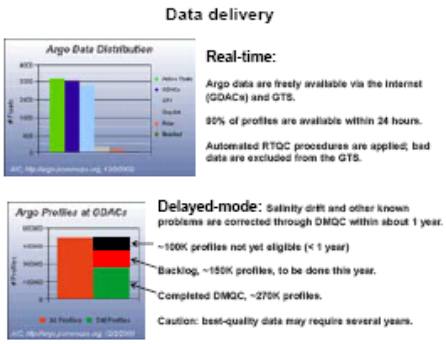


While the Argo array is currently consists of slightly more than 3000 floats, to be maintained at that level, national commitments need to provide about 800 floats per year (which has occurred for the past three years).

4 RESULTS ACHIEVED



Argo Density (% of Design) –19 April 2009



Profile Data in the World Ocean Database from the Southern Hemisphere (excluding moorings and animal-mounted sensors) as of 31 December 2009

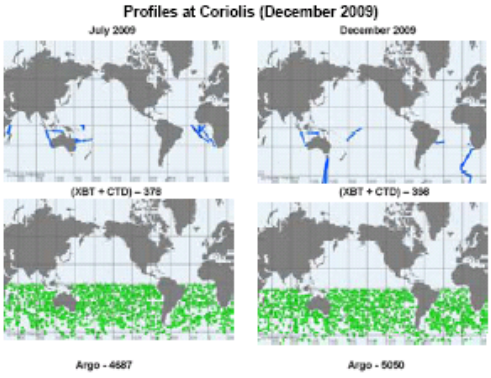
Observation	All Non-Argo	Profiling Floats
Temperature Profiles	984,438	241,131
Salinity Profiles	289,156	228,765
Salinity Profiles with Measurements Below 500 meters	153,548	271,801

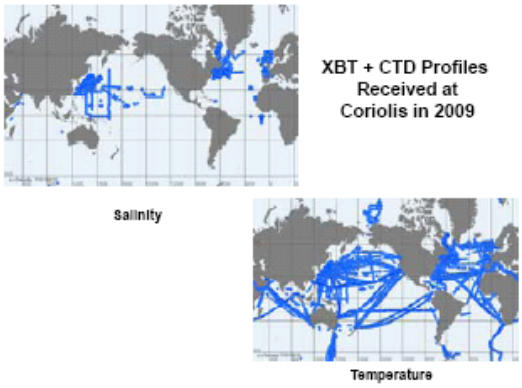
Profile Data at the Coriolis (France) Data Center

(2009 Total/Salinity: Argo – 111,825/110,079; XBT + CTD [Total/CTD] – 39,484/23,313)

Location/Month (2009)	XBT plus CTD Profiles	Argo Profiles
Global/July	4,026	9,339
Global/December	2,621	12,803
Southern Hemisphere/July (Austral Winter)	378	4,687
Southern Hemisphere/December (Austral Summer)	395*	5,050
Including and South of 30° S (July)	15	2,295
Including and South of 30° S (December)	502*	2,627

* - CTD profiles are primarily obtained by research vessels and there is a time delay in their receipt by Data Centers.





Argo is providing over 100,000 high quality profiles per year without a temporal or spatial bias to operational centers worldwide. For the first time, operational centers have data throughout the wintertime hemisphere. Argo is providing continuous data from the Southern Hemisphere, approximately 57% of the oceans.

5 BENEFITS OF CHANGE

In just four years of global coverage, Argo has provided twice as much salinity data below 500m in the Southern Hemisphere than provided by all other sources. Most temperature profile data received within hours of collection is provided by XBTs from 450 to 750 meters, Argo provides data to 2,000 m. Most non-Argo salinity data is provided by research vessels operating in limited areas of the world's oceans whereas Argo data is global.

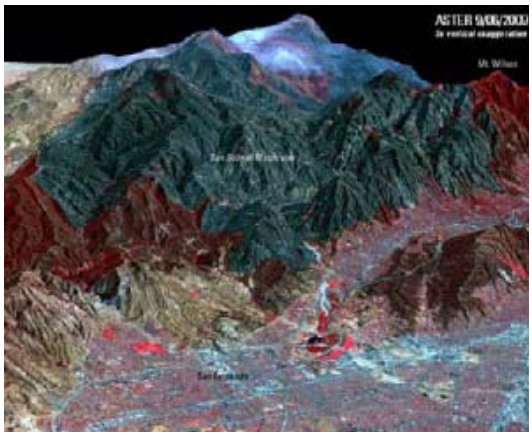
Annex 5.2

ASTER Global DEM

ANNEX 5.2

ASTER GLOBAL DEM

1 BACKGROUND



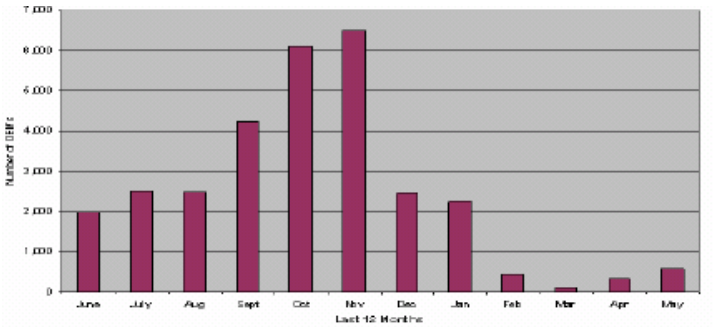
ASTER image data draped on ASTER DEM illustrating extent and topography for 2009 Station Fire, California (5X vertical exaggeration, vegetation is red, burned area dark blue-gray).

