Global Geodetic Observing System (GGOS)

Steering Committee Retreat

Munich, DGFI

Wednesday, February 15, 2006, 9:00 AM to

Thursday, February 16, 2006, 6:00 PM

Minutes (Version 0.2)

Written by
Hans-Peter Plag

(Version of 2006- 2-26 20: 8).

Participants:

Zuheir Altamimi, IGN (*Invited Participant*)
Norman Beck, NRC (*Substitute, IGS*)
Dirk Berend, GSFC (*Delegate, IVS*)
Srinivas Bettadpur, University of Texas (*Chair, GGOS WG on Missions*)
Gerhard Beutler, UNIBE (*IAG President*)
Wolfgang Bosch, DGFI (*Invited Participant*)
Claude Boucher, IPN (*Member, GEO Committee representative)*)
Bente Lilja Bye, NMA (*Chair, GGOS WG User Linkage and Outreach*)
John Dow, ESA (*Delegate, IGS*)
Hermann Drewes, DGFI (*Delegate, Commission 1*)
Bjorn Engen, NMA (*Invited Participant*)
Rene Forsberg, Danish Spacecenter (*Delegate, IGFS*)
Richard Gross, JPL (*Invited Participant*)
Werner Gurtner, AIUB, Bern (*Invited Participant*)
Chopo Ma, GSFC (*Delegate, IERS*)
Ruth Neilan, JPL (*Vice-Chair, GGOS Steering Committee*)
Erricos Pavlis, JCET/UMBC (*Delegate, ILRS*)
Michael Pearlman, Smithonian (*Chair, GGOS WG Network and Communications*)
Hans-Peter Plag, NBMG (*Vice-chair, GGOS Steering Committee*)
Markku Poutanen, Finish Geodetic Institute (*Delegate, Commission 2*)
Bernd Richter, BKG (*Chair, GGOS WG Data and Infrastructure*)
Markus Rothacher, GFZ (*Chair, GGOS Steering Committee*)
Wolfgang Schluetter, BGK/Wettzell (*Substitute, IVS*)
Tilo Schoene, GFZ (*Member, GEO Working Group Representative*)
Harald Schuh, University Vienna (*Invited Participant*)
Susanna Zerbini, University of Bologna (*Member, GEO Committee representative*)

Agenda:

1 ***09:00 - 09:15:*** **Welcome, announcements and introduction**

2 ***09:15 - 09:20:*** **Approval of Agenda**

3 ***09:20 - 09:30:*** **Minutes of the Third Steering Committee Meeting**

The minutes are available as ../scm3/minutes_sc3.pdf or ../scm3/minutes_sc3.html .

4 ***09:30 - 09:45:*** **Action Items from the last SC meeting**

The list of Action Items is available as ailist.pdf or ailist.html .

5 ***09:45 - 10:00:*** **Markus Rothacher: Scope and goals of the Retreat**

6 ***10:20 - 12:30:*** **The Vision of GGOS**

Chaired by Markus Rothacher. The session will include the following presentations

- Gerhard Beutler: Global, political vision of GGOS
- Richard Gross: Science vision of GGOS

- Wolfgang Bosch: Mass transport, mass distribution, satellite missions
- Markus Rothacher: Internal vision of GGOS

and allocate time for a subsequent discussion. All participants are invited to comment on the vision of GGOS prior to the retreat in e-mails to the SC Chairs.

7 ***14:00 - 14:45:*** **Discussion of the Draft ToR**

Chaired by Ruth Neilan. Brief presentation of the draft ToR, as prepared by Ruth Neilan with the help of others, and subsequent discussion of these. All participants are invited to comment on their expectation of GGOS, the GGOS Structure, and the GGOS products prior to the retreat in e-mails to the SC Chairs.

8 ***14:45 - 16:30:*** **Structure of GGOS and Science Panel (including coffee break)**

Chaired by Markus Rothacher. Brief presentation of the proposed structure by Markus Rothacher, and subsequent discussion with the goal

- to identify candidates for the three additional members of the Executive Committee,
- to identify candidates for the Members at large of the Steering Committee,
- to elect the members of the Science Panel.

For the last point, based on the discussion at the Third SC meeting, the Executive Committee is preparing a list of candidates for the Science Panel, and a vote on the Science Panel members is intended to be held.

9 ***16:30 - 18:00:*** **User Requirements for GGOS**

Chaired by Hans-Peter Plag. The session will include two presentations and amble time for discussion. The session is structured as follows:

- Hans-Peter Plag: Overview of users and their requirements as well as of existing User Requirements and System Performance databases
- Bernd Richter: Proposal for a GGOS UR and SP database
- All: Discussion of the proposal

The structure may still change.

10 ***09:00 - 10:30:*** **GGOS contribution to IGOS-P**

Chaired by Hans-Peter Plag. The session program will include brief presentations and sufficient time for discussions. The program is as follows:

- Hans-Peter Plag: Overview: GGOS progress towards a partner in IGOS-P
- John Dow and Ruth Neilan: Potential GGOS contributions to the Geohazards Theme
- Srinivas Bettadpur: GGOS contribution to the Global Water Cycle Theme
- Richard Gross: GGOS contribution to the Ocean, Coastal Zone, and Cryosphere Themes
- All: Discussion

The structure may still change.

11 ***11:00 - 12:00:*** **GGOS contribution to GEOSS**

Chaired by Ruth Neilan. The session has the following structure

- Hans-Peter Plag: Brief introduction to GEOSS
- Ruth Neilan: Target areas for a contribution of GGOS to GEOSS
- Hermann Drewes and Bjorn Engen: discussion of position paper

All participants are invited to contribute their thoughts concerning GGOS contributions to GEOSS (and also other organisations such as IGOS-P) prior to the retreat in e-mails to the SC Chairs.

