



# Report on Progress 2007

Cape Town Ministerial Summit

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Earth Observations for Sustainable Growth and Development

30 November 2007

## Acknowledgements

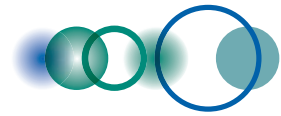
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## Executive Summary

Sustainable growth and development are vital goals of all countries, especially those with developing and emerging economies. There is growing recognition that natural and human-induced impacts on the Earth's complex environment are having significant consequences on the planet, impeding social and economic progress. Ministers at the 2002 World Summit on Sustainable Development proclaimed the importance of "promoting the development and wider use of Earth-observation technologies."

The response from the Members and Participating Organizations of the Group on Earth Observations (GEO) was to create a framework for a Global Earth Observation System of Systems (GEOSS). The aim is to establish coordinated, comprehensive and sustained Earth observations to enable countries to address the urgent challenges that are faced by an increasingly vulnerable global society. Already, the First 100 Steps to GEOSS are realizing benefits to society and the implementation of the GEO vision. This Report takes stock of the progress towards establishing the GEOSS.

In the two years since the adoption of the GEO 10-Year Implementation Plan, GEO has made many significant early advances in the implementation of GEOSS. Particularly for developing countries, the result has been improved capacity to leverage growth opportunities and an increase in resilience to the impacts of environmental change and variability.

To illustrate the value of GEOSS, this Report brings to the Minister's attention four emerging priority areas of high societal and political interest; climate change and sustainable development; water security for society and the biosphere; changing landscapes, healthy ecosystems and biodiversity; and disaster prevention and mitigation.

The concluding section of the Report issues a *Call to Action* to all GEO Members and Participating Organizations to:

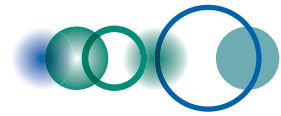
- work together to ensure full, open and timely access to data and relevant products at minimal cost
- ensure that observations are supplemented, improved, and sustained
- improve and expand modeling and prediction capabilities
- expand the commitment for capacity building and understanding user needs, especially in developing countries.

Finally, the GEO Community is asked to reaffirm its commitment to implement the Global Earth Observation System of Systems.

## Preamble

Natural and human-induced changes in the Earth's land surface, atmosphere, oceans, cryosphere, and biosphere are having significant impacts on our planet, impeding the social and economic progress of all nations, especially in the developing world. Sustainable growth and development demands well-informed policies and effective decision making. This in turn requires coordinated, comprehensive and sustained global Earth observations, as the foundation for sound scientific understanding.

The Members and Participating Organizations of the Group on Earth Observations (GEO) established a framework for a Global Earth Observation System of Systems (GEOSS). GEOSS will enable all countries to access Earth observations in order to address the urgent challenges that are faced by an increasingly vulnerable global society.



## Section I: Introduction

### The need for information, assessments and predictions

In 2007, five years after the World Summit on Sustainable Development, Ministers are gathering once again in South Africa to take stock of the progress towards establishing the Global Earth Observation System of Systems (GEOSS).

The strong messages in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, and the Millennium Ecosystem Assessment, acknowledge that we are now in an era of significant environmental and climate change with associated major societal, economic and environmental consequences predicted.

Sustainable growth and development are vital goals of all countries, especially those with developing and emerging economies. To achieve these goals there are significant challenges related to the convergence of growing populations, expanding urbanization, increasing energy and resource demands, and a changing environment.

The scientific information, assessments and predictions derived from a coordinated, comprehensive and sustained monitoring of the Earth's systems are essential to support informed policy development and improved decision-making across a wide range of societal challenges.

#### GEO and GEOSS Genesis

2003 – 1<sup>st</sup> Earth Observation Summit:  
Adopted a Declaration establishing an ad-hoc Group on Earth Observations.

2004 – 2<sup>nd</sup> Earth Observation Summit:  
Described the scope of a Global Earth Observation System of Systems.

2005 – 3<sup>rd</sup> Earth Observation Summit:  
Established the Group on Earth Observations and endorsed the GEOSS 10-Year Implementation Plan.

### GEO in Support of Other Initiatives

At the 2002 World Summit on Sustainable Development (WSSD), world leaders proclaimed the need “to promote the development and wider use of Earth observation technologies.” That vision built on the outcomes of landmark environmental Summits, especially the 1972 United Nations Conference on the Human Environment (Stockholm), the 1992 United Nations Conference on Environment and Development (Earth Summit), and the resulting Conventions on climate change and biodiversity. The WSSD and the many environmental treaties crafted over the past 30 years all have components that explicitly reference the need for Earth observations, inter alia, to help fulfill their commitments.