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) remote sensing instrument on the Terra spacecraft has been acquiring images of Earth since launch in 1999. Throughout this time data products have been openly available to the general public through sites in the U.S. and Japan. With the adoption of the GEOSS' data sharing principles in the recent release of the ASTER Global Digital Elevation Model (GDEM), ASTER data usage has dramatically increased worldwide.

Note: The GDEM was recently contributed by Japan's Ministry of Economy Trade and Industry (METI) and the U.S. National Aeronautics and Space Administration (NASA) to the Global Earth Observation System of Systems (GEOSS) for distribution at no cost to users.

2 PREVIOUS SITUATION

Following public release of the ASTER digital elevation model (AST14DEM) data product on March 16, 2001, there was an inability to meet customer demand promptly for these single-scene 60 X 60 km products, due to laborious manual processing steps in production. By June 2004, the lag from order to distribution was approximately four months. Responding to public interest, order backlogs were reduced significantly through increased automation on May 24, 2006, enabling a ten-fold average increase in the rate of production and improved data quality. While increased customer DEM demand at that time was evident, the overall distribution was low compared to recent Global DEM levels. After offering ASTER products at no-charge for several



Monthly LP DAAC AST14DEM distribution June 2005 through May 2006. The impact of pricing implementation in January 2006 is evident in the significantly reduced 2006 demand.

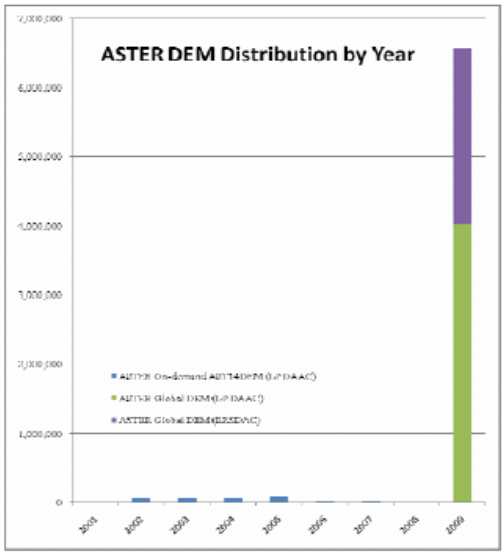
years, a charge for on-demand products, including ASTER DEMs, commenced on January 25, 2006. Subsequently, data distribution declined.

3 CHANGE IN SITUATION

As the ASTER mission matured, a spatially broad and temporally deep data archive was gradually established. With this extensive accumulation of Earth observations, it became possible to create a new global digital elevation product, the ASTER GDEM, using multi-temporal data, resulting in over 22,000 static 1^0 X 1^0 tiles. Through mutual agreement between NASA and METI, the GDEM was offered to the public at no charge from the initial release on June 29, 2009 to foster widespread use for the benefit of society. The ASTER GDEM was made available to users worldwide via electronic download from the Earth Remote Sensing Data Analysis Center (ERSDAC) of Japan and from NASA's Land Processes Distributed Active Archive Center (LP DAAC).

4 RESULTS ACHIEVED

During the first three months after product release, over 4 million GDEM tiles were distributed from the LP DAAC and ERSDAC. The ASTER GDEM release generated nearly 20,000 new user registrations in the NASA EOS ClearingHOuse (ECHO)/WIST and the ERSDAC systems.

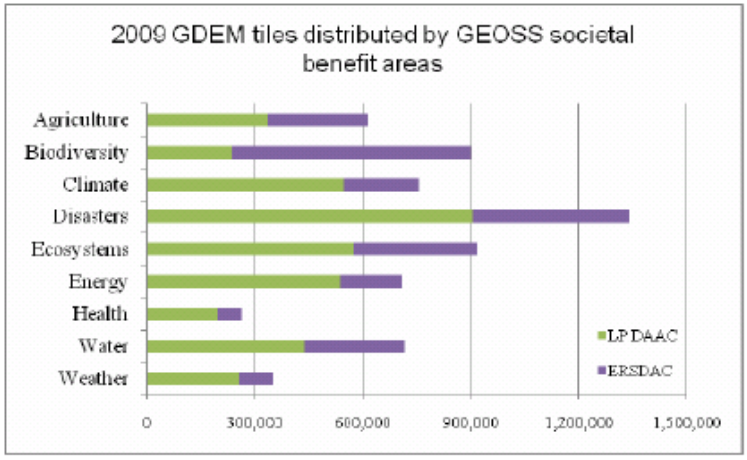


By the end of 2009, over 6.5 Million GDEM tiles were distributed by the LP DAAC and ERSDAC. Users have requested tiles over specific areas of interest as well as the entire dataset for global research. Intense global interest in the GDEM across all the GEOSS Societal Benefit Areas was shown.

The ASTER GDEM demonstrated the need and user demand for a global DEM product as well as the added benefit of not only "full and open" distribution, but "free and open" distribution.

5 BENEFITS OF CHANGE

The product improvement and free-of charge access policy changes were important contributions by the host organizations which helped researchers more readily accomplish their objectives. Strong interest was expressed by representatives from all GEOSS Societal Benefit Areas as indicated by user supplied data distribution statistics.