12 ***12:00 - 15:00:*** **Steps towards the internal integration process of GGOS**

Chaired by Markus Rothacher. The session has the following structure:

- Markus Rothacher: Summary of reactions from the components
- Zuheir Altamimi: Considerations concerning GGOS - Services interactions
- All: Discussion (after lunch)

All participants are invited to consider the following questions and to comment on these prior to the retreat in e-mails to the SC Chairs:

- What does the component you represent expect from GGOS?
- What will the component you represent contribute to GGOS in terms of products and other contributions?
- What are the critical points you see concerning GGOS implementation and goals?

13 ***15:00 - 15:30:*** **Specification of the GGOS portal**

Chaired by Markus Rothacher. The specification should be in terms of Earth science and GGOS products. Carey Noll, Bernd Richter, Angelyn W. Moore, and Bente Lilja Bye are asked to prepare a proposal. There will be a presentation by Bernd Richter.

14 ***16:00 - 16:30:*** **Preparation of the GGOS Workshop**

Chaired by Markus Rothacher. The GGOS Workshop is scheduled for 8-9 October 2006 in conjunction with the IAG Symposium in Munich. The goals of the workshop, topics to be addressed, and participants to be invited have to be identified.

15 ***16:30 - 16:55:*** **Preparation of the IUGG General Assembly in Perugia, 2007**

Chaired by Markus Rothacher.

16 ***16:55 - 17:00:*** **GGOS Meeting Calendar**

17 ***17:00 - 17:30:*** **Markus Rothacher: Summary presentation**

18 ***17:30 - 17:45:*** **Any other business**

Chaired by Markus Rothacher.

19 ***17:45 - 18:00:*** **Summary of Action Items**

09:00 - 09:15: **Welcome, announcements and introduction**

Hermann Drewes opened the meeting and welcomed everybody, and after that Markus Rothacher welcomed everybody, too. In a brief round around the table, each participant introduced herself or himself.

09:15 - 09:20: **Approval of Agenda**

Markus Rothacher introduced the agenda and explained briefly the ideas behind the different topics. The agenda was accepted without changes.

09:20 - 09:30: **Minutes of the Third Steering Committee Meeting**

The minutes are available as ../scm3/minutes_sc3.pdf or ../scm3/minutes_sc3.html . Markus Rothacher addressed the minutes of the SC3 topic by topic and asked for comments. There were no comments, and the minutes were accepted with minor corrections provided by Ruth Neilan prior to the meeting.

09:30 - 09:45: **Action Items from the last SC meeting**

Markus Rothacher reviewed the Action Items (see ailist.pdf or ailist.html), and there were no comments to the status of the Action Items.

09:45 - 10:00: **Markus Rothacher: Scope and goals of the Retreat**

Markus Rothacher explained the scope of the retreat (see Rothacher_etal_scope.pdf), following to a large extent the agenda of the meeting. In the subsequent discussion, Markus Rothacher urged everybody to ensure a good contact and input to the national GEO representatives. Zuheir Altamimi asked to make the list of these representatives available to everybody.

Action Item GGOS-SC-4-1: All Steering Committee Members to contact their national GEO representatives in order to promote GGOS in GEO. ***Responsible: All, Deadline: 2006-12-31.***

Action Item GGOS-SC-4-2: Hans-Peter Plag to make available the list of national GEO representatives on the GGOS GEO web page. ***Responsible: Hans-Peter Plag, Deadline: 2006-02-28.***

10:20 - 12:30: **The Vision of GGOS**

The session was chaired by Markus Rothacher. The first presentation was given by Gerhard Beutler (see Beutler_vision.pdf). He focused on GGOS from the IAG perspective. The presentation started with an overview of how the geodetic reference frame was delt with in the pre-space age. He pointed out that astrometric measurements were mature at the end of the 19-th century, and Earth rotation measurements were possible. In the space age, a number of geometry-related and gravity-related IAG services were established. These were complemented by two documentations services.

Looking to the future, our generation has the task to solve the generalized problem for the next century and this involves the integration of the three pillars of geodesy.

In 2003, a new IAG structure was established, which amoung others also initiated GGOS. Space-geodesy and the IAG services were technology-driven, research-oriented, and based on voluntary commitment. Today, the space-geodetic tools have become indispensible tools for Earth observations, and these monitoring activities are difficult to justify in the present mainly science-focused funding situation.

The global networks and infrastructure cannot be taken for granted, despite the fact that this infrastructure is the basis for a large portion of Earth science. There are concret threats to close important

infrastructure. Therefore, the community has to find a stabilization for the global geodetic infrastructure on the political level. For this, it is good to see that the GGOS activities since 2003 are related to GEO and IGOS-P. A governmental level is required. However, the infrastructure and the services can only be preserved in the hands of one organization.

The space-geodetic techniques are today as mature as the astrometrical methods were at the end of the 19-th century. Therefore, the community is in a good position to propose something that is stable as a global and permanent infrastructure for Earth science, which will not have to be changed after a short time. It is also the time to ask for permanent gravity missions.

Gerhard Beutler continued with a brief history of the development of GGOS and pointed out that GGOS can be considered as a continuation of Baeyer's enterprise:

- The astro-geodetic techniques were mature in 1861.
- Space-geodetic techniques are mature today.
- Baeyer's enterprise promised new science.
- GGOS promises to be the metrological basis for Earth monitoring in the 21-th century.
- GGOS needs to establish stable infrastructure
- GGOS should aim to be stable for 30+ years.

In the subsequent discussion of this presentation, several participants underline the importance of international support for the maintenance of the national infrastructure. Susanna Zerbini named the example of Matera, where international support was crucial to keep the station alive. Gerhard Beutler pointed out that in this case, it was possible to reach the ministerial level in the emergency case, but the link to this level needs to be established also for the planning phase. Markus Rothacher emphasized the importance of the outreach activities, which need to be increased.

In his talk, Richard Gross (see Gross_science_vision.pdf) sketched a science vision for GGOS, which he termed as a personal vision. Starting from the dynamic Earth, where magnetic, convective, and radiative forcings constantly change the shape and surface of the Earth, he led the audience to the three pillars of geodesy, which are observed by a number of observing systems, with the stable reference frame in the center. The observing systems are linked together and observe the variations in geodetic quantities associated with the different subsystems of the Earth. These changes are all linked to each other, and the unification of the system promises new knowledge compared to the indivudal consideration of the sub-systems. In this way, inconsistencies can be eliminated, and solutions can be strengthened. However, the unification requires common standards.

