



# The Global Geodetic Observing System: Meeting the Requirements of a Global Society on a Changing Planet in 2020

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**and many others**



# The Global Geodetic Observing System: Meeting the Requirements of a Global Society on a Changing Planet in 2020

## Today:

*H.-P. Plag: GGOS, the GGOS 2020 Process and the Users of GGOS*

*R. Gross: GGOS User requirements and Functional Specifications*

*T.A. Herring: Thoughts on Future Geodetic Reference Frames*

*M. Rothacher: The Design of GGOS in 2020*

*G. Beutler: Towards the GGOS in 2020*

*H.-P. Plag: Recommendations for the Development of GGOS*



Part 1:

*H.-P. Plag*

## **GGOS, the GGOS 2020 Process and the Users of GGOS**

- Introduction to GGOS
- Overview GGOS 2020, the Process
- GGOS Users considered in the Process



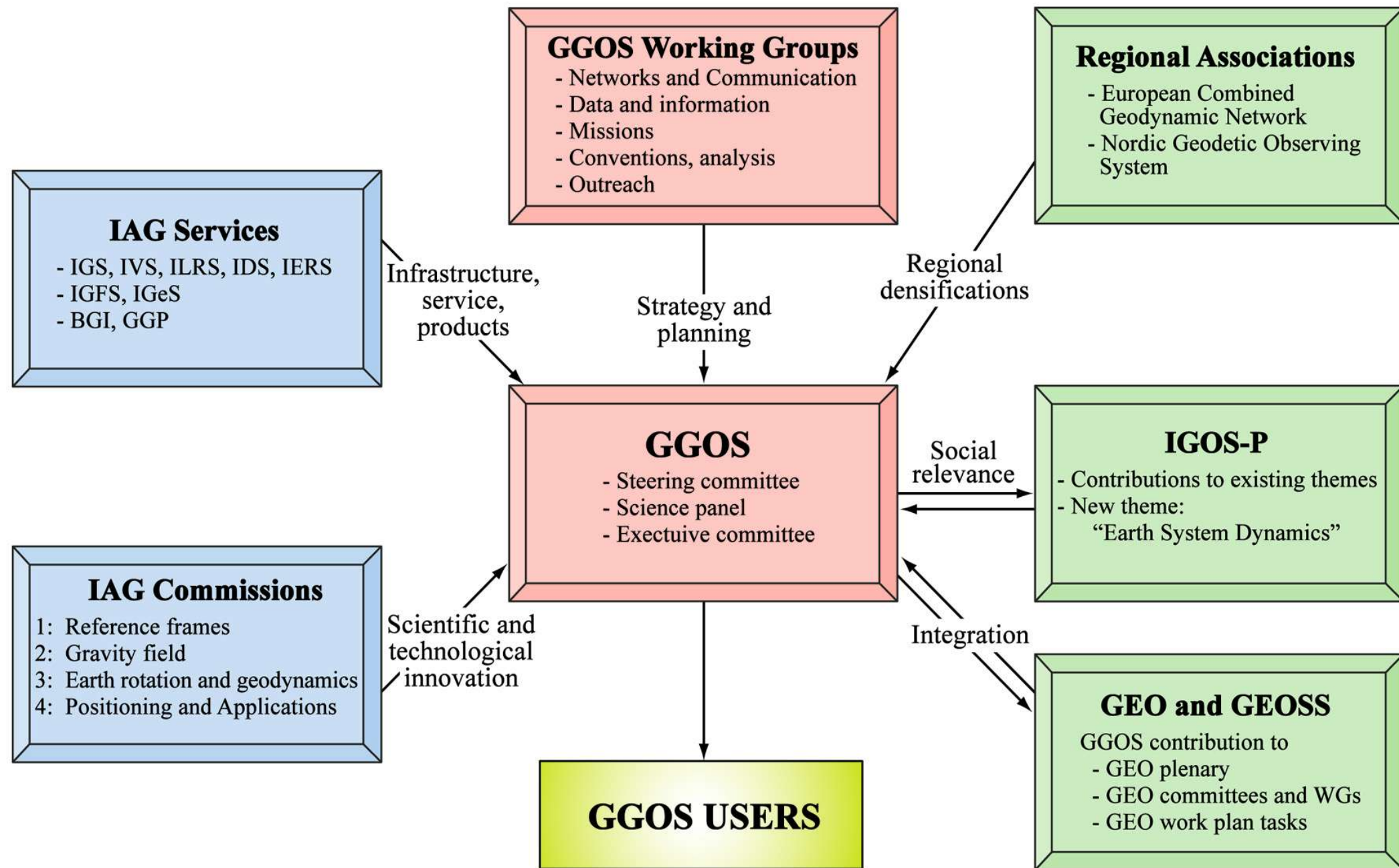
## *Establishing the Global Geodetic Observing System of the International Association of Geodesy:*