In addition to the typical uses of digital elevation models, the ASTER GDEM has also found applications in new frontiers. One example is Robert Bindschadler's research in Antarctica: "A good DEM is still desperately needed in these regions and ASTER has come closest to what is needed. ASTER elevation values consistently outperform most other DEMs along the edge of

Antarctica". Similarly, C. Hirt, M. S. Filmer and W. E. Featherstone commented "it is the unprecedented detail that will be beneficial for a number of applications". The availability of elevation information at high latitudes was appreciated by Jóhann Helgason of the National Land Survey of Iceland, stating that "As a relatively recent source the ASTER GDEM elevation data over Iceland has proved particularly useful for us" in assessing change in glaciers, "especially for the Vatnajokull glacier, that happens to be the biggest glacier in Europe".

The release of the global tiled research-grade DEM resulted in a significant increase in demand for ASTER elevation models, and increased awareness of related products. No cost access to these data has also promoted new applications of remotely sensed data, increasing their use across the full range of the GEOSS societal benefit areas.

In addition, the simplified data access and greatly expanded pool of users resulted in a number of suggestions from researchers in many disciplines for possible enhancements to future versions of the GDEM. A specific example concerned the use of a land/water mask in southern latitudes, while others addressed elimination of residual anomalies. These comments have been received in time for consideration by NASA, METI and the ASTER Science Team in the development of the next version of the product.

Annex 5.3

CBERS

ANNEX 5.3

CBERS

1 BACKGROUND

CBERS (China Brazil Earth Resources Satellite) is a satellite program for earth observation developed by Brazil and China in a technological-scientific cooperation. Three satellites have been launched since 1999; two more are currently under construction. CBERS data policy agreement considers that Brazil and China have autonomy to distribute data received by their respective ground stations according to their own rules.

2 PREVIOUS SITUATION

Brazil used to charge users for each CBERS-1 image requested. The user had to browse the images in a catalogue, choose those images he was interested in, fill in a request form, pay for the request and finally receive the images requested.

The number of CBERS-1 images sold was very low – less than 1,000 images/year. Even changes in price were ineffective to increase sales.

3 CHANGE IN SITUATION

For CBERS-2, Brazilian authorities concluded that the data policy should change. In general, satellites are short lived and costly, and the benefits to the society should be high and fast. In addition, for moderate resolution satellites, it is very difficult to have a direct return of investment based only on images sales. Thus, for CBERS-2 the policy changed to open and free-of-charge access to the catalogue and to the full resolution images. A new catalogue and browse system was implemented.

Following online registration using a simple and easy registration form, any user can browse the catalogue, choose as many images he wants, and download them for immediate use, with no bureaucracy and working on a simple and fast catalogue system.

4 RESULTS ACHIEVED

The distribution of CBERS data jumped to an astonishing 10,000 images/month. In the first year, more than 10,000 new users registered. Today, in Brazil, all the organizations linked to remote sensing, environment, agriculture, etc. are CBERS users. The same policy was adopted for CBERS-2B and will be adopted for CBERS-3 when it is launched. More than 600,000 CBERS-2 and 2B images have already been distributed to over 35,000 users in more than 5,000 organizations.

The same data policy has now been extended to neighboring countries under the footprint of the Cuiaba-Brazil ground station and for data acquired by CBERS around the world and archived at INPE´s catalogue.

5 BENEFITS OF CHANGE

Two surveys have been conducted in order to measure the benefits of the policy of free-of-charge access to CBERS data in Brazil.

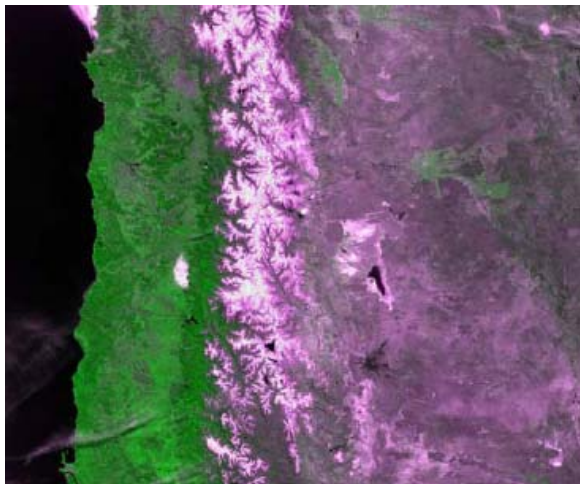
More than 98% of the users agreed with the policy of open data access. They reported that many new jobs were created because of the data policy adopted (increased number of projects, new small business, easy access to historical and current data, easy to make demonstration and proof-of-concept projects, etc.).

In addition, a significant impact was reported in the education field. In general, it is very difficult for a teacher to access remote sensing data. After the adoption of CBERS open access data, many new students could be brought to the remote sensing field. An important demonstration of the impact of the benefits of the open access data is that more than 15% of papers presented in the last two Brazilian Remote Sensing Symposia used CBERS-2 and 2B data, against less than 1% before the adoption of the open access data for CBERS.

Finally, it should be mentioned that the model of open access to this kind of remote sensing data adopted by Brazil will be adopted for next CBERS generation and has now been adopted by USGS for Landsat data.

© CBERS, 2010 (http://www.cbers.inpe.br/en/imprensa/fotografia2.htm)

CBERS-2 image of Rio de Janeiro, © CBERS, 2010
(http://www.cbers.inpe.br/download/rio_de_janeiro.jpg)



The first CBERS-2 WFI image, © CBERS, 2010
(http://www.cbers.inpe.br/_fig/cbers2_img_wfi_high.jpg

Annex 5.4

GEO Forest Carbon Tracking (FCT)

ANNEX 5.4

GEO FOREST CARBON TRACKING (FCT)

1 BACKGROUND

The GEO Forest Carbon Tracking (FCT) task goal for the demonstration phase is to produce and make available a consistent time-series of annual, border-to-border forest and carbon stocks change information products, derived from satellite data, as integrated with and validated by in situ data, across an initial set of seven 'National Demonstrator' countries (Australia/Tasmania, Brazil, Cameroon, Guyana, Indonesia/Borneo, Mexico, Tanzania).