Unified models are justified by the fact that changes in observed shape, rotation, and gravity often have common causes but are currently modeled separately. Therefore, it makes sense to develop common models and this leads to the goal of a Dynamic Earth theme.

As a foundation of the scientific mission, Richard Gross proposed the unification of observations, the unification of models, the unification of observations with models (through assimilation), and to address the dynamic Earth, by considering surface changes (natural hazards), mass transport and exchange (climate change), and angular momentum exchange.

Subsequently, Claude Boucher emphasized the importance of assimilation of observations in models, which is currently not focused on sufficiently. Richard Gross responded, that, yes, right now, we don't have geodetic models that assimilate observations, but for the vision, this should be a goal.

Wolfgang Bosch started his presentation (see Bosch_mass_transport.pdf) on mass transport, mass distribution, and satellite missions by making clear that he would report on the German project titled 'Mass transport and mass distribution', which has a duration of six years starting from 08/2006. The general objective is to reach a breakthrough in understanding and modeling processes in the dynamic Earth system. The project is motivated by an exceptional observational situation with three gravity missions and a number of other relevant satellite missions either being available or planned for the near future. The goals of the project require the work to be interdisciplinary. The project is described in Ilk et al. (2005), which is available for down-load as http://www.massentransporte.de/?33 .

Markus Rothacher provided his thoughts on the internal vision of GGOS (see Rothacher_internal_vision.pdf). After motivating GGOS by the helplessness in the face of natural disasters, which demonstrates the rather limited understanding of the Earth system, he pointed out that deeper insight into the processes is required. The geodetic techniques can contribute with observations at an unprecedented level of accuracy.

He then sketched four levels of improvements and integration for GGOS. As first level, he considered the raw data collection, where guarantee of infrastructure, continuous monitoring with satellite missions, working towards real-time and near-real time data flow and monitoring, complementation of the space-geodetic techniques with *in situ* and ground-based measurements, and the development of data flow, data access and management structures are points of improvements and progress of the present situation.

The second level are the three pillars of GGOS, where processing techniques have to progressed to an accuracy level of 10**(-10) and high temporal and spatial resolution. Real time processing of global data as well as full reprocessing capability for all techniques are required. Equally important is the consistency between the pillars. The development of operational InSAR and altimetry products for monitoring of the Earth system also belongs to this level.

The third level is integrations and combination, which applies to combination of products, the development of software packages that con combine all techniques on the observation level. The combination of InSAR and altimetry as well as the full consistency in models, standards and parametrization were also listed. Finally, a GGOS portal with easy access to all products for earth scientists and policy makers.

The fourth level focuses on modeling and interpretation. The geodetic time series need to be linked to geophysical models and the relationship between deformation, rotation and the gravity field needs to be taken into account. For that, the development of comprehensive numerical Earth models that account for the interaction between the components of the Earth system is a key step.

In the ensuing discussion, Werner Gurtner pointed out that GGOS is always focusing on the space-geodetic techniques while gravity and the gravimetric networks are absent. Zuheir Altamimi made a point that a combination of all is difficult to achieve soon but a gradual progress is possible. This was supported by John Dow, and he emphasized that the current progress is going in the right direction of towards the vision.

Bente Lilja Bye reminded that the starting point should be the users. Susanna Zerbini suggested that the vision should also consider what we could achieve if we have much higher accuracies available.

Norman Beck pointed out that the vision should make clear the output of GGOS is. Hans-Peter Plag suggested to make an attempt to come up with a short one to two sentence statement of the vision of GGOS, which might be distilled from the presentations of the morning. The vision could refer to GGOS as an indispensible part of Earth observations, which needs to be continued. Gerhard Beutler stated the vision would have to make clear that GGOS is the metrological basis for Earth observation.

In response to Werner Gurtner' s earlier statement, Rene Forsberg showed a few maps with gravimetric networks (see Forsberg_gravity_fields.pdf), explaing the air-borne and surface gravimetric networks, including also superconducting and absolute gravity networks. For GGOS requirements, the Global Geodynamics Project (GGP) for superconducting appears to be sufficient. Rene Forsberg stated that in summary, in gravity something is happening, it is not a problem for GGOS, but it needs time to develop.

Harald Schuh asked what the International Digital Terrain Model Service is, and Rene Forsberg stated that this has not yet started. Hans-Peter Plag asked whether this activity is coordinated with GEO activities, which focuses strongly on digital terrain model. Rene Forsberg said that there is no coordination, and the service is mainly for gravimetric application of the models.

Returning to a vision statement for GGOS, there was considerable discussion about the need for a short vision statement and how to reach there.

Action Item GGOS-SC-4-3: Markus Rothacher together with the EC to draft a vision statement that could be approved by the SC in April 2006. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-15.***

Chopo Ma proposed a sentence: GGOS develops and sustains science, infrastructure and data of geodesy to provide support for Earth science, mapping, and other societal needs.

14:00 - 14:45: **Discussion of the Draft ToR**

This session took place after TOP 8 had already been discussed. Thus, the current structure of GGOS was already presented and discussed by the participants. The session was chaired by Ruth Neilan.

In presenting her thoughts concerning the future ToR of GGOS (see Neilan_toward_tor.pdf), Ruth Neilan started by stating that the ToR depend on the organization GGOS will become. The ToR currently available need to be assessed for their appropriateness. In the current situation, a multi-faceted science with composite techniques requires integration. The IAG By-laws give some guidelines, and according to her, the structure set up so far is in agreement with these by-laws.

She continued by saying that so far, the organization has been established very rapidly and this was facilitated by the internet. Without the internet the current progress would not be possible. Ruth Neilan also stated that realizing the complementarity of the techniques leads to the recognition of the importance of geodetic observations and GGOS.

In considering an approach to the organization of GGOS, Ruth Neilan introduced a federation approach. For that, she told a tale of *Horton Hears a Who* .