- In 2003, GGOS was set up as an IAG Project during the IUGG meeting in Sapporo, Japan.
- First two years devoted to the definition of the internal organizational structure of GGOS and its relation to the outer world.
- In 2004, IAG joined the (*ad hoc*) Group on Earth Observation (GEO) as Participating Organization and delegated representation to GGOS.
- In 2005, the Executive Committee of IAG at its meetings in Cairns, Australia, decided to continue GGOS.
- In 2006, GGOS became a partner of the *Integrated Global Observing Strategy Partnership* (IGOS-P).



*There are two rather distinct meanings for “GGOS”:*

- the “organization GGOS”: consists of components like Steering Committee, Science Panel, Working Groups, etc.;
- the “observation system GGOS”: the infrastructure consisting of many different instrument types, satellite missions, and data and analysis centers.





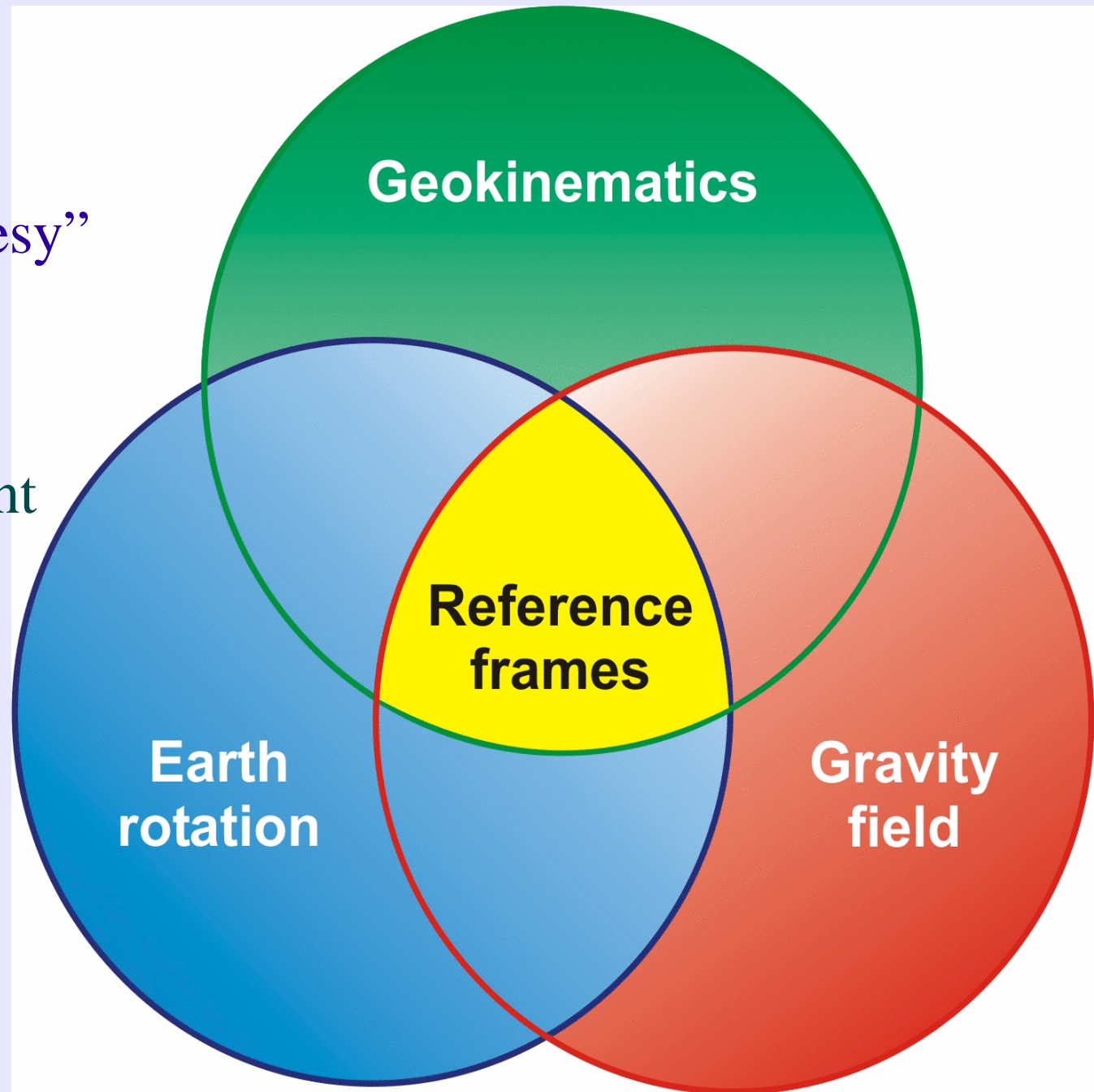


## *The Basis:*

“Three Pillars of Geodesy”

## *Central Goal:*

An integrated, consistent observing and analysis system





## GGOS 2020 Schedule

- April 2006: Request for Strategy paper of the GGOS Steering Committee.
- July 2006: Initial Writing Team established.
- October 2006: First draft Reference document available for GGOS Workshop.
- January/February 2007: Reviewer team established
- February 2/17, 2007: Versions 0.15/0.16, respectively
- February 19-22, 2007: GGOS Retreat and GGOS 2020 SWT Meeting, Oxnard, California
- Strategy and Reference documents available in April 2007
- Hearing phase, including GEO, IGOS-P, IUGG, national authorities and space agencies
- Final documents available for IUGG, July 2-13, 2007, Perugia, Italy





## Result

Two documents:

- **Strategy document:** short document for politicians, decision makers, funding agencies
