GLOBAL CLIMATE OBSERVING SYSTEM

WMO UNESCO UNEP ICSU

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

REPORT OF THE

GLOBAL OBSERVING SYSTEMS SPACE PANEL

Fourth Session

(College Park, Maryland, USA, 22-23 October, 1998)

June 1999

GCOS - 47
GOOS - 67
GTOS - 20
(WMO/TD No. 941)

UNITED NATIONS ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL FOR SCIENCE

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OF THE
GLOBAL OBSERVING SYSTEMS SPACE PANEL

1 ORGANIZATION OF THE SESSION

1.1 Opening of the Session

The fourth session of the Global Observing Systems Space Panel (GOSSP) was held at College Park, University of Maryland, Maryland, USA on 22-23 October, 1998. Dr Francis Bretherton, the newly-appointed GOSSP Chairman, opened the meeting at 08:30 on Thursday, 22 October. He welcomed the participants and thanked them for having been able to attend the meeting, which had been called on somewhat short notice. This had been necessitated by the up-coming plenary meeting of the Committee on Earth Observation Satellites (CEOS), 10-12 November 1998, in Bangalore, India. GOSSP would be represented there by Prof. John Townshend, the former Chairman of the GCOS Joint Scientific and Technical Committee (now re-named as the GCOS Steering Committee), who was attending this GOSSP meeting as an invited expert.

1.2 Adoption of the Agenda

The tentative agenda was adopted (Annex I). The Chairman then invited the attendees (Annex II) to introduce themselves.

1.3 Welcome Message from the GCOS Steering Committee Chairman

The Chairman read a welcome message from the newly-appointed Chairman of the GCOS Steering Committee, Dr Kirk Dawson (Annex III).

2 REPORT OF THE GLOBAL OBSERVING SYSTEMS AND GCOS PANEL ACTIVITIES

By way of introduction, the Chairman explained that this meeting of GOSSP represented a restructuring and perhaps re-direction of the Panel in view of the new challenges being put to it. He suggested that GOSSP itself would consist of two representatives of each of the global observing systems, i.e., the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS), known collectively as the G3OS. For this particular meeting of the Panel, the representation of the different parties was as follows: GCOS was represented by Dr John Christy, with a second GCOS representative still to be appointed; GOOS was represented by Drs David Halpern and Ian Robinson; and GTOS by Dr Josef Cihlar and Mr André Bassolé. The latter was unable to attend this meeting and had sent his apologies. CEOS was represented by Mr Yukio Haruyama from the National Space Development Agency of Japan (NASDA), Dr David Williams from the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and Mr Gregory Withee, as well as Dr Brent Smith and Mr Jamison Hawkins, from the National Oceanic and Atmospheric Administration (NOAA).

The Chairman then gave an overview of the main objectives of the meeting, which were to assess the current situation of the Panel and to discuss a work plan. In particular, the meeting attendees should discuss activities related to the database developed by CEOS and the World Meteorological Organization (WMO). The role of the Space Panel would be to serve as a link between users and providers of space observations. GOSSP should make the scientific community aware of its activities, including the importance of their inputs into the statements of requirement. It was also necessary to establish links to end-users of the information derived from the Global Observing System.

2.1 Global Climate Observing System (GCOS)

Prof. Townshend gave an overview of the evolution of the GCOS Space Panel (see Annex IV). He informed participants that GCOS had originally established this Panel to provide a synthesis of its observational requirements to be met by space-based measurements. The Panel published in 1995 the first GCOS space plan[1]. In 1996, GOOS and GTOS joined the Panel, whose remit was broadened to include their requirements and whose name was changed to GOSSP. The expanded Panel had met twice (October 1996[2] and May 1997[3]), but had not achieved full agreement on user requirements. The scope and role of GOSSP was subsequently redefined and it was asked to take on the work previously carried out by the CEOS Analysis Group (AG)[4] in examining the balance between capabilities and requirements.

GOSSP would formally report to the G3OS, who would pass on the reports to their panels. However, there was in addition an agreement that CEOS would look to the GOSSP as an important contributor to provide information on requirements for the space segments of the Integrated Global Observing Strategy (IGOS). The recommendations of GOSSP should be made available to CEOS. **[Action 1.]** Informally, the separate panels of the observing systems would be involved in dialogues with GOSSP as part of its on-going activities.

Prof. Townshend then introduced his paper on the "Terms of Reference and Operation of the GOSSP" (Annex V). He noted that the new structure and its Terms of Reference had been agreed by the GOOS Steering Committee in April 1998 and the GTOS Steering Committee in June 1998. The GCOS Steering Committee still needed to formally approve the new Terms of Reference at its next meeting in 1999. He remarked that this paper on the new GOSSP had been introduced at the last CEOS Strategic Implementation Team (SIT) meeting in March 1998 in Paris, where the International Geosphere-Biosphere Programme (IGBP), the World Climate Research Programme (WCRP), the Food and Agriculture Organization of the United Nations (FAO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the WMO were represented. However, the role of the Space Panel in relation to these bodies had not been formally addressed at that time. (For background information on CEOS membership, see Annex VI.)

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[1] GCOS Plan for Space-based Observations, Version 1.0, June 1995 (GCOS-15).

[2] Report of the GOSSP, second session, Geneva, Switzerland, October 16-18, 1996 (GCOS-29).

[3] Report of the GOSSP, third session, Paris, France, May 27-30, 1997 (GCOS-37).

[4] At the 10th CEOS Plenary, in Canberra, October 1996, CEOS established the Strategic Implementation Team (SIT) and the AG. The AG comprised providers and users of space observations, and '...was designed to build upon past work in this area undertaken by CEOS Members and Affiliates and to complement Affiliates' plans for carrying out comparative analysis of requirements versus provision so as to avoid duplication of effort (from *CEOS Yearbook, 1997*).' The work of the AG was considered as finished, and the AG was terminated, at the 11th CEOS Plenary in 1997.

In the succeeding discussion, the participants felt that without the full participation of the three global observing systems, GOSSP might tend to identify only generalities. Further, participants should not identify only present requirements but consider future ones as well, e.g., assessing the capabilities of the National Polar-orbiting Operational Environmental Satellite System (NPOESS). **[Recommendation 1.]** With respect to the discussion about the 'users', the participants agreed that the 'end-user' should be clearly identified for each requirement separately, together with intermediate users at each stage of the analysis (e.g., scientists studying ocean circulation are users of the Global Ocean Data Assimilation Experiment (GODAE)). In this context an 'end-user' is defined as an organization with substantial financial resources and/or political influence. It is expected that in due course this would include the United Nations Framework Convention for Climate Change (UNFCCC), using input interpreted by the Intergovernmental Panel on Climate Change (IPCC). **[Action 2.]**

The new mode of operation of the Panel received general agreement. Having only a small number of experts or designating corresponding experts to meetings would not only facilitate communication but would reduce travel time as well. With respect to the role of the sponsors, participants welcomed the idea of having additional representation from other programmes at meetings, e.g., the WCRP. In addition, attendees concluded that it might be more appropriate to have three representatives, and not as originally proposed two, of CEOS participating at GOSSP meetings. **[Recommendation 2.]**

The issue was raised as to how to get new operational activities underway and how to find principal investigators for them. It was remarked that the Panel itself cannot set priorities for research programmes. The Panel discussed the strategy of building on existing operational systems and of staying in close contact with the research community. The requirements evolving from this strategy would then have to be reported to the space agencies in a dialogue reflecting the realities on both sides. This reporting could be led by the Chairperson of the GOSSP, on behalf of the G3OS. **[Recommendation 3.]**

2.2 Global Ocean Observing System (GOOS)

Dr Halpern gave an overview of GOOS activities related to space-based observations. The International Conference on Satellites, Oceanography and Society (ICSOS), was held from 17-21 August 1998, in Lisbon, Portugal in connection with EXPO98, and sponsored by the Centre National d'Etudes Spatiales (CNES), the IOC of UNESCO, the National Aeronautics and Space Administration (NASA), NASDA, NOAA, the Scientific Committee on Oceanic Research (SCOR) and the WCRP. ICSOS featured a Panel discussion on "A Vision of the Future". Panellists[5] stated that an end-to-end global observing system for the oceans is a high priority for implementation.

