WHITE PAPER ON THE GEOSS DATA SHARING PRINCIPLES
[Review Draft]

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CONTENTS

I. INTRODUCTION

The World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 highlighted the urgent need for coordinated observations of the Earth in support of sustainable development. At the first Earth Observation Summit in Washington, DC in 2003, representatives of 33 countries, the European Commission and more than 20 international organizations affirmed the need for a comprehensive, coordinated, and sustained system of Earth observing systems and established the *ad hoc* intergovernmental Group on Earth Observations (GEO), co-chaired by the European Commission, Japan, South Africa, and the United States. In February 2005, GEO adopted the Global Earth Observation System of Systems (GEOSS) *10-Year Implementation Plan*, which establishes the intent, operating principles, and institutions relating to GEOSS [GEOSS, 2005].

The purpose and vision for GEOSS 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." GEOSS is seen as an important contribution to meeting the Millennium Development Goals and to furthering the implementation of international treaty obligations. GEOSS will encompass all areas of the Earth, with a particular emphasis on addressing the needs of developing country users. GEOSS will incorporate *in situ*, airborne, and space-based observations and address the integration of observations with models to support early warning and prediction. It is anticipated that GEOSS will focus initially on information needs in nine societal benefit areas, ranging from disaster management to sustainable agriculture to climate variability and change.

Consistent with these goals, GEOSS also has a role in raising awareness of the need for more Earth observation efforts and in promoting better use for decision-making and in promoting societal benefits. GEOSS, as a coordinated effort, is expected to help avoid unnecessary duplication of effort, to identify major data and information gaps, and assist

governments and Participating Organizations in planning new investments in the sharing of Earth observation and other related data.

The GEOSS *10-Year Implementation Plan* explicitly acknowledges the importance of data sharing in achieving the GEOSS vision and anticipated societal benefits. The Plan, endorsed by nearly 60 governments and the European Commission at the Third Earth Observation Summit in Brussels, highlights the following GEOSS Data Sharing Principles:

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

All new members of GEO are required to endorse the Plan and therefore these Principles. The Plan notes that "use of data or products does not necessarily imply agreement with, or endorsement of the purpose behind the gathering of such data."

In 2006, GEO established Task DA-06-01, "Furthering the Practical Application of the Agreed GEOSS Data Sharing Principles," and invited GEO Members and Participating Organizations to help implement the task. The International Council for Science (ICSU), working through its interdisciplinary committee, the Committee on Data for Science and Technology (CODATA), agreed to lead this task, under the auspices of the GEO Architecture and Data Committee. In October 2006, in conjunction with the 20th International CODATA Conference in Beijing, CODATA convened a meeting of experts

to discuss the data sharing task and associated implementation issues [see: http://www.codata.org/GEOSS/DA-06-01MeetingBeijingOct2006review.pdf]. This meeting provided important inputs into the structure and content of this *White Paper and Implementation Guidelines for the GEOSS Data Sharing Principles*.

Following the experts meeting, CODATA developed an international team of authors and reviewers to draft and refine the White Paper, and to coordinate its activities with various GEO Committees and the GEO Secretariat. The names of the individuals on the drafting and review groups, as well as of other experts who have contributed to the White Paper are provided in Appendix A. It should be noted that all the authors and contributors involved in this activity did so in their personal capacities and not as representatives of their employing organizations. The References supporting the analysis in this report are provided in Appendix B. The White Paper was also formally reviewed by representatives of many GEOSS Members, Participating Organizations, and Committees in the summer of 2007, and by the Architecture and Data Committee at its September 2007 meeting. The White Paper was then provided for information to GEOSS Members and Participating Organizations at the GEO Plenary and Ministerial Summit in Cape Town, South Africa in November 2007, and discussed in a side event organized by CODATA during that time. Since then the White Paper has undergone a series of more formal reviews within the GEO community and all the submitted comments and the authors' response to them are contained in Appendix E.

GEOSS is envisioned as a "system of systems," built upon existing observational systems and incorporating new systems for Earth observation and modeling that are offered as GEOSS components by Member countries and Participating Organizations. Developing technical interoperability between such diverse systems is clearly a major challenge, but an equally important challenge is the coordination and harmonization of data policies and procedures to facilitate the sharing and use of GEOSS data to maximize societal benefits for the widest possible range of users. Inconsistent or vague data policies and procedures

could hamper the rapid dissemination and flexible use of data and information needed for mission-critical and/or life-threatening GEOSS applications. Restrictive policies on data reuse and re-dissemination would significantly reduce the net return on investment of public funds in Earth observations and lead to unnecessary and wasteful duplication of effort. Excessive charges for data would pose substantial barriers to many users, especially those in developing countries, who may have no or few alternative sources for data.

This White Paper reviews the background issues for implementing the GEOSS Data Sharing Principles and recommends Implementation Guidelines to ensure the strongest possible framework for data sharing, consistent with both the spirit and the "letter" of the Principles. As recognized by the *10-Year Implementation Plan*, "ensuring that such information is available to those who need it is a function of governments and institutions at all levels." It is therefore incumbent on governments and institutions participating in GEOSS to continue to develop and implement appropriate policies and procedures that enable and support the GEOSS Data Sharing Principles in fair and effective ways. The Implementation Guidelines recommended here are intended to facilitate this process.

The long-run success of GEOSS is likely to be contingent upon the manner in which the visionary GEOSS Data Sharing Principles are implemented, both by the individual elements of GEOSS and by the GEO overall. Although it is apparent that no single set of rules will apply to all types, sources, and uses of data, a clear set of guidelines, definitions, and minimum expectations should help to improve the sharing of data within GEOSS and facilitate the application of GEOSS data by diverse users in the key societal benefit areas. Such guidelines should also provide useful inputs into the technical evolution of GEOSS, such as in the area of automated digital rights management and the development of appropriate metrics.

II. OVERVIEW OF DATA SHARING LAWS, PRINCIPLES, AND POLICIES

A. Introduction

As the GEOSS Data Sharing Principles make clear, there is a consensus among the GEOSS Members and Participating Organizations that data, metadata, and products that they make available through GEOSS need to be shared and exchanged on a "full and open" basis, with minimum time delay and minimum cost. "Full and open exchange" has been defined as "data and information derived from publicly funded research are made available with as few restrictions as possible, on a nondiscriminatory basis, for no more than the cost of reproduction and distribution" [NRC, 1997]. This definition is adapted from a principle for access to data from global change research that was first articulated as part of the U.S. Global Change Research Program [OSTP, 1991]. The cost of reproduction and distribution, or the marginal cost of fulfilling a user request, on the Internet is either very small or zero. This policy has been used in various international and national environmental projects and in environmental (and other) research over the past two decades. Although intended primarily for data from publicly-funded research, the policy as defined can have broad applicability to other types of public data relevant for inclusion in the GEOSS data system. Moreover, there is an emerging international consensus that openness as the default rule for government data and information—free online and unrestricted in its use—provides the greatest return on the public investments in them and serves the public interest.

At the same time, the diversity of data and data sources expected to be made available through GEOSS makes data sharing difficult and uncertain in various contexts. Different data policy frameworks have evolved for different types of data, including research

versus operational data, space-based versus *in situ* data, and data collected by public versus private organizations. Nations have developed different approaches to the ownership and use of publicly generated or funded data. When "raw", that is unprocessed, data are transformed into value-added data and information, differing intellectual property laws may be applicable. Divergent policies may also apply to data used in legal or regulatory processes (i.e., electronic records) versus data collected for other purposes such as scientific research.

Further, the sharing of GEOSS data will in some cases be subject to important exceptions such as the protection of national security, privacy and confidentiality, indigenous rights, and threatened ecological and cultural resources. By "recognizing relevant international instruments and national policies and legislation," the Data Sharing Principles clearly allow for exceptions to "full and open exchange of data, metadata, and products shared within GEOSS." Good faith efforts to limit the scope and application of exceptions are necessary to avoid the development of a complex patchwork of rules that will inhibit desirable uses of data and that will, in the end, fail to provide the desired protections.

Because of the very broad scope of potential GEOSS data and their applications there are many international and national laws, principles, and policies that may be applicable. This chapter begins by examining the variety and complexity of those authoritative sources, with particular focus on policies that promote the open availability, or full and open exchange of data relevant to GEOSS. The underlying rationales for making the data as broadly shared and with the least number of restrictions are then presented, dividing the issues between data that are generated by governments, by other entities with a mix of public and private funding, and by the private sector. Particular attention is devoted to the special status of research, educational, and developing country users. The chapter concludes with an overview of the various legal and policy exceptions to data sharing, which must be taken into account by the contributors to the GEOSS data system.

B. International and Regional Sources of Law, Principles, and Policies

The sources of laws, principles, policies, and definitions of key terms that are relevant to the GEOSS Data Sharing Principles are summarized in this section. They are presented roughly in the order of their importance to topic; that is, from international to regional to national, from specific to general, and in terms of their legal and normative effect.

It is difficult to cover all of the international sources of law, principles, and policies that have some relevance to GEOSS data sharing. These include intellectual property treaties and other types of conventions that carry the greatest legal force and binding commitments for the signatories; international remote sensing principles and policies; United Nations resolutions and declarations; the policies of UN Specialized Agencies and other intergovernmental organizations; public international data system and research program policies; and many regional agreements, laws, and policies, notably within the European Union. These may be characterized in two broad categories: those that are directly relevant to the subject matter areas of the GEOSS data sources and those that address broader information law and policy principles. The examples provided below are not comprehensive, but are intended to identify some of the more important sources of policy in support of the GEOSS data sharing principles.

1. Treaties

There are numerous treaties that cover data and information rights or data sharing obligations or restrictions in specific geographic or subject matter contexts. The various intellectual property conventions are especially important. Copyright treaties [e.g., WIPO Berne Copyright Convention, 1976, and WIPO Copyright Treaty, 1996] and their national legislative implementations (UNESCO, 2004) treat rote, factual compilations that lack creativity or originality in their selection or arrangement, particularly raw data streams, as not copyrightable. The data in those databases are in the public domain and can be used and shared freely, once lawfully accessed. However, as data become more

processed and have added value, they may become protectable under copyright law, depending on the particular jurisdiction.

Treaties concerning the environment—the Antarctic Treaty, Convention on the Law of the Sea, Ozone Protocol, Convention on Biodiversity, and the Aarhus Convention, to name but a few that have a strong connection to GEOSS—have various data and information access and sharing provisions as well. To the extent that nations participating in GEOSS are also parties to these various treaties, the agreements impose binding commitments on them with regard to the data gathered and used in those contexts.

2. International remote sensing principles, policies, and definitions

Many, but by no means all, sources of GEOSS data will be from various remote sensing satellite systems. At the global level, there are three main sources of remote sensing data principles and policies relevant to GEOSS: the *UN Principles Relating to Remote Sensing of Earth from Space* ("UN Remote Sensing Principles"; UNGA, 1986); the international *Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters* ("Charter on Space and Disaster Cooperation"; International Charter, 2000); and two sets of principles developed by the Committee on Earth Observation Satellites (CEOS). The CEOS Principles are the *Satellite Data Exchange Principles in Support of Global Change Research* ("CEOS Global Change Principles"; CEOS, 1991), plus a 1992 elaboration; and the *Satellite Data Exchange Principles in Support of Operational Environmental Use for the Public Benefit* ("CEOS Public Benefit Principles"; CEOS, 1994). These principles apply to all civil government remote sensing satellite data and some nations interpret and apply the principles to private system data as well. Although these international instruments do not have the binding force of law on the parties to GEOSS as do treaties and national legislation, they provide some of the most directly relevant guidance and normative values to the implementation of the GEOSS Data Sharing Principles, as well as useful definitions of key terms.

The UN Remote Sensing Principles. These are the first and foundational source of policy guidance for remote sensing activities. They are contained in a 1987 General Assembly Resolution and cite provisions of the 1967 Outer Space Treaty. That treaty mandates that outer space is the "province of all mankind" and requires that the exploration and use of space be for the benefit of all nations, regardless of their degree of economic or scientific development (UN, 1967).

The UN Remote Sensing Principles address access and distribution of data and information generated by civilian remote sensing systems. “Primary data” are defined as the raw data delivered in the form of electromagnetic signals, photographic film, magnetic tape, or any other means. “Processed data” are the products resulting from processing primary data, and analyzed information means information resulting from interpreting processed data. “Remote sensing activities” include operations, data collection, storage, processing, interpretation, and dissemination.

The UN Remote Sensing Principles set a standard of international cooperation among states operating remote sensing systems (sensing states) and states whose territory is being observed (sensed states), while attempting to achieve a balance between the rights and interests of both groups. On the one hand, sensing states agree to avoid harm to sensed states and to provide them with access to primary data and processed data concerning their own territory on a nondiscriminatory basis. Analyzed information available to sensing states is also to be available to the sensed states on the same basis and terms. On the other hand, sensed states are required to pay reasonable cost terms and do not have access to analyzed information that is otherwise not legally available to them (e.g., proprietary information).