She pointed out that it is important for GGOS to become a program of IAG, since project denotes a short term. The decision-making principle of GGOS should be mainly consensus based decision making and, if necessary, democratic votes. She underlined the importance of openness. Ruth Neilan sees a number of challenges, both technical and political. These include products and data analysis standards, conventions, integrity, reliability, but also keeping pace with the external processes.

Ruth Neilan posed questions about the future, the desired outcome, and the long-term targets to the participants. Is the current structure heading in the right direction? Are functional or structural changes needed? Should there be an open annual GGOS meeting, bi-annual SC meetings and monthly EC meetings? There should be a horizontal strategy development, and an embodiment of IAG. For the ToR team, she asked who is interested to help and stated that she already has several persons helping her (though without naming these explicitly). Bente Lilja Bye volunteered to join the ToR team.

There was considerable discussion concerning the role of GGOS with respect to products. There appeared to be consensus that GGOS should be the external interface for the services, which continue to have the responsibility for products. GGOS should have the task to ensure that the products are homogeneous, and that, where necessary, combined products are made available. Norman Beck expressed support for the notion of a federation of a group of services which came together to achieve something they could not achieve individually. Werner Gurtner commented on the members of GGOS and stated that the members could advertise their membership on their webpages, but for that it needs to be clear who the members are. Michael Pearlman assumed that all members of the services are also members of GGOS. This was supported by Gerhard Beutler. Michael Pearlman also pointed out that GGOS has not yet decided what business GGOS actually is going to be in. Therefore, this needs to be defined.

Markku Poutanen pointed out that the relation of GGOS to the regional implementations such as NGOS need to to be addressed in the ToR. Bente Lilja Bye noted the ESEAS as another relevant regional system. Markus Rothacher mentioned the ECGN as another regional implementation.

Gerhard Beutler proposed to follow a two step approach to the ToR, with the first step to have a mild review of the existing ToR and then in a year, based on the experience gained by then, to draft new ToR for approval in 2007. Consensus on that resulted in two Action Items:

Action Item GGOS-SC-4-12: Markus Rothacher together with the EC to review the current ToR and to draft intermediate ToR on the basis of these existing ones for the approval by the IAG EC in April as the intermediate ToR for the time up to IUGG 2007. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-13: Markus Rothacher together with the EC to prepare new ToR for the Perugia meeting defining the GGOS for the period from 2007 onward. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-04-30.***

14:45 - 16:30: **Structure of GGOS and Science Panel (including coffee break)**

It was decided to handle Top 8 before Top 7 so that the current structure of GGOS was known before the revision of the ToR was discussed. The session was chaired by Markus Rothacher.

Markus Rothacher started with a discussion of the structure of GGOS (see Rothacher_structure.pdf). The structure includes the Steering Committee, the Executive Committee, the Science Panel, the Working Groups, the Secretariat, the Services, the Commissions, and the GEO representatives. Markus Rothacher explained the composion of the SC as defined during SC3, and reviewed the list of members. Concerning the members at large, he stated that these should be elected by the full Steering Committee in order to improve the regional distribution of members. Markus Rothacher emphasized that it is important to determine the remaining delegates und substitutes until EGU 2006.

Action Item GGOS-SC-4-4: Markus Rothacher together with the EC to identify the remaining members (delegates and substitutes) for the Steering Committee in order to complete the SC. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

He also requested that the two members at large should be proposed and elected at the next SC meeting. Markus Rothacher raised the question of whether WG representatives (both for GGOS and GEO WGs and Committees) should have a vote. Srinivas Bettadpur stated that the WGs should not have a vote. There was some discussion on the voting with pros and cons for the voting of WGs. Werner Gurtner argued for only one class of members. In the end, the current situation, which gives all Steering Committee members a vote, was not changed.

Markus Rothacher also addressed the question whether IBS and ICGEM should have a delegate in the Steering Committee and how representation in the SC should be handled in the future with respect to centers such as the GGFC. There was some discussion with the conclusion that only major components in the structure of IAG Services and centers should be represented in the SC. Moreover, Bernd Richter pointed out that e.g. the GGFC is part of the IERS and as such already represented in the SC through the IERS.

Hans-Peter Plag asked about representation of the GGP in the SC, and Rene Forsberg supported a representation of the GGP. Markus Rothacher agreed to this.

The discussion turned to the Executive Committee, which was created in order to have a small and effective entity to take care of the day-to-day business. There was consensus that the three additional members should be elected when the full SC is fully defined, but candidates should be discussed. There was some discussion on the IAG President being ex-officio in the EC. The status was changed to observer status. No names for candidates were voiced.

Concerning the Science Panel, Markus Rothacher reviewed the tasks and current composition. He pointed out that the fields of atmosphere and hydrology still need to be added to the eight candidates that have agreed so far. Harald Schuh pointed out that there is nobody from China or Japan included. For atmosphere, Claude Boucher suggested Gilles Sommeria, while for oceanography, Srinivas Bettadpur suggested Chris Hughes and Hans-Peter Plag suggested Nevile Smith. No suggestions were made for hydrology. The Science Panel was accepted as suggested and the following Action Items were agreed:

Action Item GGOS-SC-4-5: Markus Rothacher to inform the Science Panel members of the result of the discussion and the fact that they were accepted as Science Panel members. ***Responsible: Markus Rothacher, Deadline: 2006-02-28.***

Action Item GGOS-SC-4-6: Markus Rothacher together with the EC to identify up to three more members for the Science Panel for the fields atmosphere, hydrology (global water cycle), and oceanography. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-7: Markus Rothacher to get feedback from Reiner Rummel concerning his willingness to serve on the SP. ***Responsible: Markus Rothacher, Deadline: 2006-02-28.***

Action Item GGOS-SC-4-8: Markus Rothacher together with the EC to write a statement on what the Science Panel is expected to do in the next 2 years (science rational and theme). ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Concerning the tasks of the SP, it was pointed out that they should carry forward the science rationale of GGOS, and develop the GGOS science plan. Markus Rothacher asked whether there should be a time schedule for the Science Panel to reach this goal. Michael Pearlman stated that there should be someone setting the requirements for GGOS, and asked whether the Science Panel could do this.