With respect to ocean biology, Dr Halpern noted that the ocean's role in climate includes biology, in addition to physical mechanisms. Satellite observations are critical to improving the knowledge pathways for biological-physical oceanographic interactions associated with fisheries and the carbon dioxide problem.

[5] NASA Associate Administrator G. Asrar; IOC Secretary-General P. Bernal; CNES Director-General G. Brachet; NASDA Executive Director S. Miura; ESA Director-General A. Rodotà.

The scientific focus of global observations of the ocean is increased understanding of climate variability and, subsequently, reduction of uncertainties of climate prediction. Important climate phenomena on seasonal-to-interannual time scales are El Niño/La Niña and monsoons, and on interannual-to-decadal time scales the North Atlantic Oscillation and water mass formation. In this context, Dr Halpern recommended reviewing the status and adequacy of 1990-2010 time series of current and planned space-based observations for sea-surface temperature, sea surface height/topography, ocean colour/phytoplankton, surface wind vector, surface wind speed and sea surface salinity, with regard to improvements in predictability of El Niño/La Niña, monsoon, water mass formation and carbon dioxide budget. **[Action 3.]**

Space-based observations of the ocean, as in the case of *in-situ* observations, will be integrated or combined together via general circulation models in order to yield simulated oceanographic variables regularly in time and space co-ordinates.

Of gravest concern are the sustainability of continuous, accurate space-based observations, reduction of deficiencies, and the reduction of degradation of end-to-end space-observation systems. It is important to note that not all space-based sensors recording a specific variable are equally accurate, and emphasis should be placed on acquiring the most accurate data because of the low signal-to-noise ratio associated with climate variations. Are space-based oceanographic observations keeping pace with developments of *in-situ* observing networks and developments of ocean modelling and data assimilation?

2.3 Global Terrestrial Observing System (GTOS)

Dr Cihlar gave a brief report on GTOS status, including recent meetings and activities of the Terrestrial Observation Panel for Climate (TOPC). He highlighted the outcome of the second session of the GTOS Steering Committee[6]. The Steering Committee focused on the following key questions for GTOS: (1) What are the shifts in the magnitude, direction, and regional and seasonal distribution of climate change and variability? (2) What is the impact of the changing climate on terrestrial ecosystems – food and fibre production, habitat? (3) Are changes in terrestrial ecosystems acting to enhance or moderate climate change? (4) How can information on terrestrial ecosystems be applied to improve the tools to assess and predict climate change and its impact?

With regard to the discussion on requirements, Dr Cihlar informed the GOSSP attendees how the TOPC has selected terrestrial variables. The first step was the analysis of requirements for biospheric, cryospheric and hydrospheric modelling. Then critical variables were identified and characterised. The individual variables were prioritised in terms of importance and feasibility. Dr Cihlar referred to the report of the third session of GOSSP[7], where the Panel decided on 12 applications for variables, and on a scheme on definition of variables[8] for Earth observations. The important issues for space-based terrestrial observation requirements are the matching of sensors and variables, the continuity of coverage, calibrated satellite data, geophysical parameter products and support for modelling and use of those products.

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[6] Report of the second session of the GTOS Steering Committee, 15-19 June 1998, Santander, Spain (GTOS-14).

[7] see footnote 3.

[8] see Annex VII of this report.

3 UNFCCC AND CONFERENCE OF THE PARTIES

3.1 Involvement of the Global Observing Systems

Dr Thomas Spence reminded participants that the third Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) had requested in its Decision 8/CP.3 that its Subsidiary Body for Scientific and Technological Advice (SBSTA), in consultation with the IPCC, consider the adequacy of the relevant global observing systems for climate and report on its conclusions to the COP at its fourth session, 2-13 November 1998, in Buenos Aires, Argentina. The report, produced under GCOS leadership, concludes that many of the observational requirements are generally known and documented and that many of the observing components are in place, but that they need substantial augmentations and enhancements to fully serve climate purposes. The full report and the executive summary are available on the GCOS[9] and UNFCCC Homepages[10].

Besides the COP-4 agenda item on 'Research and Systematic Observations'[11], another item closely related to the G3OS was land use and forestry issues[12]. GCOS is contributing to this issue through its TOPC Plan[13].

Panel participants pointed out that to have the countries' involvement and to get a national feedback would be one of the major follow-up actions coming out of COP-4. GOSSP could foster the dialogue between GCOS and the climate community by giving the discussion of 'Application Areas' (see Annex VII) primary attention. **[Action 4.]**

With regard to the issue of data exchange, it was noted that the reluctance of nations in giving data away free is mainly caused by competition from commercial operators. The Panel strongly supported the free exchange of scientific data as outlined in WMO Resolution 40[14]. The Panel was reminded that CEOS could eventually have commercial operators as Members, and that if confronted with GOSSP requirements, the implication of their reactions should be taken into consideration well in advance. However, in many cases the conflict need not be serious; for example, data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), a role model for commercialisation, are available within a couple of weeks. The anel concluded that GOSSP should develop a strategy for a commercial interface which deals with the combination of commercial data and freely-available scientific data. **[Recommendation 4.]**

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[9] http://www.wmo.ch/web/gcos/new.html

[10] http://cop4.unfccc.de/docs/cop4.html
Document number: FCCC/CP/1998/7 (Summary) and FCCC/CP/1998/MISC.2 (Full report).

[11] Agenda item 4 (Articles 4.1 (g) and 5 of the Convention).

[12] Agenda item 5.

[13] GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 2.0, June 1997 (GCOS-32).

[14] Twelfth World Meteorological Congress (Cg-XII), 30 May-21 June 1995, Geneva, Switzerland. Abridged Report and Resolutions (WMO No. 827).

4 INTEGRATED GLOBAL OBSERVING STRATEGY (IGOS)

4.1 Overview

Prof. Townshend gave an overview of the development of the IGOS. He informed the Panel that the first proposals on an IGOS were brought forward by CEOS Members in 1995. He recalled that IGOS is a strategy rather than a system, to emphasise the concept of consolidating already-existing systems. In the following years an integrated approach was developed to specify requirements and capabilities of the system. The SIT was established to demonstrate the value of the implementation through identifying prototype projects, while the Analysis Group (AG) was established to analyse the relationship between capabilities and requirements.

