



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

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(contributions from all leading authors and their co-authors)**



Time Schedule

GGOS 2020

- Request for Strategy paper of the GGOS Steering Committee in April 2006
- Draft Structure and Initial Strategy Writing Team (SWT) in June 2006
- First Meeting August 21-22, 2006, Washington, DC: Two documents (Strategy and Reference Doc.)
- First draft Reference document available on October 5, 2006
- GGOS Workshop 2006, October 8-9, Munich
- GGOS Retreat and GGOS 2020 SWT Meeting, February 19-22, 2007, Oxnard, California
- Strategy and Reference documents available in March 2007
- Hearing phase, including GEO, IGOS-P, IUGG, national authorities and space agencies
- Final documents available for IUGG, July 2-13, 2007, Perugia, Italy



Expected Output

GGOS 2020

- Two documents needed:
 - **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
- First focus is on the Reference document
- Draft Reference document now available, about 130 pages, but not yet complete ...
- A lot of work still to be done: make it consistent, no repetitions, ...
- Intensive and extensive discussions needed concerning the future structure and characteristics of GGOS (meetings and telecons)



Contents

GGOS 2020

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



Writing Team

GGOS 2020

- Editors: Hans-Peter Plag, Markus Rothacher
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- Chapter 9: Markus Rothacher, G. Beutler, W. Bosch, A. Donnellan, C. Ma, M. Pearlman, D. Smith, J. Hinderer, J. Ries, H. Schuh, F. Seitz, C.K. Shum, M. Thomas, I. Velicogna, J. Wahr, P. Willis
- Chapter 10: Gerhard Beutler, M. Pearlman, H.-P. Plag, R. Neilan, R. Rummel, M. Rothacher



1. Introduction

GGOS 2020

- The Challenge: Achieving sustainable development for an increasing population on a changing planet
- The potential of geodesy
- The need for a long-term strategy