Hans-Peter Plag pointed out that the requirements should come from users, and therefore through a user interface, which the Science Panel hardly could be.

Richard Gross asked whether the chair of the Science Panel should be in the Executive Committee in order to integrate science stronger into GGOS, and it was explained that the Chair will be invited to participate in telecons of the EC on a regular basis.

Markus Rothacher suggested to ask the SP for a document of 20 to 30 pages describing the science rationale of GGOS, which should be available in a reasonable time. The Living Earth Document was named as an example of a short document, while the Science rationale for EuroGOOS was mentioned as an example for a longer and far more detailed document. Markus Rothacher requested the shorter document to be available for the IUGG 2007.

The need for a brief document describing what GGOS is and what it aims at was pointed out by several participants and discussed. This led to the following Action Item:

Action Item GGOS-SC-4-9: Markus Rothacher together with others to draft a document describing what GGOS is and aims for. ***Responsible: Markus Rothacher, Deadline: 2006-03-31.***

Markus Rothacher continued the presentation then by reviewing the status of the GGOS WGs and pointed out again that the chair of the WG on Conventions/Modelling and Analysis still needs to be identified. After some discussion, Hermann Drewes was suggested as chair of the WG, and he stated that he has will need some time to consider this request. Markus Rothacher asked Hermann Drewes to chair the WG and to come back with a decision in short time.

Action Item GGOS-SC-4-10: Hermann Drewes to respond to Markus Rothacher on the question of whether he can chair the GGOS WG on Conventions, modeling and analysis. ***Responsible: Hermann Drewes, Deadline: 2006-02-25.***

Harald Schuh pointed out that the distinction between the IERS conventions and the work of this WG needs to be clear. There was consensus that the WG has the task to look at the over-arching questions that lead to consistency across the three pillars.

Concerning the WG 'Publishing and Legal Matters', Hans-Peter Plag recommended that the group should be continued. The issue should be taken up during the Friday morning meeting of the WG chairs.

Action Item GGOS-SC-4-11: Hans-Peter Plag to ensure that the GGOS WG on Publishing and Legal Matters is discussed during the WG Leader meeting on February 17, 2006, and that a new chair is determined. ***Responsible: Hans-Peter Plag, Deadline: 2006-02-17.***

16:30 - 18:00: **User Requirements for GGOS**

The session, which was chaired by Hans-Peter Plag, include two presentations:

- Hans-Peter Plag: Overview of users and their requirements as well as of existing User Requirements and System Performance databases
- Bernd Richter: Proposal for a GGOS UR and SP database

Hans-Peter Plag gave an introduction to user requirement issues related to GGOS (see Plag_user_requirements.pdf). He first discussed existing user interfaces and user requirement databases and used GEOSS, GEO and CEOS/WMO as examples. A key point distinguishing GEOSS

from many science-driven observation systems is that GEOSS is not only user-driven but in fact owned by a main user group, i.e. the governments and governmental oganizations of many countries. Therefore, GEO puts a lot of emphasize on the establishment of a database with user requirements for GEOSS centered around the nine societal benefit areas of GEOSS and the appropriate design of a user interface.

The CEOS/WMO database of user requirements and system characteristics is a good starting point for a similar GGOS database, which eventually can contribute to the GEO database.

In a second part, Hans-Peter Plag focused on user groups and requirements for GGOS. He mentioned relevant studies carried out in Canada, Norway, USA, and Europe, and based on these, briefly reviewed the GGOS user groups and requirements. He concluded that a lot of information about user requirements as well as the performance of the IAG services is already available and can be collected in a common database that would allow to analyse the systems in order to identify gaps in the observation infrastructure and the products provided. Formulating the vision for GGOS to improve the geodetic observing system for the benefit of society, he posed the question of whether such a database could guide the improvement of the observing system.

Hans-Peter Plag then ended his presentation with a third part focusing on a proposal for a user requirement and system performance database (see also the related position paper ../../../sci/GGOS_Retreat_plag_etal_ur_pos_paper.pdf), and the discussion of the GGOS user interface. For the latter, he pointed out that GEO and IGOS-P both have developed advanced user interfaces and suggested that GGOS makes use of these in order to achieve most with limited resources.

Subsequently, Bernd Richter made a point in his presentation (see Richter_user_requirements.pdf) that the largest use of geodetic products is in the non-scientific field, while geodesy itself is the smallest users. On the other hand, access to the IAG products is largest for geodesy, and smallest for non-scientific users. Moreover, while scientists mainly need data and observations, non-scientific users would need information.

He continued by saying that the geodetic techniques can meet some of the requirements directly (e.g. for gravity measurements), some are met with derived products and information (e.g. time series of displacements). Some products are pre-requirements, not mentioned explictly, e.g. the reference frame.

Concerning system performance, Bernd Richter pointed out the need for inventories of observations networks and space mssions, their data and products, and their association with user requirements.

At the end of his presentation, he repeated the question whether GGOS should establish a user requirement and system performance data base as a tool for system planning and assessments. In the ensuing discussion, Wolfgang Bosch pointed out that the information on the CEOS/WMO page is not well validated and to a certain extent wrong. He cautioned that a database without a good clossary would not be sufficient and would lead to missunderstanding. Hans-Peter Plag agreed with him and pointed out that the proposed structure for the GGOS database was designed to avoid these problems.

Michael Pearlman asked whether GGOS cannot leave the effort of compiling the URs and the system performance to GEO or whether GGOS could try to influence GEO to go in the GGOS direction. Hans-Peter Plag pointed out that in GEO only those voices are heard that are present in GEO; therefore, is geodesy/GGOS does not take part in the effort, then the URs for geodesy are likely to be underrepresented or partly wrong, as in the case of the CEOS/WMO database. The process requires geodetic expertise, and this can only come from GGOS.