- **Reference document:** long, comprehensive document with all the user requirements and details of GGOS in 2020 mainly for those actually doing the work



## Contents of Reference Document

1. Introduction
2. The ways, means, and achievements of geodesy
3. Observing a dynamic planet: Geodesy's contribution to science (Rummel)
4. Geodesy's contribution to the functioning of a modern society (Rizos)
5. Earth observation: Serving the needs of an increasingly global society (Sahagian)
6. Geodesy: foundation for exploring the planets, the solar system and beyond (Zumberge)
7. Integrated user requirements and functional specifications for the GGOS (Gross)
8. The future geodetic reference frame (Herring)
9. The future Global Geodetic Observing System (GGOS) (Rothacher)
10. Towards GGOS in 2020 (Beutler)
11. Recommendations



# 1. Introduction

GGOS 2020

- The Challenge: *Achieving sustainable development for an increasing population on a changing planet*
- The potential of geodesy: *metrological basis for Earth observation, monitoring system for mass transport*
- The observing system: *The current development of the Global Geodetic Observing System*
- The need for a long-term strategy



## 2. The goals, achievements, and tools of modern geodesy

GGOS 2020

Goal: Overview of the current state-of-the-art in geodesy



## 2. The goals, achievements, and tools of modern geodesy

- Geodetic Reference Systems and Frames
- The tools and products of modern geodesy
- Observing Earth's geometry and kinematic
- Observing Earth's rotation
- Observing Earth's gravity field
- Indispensable for modern geodesy: Accurate time
- Ensuring consistency of the observations of geometry, gravity field, and rotation
- Auxiliary observations and applications (*atmosphere, ionosphere, tide gauges, time transfer*)