3. Science URs

GGOS 2020

A „the geodetic dimension“

==> Internal user requirements

B „the geo-scientific dimension“

==> External user requirements



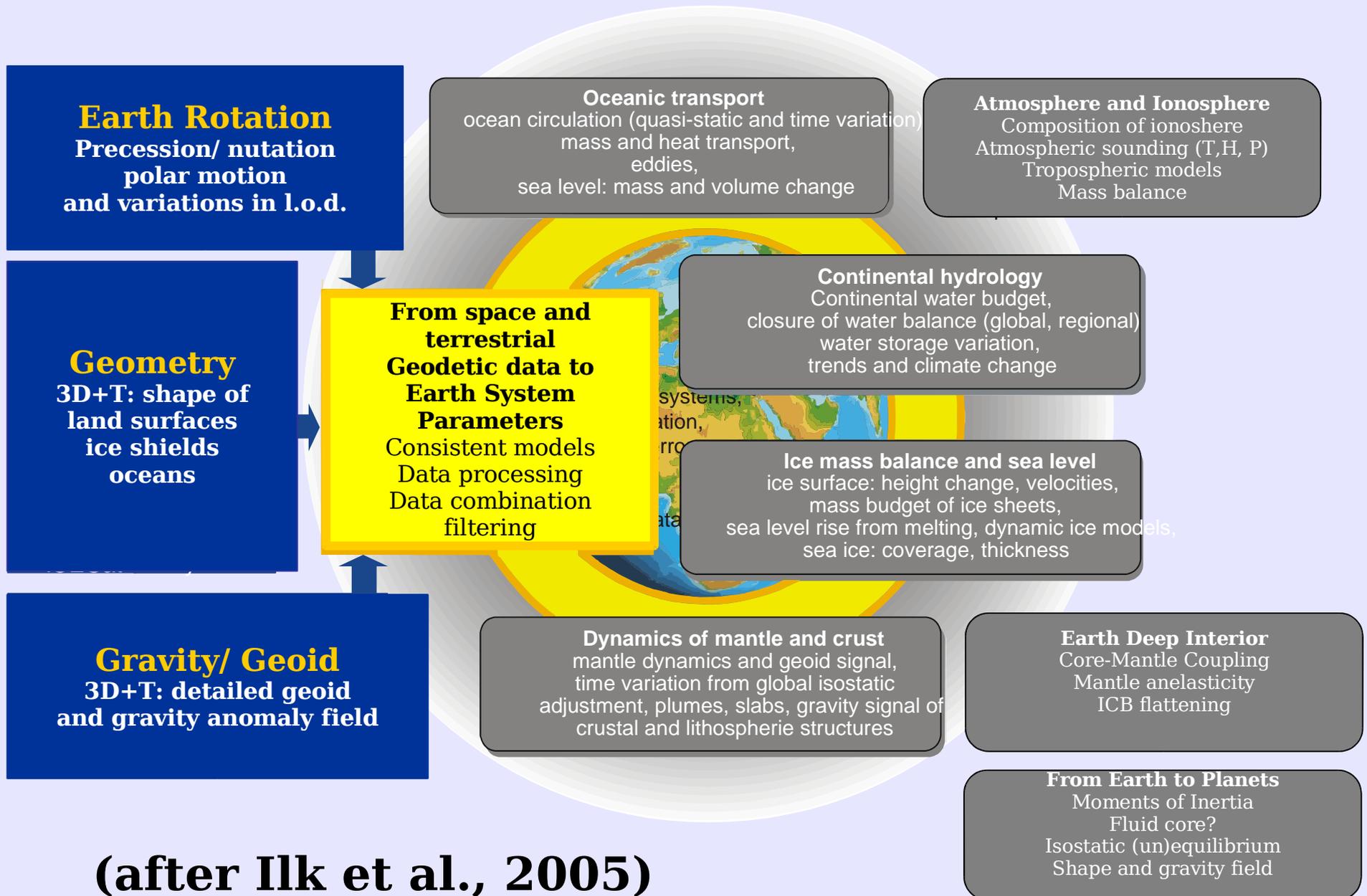
3. Science URs

GGOS 2020

A „the geodetic dimension“

- Global change quantities and their temporal changes are small and difficult to detect
- Need to be derived from combination of complementary observation and sensor systems and from models
- Needs the **combination of the three pillars of geodesy** in one well defined reference system with one part per billion (nano-geodesy), consistent in space and time and stable over decades
- The space segment has to operate as one global instrument at 1 ppb-level
- Space-borne, air-borne and terrestrial techniques are to be combined
- Need for one self-consistent **reference Earth System model** (what is our model Earth?)

A „the geodetic dimension“



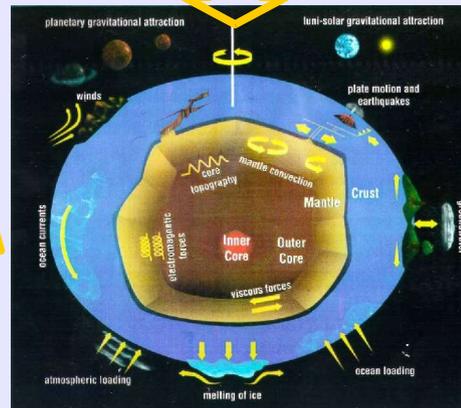
(after Ilk et al., 2005)

B „the geo-scientific 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



4. EOS URs

GGOS 2020

Understand the requirements of

- the nine societal benefit areas of Earth observation
- GEO
- IGOS-P Themes

The nine benefit areas of Earth observations:

- **Disaster:** 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:** 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