Claude Boucher asked for a documents that would define the terms used in relation to user requirements, which could be circulated in the community and agreed upon as a kind of standard in order to ensure that we understand each other.

Action Item GGOS-SC-4-14: Bernd Richter and Hans-Peter Plag together with others to write a brief document which defines the terms related to users, requirements and system performance. ***Responsible: Bernd Richter, Hans-Peter Plag, Deadline: 2006-04-30.***

After some more discussion, there was consensus that it GGOS should have a combined user requirements and system performance database, which then could be used both to ensure that the information in the GEO User requirements database is correct, and as a guide for the development of GGOS.

Action Item GGOS-SC-4-15: Hans-Peter Plag together with Bernd Richter and other to develop the proposal for the user requirement and system performance database further based on the draft position paper. ***Responsible: Hans-Peter Plag, Deadline: 2006-05-31.***

09:00 - 10:30: **GGOS contribution to IGOS-P**

In this session, which was chaired by Hans-Peter Plag, the following presentations were given:

- Hans-Peter Plag: Overview: GGOS progress towards a partner in IGOS-P
- Srinivas Bettadpur: GGOS contribution to the Global Water Cycle Theme
- Richard Gross: GGOS contribution to the Ocean, Coastal Zone, and Cryosphere Themes

Hans-Peter Plag first reviewed the IGOS-P background (see Plag_igosp.pdf and concluded that a membership of GGOS in IGOS-P implies a high-level recognition of GGOS. The main activities of IGOS-P happen in a small number of themes, which all are focused around specific societal problems. Being a member of IGOS-P would allow GGOS to initiate a theme centered around the mass transport in the Earth system, which would contribute to the problems of climate change and sustainable development.

In the second part of his presentation, Hans-Peter Plag reported briefly on the status of the GGOS membership in IGOS-P, and concluded that GGOS is close to being accepted as member, with two formal actions pending. Concerning the next steps, he pointed out that a writing team has started to prepare two documents, namely one describing the potential contribution of GGOS to existing themes, and another one outlining the rationale for a Earth System Dynamics theme.

Srinivas Bettadpur gave an overview of the contributions of geodesy to the observation of the global water cycle (see Bettadpur_water_cycle.pdf). The IGOS-P Theme 'Integrate Global Water Cycle Observation' has three goals relevant to GGOS, namely monitoring of climate variability and change, effective water management, and specification of initial conditions for numerical weather predictions. Srinivas Bettadpur pointed out that the geodetic contribution to the observation of the water cycle is undoubted and not a matter of discussion. Making a distinction between the geodetic contribution to the Theme and GGOS' contribution to IGOS-P, he stated that the GGOS contribution could be the quality assurance of geodetic products.

In his presentation, Richard Gross addressed the GGOS contributions to the Oceans and Cryosphere Themes (see Gross_ocean_ice.pdf). For both themes, the geodetic contributions includes the terrestrial and celestial reference frames, precise positioning both for *in situ* infra-structure and space-borne sensors, gravity measurements, and GNSS reflections.

In the discussion, John Dow explained that IGS increasingly progresses to real time products, which not only include access to GPS data in real time, but also improved near-real time orbits and clocks.

Gerhard Beutler emphasized that the characteristics of global monitoring as demanded by the IGOS could have been take from the ideas behind the development toward GGOS, which started years ago. Hans-Peter Plag pointed out that the 1990-ies, the development in IAG with respect to more integrated observation systems was happening in parallel to the general development in Earth observation. A milestone was the first Symposium on the Integrated Global Geodetic and Geodynamic Observing System (IGGGOS), which took place in October 1998 in Munich, i.e. in the same year as the establishment of IGOS-P.

Gerhard Beutler suggested that the Science Panel should contribute to the developement of the Earth System Dynamics Theme, and Hans-Peter Plag replied that it was agreed in the EC that the Science Panel should be contacted after its formation. This led to the action item

Action Item GGOS-SC-4-16: Hans-Peter Plag to contact the Science Panel and to ask them to contribute to the development of a paper describing the rationale for a Earth System Dynamics Theme. ***Responsible: Hans-Peter Plag, Deadline: 2006-03-10.***

Concerning offical GGOS representatives to IGOS-P themes, the following list was established:

- Ocean: Richard Gross
- Coastal: Claude Boucher and Hans-Peter Plag
- Water: Srinivas Bettadpur
- Geohazards: Susanna Zerbini and Hans-Peter Plag

11:00 - 12:00: GGOS contribution to GEOSS

The session, which was chaired by Ruth Neilan was started by Ruth Neilan with a brief introduction to a document describing the target areas for a contribution of GGOS to GEOSS, which she prepared for the SC3 (see ../../../sci/GGOS2GEOSS_scm3_081205.pdf).

Subsequently, there were three presentations:

- Hans-Peter Plag: Brief introduction to GEOSS
- Bjorn Engen: Discussion of position paper
- Bente Lilja Bye: Considerations concerning GGOS contribution to GEO

Hans-Peter Plag gave a brief introduction to GEOSS (see Plag_geoss.pdf), in which he emphasized again that GEOSS is a fully user-driven system, with the main purpose to serve the owners, that is the governments of the member countries. He illustrated the different options that Participating Organizations have to link and contribute to GEO, and, considering the limited resources of GGOS, emphasized the importance a careful decision of IAG/GGOS on where to engage.

Bjorn Engen in his presentation (see Drewes_Engen_geoss.pdf) summarized the position paper prepared by Hermann Drewes and Bjorn Engen, which was distributed at the retreat (not available as pdf). In its first part, the position paper gives an overview of the development and structure of GEO.

Subsequently, the position paper addresses the potential GGOS contribution to the nine benefit areas and the GGOS contribution to the transverse activities in GEO. The, he considered specific tasks in the GEO Work plan for 2006, and recommended several tasks for GGOS contributions.

Considering the list of transverse activities, Bjorn Engen recommended that the ITRF is proposed as new transverse activity.