4.2 CEOS and SIT Pilot Projects

The Panel was reminded of the six IGOS projects currently being conducted:

- Global Observation of Forest Cover (GOFC)
- Global Ocean Data Assimilation Experiment (GODAE)
- Upper-Air Measurements
- Long-term Continuity of Ozone Measurements
- Long-term Ocean Biology Measurements
- Disaster Management Support

These projects are prototypes and were designed to provide lessons to the space agencies for enhancing their understanding of observational requirements. GOSSP can help to filter the implementation problems and co-operate with the SIT on this issue. The Panel recognised that quick implementation of the projects is of high priority, and recommended strong support for such pilot projects. **[Recommendation 5.]**

4.3 CEOS Affiliates Database

Dr Williams gave a presentation of the WMO/CEOS Database on user requirements and space capabilities, which is a key activity in support of an IGOS. This database was established to build a bridge between information providers and users, and is maintained by WMO on behalf of CEOS.

The Panel participants continued their discussion on future activities related to the database after the meeting. The outcome has been summarised by the Panel Chairman in a report (Annex VII). This summary includes the specific objectives of the database activity and describes its initial approach.

The participants felt that the essential objective of GOSSP with respect to the database should be to clarify and to make more accessible the specific connection between the needs of the end-users in the various application areas and the individual G3OS requirements. Participants recommended to WMO and CEOS an activity to facilitate access to the database and to enhance it to include information about data products at different levels. **[Recommendation 6.]**

Taking into consideration the evolution of earth system models and of the understanding and use of earth observation data, the Panel felt it essential to constantly revisit and systematically review the database. The existing G3OS requirements should be reviewed giving special attention to the representative users in each application area. Requirements need to be regularly up-dated and checked to ensure that they are still within their given rationale. **[Action 5.]**

In order to find the best approach for implementing an extended database, which includes information about existing global products and their users, an initial GOSSP pilot study should assess a small subset of the applications and remotely sensed variables, comprising only part of the whole framework of user requirements. **[Action 6.]**

The participants in the database activity discussion agreed that a report on lessons learned from this feasibility study should be presented to the G3OS and the IGOS Partnership meetings in Rome in June, 1999. **[Action 7.]**

5 THE SPACE PLAN

5.1 Outline of the Plan

The Chairman drew the attention of participants to the draft outline of the Space Plan, version 2.0. He asked the participants to consider this outline for the next full meeting of the GOSSP. **[Action 8.]**

The Chairman drafted a strategy for a work plan, which he distributed as a hand-out to the participants. He proposed to review the status of previously-defined climate-related GCOS, GOOS and GTOS requirements, and to review the requirements and the implementation status for other GOOS and GTOS applications of space-based observations. A major issue will be the consideration of the implications of the COP-4 decisions. Finally, he suggested participating in a broader dialogue on a strategy for observations after the Initial Operational System (IOS).

5.2 Data Requirements

With respect to climate-related data requirements, the Chairman referred to the previous discussion on database activities (see section 4.3 of this report and Annex VII). Participants agreed that GOSSP should contact the G3OS Steering Committee Chairmen to discuss the approach to the IPCC for the co-ordination of requirements. **[Recommendation 7.]**

Further, it was suggested that GOOS and GTOS panels should be asked to identify satellite requirements in a simplified way. End products that are required for particular applications should be stated, including specifications of accuracy, resolution, sampling, etc. together with a general indication of what satellite data will be required and an analysis of what relevant intermediate products are routinely available. At this stage, however, there would be no need to specify details of the satellite data. These inputs would then be combined and, where products coincide with those already defined, the work of defining the satellite input in detail can be saved. **[Action 9.]**

6 GOSSP DIRECTIONS AND PRIORITIES

The participants discussed major deficiencies ('tall poles') in the current plans of space agencies. Following is a list of urgent topics on which GOSSP will focus attention, with a view to making recommendations to CEOS:

(a) Products important for climate observations and analyses have been suspended, at least temporarily, e.g., global vegetation index from LANDSAT (Pathfinder).

(b) There is no future commitment to continuation of the Moderate-Resolution Imaging Spectroradiometer (MODIS) beyond its lifetime on the AM platform to be launched in 1999.

(c) Not all scatterometers providing surface vector winds have the same performance, i.e., sampling characteristics and the quality of derived data may be different. In addition, an unproven passive radiometer should not replace a proven instrument in the NSCAT (NASA Scatterometer) class.

(d) Altimeters delivering data on sea surface topography should be of comparable quality to that of TOPEX/POSEIDON. The sun-synchronous NPOESS orbit will alias the solar tide, degrading the utility of a JASON-class altimeter.

(e) There is a lack of a global strategy for the systematic acquisition of high-resolution data ($\approx$ 30 m). These data are crucial, for example, for analyses of the terrestrial boundary layer.

(f) The crossing (or overpass) times for satellites should be more stable, especially for polar orbits.

The participants agreed that more information for each 'tall pole' should be assembled before any recommendation can be formulated. [**Action 10.**]

In a further discussion participants wanted on record that there is a great need for ground truth data and for test calibration of instruments. There was a consensus that cross-calibration and other ancillary information is just as important as asking for new satellites. Further, provision needs to be made for enough overlap between different instruments for the relative bias to be determined accurately (at least one year).

It was suggested that GOSSP should first focus on identifying global products, and then trace back those products to the capability of space instruments. The G3OS should be involved in this process and help in identifying how and where to get global products. [**Recommendation 8.**]

7 TERMS OF REFERENCE

The current GOSSP Terms of Reference (Annex VIII) were distributed for further consideration as appropriate at the next full meeting of the Panel. [**Action 11.**]

8 CONSOLIDATION OF ACTION ITEMS AND FUTURE WORK PROGRAMME

ACTIONS: The participants agreed upon the following action items:

1. Make the recommendations of GOSSP available to CEOS.

2. Identify more clearly, in collaboration with G3OS , the 'end-users' and 'intermediate users' in the statements of requirements.

3. Review in collaboration with GOOS the status and adequacy of long-term time series of current and planned space-based observations for ocean variables with regard to improvements in predictability of seasonal-to-interannual and interannual-to-decadal time scales.

4. Give the discussion of 'Application Areas' primary attention in order to foster the dialogue between GCOS and the climate community as a follow-up to COP-4.

5. Establish in collaboration with G3OS and CEOS a process to revisit and systematically review the database on an ongoing basis.

6. Undertake a GOSSP pilot study of the feasibility of enhancing the database by including information about the chain of global data products at different levels between the end-user and a satellite operator.

7. Present to the G3OS and the IGOS Partnership meetings (June 1999 in Rome) a report on lessons learned from a pilot feasibility study of the database.

8. Consider the outline of the Space Plan, Version 2.0, for the next full meeting of the GOSSP.

9. Examine, with GTOS and GOOS panels, the feasibility of a simplified form of presentation for requirements for satellite data which could be synthesized with GCOS by GOSSP into a unified statement.

10. Assemble more backup information about each major deficiency ('tall pole') in current plans of space agencies in order to formulate recommendations.

11. Review the Terms of Reference for consideration at the next full meeting of GOSSP.

RECOMMENDATIONS: The participants agreed upon the following recommendations:

1. G3OS should be encouraged to identify not only present requirements but also future ones for consideration in later phases of IGOS implementation.

2. CEOS should be invited to nominate two or three representatives to GOSSP.

3. G3OS, in collaboration with GOSSP, should establish a mechanism for reviewing and updating requirements in the light of evolving implementation by the space agencies.

4. GOSSP should develop a strategy on a commercial interface which deals with the combination of commercial data and freely-available scientific data.