GEOSS contributes substantially to achieving the United Nations Millennium Development Goals, including those focused on improving the environment, mitigating poverty, hunger and disease. The need for coordinated, comprehensive and sustained global Earth observations, data analysis and information generation, and the concept of GEOSS itself, have also been consistently reinforced by G8 Summits. The G8 leaders made a clear commitment to strengthen international cooperation on global integrated Earth observations in 2003 at Evian, and reinforced this commitment through the 2005 Gleneagles Plan of Action and the 2007 Summit in Heiligendamm.

## Aim of GEOSS

The lives and livelihoods of billions of people depend on the effectiveness of policies and decisions to address the challenges presented by environmental change and the subsequent impacts on societies and the environment. The goal of GEOSS is therefore to achieve comprehensive, coordinated, and sustained observations of the Earth system in order to improve monitoring of the changing state of the planet, increase understanding of complex Earth processes, and enhance the prediction of the impacts of environmental change. GEOSS (figure 1) aims to enable all nations to benefit from easy access to timely, quantitative, and high-quality long-term global data and information as a basis for sound decision-making. It intends to enhance delivery of benefits to society in the following Societal Benefit Areas:



### Disasters

Reducing loss of life and property from natural and human-induced disasters.



### Health

Understanding environmental factors affecting human health and well-being.



### Energy

Improving management of energy resources.



### Climate

Understanding, assessing, predicting, mitigating, and adapting to climate variability and climate change.



### Water

Improving water-resource management through better understanding of the water cycle.



### Weather

Improving weather information, forecasting, and warnings.



### Ecosystems

Improving the management and protection of terrestrial, coastal, and marine resources.



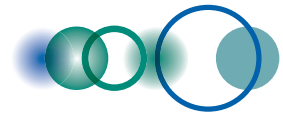
### Agriculture

Supporting sustainable agriculture and forestry and combating desertification.



### Biodiversity

Understanding, monitoring, and conserving biodiversity.