Action Item GGOS-SC-4-18: Hans-Peter Plag to investigate through which channels the ITRF can be established as a transverse activity in GEO. ***Responsible: Hans-Peter Plag, Deadline: 2006-05-31.***

In the subsequent discussion, Hans-Peter Plag cautioned the participant to be careful in what is claimed to be GGOS. For example, the satellite missions GRACE and CHAMP are not GGOS or IAG, and so are not the satellite altimetry missions. Therefore, it has to be made clear what the actual contribution of GGOS is in the application of satellite altimetry and the gravity missions. He also pointed out that some names such as the *International Center for Global Earth Models* and the *International Service of Digital Terrain Models* may be misleading, since both of these are not as general as the names might suggest. He expressed the opinion that for GGOS, it will be important to avoid association with names and products that create far more expectations than GGOS can meet.

Gerhard Beutler asked whether there is any real commitment in GEO and Bernd Richter reported that in Germany the establishment of the national implementation plan is under way. Ruth Neilan said the same for the US, though it is not clear whether there will specific funding involved. Claude Boucher noted that for the EC, GMES is a commitment, but that France also has additional national ones.

Bente Lilja Bye explained that the participation of IAG/GGOS to GEO can be discussed in two ways, one being the contributions, the other the input of expertise, through representation in the committees. Michael Pearlman stated that GGOS should be the vehicle to bring all the IAG service into GEO.

12:00 - 15:00: **Steps towards the internal integration process of GGOS**

The session was chaired by Markus Rothacher and had the following two presentations:

- Markus Rothacher: Summary of reactions from the components
- Zuheir Altamimi: Considerations concerning GGOS - Services interactions

Prior to the retreat, all participants were invited to consider the following questions and to comment on these prior to the retreat in e-mails to the SC Chairs:

- What does the component you represent expect from GGOS?
- What will the component you represent contribute to GGOS in terms of products and other contributions?
- What are the critical points you see concerning GGOS implementation and goals?

Markus Rothacher reported on the few reactions of the components (see Rothacher_internal_integration.pdf), and he focused in particular on the response from ILRS. He then addressed several important questions with respect to the role and contribution of GGOS, and the difficulties in the implementation of GGOS.

With respect to the internal integration, he emphasized the importance of the GGOS WGs and the GGOS Portal for the internal integration process. For GGOS as a federation of services, the integration is important. The work has to take place in the WGs, which should be the driving force in the internal integration process. The data portal is extremely important. The IAG services already produce very important products and the portal should contribute to the promotion of these products.

GGOS has the important tasks to support the development towards the International Altimetry Service, help to set up the IGFS, encourage the ongoing integration process in the IERS further, encourage the GGFC sub-bureaus to play an important role, get the services to have full reprocessing capabilities, and, alst but not least, to encourage the services to go towards near-real time and real time products.

He also proposed an application-oriented design of the GGOS portal, which starting from events or phenomea would lead to geodetic products and from there to the instruments and services.

Claude Boucher asked about the relation to InSAR, and how GGOS will relate to it, since InSAR is not a fully geodetic technique. Markus Rothacher stated that it will be necessary to handle this in a service. Susanna Zerbini emphasized the importance of InSAR, also pointing to the combination of GPS and InSAR, with the InSAR experts being interested in geodetic expertise. Claude Boucher mentioned that InSAR is also used for many other non-geodetic purposes. Susanna Zerbini pointed out that some InSAR groups would like to see GPS stations every 30 km which would give very good InSAR results.

Zuheir Altamimi presented some ideas concerning the GGOS role in IAG and the contribution to GEOSS (see Altamimi_considerations.pdf). He emphasized the importance of mutual agreements between GGOS and the services. In his opinon, GGOS role is to be the window for the services. Since all IAG services should contribute to GGOS, this implies that all the products of the services should be compatible/interoperable, i.e. refer to the same Reference Frame.

15:00 - 15:30: **Specification of the GGOS portal**

The session was chaired by Markus Rothacher and started with a presentation by Bernd Richter. He gave a good overview over existing data portals pointing out that many pages are more oriented towards internal expert users than external users (see Richter_specification_portal.pdf). Positive examples are pages maintained by IOC, which are application oriented.

The strategy for the portal should give each service own visibility, and allow them the continuation of their own data and information systems. He proposed that the GGOS WG on Data and Information should develop a proposal in cooperation with GGOS Linkage and outreach and the host agency of the protal.

Bente Lilja Bye requested to base the portal on the vision (see Bye_data_portal.pdf). She proposed to divide the users into groups, namely external and internal users as main groups, with the external users focusing more on applications. Questions to be considered are

- Who is the user?
- What is the application?
- What data is required and how fast does it need to be delivered?
- What does the user really need to know?

She showed a overview of GEOSS and emphasized that this is rather similar to GGOS. She continued by requesting that a specification of the portal is made that respects the fact that GGOS has different users. The portal should use, as far as possible existing data services, particularly for external user. Such services could be Google Earth for visualisation and SimCity for simulation.

For internal users, the focus should be on improved service through more integrated services. Application could be used as showcases. She concluded by stating that the work associated with the development of the GGOS portal should not be underestimated, and recommended that dedicated funding is requested in appropriate proposals.

In the subsequent discussion, two Action Items were agreed:

Action Item GGOS-SC-4-19: Bernd Richter and Bente Lilja Bye together with the Data and Infrastructure WG and the Outreach WG to develop a proposal for the data portal to be discussed at the next SC meeting. ***Responsible: Bernd Richter, Bente Lilja Bye, Deadline: 2006-03-31.***

List of products:

Action Item GGOS-SC-4-20: Michael Pearlman together with the WG on Networks and Communication to establish a list of all the products of the services. ***Responsible: Michael Pearlman, Deadline: 2006-03-31.***

16:00 - 16:30: **Preparation of the GGOS Workshop**

Markus Rothacher reported on the preparation of the GGOS Workshop, which is scheduled to take place on October 8-9, 2006, in Munich in conjunction with the IAG Symposium (see Rothacher_etal_meetings.pdf). The goals of the workshop, topics to be addressed, and participants to be invited have to be identified.