Information products and underlying observations are expected to play a central role in the implementation of national Measurement, Reporting and Verification (MRV) Systems, constituting the basis for estimating anthropogenic forest carbon stocks and forest area changes.

Developing countries are requested to implement such MRV's from the December 2009 decision by the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), at its COP 15 meeting. A major requirement for information products and underlying observations is that they should be transparent and their results are available and suitable for review as agreed by the Conference of the Parties.

A policy of full and open access to data would certainly facilitate policy implementation.

2 PREVIOUS SITUATION

Satellite data were not recognized worldwide as a viable source of information due to a number of reasons, such as cost, operational availability, actual access to data and processing tools. This has resulted in a non-systematic use of satellite observations, thus preventing the definition of interoperability standards and relegating the use of satellite remote sensing data in the domain of research or intermittent utilisation. A clear example of the resulting impacts on users' products is that FAO is starting to make systematic use of satellite data for its global Forest Resource Assessment (FRA) for the 2010 assessment. The situation is very similar for in-situ data, the other key component

3 CHANGE IN SITUATION

GEO action has greatly contributed to accelerate developments and policy changes. CBERS data access provisions and LandSat policy change have paved the way towards the application of GEOSS data sharing principles. With some constraints and for the demonstration phase only, other satellite data are made available for FCT use (such as ALOS Palsar, ENVISAT, Radarsat, SPOT Family satellites) for medium resolution observations. Different schemes were used to ensure availability, but one is emerging for commercial satellites: Governments are making "stock" purchases of data that are made available in the context of FCT. Preparation for testing the use of GEONETCast for routine transmission of images and products is expected to improve the situation.

The same applies for in-situ data, availability could apply to all data (case of Mexico) or to subsets of national data that are necessary to get to final information products.

Those described above are still interim measures that are allowing the performance of the demonstration phase. Sustainable scenarios are being defined for the subsequent phase.

4 RESULTS ACHIEVED

Commitment from CEOS (Committee on Earth Observation Satellites) members has resulted in an unprecedented coordinated data acquisition strategy in the second half of 2009 over the seven national demonstrators and in access to data acquisition for the FCT team. Several thousand images have been made available and will continue for the next few years as an increase of national demonstrators is being planned.

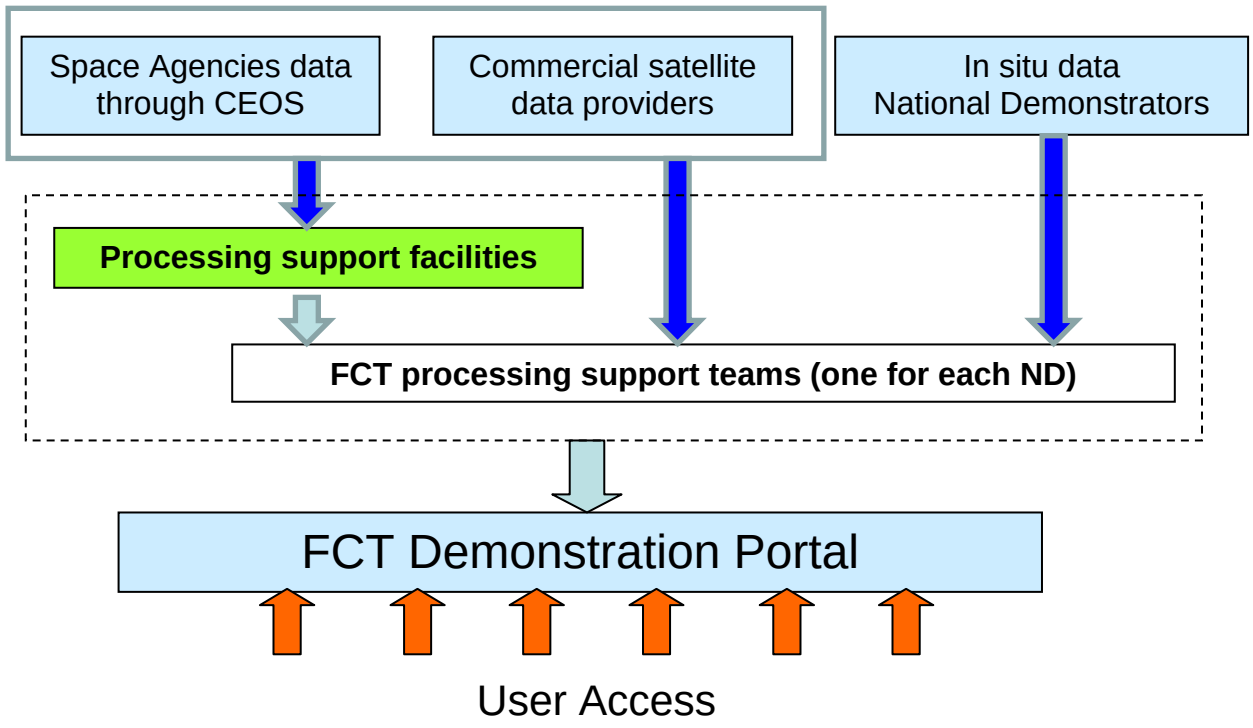
Availability of different satellite data (coherent in space and time) has also allowed the initial definition of interoperability standards.