The needs of the developing nations, however, are to be given special regard. Sensing states are encouraged to provide cooperative opportunities to such nations in a wide array of activities, ranging from data collection to establishing and operating storage stations and processing facilities. If requested, a sensing state must consult with a sensed state to

make available opportunities for participation. Regional agreements are preferred wherever feasible.

The UN Remote Sensing Principles specifically promote protection of the Earth's environment and of humanity from natural disasters. States participating in remote sensing activities that possess information useful for averting harmful phenomena are required to disclose the information to concerned states. If the potential harm threatens people, the obligation to disclose such information requires promptness and extends not only to the primary data, but to processed data and analyzed information.

The Charter on Space and Disaster Cooperation. Following the 1999 UNISPACE III conference held in Vienna, the space agencies of some major space faring countries initiated the international Charter on Space and Disaster Cooperation, which was later opened to a number of other types of participating organizations. The agreement became operational in 2000. It authorizes a broad range of participants beyond Nation-States to enable pragmatic responses to a disaster by the entities most qualified to do so, such as, rescue and civil protection, defense and security, or other services. A “disaster” includes natural and technological causes. Resources that are to be made available under the Charter include data, information, and facilities. There are definitional differences for “data” and “information” in the Charter as in the UN Remote Sensing Principles. In the Charter “space data” are narrowly defined as “raw data gathered by a space system”, controlled or accessed by a party, and transmitted or conveyed to a ground station. “Information” is data that have been corrected and processed by the parties using an analysis program, in preparation for crisis management use by associated bodies to aid beneficiary bodies. Information “forms the basis for extraction of products on location”. The Charter on Space and Disaster Cooperation and the UN Remote Sensing Principles also reinforce each other: the purpose of the Charter is to serve populations in great distress from a disaster involving loss of human life caused by a natural phenomenon (or a technological source), while the UN Remote Sensing Principles promote protection of the environment and human life from natural disasters. The Charter’s purview goes beyond remote sensing systems by defining “space facilities” as consisting of a wide

range of functions, including space systems for observation, meteorology, positioning, telecommunications, and TV broadcasting.

The CEOS Global Change Principles. These Principles affirm the value of investments made by governments and international organizations in Earth observation programs, and that both data providers and users should respect these investments. They also recognize the importance of using appropriate legal mechanisms for the exchange of remotely sensed data. The principles are as follows: global change research requires the preservation of data and easily accessible archives that include information for locating and obtaining data; the greatest use possible of international standards for storing, recording, processing and communicating data; maximizing satellite data use is a "fundamental objective" which requires the "first step" of exchange and sharing mechanisms; nondiscriminatory access is "essential"; there should be no exclusive periods of use for programs except for validations; and priorities for acquisition, archiving and purging should be harmonized. The CEOS Global Change Principles also urge the signatories to adopt the following practices: data suppliers should submit standard product catalogs; international research programs should identify data requirements; researchers need to be chosen through peer review; and written agreements (including the protection of data rights and requirements for publication) need to be signed by selected researchers and their sponsoring institutions; and data must be shared [at a minimum] among selected users.

The CEOS Public Benefit Principles. This document specifically anticipates the emerging operational requirements for global Earth observing systems. The principles apply to satellite, in situ and airborne data and focus on data acquisition, processing, and other functions as they relate to operational environmental use for the public benefit. Both real time and archived data should be available on time scales compatible with user requirements; data suppliers should supply metadata; commons standards should be used to the greatest extent possible for recording, storing, processing and communicating data; there should be no exclusive periods of data use, except for validation and the limited period should be limited and explicitly defined. "Nondiscriminatory" is defined as "all

users in a clearly defined category" who "obtain data on the same terms and conditions". "Real time" is defined as "making data available by direct broadcast or immediately after acquisition and/or initial processing."

3. United Nations Declarations and Resolutions

The provision of broad access to environmental data about the Earth has a high scientific, technological, and political profile within the United Nations system and in other major fora. Notably, the World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002, and recent meetings of the G8 Ministers have emphasized the need for the international community to monitor the environment, improve our knowledge and understanding of environmental processes and be able to predict future changes. At the WSSD, the participating nations issued a Declaration that recognized the need to support "the exchange of observations recorded from *in situ*, aircraft, and satellite networks, dedicated to the purposes of this Declaration, in a full and open manner with minimum time delay and minimum cost, recognizing relevant international instruments and national policies and legislation" [UN, 2002].

The concern for access to public information, in general, and to environmental information, in particular, was also recognized in the World Summit on the Information Society in 2003: "…the sharing and strengthening of global knowledge for development can be enhanced by removing barriers to equitable access to information for economic, social, political, health, cultural, educational, and scientific activities and by facilitating access to public domain information, including by universal design and the use of assistive technologies" [WSIS, 2003].

The United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Recommendation Concerning the Promotion and use of Multilingualism and Universal Access to Cyberspace [UNESCO, 2003], also strongly encouraged government bodies in

Member States to "develop public domain content" and provided guidance on the implementation of that objective.

4. Policies of UN Specialized Agencies and other intergovernmental organizations

The UN Specialized Agencies, such as the World Meteorological Organization (WMO), the World Health Organization (WHO), the United Nations Environment Programme (UNEP), and UNESCO, among others, have a variety of data programs and policies, some of which provide broad international access to that information. CODATA has a compilation of many of these intergovernmental and international organization policies through the year 1999 available online at

http://www.codata.org/data_access/policies.html.

For example, the WMO's World Weather Watch pools meteorological data from around the world and makes it broadly available. WMO Resolution 40 is an important data policy to which many GEOSS Members adhere and is worthwhile to reproduce in relevant part here:

> As a fundamental principle of the World Meteorological Organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted [see definition below] international exchange of meteorological and related data and products;
> Adopts the following practice on the international exchange of meteorological and related data and products:
> (1) Members shall provide on a free and unrestricted basis essential data and products which are necessary for the provision of services in support of the protection of life and property and the well-being of all nations, particularly those basic data and products, as, at a minimum, described in Annex 1 to this resolution, required to describe and forecast accurately weather and climate, and support WMO Programmes;
> (2) Members should also provide the additional data and products which are required to sustain WMO Programmes at the global, regional, and national levels and, further, as agreed, to assist other Members in the provision of meteorological

services in their countries. While increasing the volume of data and products available to all Members by providing these additional data and products, it is understood that WMO Members may be justified in placing conditions on their re-export for commercial purposes outside of the receiving country or group of countries forming a single economic group, for reasons such as national laws or costs of production;
(3) Members should provide to the research and education communities, for their non-commercial activities, free and unrestricted access to all data and products exchanged under the auspices of WMO with the understanding that their commercial activities are subject to the same conditions identified in Adopts (2) above;
Stresses that all meteorological and related data and products required to fulfil Members' obligations under WMO Programmes will be encompassed by the combination of essential and additional data and products exchanged by Members;
Urges Members to:
(1) Strengthen their commitment to the free and unrestricted exchange of meteorological and related data and products;
(2) Increase the volume of data and products exchanged to meet the needs of WMO Programmes;
(3) Assist other Members, to the extent possible, and as agreed, by providing additional data and products in support of time-sensitive operations regarding severe weather warnings;
(4) Strengthen their commitments to the WMO and ICSU WDCs in their collection and supply of meteorological and related data and products on a free and unrestricted basis;
(5) Implement the practice on the international exchange of meteorological and related data and products, as described in Adopts (1) to (3) above;
(6) Make known to all Members, through the WMO Secretariat, those meteorological and related data and products which have conditions related to their re-export for commercial purposes outside of the receiving country or group of countries forming a single economic group;
(7) Make their best efforts to ensure that the conditions which have been applied by the originator of additional data and products are made known to initial and subsequent recipients. (see: http://www.wmo.ch/pages/about/Resolution40.html)

In the context of WMO Resolution 40, "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.

Similarly, UNESCO's Intergovernmental Oceanographic Commission's (IOC) Data Exchange Policy states that all IOC Member States shall provide timely, free, and unrestricted access to all data, associated metadata and products generated under the auspices of IOC programs [IOC, 2002]. The IOC also has a specialized program for oceanographic data and information management, the International Oceanographic Data and Information Exchange (IODE), which was established in 1961. It now has 65 national oceanographic data center members that adhere to the IOC Data Exchange Policy.

Also important are the recent OECD Principles and Guidelines on Access to Research Data from Public Funding [OECD, 2007], which identify a number of guiding principles for managing such data. This document, adopted by consensus by the OECD Member States, identifies "openness" as the first principle and default rule for data access from publicly funded research. Openness is defined as "…access on equal terms for the international research community at the lowest possible cost, preferably at no more than the marginal cost of dissemination".

5. Public international data system and research program policies

There are several major public international research and data systems that have open access and unrestricted reuse policies. The oldest and perhaps the best known is the World Data Center (WDC) system that was established following the International Geophysical Year (IGY) of 1957. The IGY achieved outstanding success in promoting cooperation among nations to gather, preserve, and make openly available scientific data and information about the Earth and its space environment. Many of the features that are considered part of open access data policy were initiated through the IGY and implemented through the WDC system, making it a highly relevant model for the GEOSS initiative and its data sharing activity.

Many other public international research and data activities have followed, especially in more recent years. Notable examples include the World Climate Research Program, the International Geosphere-Biosphere Program, the International Polar Year, the electronic Geophysical Year, and the Global Biodiversity Information Facility, among many others. These cooperative research and data sharing activities endeavor to make the data contributed into their data systems and served through their online portals openly and freely available, with no restrictions on reuse. The policies of such international research programs through the year 1999 are available at: http://www.codata.org/data_access/policies.html.

6. Regional laws and policies

By far the most prolific implementation of regional laws and policies regarding data access and reuse has been in the European Union (EU). Particularly important in the GEOSS context are the Directive on re-use of public sector information [CEC, 2003] and the Directive on public access to environmental information [CEC, 2005]. The PSI Directive encourages public-sector entities to facilitate re-use and not charge more that the marginal cost of fulfilling a user request, although these principles are not mandated. The Directive on Environmental Information is more prescriptive and requires Member States to make public environmental data and information freely available to users at the source and encourages reasonable pricing externally. It also prohibits re-use restrictions on such data and information. Appendix C, contributed by Prof. Katleen Janssen, provides a compendium of some of the other most important examples.

C. National Laws and Policies Concerning Public Data Access

National laws mostly track the international sources described above. However, they are much more voluminous and varied, and in some cases add many details and nuances that are not found in the international instruments, while in other cases, particularly in the less

economically developed countries, may not be implemented at all. The two sub-sections below provide only coarse overviews of the national sources in the different categories of data.

1. National laws and policies concerning access to Earth observation data

All space based, non-military remote sensing activities are based on the starting presumption that data are to be made available, particularly to sensed states, on a nondiscriminatory basis and that data should be as openly available as possible. Data denial is the exception, not the rule, although the principle of full and open exchange is not a universal norm. Regarding high-resolution remote sensing data, however, the number of exceptions to the nondiscriminatory access policy is growing due to national security concerns, as discussed further in section II.E.1.

In general, remote sensing states claim to follow the 1987 UN Remote Sensing Principles and incorporate them, or parts of them, in national laws. Although the actual legislative and regulatory implementations vary broadly from country to country and are too numerous to discuss in the body of this report, a comprehensive survey by Prof. Joanne Gabrynowicz of national remote sensing data laws and policies is summarized in Appendix D. Some nations also have laws and policies relating to data overall (see the next sub-section), in which remote sensing data are included.

2. Other national laws and policies relevant to GEOSS data sharing

Of particular importance to the inclusion of national or nationally acquired data into the GEOSS data system are the laws and policies that govern access to the various sources of geospatial data within each nation. All countries with remote-sensing capabilities and almost all other nations have one or more geospatial data repositories. The data access and reuse policies for these data sources vary from free access and unrestricted reuse, to availability at commercial prices and highly restrictive reuse, to conditions of state secrecy and availability only to authorized individuals with national security clearances.

It is the data that can be shared from these data centers that will most likely form much of the initial contributions to the GEOSS data system.

Finally, another highly relevant set of laws and policies arises in the context of access to and reuse of government data and information. The overall public information of each country is broadly indicative of its willingness to participate fully in GEOSS and implement the Data Sharing Principles.

D. Policy Rationale for the GEOSS Data Sharing Principles

1. Introduction

As the preceding overview of laws and policies related to public data indicates, a patchwork of supportive international instruments and national policies and legislation already exists. Indeed, there are many compelling reasons for developing more comprehensive access regimes for all types of government data at the institutional, national, and international levels, with openness as the default rule [Uhlir & Schröder, 2007]. In many instances, the same or similar rationale may be extended for publicly funded data produced outside government, especially in academic and not-for-profit organizations, although some important distinctions apply.

This section examines the underlying policy rationales for various aspects of the GEOSS Data Sharing Principles. The key principles of the GEOSS data policy addressed below are: (a) the full and open access to data and information (i.e., metadata and data products) shared through GEOSS, including minimum restrictions on reuse and re-dissemination and minimum costs; (b) special consideration to research, education, and developing country users; and (c) the availability of all shared data and information with minimum time delay.