Markus Rothacher discussed the organization of the workshop and pointed out that it was co-located with a number of other relevant events (FIG/IAG/Intergeo).

The workshop program includes two parts, one on the organization and political situation of GGOS, and the other on the science of GGOS. The first part will address the current status and future developments in GGOS as well as the international activities related to IGOS-P, GEO, and GEOSS. The scientific part will focus on areas not covered by services, the interaction of the geometry, Earth rotation, and gravity, and the paths from data collection to interpretation. The first idea for four sessions was presented.

Michael Pearlman asked for space for the WG to report. It was pointed out that the WGs should contribute to the session where appropriate, and that WG reports might fit into the session 'Status and future of GGOS'.

Hermann Drewes explained about the FIG and IAG meeting, where Thursday, October 12, 2006 is reserved for a common session.

The discussion resulted in the following Action Items:

Action Item GGOS-SC-4-21: Markus Rothacher to ensure rooms for the GGOS workshop. ***Responsible: Markus Rothacher, Deadline: 2006-09-15.***

Action Item GGOS-SC-4-22: The EC to set together the local organizing committee. ***Responsible: Executive Committee, Deadline: 2006-03-15.***

Action Item GGOS-SC-4-23: The EC to draft and send out the first circular for the Workshop ***Responsible: Executive Committee, Deadline: 2006-03-15.***

16:30 - 16:55: **Preparation of the IUGG General Assembly in Perugia, 2007**

Markus Rothacher informed about the status of the preparations for the IUGG meeting in July 2007 in Perugia, Italy (see Rothacher_etal_meetings.pdf). There will be a IUGG Symposium U3 on Global Earth Observation Systems, where a GGOS presentation will be invited. It is also considered to have a 1 Day symposium on GGOS. Moreover, there will be a GGOS Steering Committee meeting. The IAG Executive Committee will also meet and it is expected that important issues related to GGOS will be on the agenda.

16:55 - 17:00: **GGOS Meeting Calendar**

Markus Rothacher presented the meeting calender (see Rothacher_etal_meetings.pdf). It was suggested to have a meeting web pages available at the GGOS web page.

17:00 - 17:30: **Markus Rothacher: Summary presentation**

Markus Rothacher reviewed the Action Items (see below).

17:30 - 17:45: **Any other business**

There was no other business.

17:45 - 18:00: **Summary of Action Items**

Action Item GGOS-SC-4-1: All Steering Committee Members to contact their national GEO representatives in order to promote GGOS in GEO. ***Responsible: All, Deadline: 2006-12-31.***

Action Item GGOS-SC-4-2: Hans-Peter Plag to make available the list of national GEO representatives on the GGOS GEO web page. ***Responsible: Hans-Peter Plag, Deadline: 2006-02-28.***

Action Item GGOS-SC-4-3: Markus Rothacher together with the EC to draft a vision statement that could be approved by the SC in April 2006. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-15.***

Action Item GGOS-SC-4-4: Markus Rothacher together with the EC to identify the remaining members (delegates and substitutes) for the Steering Committee in order to complete the SC. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-5: Markus Rothacher to inform the Science Panel members of the result of the discussion and the fact that they were accepted as Science Panel members. ***Responsible: Markus Rothacher, Deadline: 2006-02-28.***

Action Item GGOS-SC-4-6: Markus Rothacher together with the EC to identify up to three more members for the Science Panel for the fields atmosphere, hydrology (global water cycle), and oceanography. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-7: Markus Rothacher to get feedback from Reiner Rummel concerning his willingness to serve on the SP. ***Responsible: Markus Rothacher, Deadline: 2006-02-28.***

Action Item GGOS-SC-4-8: Markus Rothacher together with the EC to write a statement on what the Science Panel is expected to do in the next 2 years (science rational and theme). ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-9: Markus Rothacher together with others to draft a document describing what GGOS is and aims for. ***Responsible: Markus Rothacher, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-10: Hermann Drewes to respond to Markus Rothacher on the question of whether he can chair the GGOS WG on Conventions, modeling and analysis. ***Responsible: Hermann Drewes, Deadline: 2006-02-25.***

Action Item GGOS-SC-4-11: Hans-Peter Plag to ensure that the GGOS WG on Publishing and Legal Matters is discussed during the WG Leader meeting on February 17, 2006, and that a new chair is determined. ***Responsible: Hans-Peter Plag, Deadline: 2006-02-17.***

Action Item GGOS-SC-4-12: Markus Rothacher together with the EC to review the current ToR and to draft intermediate ToR on the basis of these existing ones for the approval by the IAG EC in April as the intermediate ToR for the time up to IUGG 2007. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-03-31.***

Action Item GGOS-SC-4-13: Markus Rothacher together with the EC to prepare new ToR for the Perugia meeting defining the GGOS for the period from 2007 onward. ***Responsible: Markus Rothacher, Executive Committee, Deadline: 2006-04-30.***

Action Item GGOS-SC-4-14: Bernd Richter and Hans-Peter Plag together with others to write a brief document which defines the terms related to users, requirements and system performance. ***Responsible: Bernd Richter, Hans-Peter Plag, Deadline: 2006-04-30.***

Action Item GGOS-SC-4-15: Hans-Peter Plag together with Bernd Richter and other to develop the proposal for the user requirement and system performance database further based on the draft position paper. ***Responsible: Hans-Peter Plag, Deadline: 2006-05-31.***

Action Item GGOS-SC-4-16: Hans-Peter Plag to contact the Science Panel and to ask them to contribute to the development of a paper describing the rationale for a Earth System Dynamics Theme. ***Responsible: Hans-Peter Plag, Deadline: 2006-03-10.***

Action Item GGOS-SC-4-17: Hans-Peter Plag to establish contact to the Theme leaders and inform them about the contact person for the themes. ***Responsible: Hans-Peter Plag, Deadline: 2006-05-31.***

Action Item GGOS-SC-4-18: Hans-Peter Plag to investigate through which channels the ITRF can be established as a transverse activity in GEO. ***Responsible: Hans-Peter Plag, Deadline: 2006-05-31.***

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