GEO FCT has developed and put online an FCT demonstration phase Portal http://www.geo-fct.org with the main function of providing on-line access to forest information products as soon as they are developed and released by the processing teams. The FCT Demonstration Portal will also provide access to satellite and in-situ data, in compliance with provisions relevant to each dataset.

5 BENEFITS OF CHANGE

National Demonstrator countries are improving their national forest carbon monitoring capabilities. The concept of a Global Forest Monitoring Network as an integral part of GEOSS and meeting all major requirements, here including those relevant to data sharing, is shaping up.

The FCT developments and demonstrations are expected to provide substantial contribution to the implementation of National MRV systems. By implementing the GEOSS approach, benefits will be delivered in different SBA's, such as Climate, Ecosystems, Agriculture and Biodiversity.



Annex 5.5

GBIF

ANNEX 5.5

GBIF

1 BACKGROUND

The vision of Global Biodiversity Information Facility (GBIF) is to make scientific biodiversity data the common property of everyone, in service to science, the Convention on Biological Diversity[1], among other international conventions, and the public good. GBIF's fundamental operating principle is free-og-charge open access to biodiversity data. This principle has been formally adopted by the current membership of 54 countries and 44 international organizations. To date, more than 300 data publishers in the GBIF network have mobilised nearly 200 million biodiversity records that are openly accessible at http://data.gbif.org.

2 PREVIOUS SITUATION

Prior to the establishment of the GBIF network, gaining direct access in a seamless way to species occurrence data from multiple datasets distributed around the world was well nigh impossible.

3 CHANGE IN SITUATION

To encourage and help data owners to become data sharers, GBIF provides assistance in the form of freely and openly distributable software that meets community standards, helpdesk services, "how-to" manuals, training workshops, etc. It also provides straight-forward data sharing (http://data.gbif.org/tutorial/datasharingagreement) and data use (http://data.gbif.org/tutorial/datauseagreement) agreements that encourage responsible sharing and use.

Data that are made available via the GBIF network belong to the data owners and remain fully under their control. The operating principles supporting the GBIF data policy include:

- Promotion of a positive and respectful data sharing-and-use environment that benefits science and society, and contributes to a sustainable future;
- Provision of a clear statement on Intellectual Property Right (IPR) issues in the Memorandum of Understanding that is signed between GBIF and each Participant;
- Building an open access policy based on trust and goodwill;
- GBIF does not operate as a commercial enterprise;
- GBIF data-sharing services and GBIF-mediated data are global public goods.

[1] The Convention on Biological Diversity itself promotes free and open access, inviting "Parties and other Governments, as appropriate, to provide free and open access to all past, present and future public-good research results, assessments, maps and databases on biodiversity, in accordance with national and international legislation" (http://www.cbd.int/doc/decisions/cop-08/cop-08-dec-11-en.pdf)

The GBIF IPR principles as set out in the Memorandum of Understanding include:

- Access to data – all users have equal access to data in databases shared in GBIF, although they are asked to respect conditions set by data providers;
- Attribution – GBIF works to ensure that the source of data is acknowledged by users and requires that attribution is maintained in subsequent uses of the data;
- Rights – GBIF does not assert any proprietary rights whatsoever to the data in the databases that are affiliated with GBIF;
- Data collection – GBIF asks for reasonable assurance from data providers that data collection was consistent with applicable laws, regulations and requirements for prior informed consent.

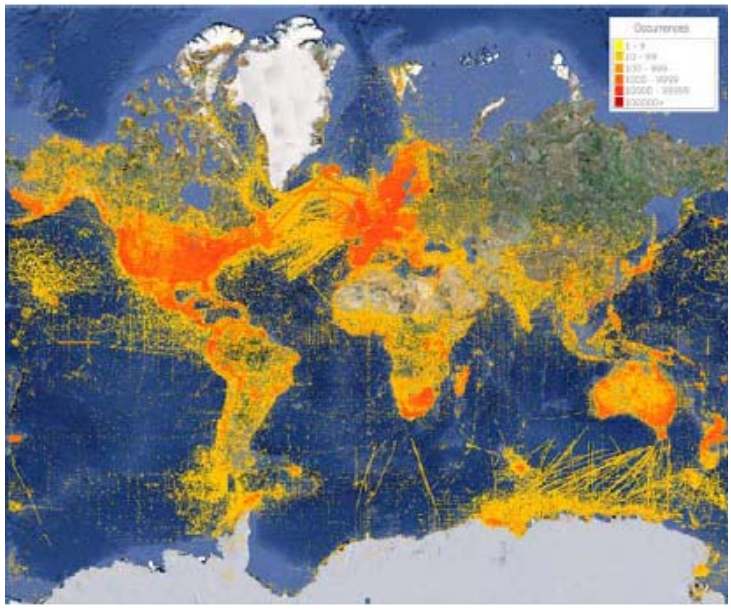
4 RESULTS ACHIEVED

GBIF's fundamental operating principle is free-of-charge and open access to Biodiversity data (http://www2.gbif.org/openen.pdf). The recognition that information technology has made the costs of sharing data marginal compared to the full costs of the research that originally generates the data provides a strong rationale for allowing further shared use, which brings many new opportunities including: fostering of new research, creation of new datasets through combination of disparate data sources, reinforcing open scientific inquiry, encouraging diversity of analysis, facilitating the testing of new or alternative hypotheses.