2. Rationale for full and open exchange and sharing of publicly generated data and information

The arguments in favour of full and open access (and unrestricted reuse) as the default rule for data and information produced by governmental or public entities may be summarized as follows [Uhlir, 2004]:

Legal considerations. Both the activities that the government undertakes and the information produced by it in the course of those activities are a public good, properly in the public domain [Kaul *et al*., 1999]. Data produced through public investments, especially those that are relevant to the nine GEOSS societal benefit areas, frequently have global public-good characteristics [Dalrymple, 2003].

Socio-economic considerations. Because the value of data depends on their use, open access online is the most efficient way to disseminate public data and information online in order to maximize the value and return on the public investment in their production [Stiglitz *et al*., 2000]. There are numerous economic and societal benefits, both direct and indirect and frequently on an exponential basis as a result of "network effects", that can be realized through the open dissemination of public-domain data and information on the Internet [CEC, 1999 and 2001; PIRA International, 2000; Weiss, 2003; Dekkers et al, 2006; OECD, 2006; Mayo and Steinberg, 2007]. Conversely, the proprietary commercialization of public data on an exclusive basis produces *de facto* public monopolies that have inherent economic inefficiencies and tend to be contrary to the public interest. This is particularly true of data in GEOSS that provide unique or historical information about the environment that cannot be obtained after the fact, or that are too expensive and inefficient to collect independently [NRC, 1999].

Ethical considerations. The public has already paid for the production of the information. The burden of fees for access falls disproportionately on the poorest and most disadvantaged individuals, including those in developing countries and not-for-profit researchers and educators, when the information is made available online. This is an important consideration for public, governmental data, such as those relevant to the nine

societal benefit areas of GEOSS, which constitute a global public good and are properly in the public domain [Longworth, 2000].

***Good governance considerations*.** Transparency of governance is undermined by restricting citizens from access to and use of public data and information created at their expense and on their behalf. Rights of freedom of expression are compromised by restrictions on reuse and re-dissemination of public information. It is no coincidence that the most repressive political systems make the least amount of government information, especially factual data, publicly available.

By agreeing to the GEOSS Data Sharing Principles, the data system operators allow those data, metadata, and products that they contribute to GEOSS to be shared under clear, predefined terms, consistent with the principle of full and open data exchange. The users of GEOSS data need the flexibility to reuse and re-disseminate resulting data products in order to maximize not only their own uses of the data, but the secondary applications of broad benefit to the world. For example, data and information needed for immediate humanitarian assistance after a natural disaster may also be vital to recovery and reconstruction efforts that are undertaken by a wide variety of both governmental and nongovernmental organizations. Users therefore need to be able to integrate, reuse, and re-disseminate data and information with minimal restrictions in order to achieve the best results in all of the GEOSS societal benefit areas and objectives. By encouraging all publicly funded contributors of GEOSS elements to provide full and open access to their data and information, without reuse or re-dissemination restrictions, GEO will ensure the critical mass of data and information needed to make GEOSS an invaluable resource to the world.

Moreover, for GEOSS to achieve its desired vision and remain consistent with its Data Sharing Principles, the costs of using the data from the system need to be free, or as low as possible, for the widest possible range of users. In particular, metadata (descriptive

documentation of the primary data set) should be made available openly at no cost, to enable users to discover sources of data and information without restriction. Metadata are essential to making GEOSS function effectively as a system of systems and to ensuring that all GEOSS data, products, and services are fully accessible on a non-discriminatory basis to all users. Charging for access to metadata would constrain many potential users from discovering useful data and information that might be of significant value to them.

Therefore, the basic presumption of GEOSS should be that Member States and other Participating Organizations are willing to develop, implement, and integrate their GEOSS components using their own resources. These organizations should recognize that they receive direct and indirect benefits from participating in the system, such as the ability to seamlessly integrate their own data with data provided by a range of other sources.

3. Data sharing considerations for data produced by entities with a mix of public and private funding

A diverse panoply of data, much of which could be relevant for inclusion in GEOSS, is produced by many different types of organizations and sectors outside government, but with government funding. Here the mixture of public and private funding with different and sometimes conflicting motivations and uses makes generalizations about data policies and principles difficult.

The issues raised in public-private relationships take many forms and contain some inherent tensions, such as openness versus exclusivity, public goods versus private investments, public domain versus proprietary rights, and competition versus monopoly, among others [Uhlir & Schröder, 2007]. This mix of motivations, priorities, and requirements is context-dependent, typically unique to the parties involved, and frequently not well-served by inflexible statutory and regulatory intellectual property frameworks. In such cases, the ordering of the respective rights and interests of the

parties involved is most efficiently accomplished through voluntary agreements under private law. Private contracts or licenses provide maximum flexibility within the larger statutory and public policy context. What is especially important to emphasize here is that such agreements can in many cases provide for conditionally open access that advances the public interest goals associated with the public funding, while effectively protecting existing proprietary private interests [Reichman & Uhlir, 2003].

At the most basic level, it is possible to provide free access to data products for not-for-profit research, educational, or developing-country users, while restricting commercial users and uses to a reimbursable, or even for-profit, basis. A number of common-use licenses have been developed by the Creative Commons organization that can be especially appropriate for making such distinctions between users and uses for copyrightable data products (such as images) in a voluntary and flexible manner, with legal certainty provided by contract and enforced through intellectual property statutes [see www.CreativeCommons.com].

Various techniques of price discrimination and product differentiation may be similarly employed, based on factors such as time (e.g., real-time access for commercial users vs. delayed access for non-profits), scope of coverage (e.g., geographic or subject matter limitations), levels of customer support or service, and other possible distinctions [NRC, 1997]. Such strategies can help promote scientifically and socially beneficial access and use, not only in the complex public-private research relationships, but even in exclusively private-sector settings.

4. Data sharing considerations for data produced by private-sector entities

The presumption for data sources emanating from the private sector is that they are proprietary, subject to commercial terms and conditions. However, at least some data from private-sector entities can meet the data sharing policy conditions of GEOSS and become part of the data system for the same reasons as discussed above.

To meet the full range of user needs identified as priorities by GEO, private-sector or hybrid public-private systems should be equally encouraged to contribute to the data and information made available to users under GEOSS. It is in the interest of all GEOSS participants to ensure that the range and use of GEOSS data continues to expand, especially in developing countries. Providing usable subsets of data, 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 providing incentives for governments, participating organizations, or other entities to contribute new elements to GEOSS.

5. Special status of research, education, and developing country users and producers of publicly funded data

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].

Most countries have policies that provide special status to the research and education sectors, recognizing their essential role in social and economic development. Such policies 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.

There are two basic issues here. One concerns the preferential access to data for users in research and education. The GEOSS Data Sharing Principles encourage GEOSS data

providers to manage 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.

The other issue focuses on the access to data produced by these sectors, particularly in publicly funded government and university research and education. As has already been noted in section II.B, there are many international research programs and related data activities that provide free 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 discipline communities [NRC, 1997; Reichman & Uhlir, 2003].

Because the value of scientific data lies in their use, 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 research [NRC, 1997; NRC, 1999; NRC 2003; Arzberger *et al*., 2004; Uhlir & Schröder, 2007].

Such policies and practices should be reinforced and expanded by GEOSS in support of the nine societal benefit areas.

In implementing the preferential access policy for research and education application, GEO should consider several issues. First, many different types of organizations are increasingly involved in research and education in both developed and developing countries, including various commercial, for-profit organizations, nongovernmental organizations, and governmental and intergovernmental agencies. Not-for-profit academic institutions may conduct research for for-profit firms that do not release the results for public use, whereas many for-profit organizations perform research and educational activities on behalf of governments for the public good. Thus, the institutional affiliation of the user is not necessarily a good indicator of the use of GEOSS data, products, and services by the user. Instead, GEO, together with its Member States and Participating Organizations, should define the types of research and education that are to be given preferential treatment in GEOSS, e.g., publicly funded research or research that leads to openly available results. Education should at least encompass all

classroom and online educational activities, but whether or not the GEO principle on research and education should apply to educational and scientific publishing is an important policy issue that the GEO community should explicitly consider.

Second, GEOSS should as much as possible inform users about the costs of the data and information they obtain, including any cost reductions provided for research and educational activities or for developing country applications. This will educate users about the costs they should expect when they move from educational and research applications to other operational applications. Tracking aggregate cost reductions for research, education, and developing country applications is also one important element in demonstrating to governments and other sponsors the continuing value of GEOSS in terms of its impact on capacity building.

And third, individuals who utilize GEOSS at reduced or no cost should be expected to provide in-kind assistance in the form of help in documenting the use and impact of data, metadata, and products received. GEOSS should take steps to make submission of qualitative or quantitative impact metrics simple, but also desirable, from a user viewpoint (e.g., as part of setting up a data subscription or notification service, or obtaining a common-use license for downloaded products). See also section IV.B.4 on metrics and indicators.

Finally, with regard to preferential policies for users in the developing world, it is important to note that the existing infrastructure for data delivery over the Internet favors users in developed countries who typically have ready access to relatively low-cost and high-bandwidth connections over those in developing countries, who have limited or expensive connectivity and who are therefore faced with higher costs of access to or delivery of data. GEO needs to work at a technical level to equalize the accessibility of data to users in developing and developed countries through cost recovery models that do not penalize uses of GEOSS data that specifically address developing country problems, or users based in developing countries. For example, since the cost of fulfilling a user

order is more likely to be driven by the complexity of the order rather than the volume of data delivered, cost-recovery charges should be based on the characteristics of an order rather than the volume of data (number of bytes) delivered. Moreover, where possible, GEO members should explore ways to waive or minimize costs for developing country uses and users, such as through direct subsidies or recognition of in-kind contributions to GEOSS.

It should be emphasized that 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, what is important is that ever increasing volumes of freely 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 freely accessible.

6. The principle of minimum time delay for all data and information shared through GEOSS

The standard for "minimum time delay" for data and information shared within GEOSS will depend on the type of data and application and the need for appropriate quality control. Some types of GEOSS data applications will be contingent upon the rapid access to data, derived products, and associated services. Maximizing the potential societal benefits of GEOSS in many cases will require minimizing the time delays in providing the data and information through GEOSS to the users.

In general, operational systems deliver relatively well defined, well understood data on key environmental or other parameters. In most cases, automated quality control procedures can minimize time delays in data delivery.

For research data, time delays may need to include a limited period of quality control by the data provider. These should reflect the norms of the relevant scientific communities or data processing centers. Research data systems tend to deal with instruments or parameters that may be less well understood than those supported by operational systems, and that may be subject to more frequent or serious quality control problems. Some delay therefore may be necessary for preparation of metadata and careful quality control procedures.

In the case of the introduction of new data (e.g., from a new instrument) into an existing GEOSS component, a period of restricted access on the part of the research or instrument team may be needed. Such periods should be kept to a minimum, reflecting the normal practices of scientists and data managers responsible for similar systems or data production activities. Delayed access should be directly relevant to the preparation of metadata and quality control procedures and not to promote exclusivity for principal investigators and other personnel.

E. Legal and Policy Limitations on Data Sharing

There are strong arguments in favour of a default rule of openness for government data and information and for research and education. At the same time there are various legitimate, countervailing laws and polices that will limit full and open data exchange and sharing of government information. Specifically, there are statutory exemptions to public access and use based on national security and law enforcement concerns, the need to protect personal privacy, respect confidential information or indigenous rights, or conserve sensitive ecological, natural, archaeological, or cultural resources. In many

jurisdictions, government data and information are treated as proprietary and protected by intellectual property laws and other restrictions. Government entities also should respect the proprietary rights in information originating from the private sector that are made available for government use, unless expressly exempted.

In certain circumstances, these types of data and information will generally only be considered for inclusion as discussed below. Because openness should be the default principle for the data and information made available through GEOSS by government members and participating organizations, however, these exceptions should be properly justified and interpreted as narrowly as possible.

1. National Security

There are, of course, many national space assets and other data collection systems that produce data similar to those that would be included in GEOSS, but that are classified as State secrets on national security grounds. Such data are unavailable for civilian use and therefore are not a part of GEOSS.

Two potential exceptions to this national security exception are possible, however. In some cases, military systems or hybrid military-civilian systems may establish dual-use policies to enable data access for both military and civilian uses. Such data policies may permit direct access to the data by defense entities and civilian users, including commercial entities, although the civilian users may not be able receive all of the data.

Another, more general, exception applies to retrospective or historical data that have been classified for some legally required period, but then subsequently become officially declassified and released into the public domain. For example, in 2001 Italy and France agreed to study and develop procedures jointly for degrading classified images, with the objective of lowering their level of classification, in accordance with the Agreement between the Government of the Italian Republic and the Government of the French

Republic on Cooperation in the Field of Earth Observation. There also have been some instances in which imagery that was previously classified for national security purposes was declassified within a short period of time. One case of such dual use data being made openly available involved declassifying imagery of a location that had just recently been used for national security purposes [Gabrynowicz, 2002]. Another involved a review by an expert committee of old classified data sets with a view to their application for environmental research, and many data were subsequently designated for advance declassification. There are various such dual use data sources of significant relevance to GEOSS objectives that should be considered for inclusion in the system, once they are properly declassified.