3. Understanding a dynamic planet: Earth science requirements for geodesy - *Identify the open scientific questions and how geodesy might be able to contribute to the answers*

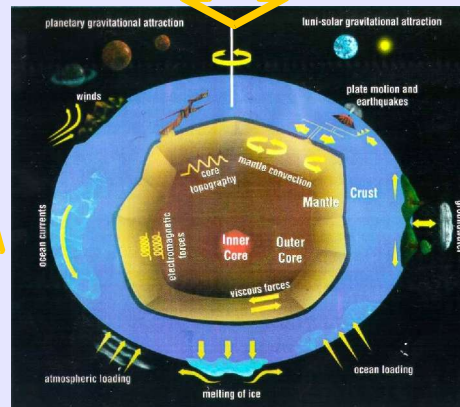
**Two main challenges:**

**A „the geodetic dimension“**

**Earth rotation**

**Geometry**

**Gravity/ Geoid**



Earth Deep Interior

Weather and Climate

Solid Earth processes

Ocean and climate

Cryosphere

Sea Level

Earth system dynamics

Mass Distribution and Transport

Earth system

Planets

**B „the geo-scientific dimension“**



3. Understanding a dynamic planet: Earth science requirements for geodesy - *Identify the open scientific questions and how geodesy might be able to contribute to the answers*
4. Maintaining a modern society - *Summarize the requirements for geodetic observations and products in support of a modern society*



Geodesy contributes to a modern society in various ways associated with a wide range of user requirements

- Spatial data infrastructure
- Navigation
- Engineering, Surveying and Mapping
- Machine Guidance
- Land Titling and Development
- Engineering Geodesy and Structural Monitoring
- Geographic information systems
- Height systems
- Timing applications
- Early warning and emergency Management
- Infomobility
- Management of and access to natural resources
- Monitoring the environment and improving predictability



3. Understanding a dynamic planet: Earth science requirements for geodesy - *Identify the open scientific questions and how geodesy might be able to contribute to the answers*
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5. Earth observations: serving the needs of an increasingly global society – *Understand the needs of the nine Societal Benefit Areas of GEO*





## The Nine Societal Benefit Areas for Earth Observations:

- **Disasters:** Reducing loss of life and property from natural and human-made disasters
- **Health:** understanding environmental factors affecting human health and well being
- **Energy Resources:** improving management of energy resources
- **Climate change:** Understanding, assessing, predicting, mitigating, and adopting to climate variability and change
- **Water:** Improving water resource management through better understanding of the water cycle
- **Weather:** Improving weather information, forecasting, and warning
- **Ecosystems:** Improving the management and protection of terrestrial, coastal, and marine ecosystems
- **Agriculture:** Supporting sustainable agriculture and combating desertification
- **Biodiversity:** Understanding, monitoring and conserving biodiversity



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5. Earth observations: serving the needs of an increasingly global society – *Understand the needs of the nine Societal Benefit Areas of GEO*
6. Geodesy: foundation for exploring the planets, the solar system and beyond – *Planetary science/geodesy and Inter-planetary navigation*





Part 6:

*H.-P. Plag*

**Recommendations for the Development of GGOS**



# 11. Recommendations

GGOS 2020

## **Recommendations:**

- Framework conditions
- Infrastructure
- Products
- Organizational
- Specific actions

## **Relevant for**

- Committee on Earth Observing Satellites (CEOS)
- Integrated Global Observing Strategy – Partnership (IGOS-P)
- Group on Earth Observation (GEO)





# 11. Recommendations

GGOS 2020

## Framework conditions:

- *transition from research to operational (including funding)*
- *international agreement on reference frame*

## Infrastructure:

- *operational core*
- *closure of spatial gaps*
- *improved tie to Center of Mass (SLR, gravimetry)*
- *monitoring of mass transport (gravity missions) – Earth system service*

## Products:

- *new reference systems and improved frames*
- *real-time access to reference frame*
- *GNSS seismology*

## Organizational:

- *association of GGOS with United Nation Agency (UNESCO)*
- *Intergovernmental Geodetic Commission*