## THE Global Earth Observation System of Systems

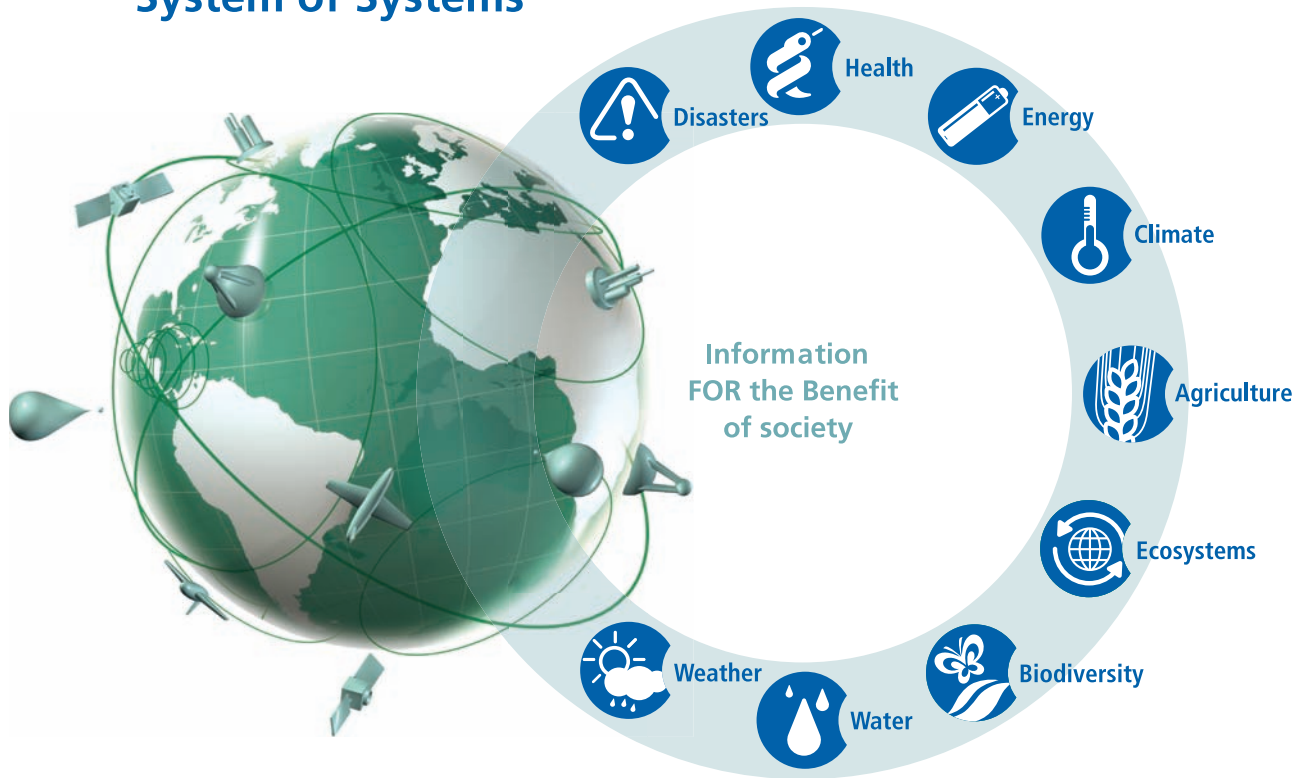


Figure 1 – The vision for GEOSS

The vision for GEOSS is to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.

A fully-implemented GEOSS will be of enormous value, linking both existing and new component systems provided by GEO Members and Participating Organizations. GEOSS will enable improved monitoring of the state of the Earth, increased understanding of complex Earth systems and processes, and improved accuracy and reliability of predictions of these changes. GEOSS will also support all countries in implementing their international environmental treaty obligations.

## Section II: Report on GEOSS Early Achievements

### The First 100 Steps to GEOSS

The GEO community is benefiting from coordinated planning and improved interoperability of systems, increased collaboration, streamlined communications, more efficient exchange of data and information, improved access to global Earth observation data, and a better understanding of user needs. GEOSS is guided by the 10-Year Implementation Plan approved by Ministers in 2005. The Plan includes 2-year, 6-year, and 10-year implementation targets. Since its adoption two years ago, GEO Members and Participating Organizations have taken substantive and significant steps towards achieving these targets in five broad categories:

- development of an efficient *organizational and governance structure*
- *mobilization* of the Earth-observation community
- establishment of key *cross-cutting initiatives* facilitating better data access and exchange
- commencement of *capacity-building* initiatives
- achievement of *results* within and among Societal Benefit Areas

As an overall assessment of the 106 GEO 2-year implementation targets, very good to excellent progress is being made towards 70 of them, good progress but more actions are needed for 27, while insufficient progress has been made towards 9. A full description of progress towards the 2-year GEOSS implementation targets and associated tasks, with reference to the Early Achievements, is provided in the GEO Secretariat Work Plan 2007 Progress Report.

The Annex of Early Achievements to this Report details specific achievements and contributions of Members and Participating Organizations. These *First 100 Steps to GEOSS* are concrete examples of societal benefits that are already being realized through the GEO process.

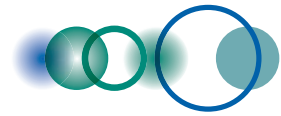
### Establishing an Organization and Governance Structure

As a new international initiative with demanding requirements for rapid implementation of GEOSS, GEO established a governing Plenary, an elected 12-member Executive Committee to maintain momentum between Plenary meetings, four technical Committees to inform and aid global coordination of key aspects of GEOSS, ad-hoc Working Groups to address specific issues, and a Secretariat to coordinate and support implementation activities. The organization and governance structure has contributed to the implementation of GEO and facilitated its early achievements.

#### GEO Committees and Working Groups

- Architecture and Data Committee
- Capacity Building Committee
- Science and Technology Committee
- User Interface Committee
- Working Group on Tsunami Activities





GEO membership has increased over the last two years (Figure 2). Equally important, Member commitment and contributions have increased substantially.



Figure 2: Growth of GEO Members and Participating Organizations

GEO has become an effective forum for the global and regional implementation of the principles of coordinated, comprehensive and sustained Earth observations within the framework of GEOSS. GEO Members have started to organize national GEO Committees or Secretariats to coordinate and mobilize national efforts. These countries are organizing their national Earth observation strategies to align with the concept of GEOSS.

### **Mobilizing the Earth Observation Community**

GEO provides a common vision for Members and Participating Organizations to focus their mobilizing and coordination efforts. The principles and activities have been embedded in many programmes and organizations, catalyzing the creation of interdisciplinary knowledge networks, or 'Communities of Practice', to ensure that user needs are reflected in GEOSS. Many Participating Organizations have redefined their objectives or adjusted partnerships to be more closely aligned with GEO Goals. Most global observing systems, including those of United Nations Special Agencies and Programmes, have been registered as components of GEOSS.