Although civilian government and private-sector remote sensing systems are not classified, they may occasionally collect data that have national security implications and that may be withheld pursuant to the laws in the controlling jurisdictions. This is particularly an issue regarding high-resolution data collected by non-classified space systems. The number of exceptions to the nondiscriminatory access policy is growing in Canada, Europe (Germany, France, and Italy), India, Israel, and the United States, among others. Recent and pending legislation demonstrate that national security interests are being expanded further over general data access. Governments are engaging in what is more correctly characterized as “controlled access”, rather than “restricted access” and are construing the 1987 U.N. Remote Sensing Principles more narrowly. For example, new Canadian legislation specifically contends that a sensed State’s right to data of its territory is limited to data used for resource management purposes [Mann, 2006]. In recently enacted German legislation, the terms “non-discriminatory” and “reasonable” are interpreted by imposing security aspects on data distribution, and thereby restricting a sensed State’s access to data of its own territory subject to Germany’s security or foreign policy interests. [For a review of this legislation prior to its enactment, see Gerhard and Schmidt-Tedd, 2005. An analysis of the law as enacted is forthcoming in Vol. 34, No. 1 of the Journal of Space Law in 2008.].

2. Proprietary Rights

The intellectual property (IP) status of data, databases, and data products is a complex legal subject, depending on the jurisdiction, the source of the data, and the level of creativity. In addition to copyright, proprietary rights can be enforced using trade secret law, unfair competition law, database protection laws (e.g., those in the E.U., such as the 1996 Directive on the legal protection of databases), and private contracts and licenses.

Some countries, such as the United States, expressly exclude government-generated information from copyright. In many other nations, public information is subject to IP protection, although this may be tempered by competing policies, such as the public's right to know and the other policy arguments in favour of openness presented in earlier sections of this chapter. Moreover, to the extent that the public information is copyrightable, the government can make it openly available with minimum re-use restrictions by applying common-use licenses such as the Creative Commons templates.

On a spectrum with raw data at one end and a highly processed, value-added product on the other, there are varying degrees of statutory IP protection. In general, raw data produced technologically without benefit of human intellectual creativity is unprotected by copyright. More complex information such as metadata and data products that are identified in the GEOSS Data Sharing Policy, however, typically requires creativity and originality in its production, thereby making it copyrightable. Determining where to draw the line on what data, metadata, and products are protectable or not under statutory IP law can be difficult to determine and enforce, which is why most proprietary digital data and information are now protected by restrictive private-law contracts and licenses and by technological means.

Finally, as noted in section II.D.6 above, researchers typically have a proprietary period of exclusive use of data that they have collected using public funds. This period may be established by a research contract or grant for some specific period of time, such as one to three years, or disclosure may be triggered by the publication of results based on the data

collection. Following publication, the data on which the results are based need to be made available so that the results can be verified [NRC 1997].

3. Personal Privacy

An important distinction must be made between data collected on human subjects and data on other, impersonal subjects. Data on human subjects are restricted in various ways on ethical and legal grounds to protect personal privacy. Internationally, the OECD issued guidelines on this topic [OECD, 1980] and the EU has strong personal privacy protections [Directive 95/46/EC on the protection of personal data, and Resolution No. 108 of the Council of Europe, 1985]. Many countries also have adopted legislation and regulations that protect personal privacy at the national level. Typically, data sources that have been subjected to de-identification of personal information can be shared or made otherwise available, and these types of data may be considered for inclusion in the GEOSS data system.

4. Confidentiality

Data designated as confidential can only be transferred on a very limited, privileged basis, subject to specific contractual provisions between the data source and the recipient. Such data should not be disclosed, and certainly not shared though GEOSS.

5. Indigenous Rights

Observational data (e.g., remote sensing images or photographs) of some indigenous peoples or lands within their jurisdiction may not be either collected or shared. In other cases, data concerning traditional knowledge may not be shared or exploited commercially. Such data types that compromise legitimate indigenous rights may not be made available through GEOSS.

6. Conservation and Protection of Sensitive Ecological, Natural, Archaeological, or Cultural Resources

International treaties that protect rare species of animals and plants, such as the 1975 Convention on International Trade in Endangered Species of Wild Fauna and Flora, as

well as biodiversity more generally, such as the 1992 Convention on Biological Diversity, also prohibit disclosure of information about their specific location. Such limitations are implemented and enforced through the legislation and regulations of most countries. Similarly, archeological and cultural sites and relics may be subject to statutory protection as well. Such data cannot be shared through GEOSS either, unless specific steps are taken to meet applicable legislation and regulations.

III. ILLUSTRATIVE CASE STUDIES

This section provides a selection of examples in several of the nine societal benefit areas regarding the potential implications of the GEOSS Data Sharing Principles, depending on key implementation choices. The objective is to illustrate the benefits of data sharing, as well as some of the important obstacles and problems that will most likely surface during the implementation and operation of GEOSS. Given the diversity and complexity of expected applications of GEOSS data, it is not feasible to analyze all possible situations nor to assess objectively the relative importance of different issues. Nevertheless, it is still instructive to review past experience and work through some illustrative scenarios to better understand how strong adherence to the Data Sharing Principles may be able to increase the utility and overall sustainability of GEOSS as a system.

A. Access to Real-time and Historical GEOSS Data for Rapid Humanitarian Response

Perhaps the most visible and pervasive motivation for the establishment of GEOSS is the potential for more rapid and comprehensive monitoring of natural and technological hazards, improved warning and prediction of dangerous events or episodes, and associated improvements in disaster mitigation and response. Better historical data on hazards can help improve risk assessment and planning for future hazards from local to global scales [UNDP, 2004; Dilley *et al.*, 2005; Arnold *et al.*, 2006]. Monitoring of hazardous conditions, through both satellite- and ground-based sensors, can help scientists to improve understanding and prediction of dangerous events. Governmental authorities and other organizations are able to react more quickly when dangerous situations develop. In many cases, such real-time data need to be integrated with computer simulation models to improve the predictions needed for early warning and response, e.g., when a cyclone approaches a populated coast, or weather conditions are likely to result in severe storms or wildfires. Of course, if the disaster is pervasive, communications may break down completely and no system is going to be useful if its information cannot be disseminated where it is needed.

Because time is often the most critical factor in response to hazardous events and it is important to get as many relevant data sources into GEOSS, automated access and integration of data and information from multiple systems within GEOSS is a *sine qua non*. This raises several potential scenarios: *1)* all GEOSS data have to be completely free and open; *2)* all digital rights and cost recovery issues can be addressed after the fact; or *3)* all digital rights and cost recovery issues can be established beforehand, dealt with through automated means online, and updated as appropriate.

Although as a matter of principle scenario 1 is the best option for most GEOSS data, the problem is that some proprietary or otherwise restricted data important for disaster response may not be free and open and therefore may not be accessible to GEOSS users. For example, after the 2004 South Asian tsunami, by far the most detailed imagery of damaged areas along the Indian Ocean coasts came from commercial high-resolution satellites that in many cases imposed reuse and re-dissemination restrictions. Use of these data by the United Nations and other humanitarian organizations had to be negotiated with the relevant sources [UN Geographic Information Support Team, personal communication, 2007]. It is obviously in the interest of the GEOSS community to ensure that the best available data needed for sound decision making are accessible through GEOSS, but delays in access and reuse of essential data in time-critical disasters should not be increased by bureaucratic negotiations.

Scenario 2, in which digital rights and cost recovery issues are addressed after the fact, poses a number of difficulties, including the likely unwillingness of data sources to make their data available through GEOSS without guarantee of cost recovery and control on use of their data. Legitimate users may also feel constrained on their use of data if they feel that they may be subject to some level of liability for their use and re-dissemination of data in a crisis situation.

Scenario 3 is the best available option to get proprietary or otherwise restricted data into GEOSS; that is, implementation of automated digital rights management within GEOSS

to support real-time access to data and information while respecting pre-determined data usage conditions, which can be updated as appropriate. Such usage conditions should include a) clear definitions of rights and limitations in using data and disseminating derived products in humanitarian situations, b) recovery of costs in line with the GEOSS Data Sharing Principles and recommended Implementation Guidelines and c) a statement that the Implementation Guidelines are a starting point and individual Member States and Participating Organizations are free to provide data and usage rights beyond the principles and guidelines. Since digital rights will be clear in advance, users would be able to adapt their practices to ensure appropriate levels of access prior to a crisis (e.g., if they need to pre-register as a humanitarian organization).

B. Research Uses of Integrated GEOSS Data for Climate Change Impact Assessments

Recent reports by the Intergovernmental Panel on Climate Change (IPCC) have highlighted the multidimensional nature of ongoing climatic variability and predicted climate changes and the many ways in which human health and wellbeing could be affected from global to local scales [IPCC, 2007a, b, c]. Research on the impacts of climate change and potential adaptation and mitigation strategies is increasing rapidly around the world, with particular attention to possible interactions across sectors and issues, e.g., agriculture, water, energy, hazards, and health.

A major constraint on past research efforts has been the difficulty of assembling and integrating diverse data types from multiple instruments and platforms, disparate data systems, and different disciplines. The spatial coverage of measurements often varies significantly over time, and the development of reliable, consistent time series for key climatic and environmental parameters requires careful calibration, inter-comparison, and quality control. Of particular importance are inter-comparisons between remote sensing and *in situ* measurements: satellite- and aircraft-based instruments have the potential to provide data on very large areas of the globe on a regular basis to support both research and applications, but ground-based *in situ* measurements are also needed to calibrate

these data and in many cases provide more detailed, frequent, long-term, and/or dense observations for specific regions of interest.

Another challenge is the need for integration of data across scientific disciplines, especially across the natural and social sciences, in order to better understand the interactions between climate and human activity and welfare. For example, it is often necessary to translate remote sensing data collected as pixels on a grid into summary statistics for administrative or political regions that can be used by social scientists or decision makers [NRC, 2002].

GEOSS offers the potential for significant improvement in coordination and quality control of data gathered from different instruments and multiple observing platforms and in providing an overall framework for rapid integration of both remote sensing and *in situ* datasets. By promoting interoperability among many different data sources and systems from around the world, GEOSS will facilitate testing and inter-comparison of measurements and increase the representation and reliability of the results. By increasing the density, frequency, and longevity of measurements, GEOSS can also facilitate more detailed, localized studies of climate change and its potential impacts.

A critical issue for the research community is not only access to relevant data, but a clear understanding of how the data were collected, what quality control procedures were utilized, and what transformation and analysis techniques were applied. A basic step in obtaining such understanding is access to appropriate metadata, i.e., documentation that describes data sources and processing. Encouraging all data providers to provide adequate metadata for their data is therefore a key priority for GEOSS. Free and open access to this metadata is then necessary to ensure that all users can discover the data they may need.

A second critical issue for both researchers and data sources is appropriate data attribution. For data providers to continue providing high quality data and metadata to GEOSS in the long term, they will need to receive appropriate recognition for the data

they supply. From the viewpoint of the scientific community, being able to precisely trace data "provenance"—i.e., data sources and processing histories—is essential to the reproducibility of scientific research. From the viewpoint of commercial providers, identifying them as the data source can enhance the reputation of their products and provide a further incentive to provide access to their data.

C. Local Government Uses of High-resolution GEOSS Data for Biodiversity Conservation

Numerous, often new and dynamic, biological issues are now beginning to be addressed by local government decision makers and managers, as well as the public. Of the many new diseases (e.g., hanta virus, West Nile virus, avian flu), approximately 75 percent can affect both humans and wildlife. The number and economic impact of invasive alien species are dramatically increasing. Biodiversity is being reduced and native plants and animals are being added to the threatened and endangered list (which can dramatically restrict local development activities). There is much to be gained from conserving biodiversity, as humans depend upon plants and animals species for food, medicines, and raw materials. There is also no doubt that the beauty and variety of living species also greatly improves the quality of our lives.

There are numerous operational and economic reasons why local governments must monitor, understand, and manage local biodiversity and ecosystems. Local governments need biodiversity data to develop risk analyses and prevention plans in addressing threats to public health. Monitoring and managing/regulating land cover (including vegetation) changes in rapidly expanding urban areas are also very important.

Of the vast amount of biological data collected globally each year to study the above mentioned issues, most of it is inaccessible, because it is not digital, standardized, and/or archived with appropriate metadata. In particular, GEOSS can assist local governments around the world by providing easy access to integrated and updated biodiversity, ecosystems, and associated geophysical data and information that are critical for making

informed policy and management decisions. For this particular user community, GEOSS functionality will need to combine such interdisciplinary and diverse information as Earth observations from satellites and aircraft, weather data from satellites and ground stations, historical trends from existing information, and ground observations. These integrated data sets would be used with GEOSS-developed data processing tools, as appropriate, to assess current conditions and make forecasts associated with land cover, biodiversity and ecosystem trends and associated change analyses (i.e., preferably characterizing the types, rates, and temporal and spatial variability of change; documenting driving forces; and predicting the consequences of change). In addition, GEOSS could help enable free web-based, user friendly, easily accessible, and very efficient data input, editing, analysis, visualization, and access, and provide summary statistics and analyses tailored for operational use by local governments.