In December 2009, GBIF became one of the founding signatories of the Friends of the Conservation Commons, which promotes the principles of the Conservation Commons centered on Open Access, Mutual Benefit, and Rights and Responsibilities.

5 BENEFITS OF CHANGE

As of April 2010, almost 200 million occurrence records derived from over 9,800 datasets from over 300 publishers and spanning a wide range of geospatial, temporal and taxonomic coverages (albeit still with many crucial gaps) have been made available (http://www.gbif.org/participation/data-publishers/who-is-publishing/).

- 

Data repatriation to countries of origin is a particularly successful application of publishing to the GBIF network. It is well known that the greatest concentrations of biodiversity are found in developing countries but most of the data and information about it are located in developed countries. Now, countries have, through GBIF, quick and easy access to data about their own biodiversity served by institutions around the world (http://data.gbif.org/countries/datasharing).

Annex 5.6

International Polar Year

ANNEX 5.6

INTERNATIONAL POLAR YEAR

1 BACKGROUND

The International Polar Year (IPY) is a large scientific program, organized through the International Council for Science (ICSU) and the World Meteorological Organization (WMO), focused on examining a wide range of Arctic and Antarctic physical, biological and social research topics.

2 PREVIOUS SITUATION

More than any other international program, IPY emphasized interdisciplinary study which raised the issue of interdisciplinary data access (format, access, distribution, etc). Unfortunately, very little data generated in previous IPYs (1882, 1932-33 and 1957-58) remain. In addition, assessing polar environmental change using comparable data from previous IPY is very limited if not impossible. To ensure this legacy, data must be readily accessible and preserved in accordance with international standards* and must be fully documented so that future users can assess the nature of the observations and quality of the data to guarantee consistent analysis.

* http://www.earthzine.org/2008/03/27/securing-the-legacy-of-ipy/

3 CHANGE IN SITUATION

Recognizing that the production, management, and dissemination of scientific data and information have become increasingly critical functions within the scientific research enterprise an IPY Data Policy has been adopted for the 2007-2008 program which all IPY projects have agreed to adhere to. The objective of this policy is to ensure "the security, accessibility and free exchange of relevant data that both support current research and leave a lasting legacy". Key requirements of the policy include:

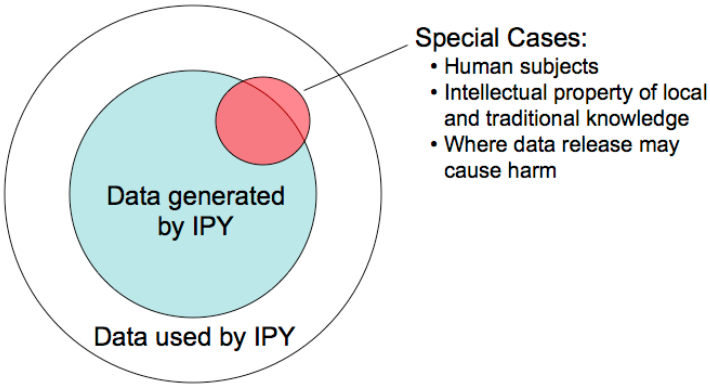
- full, unrestricted, open and timely release of IPY data (with limited exceptions*);
- deposit of basic descriptive metadata in an internationally recognized, standard format to an appropriate catalog or registry;
- formal acknowledgement of data authors (contributors) and sources.

In addition to the data policy, the IPY Data Policy and Management subcommittee has defined a core set of information necessary to describe each IPY data set and allow simple discovery across disciplines. This core set of information was defined as the IPY Metadata Profile. All data registries and repositories collecting data and metadata from IPY projects are required to collect and share sufficient information to adhere to the IPY Metadata Profile requirements.

IPY Data Policy: http://classic.ipy.org/Subcommittees/final_ipy_data_policy.pdf

IPY Metadata Profile: http://ipydis.org/data/metadata.html

* A subset of data both generated and used by IPY needed special policy and access considerations because they were legitimately restricted in some way.



4 RESULTS ACHIEVED

Although there is no single or comprehensive IPY data system, IPY investigators are making their data available through a network of existing and specially funded data centers, repositories, and distribution systems including project web sites. The IPY Data and Information Service (IPYDIS) is the main portal for information, IPY data and other data sources. It is a global partnership of data centers, archives, and networks working to ensure proper stewardship of IPY and related data. IPYDIS contains the data contributed by all IPY-registered projects world-wide.

To be recognized as a formal IPY Data Repository, the repository must:

- contain data collected as part of IPY and specifically identify those data as IPY data;
- provide continual access to IPY data;
- ensure the long-term preservation of IPY data either at the repository or through a formal plan to transition the data to a suitable long-term repository;
- adhere to the IPY Data Policy;
- adhere to standards and guidelines developed by the IPY Data Policy and Management Subcommittee, including the IPY Metadata Profile.

IPY Data System: http://ipydis.org/index.html

5 BENEFITS OF CHANGE

- Increased collaborative scientific research in Polar Regions;
- Enhanced capacity for polar science and strengthened capacity in the North;
- Allowed unprecedented access to data and information;
- Showcased space science and technologies.