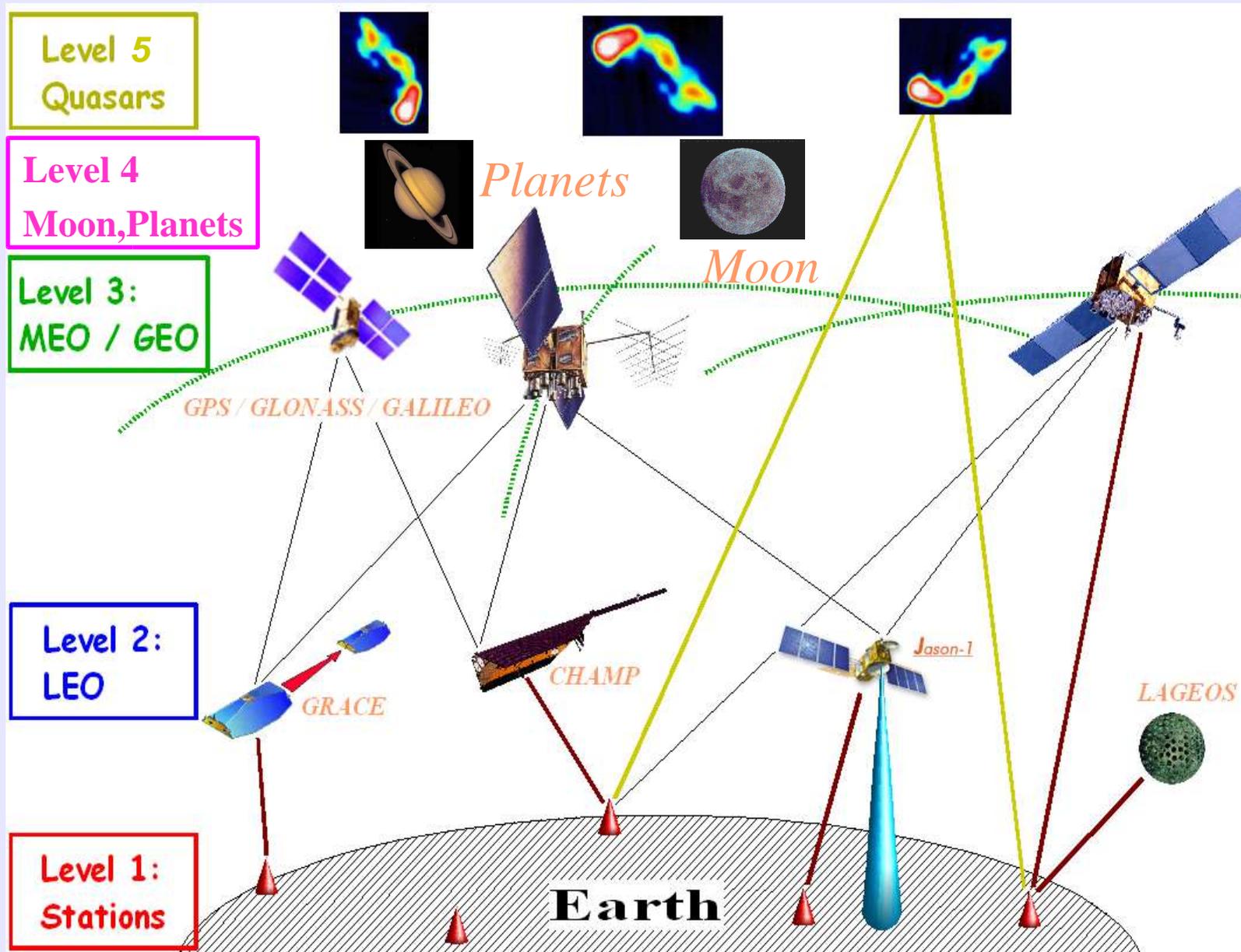
4. EOS URs

GGOS 2020

Topics addressed in the Chapter:

- **Disasters:** tsunamis, EQs, volcanoes, storms, landslides, creep, subsidence, floods
- **Energy resources:** wind, Oil pumping-induced subsidence, geothermal
- **Climate change:** ocean, atm. circulation, health
- **Water:** sea level, fresh water resources, lakes, streams, ground water, ice, dams, water mass redistribution, soil moisture
- **Weather:** enhancing prediction tools, extreme events, space weather
- **Ecosystems and Carbon cycle:** Land cover (forests, desertification), wetlands
- **Land use:** agriculture & irrigation, deforestation, desertification, erosion/deposition, urbanization

Integration of 5 Layers to a GGOS





11. Recommendations

GGOS 2020

Preliminary Recommendations:

- Operational gravity missions (GRACE-type)
- Satellite altimetry
- More satellite laser ranging (both ground stations and LAGEOS-type satellites)
- Integration InSAR and GNSS

Relevant for

- CEOS
- IGOS-P
- GEO



Theme Proposal

GGOS 2020

- “Earth System Dynamics” Theme proposal based partly on Chapters 3 and 4, but also 7, 9 and 11
- Should get some input from the other Themes (Theme leaders?)
- Proposal ready in March/April 2007
- Proposal can be presented/discussed at IGOS-P 14