GEO plans to build on and enhance existing capabilities by ensuring an operational source of existing critical data sets to drive decision support tools when needed, and integrating new data sets to enhance the performance of decision support tools and systems. Therefore, from a remote sensing perspective and for this particular local application, there also needs to be a continuing commitment to provide: 1) a global updated seasonal land cover data base at high resolution (30m; i.e., continuity of Landsat-type observations), and 2) even higher resolution (i.e., 1 to 4m) land cover enhancements and timely updates that are focused on rapidly developing/changing urban communities. Biologists, ecologists, and local natural resource managers and decision makers will also operationally need access to such additional data as: updated higher resolution topography, time series vegetation greenness, measurements of seasonal vegetation characteristics, length of growing season, onset of greenness and onset of senescence (e.g., brown-down, which are also useful in the study of and management of drought, fire, and soil moisture), estimates of soil moisture (presently using precipitation data to model and estimate soil moisture content), and volume of water bodies (which is critical for estimating the water available to local biodiversity and ecosystems).

For local communities to operationally use GEOSS data and information, the best scenario is for all GEOSS data to be completely free and open with all digital rights and cost recovery issues being dealt with in real-time through automated means by GEOSS. However, biodiversity data can be quite sensitive (e.g., location of endangered species, global species assessments, and protected areas). GEOSS could still provide such data to local communities, while respecting pre-determined data usage conditions. GEOSS may need to develop procedures to degrade or filter sensitive biodiversity data to a useful and acceptable level, or else work out an approach to sharing sensitive data in a secure mode with formal agreements between GEOSS, the data providers, and the local governments. Metadata associated with biological data (i.e., museum specimens, field notes, global species assessments) also need to be standardized and encouraged, if not required (e.g., by funding sources), as well as the consistent and timely input of these data into responsible and accessible GEOSS associated archives/servers. Local user training (i.e., available data, products, applications, and system use) also needs to be provided by GEOSS to the local government user community.

IV. IMPLEMENTATION ISSUES FOR GEOSS DATA SHARING PRINCIPLES

A. Implementation Issues

1. Alternative approaches for implementing the data sharing principles

Different approaches may be chosen for implementing the data sharing principles, ranging from formal, legal requirements established by a treaty at the international level and through legislation or administrative regulations at the national level, to much softer and less binding guidelines or ad hoc approaches. Each of these options presents some tradeoffs that the parties need to consider in advance. The Implementation Guidelines at the end of this report suggest that an approach that reflects non-binding, but commonly-decided guidance with respect to the data sharing principles is likely the best option for GEOSS participants to consider.

Mandated policies. One of the possible options for implementing any international activity, including data sharing, is through a mandated policy. This would require the Member States to enter into a binding agreement, such as a multilateral treaty. During the negotiations of this convention, the Member States would come to a mutual agreement on the obligations they take upon themselves for sharing Earth observation and other GEOSS-related data. By adopting the convention and implementing the provisions through legislation and regulations at the national level, they would be accepting these obligations. Such an agreement would have to allow Participating Organizations to accede to its rights and obligations. These provisions could be modeled on those contained in the space treaties that allow participation by nongovernmental organizations.

Mandated policies may include sanctions for non-compliance, but not necessarily. However, the effectiveness would be undermined if the obligations are not taken seriously or if enforcement is lax. The biggest drawback to this option is that a mandated policy is difficult to obtain because this would take a strong commitment of all Member States and Participating Organizations and leave very little room for national or regional

characteristics or customs, or provide too much restriction on the freedom and autonomy of the Member States and Participating Organizations. Indeed, GEOSS participants have already indicated that their participation is purely voluntary and non-binding, and thus any mandated policies through binding agreements are only possible if the GEOSS cooperative arrangement were renegotiated and restructured sometime in the future.

Implementation guidelines on a minimum set of commonly decided principles. Between the maximalist and minimalist implementation options outlined above, the data sharing principles can be implemented via international guidelines, adopted by consensus, that encourages, but does not mandate, adherence. Desired actions can be encouraged through education, financial assistance, technical assistance, peer influence and other inducements. The advantage of this approach is that the Member States and Participating Organizations retain their full autonomy and can implement these guidelines and practices in their national jurisdiction in whatever way they want. The disadvantage is that the Implementation Guidelines might not be fully implemented and would be less well adhered to than under a mandatory policy.

As a practical matter, however, this type of internationally decided approach could be the only one of the options that is acceptable. It is counter-productive to enforce or otherwise make mandatory anything in an environment where all contributions are voluntary or "best efforts," and where the governing body is operating in a non-legally binding manner. While the participation in and contributions to GEOSS are not legally binding, the presumption must be that the GEO Member States and Participating Organizations are taking part in good faith and will do all they can to make data sharing successful and productive .

2. Involving stakeholders and ensuring sustainability

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 GEO goal of implementing the GEOSS data sharing principles, the long-term and sustained involvement of all the other stakeholder groups is also important. Without the commitment of stakeholders across the sectors and from all the Member States, data sharing will remain an abstract principle and never become reality. 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.

As the most important output of GEOSS, data access and use provide a strong incentive to join the network. Because local participants can in many cases exist by serving internal or local needs with local data, motivating a member to incur the additional cost of collecting and maintaining 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.

3. Promoting the open access ethos

In view of the vision of GEOSS to realize a future where the decisions and actions for the benefit of humanity are informed by coordinated, comprehensive, and sustained Earth observations and related data sources [GEOSS 2005], the importance of easy access and unrestricted reuse of the data cannot be overestimated. All GEOSS participants and potential participants therefore need to be made aware of the importance of the GEOSS data sharing principles. While many countries have legislation in place to provide information to their citizens, as discussed in chapter III, an effective culture of data sharing needs to be instantiated among the various GEOSS stakeholders. A strategy for promoting and enforcing the data sharing ethos is thus essential.

4. Supporting transparency

Ensuring transparency towards the citizens has a broader meaning than providing them with access to information. A democratic and transparent government allows the citizen to know and to some extent take part in the decision-making process, and to hold the government accountable for its actions. Such meaningful participation is supported by the availability of information. The sharing of data is essential for transparency of decision-making, and this transparency in turn is likely to lead to better decision-making, as the government's actions are followed by the citizens.

Obstacles to transparency include cultural factors and attitudes toward the availability of public information. Excessive official secrecy is a problem in many jurisdictions. Language is another limiting factor. Although English is the accepted language of GEOSS-related activities, not all participants understand English nor are GEOSS data and metadata routinely translated into English.

The GEOSS Data Sharing Principles and the Implementation Guidelines will support governmental transparency by promoting the availability and sharing of data and information in the nine societal benefit areas. However, the participants are encouraged to reach beyond the GEOSS data policy and guidelines and apply these principles more broadly within their public sector.

B. Incentives for Compliance with the Data Sharing Principles

1. Support of other important policy objectives

The GEOSS data sharing principles are intended to improve data access and reuse among all of the stakeholders of a well-functioning Earth observation system of systems, with particular attention to the favorable status of the research and education communities and data users in developing countries for reasons set forth in section III.C. It is essential to keep in mind that data sharing is more than a goal in itself; it is an indispensable means to reaching important policy objectives relating to health, environment, poverty, 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, researchers and policy-makers can react with timely and well-informed decision-making to national, regional, or global issues that threaten the environment, human health, or safety.

An example that quickly comes to mind is the tsunami of 26 December 2004. 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, resulting in some warming of the global climate over the coming decades. Responding to these changes, either 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.

2. Credit to contributors

Sharing of data, especially online because of the potential for exponential network effects, can be much more productive with the involvement of as many stakeholders in the system as possible. Both the data producers and distributors can be encouraged or given incentives to share if they are properly credited for their contributions, not only internally within their institutions, but also externally in their communities of practice and the general public. Acknowledgement of the producers and contributors of the data, metadata, and products should be common practice within the GEOSS system. Being a part of GEOSS, sharing data with other stakeholders, and consequently improving policies on the environment or human health can provide the participants with enhanced reputational benefits and confer goodwill and appreciation from other Member States, Participating Organizations, public agencies, and the general public.

3. Digital rights management and automated online cost recovery mechanisms

A major concern of proprietary data sources, which frequently limit the access to and exchange of data, is that their data are being misused or used for different purposes than they were originally intended or authorized, leading to possible damage, liability, or infringements of intellectual property rights. One possible way to ensure that proprietary data are protected properly, but can still be shared to some extent, is through digital rights

management (DRM) technologies. While DRM can have negative effects on deriving full value from the use of data, particularly data produced in the public sector, it can provide some advantages in the GEOSS data sharing context in its uses for the automatic management of data. If properly applied, it can provide clear and standard conditions for obtaining and using data, ensuring easy dissemination. In this way, it may respond to the concerns of the proprietary data sources involved in GEOSS and make them more receptive to making their data available, even if on somewhat more restrictive terms and conditions.

In particular, new methods for automated, flexible digital rights management and common-use licensing (such as Creative Commons licenses) for otherwise copyrighted data products provide the capability to manage a reasonable range of data restrictions in a rapid and seamless manner online. These methods can also help educate users about their rights, responsibilities, and restrictions regarding the data or information they obtain from GEOSS. Such approaches offer greater flexibility and the potential to promote both planned and unforeseen societal benefits than more traditional approaches that rely on technical controls, while reducing transaction costs.

Moreover, as the diversity and volume of resources and services offered by GEOSS increase, users will have more choices of data and information types and sources to address their needs. For example, they may need to choose between access to free data, which they may need to process themselves, or to value-added information or services, for which charges will most likely apply, but which can save them time or effort. They may face tradeoffs between the higher costs of high resolution data vs. free or low-cost low resolution data, between more processed quality-controlled data vs. raw data, or between real-time vs. near real-time or historic data. Some users may need to obtain data without re-dissemination or reuse restrictions, whereas others may be willing to live with restrictions in return for lower costs. To facilitate these decisions, it is important for GEO to explore implementation of online cost recovery mechanisms similar to those now common on the Internet in industry. Such systems should greatly reduce the transaction costs for cost recovery and provide users with much more detailed and accurate

information on the costs of accessing alternative data and information available through GEOSS, while encouraging participation of potential GEOSS data providers, particularly from the private sector.

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4. Metrics and indicators for cost/benefit analyses and evaluation of performance

As noted elsewhere in this report, a vital issue for GEOSS is its economic sustainability over the long term. This encompasses not only the ways in which specific costs for supporting the dissemination and use of GEOSS data can be shared equitably and efficiently between producers and users in developed and developing countries, but also the development of qualitative and quantitative metrics that can clearly justify continued public investment in GEOSS components and the system as a whole. Harmonization of data sharing policies regarding cost recovery, data attribution, and usage metrics could be of great value in ensuring that GEOSS will continue to receive the support it needs to function well.

There are at least two ways in which metrics can be used to promote participation in and improve the performance of GEOSS. One is through an empirical analysis of the benefits of data sharing and unrestricted reuse of data. Fact-based assessments can make a strong case in support of the GEOSS Data Sharing Principles by developing objective metrics and more subjective indicators that measure the positive economic and social effects of making data openly available and usable, especially online.

Metrics and indicators also can be valuable in encouraging GEOSS stakeholders to continue to participate and abide by the principles. Monitoring and evaluation tools can even be used to promote compliance with the policies as an enforcement tool, as discussed below, and as a means of positive attribution. The use of evaluation methods can be both expensive and onerous, however, so the costs of doing such evaluations and their actual benefits need to be carefully considered prior to implementation.

Finally, because a key objective of GEOSS is to provide integrated GEOSS data and information from multiple sources to users as quickly and seamlessly as possible, it is vital that GEOSS develop straightforward methods for assessing usage and the results of that use. This will enable GEOSS to report on usage and impact to GEOSS components, which in turn can use these metrics to justify continued operations, system improvements, and/or specific subsidies for research, education, and developing country applications.

Toward this end, GEO Members and other sponsors and participants in GEOSS will need statistical information on the volume and diversity of data and information delivered by GEOSS, on the services rendered for users, and on the user community itself. But equally important will be metrics and indicators, both quantitative and qualitative, which characterize the impact of GEOSS across, at a minimum, the nine societal benefit areas. Planning for such assessments in a systematic manner at an early stage, while difficult, will help GEOSS evolve more quickly and effectively.