## **Improving Interoperability – Cross-Cutting Initiatives, Technologies and Systems**

GEOSS is becoming the mechanism for the coordination and collection of Earth observation data, their processing and delivery into useful information and prediction products for experts, decision makers, and the general public. Initial activities have focused on improving data access and data sharing, advocating the protection of radio frequencies for use by the global Earth observation community, advancing the development of interoperability between systems through international standards and other interoperability arrangements, developing mechanisms for the sharing and use of data and information products, and developing detailed specifications and demonstrations of the underlying architecture and user-interface components of the 'System of Systems'.

GEO is enabling users to locate, access, and share data, information, services and applications through a Clearinghouse and Web Portal (GEOPortal). Interoperability arrangements, such as the GEOSS component and service registration, the standards registry, and a forum to achieve consensus interoperability arrangements serve the GEOSS community significantly in addressing issues within and among Societal Benefit Areas.

The implementation of GEOSS depends on advances in scientific research and technology development. At the same time, GEOSS is a driver for research and development by providing access to data, facilitating the development of new observing systems, and encouraging the increased analysis of data sets and their conversion to information. These key GEOSS research areas include:

- integration of existing national or regional research activities within GEOSS
- cross-cutting research activities involving several Societal Benefit Areas
- research activities necessary for emerging Earth observation systems
- research activity to support Earth observation capacity building

## **Enhancing Capacity Building and User Outreach**

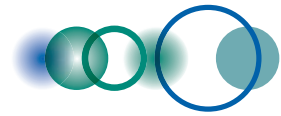
Building capacity to reduce the human, institutional and infrastructure limitations for using Earth observations are an integral component of GEOSS. Capacity building includes education and training, and promoting technologies that are required to use Earth observation data and information. The GEO Capacity Building Strategy has initiated work on the following priorities to:

- create a GEO Web portal (GEOPortal)
- implement a satellite-based information dissemination system (GEONETCast)
- promote Earth observation capacity building networks
- advocate the development and use of open-source software
- support national and regional capacity
- engage donors in capacity building priorities

GEO has initiated a broad and ongoing dialogue between recipients, donors and facilitators of Earth observation capacity building with an emphasis on responding to local user needs.

## **Achieving Results for Societal Benefit**

GEOSS builds on existing systems and accelerates the development of others. Early achievements across the Societal Benefit Areas include a programme to monitor the health of forests, a global wildfire-detection and early-warning system, defining a system to observe and monitor the status of biodiversity, cooperative ventures to improve daily global weather forecasts, an application to provide access to information on solar-radiation for clean-energy initiatives, deployment of a world-wide network of ocean sensors for monitoring changes in ocean circulations, and facilitating the planning for constellations of satellites for monitoring the state of the Earth.



Other early achievements include monitoring Africa's diverse environmental challenges, implementation of an African meningitis warning system, expansion of a drought-monitoring programme in North America, improved water-resource monitoring and management in Asia, and development of a disaster information-sharing system in the Asia Pacific region. A system in Central America monitors ecological change and forecasts the weather. Europe has an initiative on Global Monitoring for Environment and Security - GMES, including the implementation of a series of information services to address the atmospheric, marine and terrestrial domains, as well as emergency response and climate change.

## Section III: GEO as an Integrating Process: Reducing Vulnerability from Environmental Change

The early achievements of GEO demonstrate that its Members and Participating Organizations are making significant early progress towards realizing the GEOSS vision. Earth observations assimilated into predictive models provide the scientific underpinning for understanding the risks and vulnerabilities associated with environmental change and variability. With political will, and practical engagement, a fully implemented GEOSS will further improve our ability to address many of the critical global challenges. Four emerging priority areas of high societal and political interest effectively illustrate where GEO can reduce the vulnerabilities to environmental change.

### **Climate Change and Sustainable Growth**

Observation and forecasting of climate change are essential for predicting impacts and developing adaptation measures to mitigate the adverse effects of the changing climate. Predictive and observation capacities are needed to define policies for sustainable growth and to monitor their effectiveness. GEOSS contributes to this through more comprehensive and precise monitoring and predictions which will significantly improve the understanding of vulnerabilities to climate change at global, regional, and local scales.