5. Strong encouragement and support should be given to pilot implementation projects such as those of SIT.

6. WMO and CEOS should facilitate access to the database and consider an activity to enhance it by including information about data products and users.

7. GOSSP Chairman to contact G3OS Steering Committee Chairmen to discuss approach to IPCC for coordination of data requirements.

8. G3OS should work with GOSSP in identifying global products for inclusion in the database.

9 OTHER BUSINESS

The Chairman reminded the participants of the following up-coming meetings:

14-15 January 1999:	4th SIT meeting, San Diego, California, USA;
9-12 February 1999:	GCOS Steering Committee in Geneva, Switzerland;
April 1999:	GOOS SC, Beijing, China;
April-July 1999:	GCOS Science Panels (AOPC, OOPC tentatively May 1999 in Melbourne, Australia: TOPC, tentatively July 1999, in Birmingham, UK);
June 1999:	G3OS Sponsors meeting in Rome, Italy;
July 1999:	Unispace III, in Vienna, Austria;
November 1999:	CEOS Plenary in Sweden.

10 DISCUSSION ON PANEL MEMBERSHIP

The membership for the Panel will be formalised in consultation with the Chairmen of the G3OS Steering Committees for the next full meeting of the GOSSP.

11 CLOSURE

The Chairman closed the meeting on Friday, 23 October 1998 at 1700 hrs. The date and venue of the next full GOSSP meeting would be determined in due course.

ANNEX I

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ANNEX II

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ANNEX III

WELCOME MESSAGE FROM THE CHAIRMAN OF THE GCOS STEERING COMMITTEE

I am pleased to see that so many members of the GOSSP were able to come together at such short notice to prepare for the upcoming meeting of the CEOS in November. I am just sorry that I could not be with you in person to take part in your deliberations, but prior commitments have taken me to Australia for a few weeks. However you do have present at your meeting Prof. John Townshend, my predecessor as Chairman of the GCOS JSTC, who is well versed in the restructuring of the GOSSP and our expectations for your work. Knowing John, I am sure he will make these expectations well known during the course of the meeting. Also a personal thank you John for completing this task of restructuring and for carrying our interests forward into the CEOS meeting.

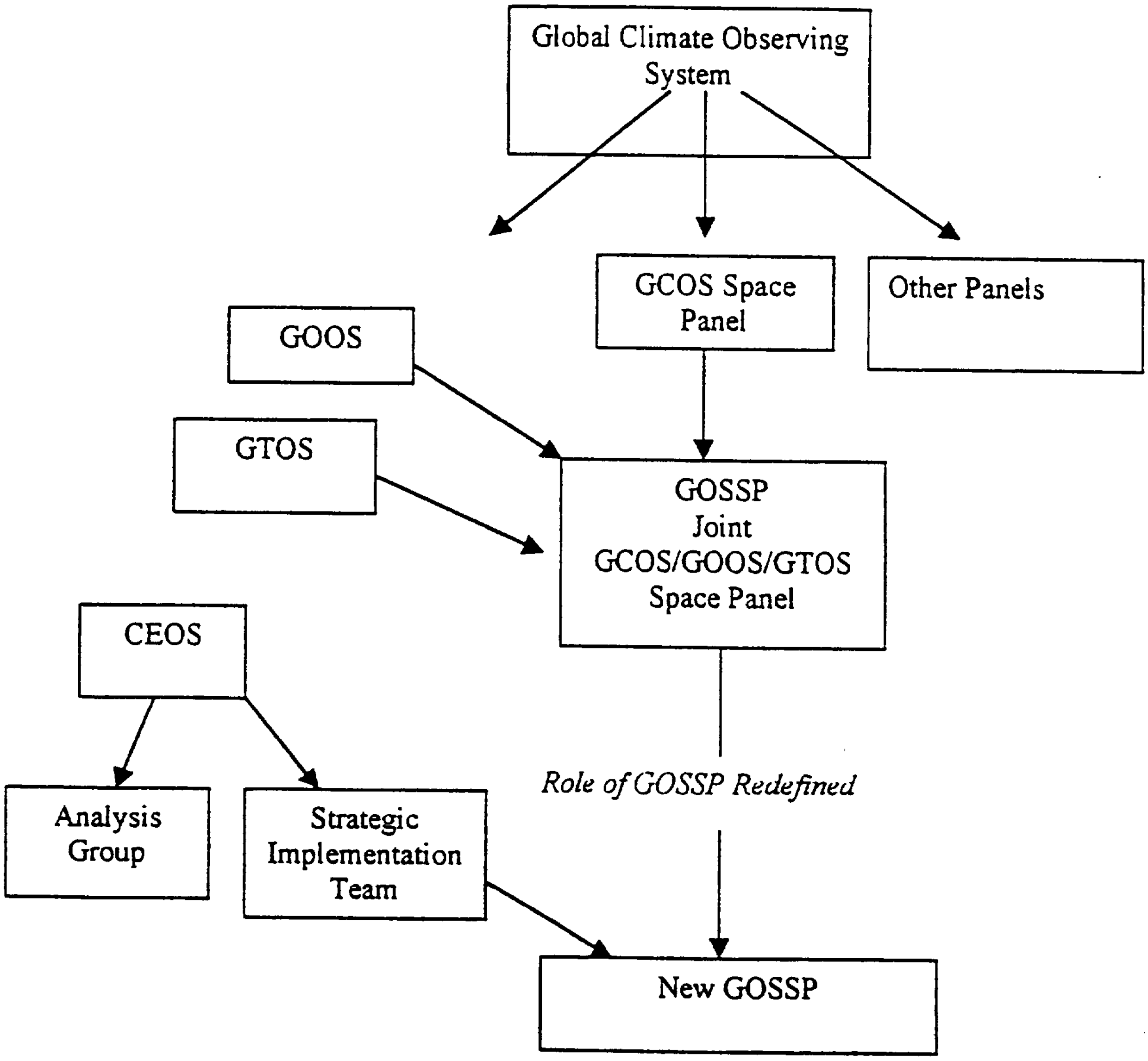
Like GOSSP, the GCOS is undergoing significant change itself. By the end of this year there will have been a complete turnover of staff in the secretariat. I would like to acknowledge the substantial contribution made by Dr Tom Spence to the development not only of GCOS but the whole range of G3OS activities. Without his pioneering work you would not be here today. I would also like to recognise the contribution of Dr Carolin Richter to the work of the GCOS panels and to wish her well on her return to Germany in the new year. In addition to these staff changes, our sponsors have identified significant changes in the role to be played by the GCOS secretariat and its associated guidance mechanisms. These changes reflect their desire to see GCOS move beyond its planning phase and forward into implementation. The work undertaken over the past few years has demonstrated that we know most of the observational parameters required and in many cases how they should be measured. Now we are being challenged to see that the systems and networks required by our various communities of users are indeed put into place. We know that no one system or network can or will ever meet all of our requirements. What is needed is a composite observing system. One where *in-situ*, remote and space-based observations come together in a complementary manner to provide the necessary information resources. Given the nature and enormous magnitude of the GCOS undertaking, I believe that we can only proceed by identifying "chewable chunks" or "pilot projects". Such projects or undertakings should be designed in such a manner as to involve a partnership between the users and providers of observations so that we can; a) ensure that it is real needs that are being met and that b) operational systems are put into place. This will of course require active cooperation with our partners in the Global Observing System and especially those involved in the space programmes.