5. Peer pressure

In general, the potential embarrassment of being caught violating rules, not complying with guidelines, or simply not contributing a “fair share” is a strong motivation for compliance, particularly in small communities of practice where many of the stakeholders are known to each other. When Member States, Participating Organizations or public agencies see that their peers are complying with the data sharing principles and are achieving the desired results, they will be inclined to follow these examples. This will especially be the case if the general public is aware of these good examples and is demanding that their Member State, a Participating Organization, or public agencies do the same. No Member State or Participating Organization wants to be considered as the “weakest link in the data chain”, or to be labeled as being less interested or unwilling to share its data with other stakeholders in the GEOSS partnership. This also is true for helping to promote sharing norms among data users, or conversely assisting in compliance with various applicable restrictions on uses. Nevertheless, peer pressure by itself is insufficient in most cases as a mechanism for ensuring that the stakeholders are adhering to the GEOSS norms, values, and legal rules on data sharing.

6. Developing other means for encouraging compliance by both data providers and users with the GEOSS Data Sharing Principles

Although peer pressure is important for helping to promote compliance with the GEOSS Data Sharing Principles, it is unlikely to be sufficient. Users—and the GEO purpose—will become frustrated if the exceptions start to become more prevalent than the rule. Because the GEOSS Data Sharing Principles set a high standard for data access, it is important for GEO to develop effective mechanisms and procedures to encourage GEOSS data providers to comply with the Data Sharing Principles and that any disputes about their implementation are handled as quickly and transparently as possible. GEO needs to have a way to make sure that the data providers continue to meet the established criteria for participation; otherwise, the overall "system of systems" is unlikely to attain its full potential.

Since the success of GEOSS depends to a large extent on establishing and maintaining data dissemination processes and activities founded on the agreed Data Sharing Principles, the Member States, and Participating Organizations, supported by the GEO Secretariat, therefore need to develop a comprehensive implementation plan that is consistent with the Principles and related Implementation Guidelines. This will require consultation with all major GEOSS stakeholder groups and continuing outreach efforts.

Similarly, users need to not abide by the agreed terms and conditions on use of the GEOSS data providers, consistent with the Data Sharing Principles. Appropriate sanctions on users who do not respect the data providers' terms and conditions need to be developed by the GEOSS Members and Participating Organizations, and may include a variety of sanctions, including the denial of access to non-compliant users.

APPENDICES

APPENDIX A

Contributors to this Report

CODATA Core Author Group

Paul F. Uhlir, Chair of Core Author Group

Robert Chen, Chair of CODATA Task Group

Joanne Irene Gabrynowicz

Katleen Janssen

Charles Barton

Jack Hill

CODATA Review Group

Santiago Borrero
Dora Ann Lange Canhos
V.P. Dimri
Yukiko Fukasaku
Huadong Guo
Alexei Gvishiani
Bernard Minster
Steve Rossouw
Fraser Taylor

Acknowlegements of Other Contributors

[to be added]

APPENDIX B

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APPENDIX C

Regional European Data Sharing Policies

European Community – directive on re-use of public sector information	Members: European Union (27 Member States) + EEA Countries (Iceland, Norway and Liechtenstein)	Directive 2003/98 of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:EN:PDF	The PSI directive lays down a minimum set of rules for public sector bodies to make their documents available to the private sector for re-use. Re-use is defined as "the use by persons or legal entities of documents held by public sector bodies, for commercial or non-commercial purposes other than the initial purpose within the public task for which the documents were produced. Exchange of documents between public sector bodies purely in pursuit of their public tasks does not constitute re-use". Member states are not under any obligation to make their documents available for re-use, but are encouraged to do so under specified conditions. These conditions include time limits, available formats, fees and transparency. The directive also makes sure the public sector bodies comply with the rules of fair competition. If a public sector body creates value-added products or services on the basis of its own documents for commercial activities outside of the scope of its public tasks, the same charges and conditions should apply to the supply of the documents as those for other users. Exclusive agreements are prohibited, unless such an exclusive right is necessary for the provision of a service in the public interest.

European Community – directive on public access to environmental information	European Union (27 Member States) and EEA (Liechtenstein, Norway and Iceland)	Directive 2003/4 of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EC (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:041:0026:0032:EN:PDF)	The directive on access to environmental information aims to guarantee the right of access to environmental information held by or for public authorities and to ensure that environmental information is progressively made available to the public. It introduces the dispositions of the Aarhus Convention in Community law. The directive ensures free-of-charge on-site viewing of environmental information while allowing the public authorities to charge a reasonable fee for supplying the information. As a general rule, the charges may not exceed the costs of production. However, when a public authority makes its environmental information available commercially in order to guarantee continued collection and publication of such information, market rate charges are allowed. The directive also contains obligations for the Member States regarding the dissemination of environmental information. The Member States have to ensure that environmental information progressively becomes available in electronic databases which are easily accessible to the public through telecommunication networks. The Member States have to take the necessary measures to ensure that, in the event of an imminent threat to human health or the environment, whether caused by human activities or due to natural causes, all information held by or for public authorities which could enable the public likely to be affected to take measures to prevent or mitigate harm arising from the threat is disseminated, immediately and without delay.

Europe – EUMETSAT www.eumetsat.int	Members: Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom Cooperating States: Czech Republic, Poland, Slovenia, Hungary, Romania, Latvia, Lithuania, Bulgaria, Iceland, Estonia	Convention for the establishment of a European Organisation for the exploitation of meteorological satellites as amended by the EUMETSAT Council in Resolution EUM/C/Res. XXXVI of 5 June 1991, and subsequently accepted by all EUMETSAT Member States EUMETSAT Data Policy document (Council Resolution EUM/C/98/ Res.IV)	**Availability of data for the Member States** The National Meteorological Services (NMSs) of the Member States receive all EUMETSAT data, products and services for their official duty at no cost, except for the cost of decryption key units. Official Duty is defined as all activities which take place within the organisation of a NMS and external activities of a NMS resulting from legal, governmental or intergovernmental requirements relating to defence, civil aviation and the safety of life and property. Insofar as required for Official Duty use, the NMSs may grant access to other Departments within their respective National Administrations, subject to arrangements in accordance with national legislation, but all conditions defined in the data policy remain attached to the use of the data. **Availability of data for others** • Essential data The EUMETSAT Council has defined a set of data, products and services that is available on a free and unrestricted basis as “essential” data and products in accordance with WMO Resolution 40 (Cg-XII). • Non-essential data NMSs of non-Member States have access without charge to Three-hourly Meteosat Data for Official Duty use. They have access to Hourly, Half-hourly and Quarter-hourly Meteosat Data for Official Duty use in accordance with the conditions specified in the data policy. The annual fees are determined

			based on the GNI per capita derived from World Bank Statistics. For limited periods, to support the monitoring of disasters or emergencies and in accordance with relevant UN resolutions, the full set of Meteosat Data will be made available without charge. For Official Duty use by NMSs of non-Member States subject to tropical cyclones, the full set of Meteosat Data will be made available without charge.
European Space Agency www.esa.int – ENVISAT, Earth Explorer	Members: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Canada, Hungary and the Czech Republic also participate in some projects under cooperation agreements.	Convention for the establishment of a European Space Agency of 30 May 1975 ENVISAT Data Policy of 19 February 1998	The conditions attached to the distribution of Envisat or Earth Explorer data depend on the use of the data. The following two categories of use are defined. *Category 1 use*. Research and *applications development* use in support of the mission objectives, including research on long term issues of Earth system science, research and development in *preparation for future operational use*, certification of receiving stations as part of the ESA functions, and ESA internal use. *Category 2 use*. All other uses which do not fall into category 1 use, including operational and commercial use. Envisat data is available in an *open and non discriminatory way*, in accordance with the United Nations Principles on Remote Sensing of the Earth from Space (United Nations Resolution 41/65, 3 December 1986). The Envisat distributing entities have to provide services to users in a fair and non-discriminatory way. ESA determines the price for all Envisat data

			intended for category 1 use. The price is set at or near the cost of reproduction of the data. Envisat products for category 1 use are disseminated under controlled licensing conditions which stipulate the rights of use and further distribution. If the data are received free, the rights of use will include the obligation to report on and publish the research findings from the use of Envisat data, and the obligation to present such results in symposia organised by ESA. ESA has delegated the responsibility for disseminating data and products for category 2 use to a number of distributing entities. These entities are selected through a tender procedure. For category 2 use, ESA determines the price of Envisat standard products and services which it provides to the distributing entities. The price is set at a level comparable to the price for category 1 use. Distributing entities are allowed to set prices for Envisat standard products and services at or above the price level which ESA charges the distributing entities. For specific purposes, and with the prior agreement of ESA, distributing entities will be allowed to set prices for data products below the price level which ESA charges the distributing entities.
EUROPE – GMES www.gmes.info	Cooperation between European Union (27 Member States) and European Space Agency	Council Resolutation of 16 November 2000 on a European space strategy "A European Approach to Global Monitoring For Environment and Security (GMES): Towards	No official data policy available yet. One of the tasks of the GMES Bureau is to develop a data policy for the different types of data that are involved in GMES. To prepare this policy, a study was made by University College London for the Working Group on Data Policy Assessment. The document can be found at

		Meeting Users' Needs", joint document from ESA and the European Commission Communication from the European Commission to the Council and the European Parliament of 10 November 2005, "Global Monitoring for Environment and Security (GMES): From Concept to Reality" Commission Decision of 8 March 2006 creating a Bureau for Global Monitoring for Environment and Security (GMES)	http://www.gmes.info/library/index.php?action=standarddownload&filename=DPAGDFinalReport.pdf&directory=6.%20Cross-Cutting%20Studies%20Documents&
European Union INSPIRE – www.ec-gis.org/inspire	European Union (27Member States)	Directive 2007/2 of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	The aim of INSPIRE is to create an infrastructure for spatial information in the European Community for the purposes of European Community environmental policies or activities which may have an impact on the environment. The European Directive has entered into force on 15 May 2007 and has to be transposed into national legislation by 15 May 2009. INSPIRE is based on the following data principles: • Data should be collected once and maintained at the level where this can be done most effectively. • It should be possible to combine seamlessly spatial data from different sources and share it between many users and applications.

			• Spatial data should be collected at one level of government and shared between all levels. • Spatial data needed for good governance should be available on conditions that do not restrict its extensive use. • It should be easy to discover which spatial data is available, to evaluate its fitness for purpose and to know which conditions apply for its use. It applies to 34 spatial data themes, including coordinate reference systems, administrative units, hydrography, land cover, orthoimagery, geology, meteorological geographic features, … The INSPIRE directive contains obligations for the Member States and their public authorities regarding the creation of metadata and data specifications. The Member States also have the obligation of providing a network of services for the spatial data themes in the annexes: - discovery services making it possible to search for spatial data sets and services on the basis of and to display the content of the metadata; - view services making it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata; - download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly; - transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability; - services allowing spatial data services to be 'invoked'. Access to these services must be provided through

			the geo-portal that will be established by the European Commission. Discovery and view services have to be provided free of charge. However, it is possible for a public authority to charge for the use of the view service, where such charges secure the maintenance of spatial data sets and corresponding data services, especially in cases involving very large volumes of frequently updated data. The other services can be charged for by choice of the Member States. The directive also contains obligations concerning data-sharing between the public authorities. The Member States have to adopt measures for the sharing of spatial data sets and services between their public authorities, enabling these public authorities to gain access to spatial data sets and services, and to exchange and use those sets and services, for the purposes of public tasks that may have an impact on the environment. These measures have to preclude any restrictions likely to create practical obstacles, occurring at the point of use, to the sharing of spatial data sets and services. It is allowed for public authorities to licence spatial data sets and services and/or require payment from other public authorities or the institutions and bodies of the European Community. These charges and licenses have to be compatible with the general aim of facilitating the sharing of spatial data sets and services. Where charges are made, these have to be kept to the minimum required to ensure the necessary quality and supply of spatial data sets and services together with a reasonable return on investment, while respecting the self-financing requirements of public authorities supplying spatial

			data sets and services, where applicable. Spatial data that is provided by the Member States to the institutions and bodies of the European Community in order to fulfil their reporting obligations under the environmental Directives are not subject to any charging. The data sharing arrangements that are set up by the Member States under these rules have to be open, on reciprocal and equivalent basis, to bodies established by international agreements to which the European Community and Member States are parties. Member States can limit sharing when it would compromise the course of justice, public security, national defence or international relations. Specific Implementing Rules will be created addressing the dissemination of spatial data by the Member States to the bodies and institutions of the European Community.
Europe – EIONET www.eionet.europa.eu	Members: European Union (27 Member States), 4 EFTA Countries (Iceland, Norway, Liechtenstein and Switzerland), Turkey and European Environment Agency. FYR Macedonia, Croatia, Bosnia & Herzegovina, Serbia,	Council Regulation (EEC) on the establishment of the European Environment Agency and the European environment information and observation network (Eionet) [No.1210/90	Eionet is a partnership network of the European Environment Agency (EEA) and its member and participating countries. It consists of the EEA itself, a number of European Topic Centres (ETCs) and a network of around 900 experts from 37 countries in over 300 national environment agencies and other bodies dealing with environmental information. These are the national focal points (NFPs) and the national reference centres (NRCs). Eionet aims to provide timely and quality-assured data, information and expertise for assessing the

	Montenegro and Albania also participate in the EEA and Eionet work.		state of the environment in Europe and the pressures acting upon it. This enables policy makers to decide on appropriate measures for protecting the environment at national and European level and to monitor the effectiveness of policies and measures implemented. The European Environmental Agency has identified a set of priority annual data flows, in the area of air quality, air emissions, inland waters, marine and coastal waters, contaminated soil, nature conservation and land cover. These data are used to update the core set of environmental indicators which form the basis of EEA reports and assessments. As far as possible, data and information which have already been reported by the countries in the framework of EU or international obligations are used within Eionet, entailing that data collected once at a national level can be used for many purposes at national, EU and international level. The data service provides access to most data sets and applications which have been used in EEA's periodical environmental reports and metadata for data that are maintained by other international organisations. In the Data section data sets can be accessed. The data sets contain aggregated data, typically on a country level, with a geographical coverage of at least 15 EU Member States. Graphs and, in the future, maps can be generated from the datasets. Information about the source of each data set and its geographical and temporal coverage is provided. In the Maps and graphs section one can find and download maps and graphs used in EEA products.