International Polar Year
Data and Information Service
Site Search
Search
Community
Data
Support
About
The International Polar Year Data and Information Service (IPYDIS) is a global partnership of data centers, archives, and networks working to ensure proper stewardship of IPY and related data. The National Snow and Ice Data Center acts as a coordination office for the IPYDIS to ensure the long term preservation and broad, interdisciplinary, and non-expert access to IPY data. Another coordination office focused on near-real time and operational data streams is based at the Norwegian Meteorological Institute. Other national and international coordination offices are also being established.
Photo © Bjørn Anders Worren
Through these Data Coordination Offices, the IPYDIS plans to visibly track the data flow for IPY. To help with this effort, IPY Project coordinators are asked to provide ipydis@ipydis.org with a data management point of contact and information about data archiving arrangements. This is essential to identifying IPY data repositories and other IPYDIS participants. Please see the Data section of this site for more information about registering and accessing IPY data.
IPYDIS News
See Also
IPY Home Page
IPY Data Policy (PDF file, ~110 KB)
IPY Publications Database
IPY Discussion Forum
IPYDIS Wiki

Annex 5.7

Landsat

ANNEX 5.7

LANDSAT

1 BACKGROUND

The Landsat Program is a joint effort of the U.S. Geological Survey (USGS) and National Aeronautics and Space Administration (NASA) to gather Earth resource data using a series of land observing satellites. Whereas NASA's role is the development and launch of Earth observing instruments and spacecrafts, the USGS is responsible for flight operations, maintenance, and management of all ground data reception, processing, archiving, product generation, and distribution. A primary objective of the Landsat Program is to ensure a collection of consistently-calibrated Earth imagery. Today, the Landsat Project at USGS manages two active satellites – Landsat 5 and Landsat 7 – and the entire historic archive of data collected since 1972 – more than 2.4 million images.

2 PREVIOUS SITUATION

Landsat 1 was launched on July 23, 1972. Subsequent Landsat missions have continually acquired data from around the globe. Scientists, educators, and the public have used these data for a wide-ranging array of activities, from disaster relief efforts to the placement of cell phone towers. The USGS previously charged nominal fees for Landsat data, which proved to be a barrier to the use of the 38+-year archive of more than 2.4 million images. A recent USGS policy change enabled Landsat data to be distributed at no charge via the internet. Before the policy change, the highest year of distribution was in US Fiscal Year 2001, when approximately 25,000 scenes were delivered. New web-based technology has made Earth observation data easily accessible to all interested people.

3 CHANGE IN SITUATION

Since October 2008, a change in data policy has enabled Landsat satellite data to be distributed via the internet to users all over the world, at no cost. The USGS is allowing all people to discover, use, and learn from these observations by creating "archives without walls"; and as a result, more than 2 million Landsat images have been delivered to customers. This 2 million scene distribution represents a fifty-fold increase in Landsat scenes – a major USGS contribution to the global user community.

> *"The opening of the Landsat archive to free, web-based access is like giving a library card for the world's best library of Earth conditions to everyone in the world."*
>
> - Adam Gerrand, UN Food and Agriculture Organization

4 RESULTS ACHIEVED

More Landsat data has been processed and distributed this year than in the entire history of U.S. Landsat missions. Particularly exciting is the fact that the oldest data in the archive, from more than 38 years ago, are being downloaded at unprecedented levels. Each Landsat image covers more than 12,000 square miles. There are approximately 57.5 million square miles of land mass on Earth. Two million Landsat scenes represent more than 24 *billion* square miles, which would cover the Earth's landmasses more than 400 times!

5 BENEFITS OF CHANGE

Free-of-charge Landsat data enable richer and more complex research, and further encourage new communities to explore uses for these data. As archived data have become openly available, preliminary evaluations their delivery indicate a sevenfold increase in the scientific and educational users of Landsat.

Annex 6

Definitions, Sources, References Used within Implementatin Guidelines for the GEOSS Data Sharing Principles

ANNEX 6

DEFINITIONS, SOURCES, REFERENCES USED WITHIN IMPLEMENTATION GUIDELINES FOR THE GEOSS DATA SHARING PRINCIPLES

1 ATTRIBUTION (SEE CITATION) (REF. REDISTRIBUTION)

- The ascribing of a work to a particular author. (Webster's Ninth New Collegiate Dictionary);
- The act of establishing a particular person as the creator of a work. (The Free Dictionary, Answers.com Dictionary).

2 CAPACITY BUILDING

Capacity building often refers to assistance which is provided to entities, usually developing country societies, which have a need to develop a certain skill or competence, or for general upgrading of performance ability. Most capacity is built by societies themselves, sometimes in the public, sometimes in the non-governmental and sometimes in the private sector. Many international organizations, often of the UN-family, have provided capacity building as a part of their programmes of technical cooperation with their member countries. Bilaterally funded entities and private sector consulting firms or non-governmental organizations, called (NGOs) have also offered capacity building services. Sometimes NGOs, in developing countries are themselves recipients of capacity building.

Capacity Building is, however, not limited to international aid work. More recently, capacity building is being used by government to transform community and industry approaches to social and environmental problems. (The Free Dictionary)

3 CITATION

A quoting of an authoritative source for substantiation. A source so cited; a quotation. (The Free Dictionary)

4 DATA

Data referred here in the context of GEOSS data sharing means all Earth observation data, in-situ data, spatial and non-spatial data.

5 DATA DEMOCRACY

A GEO Task concerned with free-of-charge and open distribution of data and associated services, especially focused on usability by Developing Countries.

6 DEVELOPING COUNTRY

Developing country is a term generally used to describe a nation with a low level of material well being. There is no single internationally-recognized definition of developed country, and the levels of development may vary widely within so-called developing countries, with some developing countries having high average standards of living.

Some international organizations like the World Bank use strictly numerical classifications. The World Bank considers all low- and middle- income countries as "developing". In its most recent classification, economies are divided using 2008 Gross National Income per capita. In 2008, countries with GNI per capita below US$11,905 were considered developing. Other institutions use less specific definitions.