#### **Climate Change and Sustainable Growth**

Examples of Regional / Global Programmes and Activities  
(see Annex of Early Achievements)

- State of the climate annual report
- Global Monitoring of Greenhouse gases
- Global Precipitation Climatology Center
- Monitoring Droughts from Space
- Climate for Development in Africa (ClimDevAfrica)
- European cryospheric climate monitoring system (EuroCryoClim)
- NPOESS / GCOM cooperation

GEO Members and Participating Organizations have integrated projects for coordinated global greenhouse-gas observations, improved detection of climate change indicators and their impacts, and provision of better access to information products for policy makers. The audience for this information is broad, encompassing public policy and decision makers.

## Water Security for Society and the Biosphere

Comprehensive knowledge and effective management of water is paramount to every nation's well-being and economy, as water quality and availability can limit sustainable growth and development. GEOSS contributes to understanding the changing water cycle and its impacts on water supplies for human consumption, agriculture and industry, maintenance of healthy ecosystems, and mitigation of floods and droughts. This understanding significantly improves the prediction of extreme weather events that result in drought or floods, and helps monitor the state of the oceans and the impacts of land-based sources of pollution.

### Water Security for Society and the Biosphere

Examples of Regional / Global Programmes and Activities  
(see Annex of Early Achievements)

- Global Runoff Data Centre (GRDC)
- Global Precipitation Climatology Center (GPCC)
- Asian Water Cycle Initiative (AWCI)
- Monsoon monitoring (HARIMAU)
- North American Drought Monitor
- Water Information System for Europe (WISE)
- Sentinel Asia

10 GEO is demonstrating that operational monitoring systems provide effective tools for better understanding the scope and potential impact of water-related events. Decision makers can use these tools to analyse and predict the impacts of water quality and availability, and then to develop effective mitigation strategies. GEO efforts are targeted at developing regional and continental scale systems for monitoring and managing crucial water resources.

## Changing Landscapes, Ecosystem Health and Biodiversity

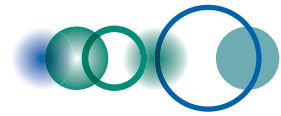
Biodiversity is the major building block of ecosystem health, resilience and sustainability of life on Earth. Natural systems provide a wide range of ecological services, including plant varieties for new crops, industrial materials and medicines, cleansing of water and the atmosphere, as well as leisure and cultural values. There are increasing demands for land and marine resources for urban growth, agriculture, forestry and fisheries, all of which are placing increasing pressure on natural systems and the critical habitats required to conserve biodiversity. To achieve a sustainable future, the economically productive use of land and marine resources for agriculture, forestry, and aquaculture resource production must be balanced with careful environmental stewardship.

### Changing Landscapes, Ecosystem Health and Biodiversity

Examples of Regional / Global Programmes and Activities  
(see Annex of Early Achievements)

- Biodiversity Observation Network
- Census of Marine Life
- Continuous Plankton Recorder survey
- Large-Marine Ecosystem Indicators of Global Change
- African Protected Areas
- Invasive Species Monitoring
- Biodiversity Interoperability Study

GEO is improving our knowledge of changes taking place in the Earth's land, coastal regions, cryosphere, oceans, and atmosphere. The development of integrated and predictive models that link the physical changes to the Earth and to the biological systems will help decision makers to evaluate different scenarios, plan and take appropriate actions.



## Disaster Mitigation and Response

Improving our ability to monitor, forecast, mitigate, and respond to natural and human-induced hazards is critical to reducing their impact. GEO is coordinating the Earth observations required for hazard detection and risk assessment. It is also advancing our capability to predict the occurrence of events so that mitigation and response actions may be better planned and executed.

### Disaster Mitigation and Response

Examples of Regional / Global Programmes and Activities  
(see Annex of Early Achievements)

- Global Wildland Fire Early Warning System
- Standards-based, All-Hazards, All-Media Public Warning
- Air Quality Forecasts and Decision Support for Respiratory Health
- Meningitis warning system for Africa
- Center for Satellite-based Crisis Information
- IFFI-Italian Landslides Inventory

GEO's facilitation of programmes and activities are beginning to show results. These include enhanced tsunami warning systems in the Indian Ocean, the establishment of a global wildfire detection and early warning system, improved forecasts and warnings of severe weather, enhanced detection of trans-continental air pollution, sustained high-quality global mean sea-level observations, cooperative satellite imaging for disaster response, and development of disaster information sharing systems. GEO has already enabled the sharing of valuable lessons learned and the extension of successful systems beyond their initial scale to address global concerns.