European Community – Water Framework Directive & WISE (water information system for Europe)	27 Member States + Norway Cooperation with European Commission, European Environment Agency for WISE portal	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy (	The Water Framework Directive is a legislative framework to protect and improve the quality of all water resources such as rivers, lakes, groundwater, transitional and coastal water within the European Union. One of the key activities under the joint implementation for the Water Framework Directive is the improvement of the information exchange between Countries, European institutions, the various stakeholders and the interested public. In order to promote an increases information exchange and to facilitate the work in the numerous expert groups, the Commission set up an internet-based platform, the so-called "WFD CIRCA" (see http://ec.europa.eu/environment/water/water-framework/iep/index_en.htm) WISE (the Water Information System for Europe) is being developed since 2006 and should be fully operational by 2010. It will serve as the electronic reporting system for the Member States for reporting on the monitoring frameworks of the Water Framework Directive and for reporting under the Urban Waste Water Treatment Directive (UWWD)[1], Bathing Water Directive (BWD), Nitrate Directive (NiD), Drinking Water Directive (DWD) and other mandatory or voluntary reporting to the EU level, in particular submissions to the European Environment Agency (EEA) and ESTAT. All authorised WISE data providers which have the right to upload data into WISE, which are officially nominated for compliance reporting or submitting

[1] For example, the reporting for Urban Waste Water Treatment Directive on the basis of Articles 15(4), 16, 17 is foreseen via WISE in 2009 at the latest.

			other data will be able to view all the submitted data. After the data submission has been finalised, the correspondent folder will be released by the authorised WISE data providers of the Member State. This means that viewing and download of datasets will be possible for all other authorised WISE data providers unless the data provider has explicitly restricted the data dissemination (see http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/w-wise_background&vm=detailed&sb=Title) . The WISE data policy (for spatial and non-spatial data) defines the arrangements for use and publication of the information and data submitted to WISE. As a matter of principle, all information and data will mostly be used within the EU bodies mainly for the purpose that they have been defined for in the approved reporting sheets. However, such data can also be used for other uses inside the European Commission and the EEA on the basis that such use is appropriate and that the original information and data is not made publicly available (internal use only). The intention is to minimise the restrictions on publication and in any case to make WISE data available free-of-charge in accordance with INSPIRE, with specific conditions for external use.
European Community - SEIS (Shared Environmental Information System)	EC (27 Member States)	Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions – Towards a Shared	The Communication sets out a set of principles on the basis of which the collection, exchange and use of environmental data and information should be organized in the future. In the course of 2008, a legislative instrument will be proposed to formalize these principles. The principles upon which the Shared

		Environmental Information System (COM(2008) 46 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0046:FIN:EN:DOC)	Environmental Information System (SEIS) is to be based are as follows: • information should be managed as close as possible to its source; • information should be collected once, and shared with others for many purposes; • information should be readily available to public authorities and enable them to easily fulfil their legal reporting obligations; • information should be readily accessible to end-users, primarily public authorities at all levels from local to European, to enable them to assess in a timely fashion the state of the environment and the effectiveness of their policies, and to design new policy; • information should also be accessible to enable end-users, both public authorities and citizens, to make comparisons at the appropriate geographical scale (e.g. countries, cities, catchment areas) and to participate meaningfully in the development and implementation of environmental policy; • information should be fully available to the general public, after due consideration of the appropriate level of aggregation and subject to appropriate confidentiality constraints, and at national level in the relevant national language(s); and • information sharing and processing should be supported through common, free open-source software tools. An implementation plan will be drawn up by the Commission in 2008, in collaboration with Member States and the European Environmental Agency.

Table compiled by Katleen Janssen

APPENDIX D

National Remote Sensing Laws and Policies

Country	National Space and/or Remote Sensing Law	Relevant Regulations, Policies, and Some Other Related Laws	Data Policy
Argentina	Creation of the National Commission on Space Activities, National Decree No. 955/91 Establishment of the National registry of Objects Launched into Outer Space, National Decree,125/95	None	National Commission of Space Activities data distribution policy allows for free and open access of data, catalyzed by the nation's interest in prevention and preparedness for future disasters. Can engage in commercial activities and distribute data accordingly.
Australia	Space Activities Act of 1998, No. 123	Space Activities Regulations of 2001, No. 186, *Regulatory Practices for National Space Organizations*, Procedure for licensing, operating and launch activities	GeoScience Australia provides data free on the internet and sells it in a packaged form on CD.
Austria	None	None	None
Belgium	Law on the Activities of Launching, Flight Operations or Guidance of Space Objects	In progress	In progress
Brazil	Law No. 8.854 of 10 February 1984 (Established the Brazilian Space Agency) Resolution on Commercial Launching Activities from Brazilian Territories, Resolution No. 51, Jan. 26, 2001 Resolution on procedures and on definition of necessary requirements for the request, evaluation, issuance, follow-up and supervision of licenses for carrying out launching	Portaria AEB (Administrative Edict), No. 27, Regulation on procedures and on definition of necessary requirements for the request, evaluation, issuance, follow-up and supervision of licenses for carrying out launching space activities on Brazilian Territory.	Summary: Currently under CBERS agreement, open access but possible movement to adopt other policies. Data downlinks licensed based on per-minute fee basis. China and Brazil may agree in a few special cases agree to transfer data free. Now includes Mozambique, Angola, and some other African countries. CRESDA and Brazilian ground stations have unlimited access. Distributors are licensed. Independent price list for distribution solely within national market. Can not be exported

	space activities on Brazilian territory, Administrative Edict No. 27, June 20, 2001 Complementary Protocol to the Framework Agreement Between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Applications of Outer Space Science and Technology on the Cooperation for the CBERS Application System, 2004. For the Government of the Federative Republic of Brazil For the Government of the People's Republic of China CBERS Data Policy		abroad. INPE and CRESDA set international prices. General Considerations: The downlink data is open to any country or organization and is based on the conception that CBERS imagery will be distributed by licensed representatives who operates an application system infrastructure that performs data reception and processing….Each ground station receives the image raw data and process it into image products, which will then be distributed to users. The licensing of CBERS data downlinks is based on fees which are charged in a per-minute basis. China and Brazil may, in a few special cases, upon mutual consultation, decide on the transfer of data free of charge. The ground stations operated by INPE in Brazil and by CRESDA in China have unlimited access to all data collected within their footprint. The policy for distribution of data collected by those ground stations will be defined by each operator. Licensing Policy For International Ground Stations (a) CBERS data reception, processing and distribution to other countries will be carried out by licensed representatives jointly appointed by CRESDA and INPE. (b) The licensed representative will

			commercialize CBERS data downlink to ground stations based on a annual fixed basis, based on a fee determined by INPE and CRESDA. The annual fee will be determined by the conditions of the ground stations, including geographical location and antenna footprint. Product Distribution Policy The commercial agreement between licensed representatives and distributors shall include the following: (a) The right of receiving, processing and distributing CBERS data shall be granted to the distributor by the licensed representative…… (f) Each distributor could set its native price list independently for distribution solely within its respective national market. Images distributed within the distributor's national market may not be exported abroad. (g) When distributing abroad, the distributor must refer to the international price list set by INPE and CRESDA.
Canada	Canadian Space Agency Act, 1990, c. 13 (Assented to May 10, 1990). Remote Sensing Space Systems Act, 2005	Bilateral US-Canada Agreement on Commercial Remote Sensing Satellite Systems Department of Industry Act Department of Foreign Affairs and International Trade Act National Defence Act Canadian Charter of Rights and	Incorporates all aspects of Canadian Access Control policy. Availability in accord with UN Remote Sensing Principles. Sensed states only automatically given access to data for improving natural resources management. License Conditions: Raw data and remote sensing products from the system about the territory of any country—but not including data or

		Freedoms, Article 1 Personal Information and Electroniocs Documents Act Access to Information Act	products that have been enhanced or to which some value has been added—be made available to the government of that country within a reasonable time, on reasonable terms and for so long as the data or products have not been disposed of" Priority access: Minister of Foreign Affairs may order if there are reasonable grounds that continued operations would be injurious to international relations inconsistent with international obligations Minister of Defence may order if there are reasonable grounds that continued operation would be injurious to defence of Canada or safety of Canadian Forces Solicitor General may order any service to Royal Canadian Mounted Police Canadian Security Intelligence Government for critical infrastructure protection or emergency preparedness Reasonable grounds service is desirable to fulfill respective responsibilities
China	Provisions and Procedures for the Registration of Space Objects, 2001. Interim Measures on the	None known. General policy statement in a white paper: China's Space Activities by The State Council Information Office, P.R.C. November, 2000; Beijing	Summary: Currently under CBERS agreement, open access but possible movement to adopt other policies. Data downlinks licensed based on per-minute fee basis. China and Brazil may agree in

	Administration of Permits for Civil Space Launch Projects, 2002. Complementary Protocol to the Framework Agreement Between the Government of the People's Republic of China and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Applications of Outer Space Science and Technology on the Cooperation for the CBERS Application System, 2004. For the Government of the Federative Republic of Brazil For the Government of the People's Republic of China CBERS Data Policy	CNSA 2003-12-15. "The Chinese government holds that international space cooperation should follow the fundamental principles listed in the "Deceleration [sic] on International Cooperation on Exploring and Utilizing Outer Space for the Benefits and Interests of All Countries, Especially in Consideration of Developing Countries' Demands" General policy statement in an October 12, 2006 white paper from the Information Office of China's State Council titled "China's Space Activities in 2006".: "China is unflinching in taking the road of peaceful development, and always maintains that outer space is the common wealth of mankind. While supporting all activities that utilize outer space for peaceful purposes, China actively explores and uses outer space and continuously makes new contributions to the development of man's space programs."	a few special cases agree to transfer data free. Now includes Mozambique, Angola, and some other African countries. CRESDA and Brazilian ground stations have unlimited access. Distributors are licensed. Independent price list for distribution solely within national market. Can not be exported abroad. INPE and CRESDA set international prices. General Considerations: The downlink data is open to any country or organization and is based on the conception that CBERS imagery will be distributed by licensed representatives who operates an application system infrastructure that performs data reception and processing….Each ground station receives the image raw data and process it into image products, which will then be distributed to users. The licensing of CBERS data downlinks is based on fees which are charged in a per-minute basis. China and Brazil may, in a few special cases, upon mutual consultation, decide on the transfer of data free of charge. The ground stations operated by INPE in Brazil and by CRESDA in China have unlimited access to all data collected within their footprint. The policy for distribution of data collected by those ground stations will be defined by each operator.