Clearly the undertaking of implementation projects will require the commitment of governments, agencies and other organizations to a much larger extent than we have been able to achieve in the past. Obtaining those commitments will not be easy given the difficult financial times in which many nations find themselves. However, demonstrating a clear relevance to their needs will certainly be one of the key components of any strategy. In this regard, it is possible that working with governments through the United Nations Framework Convention on Climate Change could provide a useful mechanism. We should have a better sense of whether this will work following the next meeting of the Conference of the Parties later this year. While such a focus on climate change is important, we must not ignore the current and pressing needs of governments for better climate information now so that they can adapt to climatic variability on an annual time-scale.

It is clear that we all have a substantial challenge ahead of us. But with your active support and advice we will be able to see continued progress with the development and implementation of GCOS and its companion systems the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS). May I wish you and your Chairman Dr Francis Bretherton a very successful meeting and I look forward to hearing your recommendations.

ANNEX IV

THE EVOLUTION OF GOSSP



ANNEX V

TERMS OF REFERENCE AND OPERATION OF THE GLOBAL OBSERVING SYSTEMS SPACE PANEL (PROPOSED, J. TOWNSHEND)

The mission of GOSSP is to monitor evolving requirements for and capabilities of space observations, to ensure that space agencies receive integrated requirements for space observations based on the individual sets of requirements set by the global observing systems and to assess whether these requirements are being met.

1. FUNDAMENTAL RESPONSIBILITIES:

(i) Creation of an integrated set of requirements for presentation to the space agencies based directly on the separate, endorsed requirements of each of the senior science panels of the global observing systems – i.e., the GCOS Steering Committee, GOOS Steering Committee and the GTOS Steering Committee. This allows agencies to better comprehend issues such as how particular sensors will satisfy multiple requirements of different user communities.

(ii) Working with the space agencies, match the requirements from (i) against the stated capabilities of the space agencies' remote sensing systems to assess apparent deficiencies and overlaps in terms of continuity, coverage, precision, etc. A related sub-task should be to optimise methods for highlighting deficiencies.

(iii) Establish procedures for maintenance of the requirements database and, using advice from the science panels, ensure that the requirements are periodically updated.

(iv) Represent the interests of the global observing systems by communicating the results of tasks (i) and (ii) to the space agencies, especially through co-ordinating bodies such as CEOS.

(v) Based on the previous responsibilities the Panel should identify, on a periodic basis, high priority, key issues that need to be raised with space agencies for improvements to the observing system.

(vi) The results of its work should be reported to each of the observing systems and, through them, endorsement of the requirements and any priorities given to them should be obtained.

2. MODE OF OPERATION

GOSSP has as its core membership a small number of experts, but can bring in other participants as needed.

Each systematic discipline panel of the observing systems can nominate an *ex officio* member who would be able to attend meetings and participate in the activities of the GOSSP as deemed appropriate by the systematic discipline panel.

GOSSP has the responsibility to oversee and evaluate the execution of tasks (i) and (ii), but it is anticipated that this work would be primarily carried out by experts working on behalf of the Panel and overseen by the Panel.

Apart from overseeing the largely mechanical task of maintaining the databases, most of the work of the Panel is likely to be focused on specific issues. Examples of these include an examination of how a new technology could satisfy long-term observational requirements or the extent to which the sensors available for one particular part of the electromagnetic spectrum could satisfy multiple users. The anel has the responsibility of deciding whether to call on specialist groups to deal with specific space observing issues.

3. MEMBERSHIP OF GOSSP

Representation on Committee:

1) Global Observing Systems:

GCOS:	2 members
GTOS	2 members
GOOS	2 members

Generally these people should not be from space agencies or, if they are, then they should not be part of the operational/implementation activities of the space agency.

Each observing system nominates its own representatives and will be responsible for funding their attendance at any meetings.

2) One additional person serves as Chairman, selected jointly by the global observing systems.

3) Potential additional members from the other affiliates of CEOS such as IGBP, WCRP etc. Before each meeting the membership and the agenda will be circulated to affiliates and if they think their interests might not be well represented they can nominate additional experts for that particular meeting.

4) CEOS can nominate up to 3 individuals as experts to participate in the work of GOSSP and to attend its meeting.

5) *Ad hoc* members for particular meetings can be invited by GOSSP. It is proposed that, depending on the agenda, the Committee co-opt additional experts.

4. RELATIONS WITH SPACE AGENCIES

GOSSP works through the Space Agencies to ensure implementation of its recommendations. In terms of international bodies it has a special relationship with CEOS. The Strategic Implementation Team of CEOS at its meeting in Paris in March 1998 stated that:

"The role of the Global Observing Systems Space Panel (GOSSP) as a co-ordinating body for user requirements was strongly endorsed by CEOS SIT. Further, a strengthening of its role and authority was encouraged to facilitate:

1. dialogue between key communities who commit to the implementation of an IGOS, and

2. to meet CEOS' requirement for an integrated and prioritised set of user requirements."

CEOS has representation through attendance as experts at GOSSP meetings.

Interactions with space agencies may be required through other mechanisms including approaching individual space agencies.

ANNEX VI

CEOS MEMBERS AND ASSOCIATES

CEOS Member	Strategic Implementation Team (SIT)
NASA	**X**
NOAA	**X**
ESA	**X**
EUMETSAT	**X**
European Community	**X**
STA/NASDA (Japan)	**X**
CNES (France)	**X**
BNSC (UK)	**X**
DLR (Germany)	**X**
INPE (Brazil)	**X**
ISRO (India)	**X**
CSA (Canada)	**X**
CSIRO (Australia)	**X** (outgoing SIT Chair)
ASI (Italy)	**X**
SNSB (Sweden)	**X**
RSA (Russia)	
ROSHYDROMET (Russia)	
CAST (China)	
NRSCC (China)	
NSAU (Ukraine)	

CEOS Observer*: CCRS/Canada, Norway, Belgium, New Zealand.

CEOS Affiliates*: FAO, GCOS, GTOS, GOOS, ICSU, IGBP, IOC, ISPRS, ESCAP, UNEP, UNOOSA, WCRP, WMO.

* Observer and Affiliate categories have been combined to Associate (CEOS-XII, 10-12 November 1998, Banagalore, India).

ANNEX VII

PROPOSED GOSSP DATABASE ACTIVITIES

1. Introduction

1.1 The Integrated Global Observing Strategy (IGOS) consists of a loose aggregation of complex components with multiple overlapping and sometimes competing uses. These components are contributed by many nations but managed collectively and voluntarily: (i) to minimize unnecessary but costly duplication; and (ii) to eliminate gaps or inadequacies that negatively impact the overall performance for what are deemed to be the most important applications. Most demanding of resources and co-ordination are sustained measurements of critical environmental variables on a global scale, and the preparation from those observations of reliable products at various levels of integration to serve a variety of application areas of major economic or policy significance. The application areas[15] of primary interest to G3OS, which have significant requirements for measurements from space, are listed in Table 1.

Atmosphere	Land	Ocean	Application Area
	X	X	Ecosystem Productivity
	X		Sustainable Land Use
	X		Hydrological Resources
X	X	X	Green House Gas Trend *(Sources, sinks, dynamics, concentration)*
	X	X	Biodiversity and Ecosystem Health
X	X	X	Climate Trend Assessment / Impact
X		X	Hazard Mitigation
		X	Transport Services
		X	Coastal Zone Management
X		X	Climate Modelling *(Boundary, Initialisation, Validation)*
X			Improved Operational Prediction *(Seasonal, Interannual)*
	X	X	Biogeochemical Cycling

X Major Focus Contributing Effect

Table 1. GOSSP Application Areas. Further details can be found in the report of GOSSP-3 (GCOS-37), Annex VII.