### ***The Challenge***

Earth observations provide essential data and information for making informed policies and decisions. The challenge is to sustain the interest and commitment of Governments and to marshal sufficient resources to implement the vision of a coordinated, comprehensive, and sustained 'System of Systems' that supports measures to protect our planet and its people.

This Report and the accompanying Annex describe how the efforts of GEO have made substantial progress in the early implementation of GEOSS. To continue delivering benefits to Societal Benefit Areas, Members and Participating Organizations must maintain their commitment to the GEO vision. Further support will accelerate the capacity to make the critical decisions facing global leaders on the issues of Sustainable Growth and Development in an era of significant environmental change.

## Section IV: Next Steps

In its evolution from concept to action and implementation, GEO continues to build the international framework needed to leverage national investments in Earth observations, prediction, and information systems to realize concrete results across all Societal Benefit Areas. GEOSS contributes to improved science, improved modeling and prediction systems, improved information uses, and sustainability of primary observation, data and information systems. An ever-widening range of user communities are partnering with GEO, and new products and applications are continually being developed. The success of these activities is due to their high visibility and the high-level support for GEO.

GEO has also identified a number of existing gaps and deficiencies in today's global observation systems that must be addressed in order to ensure that critical observations will continue into the future. These include significant gaps in coverage of geographic areas and a need for greater commitment to system sustainability. There is also insufficient knowledge of the interconnectedness of the atmosphere-land-ocean and sea-ice components of the Earth system. Moreover, considerable work remains to be done to fully incorporate GEOSS products into the decision-making processes, and to reduce restrictions on Earth observation data access and use.

### A Call to Action

Expressing the collective voice of the GEO community, a *Call to Action* is hereby made to all GEO Members and Participating Organizations, with emphasis on the following:

- **All GEO partners must work together to ensure full, open and timely access to data and relevant products at minimal cost.**

To fully realize the benefits of GEOSS, it is imperative to have a framework that will support the GEO principle of free and open exchange of data. This includes the establishment of an end-to-end, integrated and harmonized framework to govern the terms and conditions related to the access, sharing, collection, utilization, distribution and archiving of data and products. Data and products must be properly collected, analyzed and disseminated in order to support the public good across Societal Benefits Areas, and access to the radio frequencies indispensable for Earth observations from space and ground must be protected.

- **Observations need to be supplemented, improved, and sustained.**

- ***In-situ* networks and airborne systems.**

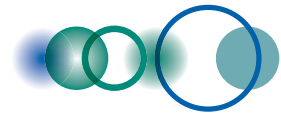
The modernization, coordination, expansion, and maintenance of existing and new networks and systems are essential to address existing observation gaps and to ensure continuity of essential data for GEOSS.

- **The sustained component of space-based observing systems needs to be expanded.**

Space agencies are encouraged to actively pursue the coordinated deployment of satellite constellations and the development of instruments aimed at fulfilling the observational needs of all Societal Benefit Areas in a sustained manner, while maintaining their efforts to improve observations through research and innovation.

- **Data networks and systems.**

Space agencies, agencies providing in-situ networks and airborne systems, and users, are all encouraged to pursue the coordinated development of interoperable data and data-processing systems, data archiving, and spatial data infrastructures for effective data updating and exchange.



- **Modeling and prediction capabilities need to be improved and expanded.**

Mitigating socio-economic hazards requires major advances and commitments in the prediction of environmental change and the modeling of the Earth system. The GEO community must develop a new generation of models to ensure advancement in predicting both evolutionary and high-impact events.

- **The path to sustainability for GEO requires a renewed commitment for capacity building and understanding user needs, especially in developing countries.**

GEO itself is a capacity building exercise to bridge the gap between developing and developed nations, and to engage all countries as partners in the GEO process. To achieve this, the perspectives of users and developing countries need to be better incorporated into GEO plans and activities. Emphasis must be placed on educating communities, facilitating coordination and collaboration, and providing and maintaining infrastructure that will help to ensure better decision-making for sustainable growth and development.

It is important to underscore the significant early achievements of GEO in building GEOSS, and that many mechanisms have been successfully implemented to meet the targets put forth in the 10-Year Implementation Plan. However, continued support and cooperation remains paramount to the further success of GEOSS.

As we continue to weave the fabric of GEOSS, to mobilize communities, change cultures, develop dialogue and facilitate integration, it is only fitting that the GEO Community is meeting in South Africa to reaffirm the commitment to implement the Global Earth Observation System of Systems – GEOSS – as an essential element to achieve the theme of our Ministerial Summit – *Earth Observations for Sustainable Growth and Development*.



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