			Licensing Policy For International Ground Stations (a) CBERS data reception, processing and distribution to other countries will be carried out by licensed representatives jointly appointed by CRESDA and INPE. (b) The licensed representative will commercialize CBERS data downlink to ground stations based on a annual fixed basis, based on a fee determined by INPE and CRESDA. The annual fee will be determined by the conditions of the ground stations, including geographical location and antenna footprint. Product Distribution Policy The commercial agreement between licensed representatives and distributors shall include the following: (a) The right of receiving, processing and distributing CBERS data shall be granted to the distributor by the licensed representative…… (f) Each distributor could set its native price list independently for distribution solely within its respective national market. Images distributed within the distributor's national market may not be exported abroad. (g) When distributing abroad, the distributor must refer to the international price list set by INPE and CRESDA.
European Community		EC Directive 96/9/EC, Articles 7 (1); 10 (1); 10 (2); 10 (3); Recital 41; Recital 53	

France	Draft Law for General Space Activities accompanied by Advisory Letter from the Conseil d'Etat, French High Court on Administrative Matters. It is likely to have a separate chapter to include remote sensing rules. Government of France – CNES Administrative Act Loi N° 61-1382, dated 19/12/1961JO 10/12	Decree n° 84-510, dated 28 June 1984, named, Décret relatif au Centre national d'études spatiales (JO 29/06), modified by decree n° 89-77 (6/2/1989), decree n° 93-277 (03/03/1993, decree n° 93-1441 (27/12/1993) and decree n° 96-308 (10/04/1996). Additional, In progress.	EC Database Protection Directive 96/9/CE (1996) implemented by Loi 98-536. Additional, in progress.
Germany	Satellitendatensicherhertsgesetz Proposed 3-part law, drafted and in progress.	Proposed. For advanced systems. Three kinds of licenses: 1. satellite operation 2. general data distribution 3. specific data transactions	Proposed. National security is priority with commercial aspects secondary. Intent of proposed data distribution mechanism is to create a system in which an operator ("Betreiber"), a distributor ("Datenanbieter") or an operator/distributor ("Betreiber zugleich Datanbieter") will be licensed. To distribute data to users, they will be required too implement a "geomatrix" provided by the government that includes a check list to determine sensitivity of the transaction. There is potential liability if a distribution mistake is made. Penalties may include incarceration.
Hong Kong (special administrative region of China)	An Ordinance to Confer Licensing and Other Powers on the Chief Executive to Secure Compliance with International Obligations of the People's Republic of China with Respect	None.	None.

	to the Launching and Operation of Space Objects and the Carrying on of Other Activities in Outer Space, 13 June 1997, amended 1999.		
India	No space or remote sensing law.	No space or remote sensing regulations. Information Act 2000 Convergence Act 2001 Indian Constitution, Art. 51	Remote Sensing Data Policy (RSDP), ISRO: EOS:Policy-01:2001 Indian Space Research Organisation HQ, Bangalore-560 094 Government owns all data. All data up to 5.8 m is available. Higher on a case-by-case basis. High-resolution committee established. Restricts access to some foreign data within India.
Iran	Parliament approved bill to establish Iranian Space Agency, 2003 Decisions of the Supreme Aerospace Council	None	None
Japan	Law Concerning Japan Aerospace Exploration Agency. Law No. 161 of 13th December 2002, Chapter 3: Operations, Article 18: (Scope of Activities), 1. (5) "Dissemination of the activities referred to in each of the preceding Items, and promotion of utilization thereof." Japanese Draft Basic Law on Space Development (in progress).	Fundamental Policy of Japan's Space Activities, Revised on January 24, 1996, Space Activities Commission The Basic Law on Science and Technology (1995) 1999 Law Concerning Access to Information Held by Administrative organs, Law No. 42.	1. Long Term Plan of Space Development. Issued by Space Activities Commission (SAC) in September 2003' "Japan shall develop data archive systems so that users can use satellite observation data easily and effectively and promote utilization and circulation of data." 2. Japan's Earth Observation Satellite Development Plan and Data Utilization Strategy. Issued by Space Activities Commission (SAC) in July 2005. 3. Earth Observation Promotion Strategy, Council for S&T Policy, Cabinet Office, Govt. of Japan, 27 December 2004

			Detailed data policy for each satellite in progress. No formalized policy. Currently thinking about this. In principle: all data open to public. No specific resolution limit.. Satellite by satellite basis. Who is requesting data and why? Could be discussed internally. Guiding principles: --All data can only be used for peaceful purposes. --JAXA retains intellectual property rights to all data User categories: 1. Public data users Contribute to promotion of data utilization Cost of reproduction Should be “almost no charge” on networks Distributed by JAXA 2. Other data users Includes commercial Low price but not less than offered by private companies Distributed through private enterprise National security Information Gathering Satellite (IGS) Classified data Rules to be established for processed data Solve Earth observation data provision issues Encourage data use

			Ideal Ways to Provide data: --Government initiative and must be made widely available to benefit society --implement standard data processing and enable people other than observation technology experts to use data --establish environment to have private entities meet various needs --use the Internet
Malaysia	Security Act	Instruction 20 for Disaster Response National Space Policy	No restrictions on data distribution until higher than 5 meters spatial resolution. Then inquiry is made into who is buying the data and why. Similar policy regarding topographic maps. A restricted data policy is in review for space and aerial data for both foreign and Razaksat data. Malaysian Federal Treasury Department sets data pricing policy. Need to sell data at twice the cost to recover costs. Client's Charter. Provides data and value added products on commercial contract basis. Time line: Digital 5 days Computer printed product 2 – 3 weeks Photographic printed product 2 – 3 weeks Digital or printed value-added product 4 – 6 weeks Data and information for disaster applications "utmost priority" and as soon as technically possible.

Nigeria	None	Prohibitions of Copyright Act National Geospatial Data Infrastructure Policy Legal Subcommittee	In process by National Geospatial Data Infrastructure Policy Legal Subcommittee (to include data derived from *Nigeriasat* 2)
Poland	None	None	As per contract with satellite data provider and, by incorporation, national requirements to which the satellite data provider is subject.
Russian Federation	Law on Space Activities, Federal Law No. 5663-1, from August 20, 1993, as amended by Federal law No. 147-F3, 1996.	Rules on the Licensing of Space Activities, Rules No. 403 from June 30, 2006.	1996 National Space Policy Concept Unpublished National Remote Sensing Development Concept in progress.

South Africa	South African Space Affairs Act, No. 64, 1995. (Expected to be substantially revised soon.)	None	None specifically related to data from national satellites. Emerging data policy has not yet been published, but the intention is to grant free access to academic and government users. The question of whether commercial users should pay costs has not been resolved yet. Other data generated by publicly funded institutions makes data as widely and as easily accessible as possible, and commercial users are charged.
South Korea	Law on Space Activities, Federal Law No. 5663-1, from August 20, 1993, as amended. Act on the Promotion of Space Activities, Nov 2005	None	None
Spain	Royal Decree No.278-1995, Space Exploration.	None	None

Thailand	None	None	Lower price to government than private sector. Free data for educational use, use report required in exchange. Data access is on a case-by-case basis for the private sector. Free data for disasters. Policy being formulated for THEOS. Should be nondiscriminatory. Will be free for government. A consultant's report will go to GISTDA's Board for implementation. The minister of Science and Technology approves.
Ukraine	Law of Ukraine on Space Activity, No. 503/96-VR. 1996.	Authorized. Some contained in statute.	None.
United Arab Emirates	Federal Act 20 (1991) (Aerial remote sensing.)	None	As per contract with satellite data providers and, by incorporation, national requirements to which the satellite data provider is subject.
United States of America	The 1992 Land Remote Sensing Policy Act National Defense Authorization Act for Fiscal Year 2005 The Communications Act of 1934	Bilateral US-Canada Agreement on Commercial Remote Sensing Satellite Systems 15 CFR Part 960 Licensing of Private Land Remote-Sensing Space Systems; Final Rule U.S. National Space Policy, October, 2006 White House, Office of Science and Technology Policy and National Security Council,	1. 1992 Land Remote Sensing Policy Act: 5622. Conditions for operation (b) Licensing requirements [for commercial systems] Any license issued pursuant to this subchapter shall specify that the licensee shall comply with all of the requirements of this chapter and shall— (1) operate the system in such manner as to preserve the national security of the United States and to observe the international obligations of the United States in accordance with section 5656 of this title; (2) make available to the government of

		February 2, 2000 Memorandum of Understanding Concerning the Licensing of Private Remote Sensing Satellite Systems U.S. Commercial Remote Sensing Policy, April 25, 2003	any country (including the United States) unenhanced data collected by the system concerning the territory under the jurisdiction of such government as soon as such data are available and on reasonable terms and conditions; (3) make unenhanced data designated by the Secretary in the license pursuant to section 5621 (e) of this title available in accordance with section 5651 of this title; § 5651. Nondiscriminatory data availability (a) General rule Except as provided in subsection (b) of this section, any unenhanced data generated by the Landsat system or any other land remote sensing system funded and owned by the United States Government shall be made available to all users without preference, bias, or any other special arrangement (except on the basis of national security concerns pursuant to section 5656 of this title) regarding delivery, format, pricing, or technical considerations which would favor one customer or class of customers over another. (b) Exceptions Unenhanced data generated by the Landsat system or any other land remote sensing system funded and owned by the United States Government may be made available to the United States Government and its affiliated users at reduced prices, in accordance with this

			chapter, on the condition that such unenhanced data are used solely for noncommercial purposes. 2. National Defense Authorization Act for Fiscal Year 2005, SEC. 1034. Nondisclosure of Certain Products of Commercial Satellite Operations. (a) Disclosure Prohibited.--Land remote sensing information may not be disclosed under section 552 of title 5, United States Code. (b) Land Remote Sensing Information Defined.--In this section, the term ``land remote sensing information''-- (1) means any data that-- (A) are collected by land remote sensing; and (B) are prohibited from sale to customers other than the United States Government and its affiliated users under the Land Remote Sensing Policy Act of 1992 (15 U.S.C. 5601 et seq.); and (2) includes any imagery and other product that is derived from such data. (c) State or Local Government Disclosures.--Land remote sensing information provided by the head of a department or agency of the United States to a State or local government may not be made available to the general public under any State or local law relating to the disclosure of information or records.

			(d) Safeguarding Information.--The head of each department or agency of the United States having land remote sensing information within that department or agency or providing such information to a State or local government shall take such actions, commensurate with the sensitivity of that information, as are necessary to protect that information from disclosure prohibited under this section. (e) Other Definitions.--In this section, the terms ``land remote sensing'' and ``United States Government and its affiliated users'' have the meanings given such terms in section 3 of such Act (15 U.S.C. 5602).
United Kingdom	Outer Space Act, 1986.	None	None
COOPERATIVE SYSTEMS			
CBERS (Brazil and China)	Complementary Protocol to the Framework Agreement Between the Government of the People's Republic of China and the Government of the Federative republic of Brazil on Cooperation in the Peaceful Applications of Outer Space	N/A	Summary: Currently under CBERS agreement, open access but possible movement to adopt other policies. Data downlinks licensed based on per-minute fee basis. China and Brazil may agree in a few special cases agree to transfer data free. Now includes Mozambique, Angola, and some other African

	Science and Technology on the Cooperation for the CBERS Application System, 2004. For the Government of the Federative Republic of Brazil For the Government of the People's Republic of China CBERS Data Policy		countries. CRESDA and Brazilian ground stations have unlimited access. Distributors are licensed. Independent price list for distribution solely within national market. Can not be exported abroad. INPE and CRESDA set international prices. General Considerations: The downlink data is open to any country or organization and is based on the conception that CBERS imagery will be distributed by licensed representatives who operates an application system infrastructure that performs data reception and processing….Each ground station receives the image raw data and process it into image products, which will then be distributed to users. The licensing of CBERS data downlinks is based on fees which are charged in a per-minute basis. China and Brazil may, in a few special cases, upon mutual consultation, decide on the transfer of data free of charge. The ground stations operated by INPE in Brazil and by CRESDA in China have unlimited access to all data collected within their footprint. The policy for distribution of data collected by those ground stations will be defined by each operator. Licensing Policy For International Ground Stations

			(a) CBERS data reception, processing and distribution to other countries will be carried out by licensed representatives jointly appointed by CRESDA and INPE. (b) The licensed representative will commercialize CBERS data downlink to ground stations based on a annual fixed basis, based on a fee determined by INPE and CRESDA. The annual fee will be determined by the conditions of the ground stations, including geographical location and antenna footprint. Product Distribution Policy The commercial agreement between licensed representatives and distributors shall include the following: (a) The right of receiving, processing and distributing CBERS data shall be granted to the distributor by the licensed representative…… (f) Each distributor could set its native price list independently for distribution solely within its respective national market. Images distributed within the distributor's national market may not be exported abroad. (g) When distributing abroad, the distributor must refer to the international price list set by INPE and CRESDA.
COSMO-SkyMed and Pleiades (France and Italy)	Ratification and Execution of the Agreement Between the Government of the Italian Republic and the Government of the French Republic on Cooperation in the Field of Earth Observation, Done in Turin,	N/A	1. The Parties are agreed on the following principles: a) The data requested by one or the other of the Defence Ministries shall belong to the Defence Ministry having requested the programming. b) For other data:

	29th January 2001. Published in the Gazzetta Ufficiale (Official Gazette) 31st January 2004, no 25		i) the French Party is owner of the data generated by the optical component; I ii) the Italian Party is owner of the data generated by the radar component. 2. Civil and commercial distribution: In accordance with the common provisions on the use of data set forth in Article V, concerning the distribution and commercialisation of products derived from the dual-use satellite system, the Parties shall, in the course of Phase 1, define a common distribution policy. Each of the Parties shall designate a body to act as the interface with civil and commercial users, and to formulate, promote and distribute the data destined for civil and commercial users. (RE: Optical system. As further formulated pursuant to the Turin Agreement) CNES holds copyright License to use granted to defense, cooperating countries, and institutional users for non-commercial use full and exclusive license for data under responsibility of commercial operator. System resources, including data, allocation: 40% = institutional bodies less than 10% = defense

These charts are provided by the National Center for Remote Sensing, Air, and Space Law at the University of Mississippi School of Law. The information contained in this chart represents information as of January 3, 2007.