1.2 In such a management regime, a potent tool is an analysis of the costs and benefits of proposed or threatened changes in any part of the observing system or product preparation activities. A prerequisite is the ability to display clearly and convincingly to all parties the consequences for each application area of such potential changes. The CEOS/WMO database of requirements and capabilities is a promising step in the development of such a tool. The purpose of the GOSSP activity proposed

[15] The term "Application Area" is used here instead of "Application", because there may be many distinct end-users within an Application Area. An "end-user" is an identifiable organization with substantial economic resources or political clout. Stated end-user needs should in principle be verifiable by reference to a representative sample of end-users.

here is to enhance its usefulness by clarifying and making more accessible the specific connection between the needs of end-users in the application areas and individual requirements contributed to that database by G3OS.

1.3 Application areas, and the quasi-operational institutions generating products to serve them, have their own dynamic, which also requires analysis if valid conclusions are to be drawn about the consequences to the end-user of technical or programmatic decisions in the space component. Indeed the computer models involved in product generation, and the potential trade-offs among the diverse sources of data upon which they draw, may well rival in complexity the design and operation of satellite systems themselves. It thus seems appropriate to consider a parallel activity to make the relationships among them equally accessible, for example as an on-line text oriented database which may be searched using keywords familiar to practitioners appropriate at different levels (application, earth scientist, provider of ancillary information, instrument scientist, satellite systems designer). This database would of course be linked to, or integrated with[16] the CEOS/WMO database. The complexity deriving from the many relevant combinations of instrument, variable, and application makes it difficult for any one individual to carry all the possibilities in his or her head at one time, and makes such an electronic tool well nigh indispensable[17] for comprehensive analyses.

1.4 The information required for this GOSSP activity has in principle already been sifted by the various G3OS panels, which have contributed the requirements that are already in the database and is summarized in their reports. However, in the judgement of GOSSP, the documentation of the rationale for these requirements has been uneven. Without additional specialist knowledge to supplement the published reports it is often difficult or impossible to trace the consequences of unmet requirements all the way back to representative users in each application area. Since the importance attached to different application areas varies with funding agency and time, this difficulty greatly reduces the credibility of any crosscutting analyses built upon the database. Thus a more systematic reformulation of the collective information which currently exists would seem to be indicated, together with the building of experience in just how that information may effectively be used in observing system design and implementation.

1.5 Furthermore, as circumstances change, the requirements for space observations must be updated and carefully checked to ascertain whether they are indeed being met. This task would be much simplified if a larger group of interested and knowledgeable parties could independently access and critique the specific rationale in addition to the stated requirement itself. A complicating factor is the

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[16] The phrase "linked to, or integrated with," covers important questions whether the existing CEOS/WMO format is flexible enough to accommodate the proposed parallel activity without distorting its information content, and of how to create and grow an experimental extension to the CEOS/WMO database without disrupting existing uses. Analysis of these questions is part of the proposed initial phase.

[17] It is unclear how far this complexity can be captured in a database with a limited flexibility without loss of accuracy. A major task of the initial phase is to experiment with the trade-offs between searchability (which requires categorization of individual entries) and expressive power. The strategy will be to use a format that invokes defined keywords and prescribed relationships among them, but also permits free form annotation. For example, a thesaurus indexes all the terms, which are treated as synonyms for a given keyword, and hence, so far as the database is concerned, may enter into similar relationships. However, nuances of meaning can be retained by using the original terms in plain language and linking via the thesaurus. Such capabilities are built into XML (eXtensible Markup Language) which is widely expected to replace HTML in the next generation of web browsers. However, tools for exploiting it are not yet in widespread use.

evolution of earth system models and of the understanding (and therefore consensus algorithms) of the use of earth observation data. This affects the database design and maintenance but also the requirements for satellite data themselves. A constant revisit and systematic revision of the database will thus be essential if it is to remain a "living" document.

1.6 Finally, it should not be taken for granted that resources will automatically be available and optimally focussed on all the necessary steps in the preparation of the required range of data products, even if the satellite segment is satisfactory. Some duplication is desirable here to compare alternative methodologies and to encourage creativity. However, only by identifying and consulting with representative institutions doing the work will the true data needs and their dependencies be established, so that the consequences of weaknesses and redundancies can be assessed. It is important to identify those institutions explicitly, not only for the credibility of the assessment but also to enable tracking of the implications as their capacity and methodologies evolve. Where quasi-operational capacity does not now exist, the experience of research efforts and pilot projects in accomplishing those same steps must be identified and harnessed. Indeed in the land and ocean domains most of the products available to the Global Observing Systems for the next 5 years are likely to be generated in research institutions.

2. A Conceptual Framework

2.1 A conceptual framework for identifying the intermediate steps between the data measured directly from space and a variety of application end-users is shown in Figure 1.