Countries with more advanced economies than other developing nations, but which have not yet fully demonstrated the signs of a developed country, are grouped under the term **newly industrialized countries**.

Kofi Annan, former Secretary General of the United Nations, defined a developed country as follows. "A developed country is one that allows all its citizens to enjoy a free and healthy life in a safe environment."[8] But according to the United Nations Statistics Division,

There is no established convention for the designation of "developed" and "developing" countries or areas in the United Nations system.

And it notes that:

The designations "developed" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process.

(Wikipedia)

7 EDUCATION (SEE FAIR USE)

The activities of educating or instructing; activities that impart knowledge or skill. Knowledge acquired by learning and instruction. The gradual process of acquiring knowledge (http://wordnetweb.princeton.edu/perl/webwn?s=education)

8 FAIR USE

One of the rights accorded to the owner of copyright is the right to reproduce or to authorize others to reproduce the work in copies or phonorecords. This right is subject to certain limitations found in sections 107 through 118 of the copyright law (title 17, U. S. Code). One of the more important limitations is the doctrine of “fair use.” The doctrine of fair use has developed through a substantial number of court decisions over the years and has been codified in section 107 of the copyright law.

Section 107 contains a list of the various purposes for which the reproduction of a particular work may be considered fair, such as criticism, comment, news reporting, teaching, scholarship, and research. Section 107 also sets out four factors to be considered in determining whether or not a particular use is fair:

The purpose and character of the use, including whether such use is of commercial nature or is for nonprofit educational purposes

- The nature of the copyrighted work;
- The amount and substantiality of the portion used in relation to the copyrighted work as a whole;

- The effect of the use upon the potential market for, or value of, the copyrighted work.

The distinction between fair use and infringement may be unclear and not easily defined. There is no specific number of words, lines, or notes that may safely be taken without permission.

(U.S. Copyright, http://www.copyright.gov/fls/fl102.html)

9 FREE AND UNRESTRICTED

THE CONGRESS…Urges Members to:

(1) Strengthen their commitment to the free and unrestricted exchange of meteorological and related data and products;

"Free and unrestricted" means non-discriminatory and without charge [Resolution 23 (EC-XLII) — Guidelines on international aspects of provision of basic and special meteorological services]. "Without charge", in the context of this resolution means at no more than the cost of reproduction and delivery, without charge for the data and products themselves

From Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities

Ref Resolution 23 (EC-XLII) — Guidelines on international aspects of provision of basic and special meteorological services

10 FULL AND OPEN

Data, metadata and products made available through GEOSS are made accessible with minimal time delay and with as few restrictions as possible, on a nondiscriminatory basis, at minimum cost for no more than the cost of reproduction and distribution.

(Implementation Guidelines for the GEOSS Data Sharing Principles, November 2009).

11 INFORMATION

Data that have become meaningful as a result of collection, processing, organization, and interpretation, in light of some hypothesis.

(Bits of Power; issues in Global Access to Scientific Data, National Research Council, National Academy of Sciences, USA, 1997.

12 LIABILITY

Something for which one is liable; an obligation, responsibility, or debt. (The Free Dictionary).

13 PUBLIC GOOD

- The general welfare of the people; the best interests of the community. (http://en.wiktionary.org/wiki/public_good);
- Item whose consumption is not decided by the individual consumer but by the society as a whole, and which is financed by taxation. A public good (or service) may be consumed without reducing the amount available for others, and cannot be withheld from who do not pay for it. Public goods (and services) include economic statistics and other information, law-and-

order enforcement, national defense, national parks, etc. No market exists for such goods, and they must be provided to everyone by the government. (BusinessDictionary.com);

- A good or service that is provided to the public without profit. (http://libraryclass103.wordpress.com/2009/01/20/definitions-set-1/);
- As understood in economic theory, ' a public good is a good or service for which it is impossible or undesirable for reasons of efficiency to charge customers a price or a user fee for services rendered. Public goods are therefore frequently provided by Government and paid for out of tax or other general revenues. Examples of public goods are streets and highways, national defense, parks and recreational areas, police services, general weather forecasts, and various informational services. (Remote Sensing and the Private Sector: Issues for Discussion,

14 PUBLIC INTEREST

14.1 Definition

Welfare of the general public (in contrast to the selfish interest of a person, group, or firm) in which the whole society has a stake and which warrants recognition, promotion, and protection by the government and its agencies. Despite the vagueness of the term, public interest is claimed generally by governments in matters of state secrecy and confidentiality. It is approximated by comparing expected gains and potential costs or losses associated with a decision, policy, program, or project. (BusinessDictionary.com).

15 PUBLICLY FUNDED

See ***Research data from public funding***

16 REDISTRIBUTION

Distributing again; the act or instance of distributing or the state or manner of being distributed again. (The Free Dictionary).

17 RESEARCH (SEE FAIR USE)

Systematic investigation to establish facts or principles or to collect information on a subject. (The Free Dictionary).

18 RESEARCH DATA FROM PUBLIC FUNDING

Research data from public funding is defined as the research data obtained from research conducted by government agencies or departments, or conducted using public funds provided by any level of government. Given that the nature of "public funding" of research varies significantly from one country to the next, these *Principles and Guidelines* recognise that such differences call for a flexible approach to improved access to research data. –

From OECD PRINCIPLES AND GUIDELINES FOR ACCESS TO RESEARCH DATA FROM PUBLIC FUNDING – © OECD 2007