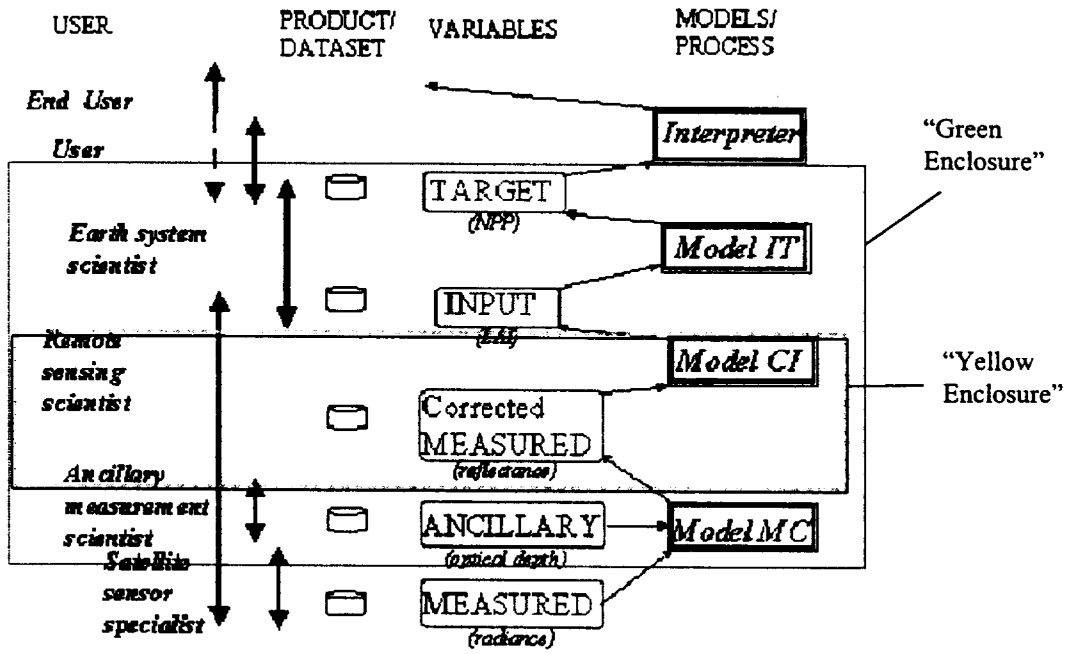

Figure 1 Classes of Variable and Products and their uses in Global Observations. Modified from Terrestrial Observations Panel for Climate (TOPC-4, GCOS 46)

```
<?xml version="1.0" standalone="yes"?>
<!-- xml comment - does not render-->
<!-- DRAFT 0.5 -->
<!-- This is a preliminary version to illustrate the general idea -->
<!-- It is ONLY AN ILLUSTRATION  -->
<!-- Neither the XML markup nor the stated facts are accurate -->

<g3os requirement>
 <g3osid> TOPCxxx v0.5 </g3osid>
 <application_area>Climate Change </application_area>
 <end-user> IPCC </end-user>
 <target_variable> Climate Reanalysis
  <current_product>
   <name> NCEP Reanalysis</name>
   <address>NCAR/Jenne </address>
   <time_coverage></time_coverage>
   <spatial_coverage>Global </spatial_coverage>
   <input_data>NCEP Archive Radiosondes</input data>
   <input_data>NOAA Satellite Retrievals </input data>
   <comment> Satellite retrievals regressed to radiosondes.</comment>
   <quality_review>
    <name></name>
    <address></address>
    <rating>Marginal </rating>
    <comment> for long term climate change</comment>
    <comment>Unknown Observing System Drift. Radiosonde calibration liable
to change with
redesign. Microwave Tropospheric Brightness Temperature can provide an
independent check
</comment>
   </quality_review>
  </current_product>
  <current_product>
   <name>ECMWF Reanalysis </name>
   <address>ECMWF </address>
  </current_product>
 </target_variable>
 <corrected_variable>
  <name>Microwave Brightness Temperature (Troposphere)</ name>
  <current_product><!-- Repeatable -->
   <name>Microwave Brightness Temperature </name>
   <author>Roy Spencer </author>
   <author>John Christy </author>
   <address>"christy@vortex.atmos.uah.edu"</address>
   <spatial_coverage> Global </spatial_coverage>
   <temporal_coverage> 1978 - 1998 </temporal_coverage>
   <spatial_resolution> 250 km </spatial_resolution>
   <repeat_time>1 month </repeat_time>
   <input_data>NOAA/POES MSU Band 6 </input_data>
   <ancillary_data>Prelaunch Spectral Window</ancillary_data>
   <ancillary_data>NOAA/POES MSU Band 7</ancillary_data>
   <comment> Enables partial separation of stratosphere </comment>
```

<algorithm>raw radiances corrected for zenith angle, calibration corrections applied,
converted to brightness temperature, spatially weighted average</algorithm>
<quality_review>
<reference></reference>
<rating> marginal for long term trends<rating>
<comment>calibration uncertainties +/- 0.2 K due to insufficient satellite overlap
</comment>
</quality_review>
</current_product>
</corrected_variable>
</g3os_requirement>

Figure 2 Example of a data record in the database in XML markup.

This diagram is a modified version of Figure 1 in the report of TOPC-4[18], to which the reader is referred for additional explanation. It shows that there are several different levels of intermediate user, each of which has distinct needs for data sets or standard products, and is also using a model to generate new products. If the heritage of statements of requirements for measurements from space is to be easily understood and updated, references are needed to documentation on representative specific models and products at each of these levels. Thus each of the boxes representing models, variables, and products/datasets needs one or more entries. Then as changes in processing are made to reflect increased understanding and changing technology, it should be possible to trace any implied modifications in the requirements for satellite data. An example of such a modification is provided by current trends in the technology for reanalysis of past weather patterns to provide a consistent, long-term, climate record. Some major centres performing such reanalysis now prefer to assimilate the satellite radiances directly, rather than through independently-derived geophysical variables. This development radically changes the manner in which the observational requirements must be described, with key information originating in the centres involved. Figure 2 shows a tentative example of the needed content information for an individual record in the database.

2.2 Figure 1 indicates by a green enclosure the conceptual areas which are embraced by this activity to enhance the database. Formal GOSSP responsibility is focused on the areas in the yellow enclosure, so the active collaboration of other G3OS panels will be required. In the initial phase of the activity, a pilot study under GOSSP leadership with *ad hoc* consultations will cover the same areas but for only a small subset of applications and variables, in order to refine the approach and assess the feasibility of full scale implementation.

2.3 The information eventually needed for this activity is specific and detailed, and the labour involved in assembling it for an unrestrained range of cases could be quite daunting. For the initial phase of the activity, the number of cases considered will be arbitrarily restricted while issues of methodology are being worked through. It is anticipated that subsequently the task can be substantially simplified using informed judgements based upon the following considerations:

a. The principal concern here is with well-calibrated, consistent, quasi-operational, measurements on a global scale which must be sustained over one or more decades. These will be used among other things for prediction of inter-annual variability and documentation of longer-term trends. Once in place, there will be other important temporary or regional "uses of opportunity" for such data, which will enhance the overall value of the measurements, but the requirements for these uses will not determine those for the global observing system.

b. The significant data product generation and analysis activities, at all levels including the application end-users, will also be quasi-operational and will normally be performed at institutions dedicated to the purpose. Provided requisite information is indeed fully and openly exchanged, a pre-requisite for inclusion in the IGOS, there will at any one time be a limited range of relevant "near state of the art" or "community consensus" algorithms for producing each product in wide use, and the methodology and machinery for doing so is likely to evolve only as fast as it is demonstrably cost effective to make changes.

[18] Report of the Terrestrial Observation Panel for Climate, fourth session, Corvallis, May 26-29, 1998, Oregon, USA (GCOS-46)

Requirements for temporal consistency and product intercomparison will tend to slow such changes still further.

c. From this perspective, the best near-term predictor of the future state of the observing system is its present state. An accurate characterization of the present system, and of the adequacy and shortcomings of all its components and their end-to-end connections, must be the bedrock of any analysis which is likely to lead to future improvements. Under severe competition for resources, potential applications that require major increases in capability will have to be preceded by stepwise increments in that direction that are less ambitious but with a more immediately demonstrable payoff at the application level. Thus a clear and complete description of the complete chain of improvements at all intermediate levels which are necessary before that payoff can be achieved is absolutely central to useful statements of requirements. However, only a limited number of specific possibilities will warrant the scrutiny and effort required for building a complete case.

3. The First Phase of GOSSP Activity

The first phase of GOSSP activity will be a pilot study to explore the feasibility of implementing the concepts sketched in Section 1.

3.1 Overall objective

Capture documentation of existing G3OS requirements and their heritage into a searchable database with sufficient clarity to enable all parties from end-user to instrument designer to understand the probable implications of proposed/planned changes in the system or in external circumstances.

3.2 Specific objectives

i. Complement/extend the existing WMO/CEOS database to facilitate access to the heritage of G3OS statements of requirements by individuals who were not directly involved in the process.

ii. Build end-to-end views (G3OS application to in-flight instrument) of the relationship between requirements and implementation with particular reference to sustained measurements from space and associated activities.

iii. Increase the ease and effectiveness of involvement in the decision process by actual and potential users at all levels of data product and analysis.

iv. Establish a methodology, which, if implemented systematically, would enable analyses leading to informed judgements on an ongoing basis of the probable opportunities for, or impacts on, each G3OS application area of potential incremental changes or modifications of the currently implemented global observing system, including ground-based measurements and intermediate levels of product generation.

3.3 Approach

a. GOSSP prepare a template for the required information, including one or more strawman examples for each G3OS. A tentative example is shown in Figure 2.

b. The appropriate G3OS representatives on GOSSP, with assistance from GOSSP chair, engage appropriate panels of their organization in a dialogue which results in filling out this template accurately for a handful of end-users and Level 2 geophysical data products, or in modification of the template if appropriate.

c. The complexity of this prototype should be limited by recourse to labelled stubs[19] to represent required inputs that would have to develop in detail in a working model. The focus should be a few examples in depth (i.e., a single connected, complete, credible chain from a required product variable to an end-user, with at least a stub for every node or comment in that chain). The required product variable would be characterized in the CEOS/WMO format, and should in principle already be an entry in that database.

d. Conceptually, the desired chain is a development of the stub currently provided by the label in the database identifying the source of each requirement (e.g., GCOSxxx). In general each user class in each application area will give rise to its own set of requirements, though in practice for any given variable one or two applications are likely to be most demanding. To achieve the overall objectives of tractability, it is important to identify within the chain itself the intermediate users and their associated models and data requirements, guided by the scheme in Figure 2 with modification where required. Most important is to avoid specifications which substantially depend upon unstated assumptions by individuals at intermediate levels about supposed changes in observational capability or needs of end-users.

e. In general, each node in this chain represents a variable or algorithm/process, which uses such variables as input or output. The variable name in each case is accompanied by reference to at least one currently available global product and/or a discussion of the required coverage, resolution, and accuracy for that product. Each algorithm/process is accompanied by a brief statement of the underlying principle, specifics of the input, output and ancillary variables required, and reference to at least one institution[20] using or prototyping that algorithm for routine operation.

f. Explanatory text should be attached to each node or link in this chain wherever possible by reference with paragraph number to an existing G3OS document, or to other credible published authorities such as peer reviewed survey articles or assessments.

4. Issues

4.1 Specification of accuracy requirements always involves difficult judgements, and easily degenerates into a meaningless exercise in numerology. The CEOS/WMO requirements are for products describing spatially continuous fields of geophysical variables derived from satellite data, and are expressed in terms of geographic coverage, spatial resolution, repetition interval, RMS error, and bias. Whereas it is simple to understand, this format implicitly assumes the regular repetitive sampling

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[19] A "stub" is a programmer's term for a short segment of code that is a placeholder for a subroutine or module that still has to be developed. The stub has the correct formal interface with whatever it is connected to (e.g., the list of parameters being passed), but no substantive content.

[20] For land there may be only experimental products at this time produced by a variety of organizations or research groups. Rapid evolution is to be expected in the next 5 years.

pattern normally characteristic of sequential measurements from satellite orbit, and is, for example, not well suited to the ancillary data from a surface network that is used to determine regional variations of some parameter in the retrieval algorithm. For example, the output of a numerical weather prediction model may provide atmospheric temperature to +/- 0.2 K over continental North America, but only to +/- 1K over the ocean far from any radiosonde station. The CEOS/WMO specifications are intended to be translated by instrument designers into tolerances in radiometric accuracy, spectral resolution, precision orbit maintenance, and the like, without unnecessarily restricting trade-offs which can greatly reduce costs. There may be critically important qualifications to the tabular format that can only be specified in words, e.g., that TOPEX/POSEIDON-class altimetry cannot be attained from a single satellite in sun-synchronous orbit because it aliases the solar tide. Thus in specifying requirements for coverage, resolution and accuracy for ancillary data or data products at intermediate levels, it is important to use a format which is appropriate to the purpose at hand, and to provide or point to enough information to enable an outsider to understand what is really intended. Where credible analyses or empirical studies of error propagation through retrieval algorithms are available, they too should be referenced.

4.2 Judgement will be needed to convert statements of comfort or deficiency into the CEOS/WMO categories "optimum" and "threshold", but note that these terms are product-specific within each application area (e.g., present SST and winds might be adequate for El Niño/La Niña prediction but not for the Asian monsoon). This is why it is so vital not to lump requirements prematurely. However, there may also be many other applications for which there are several alternative sources of SST and wind data of sufficient quality, and provided the data continue to be available there is no issue. These could indeed be lumped, but should still be identified in more general terms, so that that their economic or policy value will get counted in justifying SST and wind measurements in general. A key question for this feasibility study is how well such semi-quantitative reasoning works across the board to get at the tall poles and the value of fixing them. Where we can do credible observing simulation experiments, they too provide key information which must be built into the reporting template in such a way that it can both influence cross-cutting analyses and be updated as appropriate.

5. Reporting

5.1 A report on lessons learned from this feasibility study will be presented to the G3OS and the IGOS Partnership meetings in Rome in June, 1999.

5.2 As a demonstration, information from these completed templates will be entered into a database that can be linked to the CEOS/WMO database, or possibly incorporated as an experimental contribution from a CEOS Affiliate.

ANNEX VIII

TERMS OF REFERENCE
(CURRENT)

Recognizing the need for a comprehensive approach to the various space-based observational activities for the global observing systems, the Steering Committee of GCOS, the Steering Committee for GOOS, and the Steering Committee for GTOS have established a Global Observing Systems Space Panel (GOSSP).

Terms of Reference:

Based on guidance from the GCOS, GOOS and GTOS Steering Committees (SCs), the primary tasks of the Panel are:

- To maintain and further develop the plan for the space-based observation components of the global observing systems considering the requirements from the scientific panels;
- To develop, integrate, and promote the space-based observational requirements of the user communities carrying out global studies and providing related advice and services;
- To recommend to the space agencies how these requirements may be met (e.g., through such bodies as the Committee on Earth Observation Satellites or the Co-ordination Group on Meteorological Satellites);
- To facilitate the participation of the global observing communities, in particular in developing countries, through regional activities;
- To identify and evaluate problems, and advocate solutions;
- To report regularly to the GCOS, GOOS, and GTOS SCs.

The GOSSP will be the focus for exploiting space systems in meeting the objectives of the global observing systems. The Panel must continually refine, update, and interpret the implications of the requirements of the user communities carrying out global studies, and provide related advice in terms of space instruments and satellite payloads flown by the data providing agencies.

ANNEX IX

ACRONYMS

AG	Analysis Group (of CEOS/SIT)
CEOS	Committee on Earth Observation Satellites
CNES	Centre National d'Etudes Spatiales
COP	Conference of the Parties (UNFCCC)
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FAO	Food and Agriculture Organization of the United Nations
GCOS	Global Climate Observing System
GODAE	Global Ocean Data Assimilation Experiment
GOFC	Global Observation of Forest Cover
GOOS	Global Ocean Observing System
GOSSP	Global Observing Systems Space Panel
GTOS	Global Terrestrial Observing System
ICSOS	International Conference on Satellites, Oceanography and Society
ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOS	Initial Operational System (of GCOS)
IPCC	Intergovernmental Panel on Climate Change
LANDSAT	Land Remote Sensing Satellite
MODIS	Moderate-Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NSCAT	NASA Scatterometer
SBSTA	Subsidiary Body for Scientific and Technological Advice
SC	Steering Committee
SCOR	Scientific Committee on Oceanic Research
SeaWiFS	Sea-viewing Wide Field-of-View Sensor
SIT	Strategy Implementation Team
SST	Sea-surface temperature
TOPC	Terrestrial Observation Panel for Climate
TOPEX/POSEIDON	Ocean Surface Topography Experiment
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WCRP	World Climate Research Programme
WMO	World Meteorological Organization