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**REPORT OF THE GCOS
DATA AND INFORMATION MANAGEMENT PANEL**

First Session

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REPORT OF THE GCOS

DATA AND INFORMATION MANAGEMENT PANEL

I. OPENING OF THE SESSION

The Global Climate Observing System (GCOS) Data and Information Management Panel (**DIMP**) held its first meeting February 7-10, 1995 in Silver Spring, Maryland, USA. The meeting was hosted by the National Oceanic and Atmospheric Administration (NOAA) and chaired by Mr. G. Withee, who had earlier chaired the Data System Task Group.

1.1 Welcome

The Chairman welcomed the participants and expressed gratitude for their attendance (Annex I). Since the meeting was the first session of the Data and Information Management Panel, he noted the Terms of Reference (Annex II), and invited the meeting participants to introduce themselves and describe their roles and responsibilities related to GCOS.

1.2 Approval of the agenda

The agenda as given in Annex III was adopted.

2. GCOS STATUS AND UPDATE

The Chairman invited Mr. **McGuirk's** comments on behalf of the GCOS Secretariat. Mr. **McGuirk** greeted the participants on behalf of the World Meteorological Organization (**WMO**) Secretary General and noted that a primary objective of the meeting was to examine the implementation plan for the GCOS data system and to fill in details and add specifics for implementing the plan.

Prof. Townshend, Chairman of the GCOS/GTOS Terrestrial Observation Panel and therefore an *ex officio* member of the GCOS Joint Scientific and Technical Committee (JSTC), provided an overview of GCOS. He explained that GCOS is an international programme to develop a comprehensive world-wide observing system to meet the needs for climate system monitoring, climate change detection, and response monitoring; economic development; and research to improve understanding, modelling, and prediction of the climate system. He described the three-pronged GCOS strategy, which is to: 1) evaluate observational requirements and current observational systems to define an Initial Operational System to be realized early in the next century; 2) identify and specify key observations that are urgently required and should be added to the operational system; and 3) identify future research and development that is likely to lead to additional operational requirements and additions to the operational programme. Prof. Townshend stressed that GCOS is not a research organization and will not perform research and development tasks.

Prof. Townshend explained the relationship of GCOS to the Global Terrestrial Observing System (GTOS) and the Global Ocean Observing System (GOOS). He noted that there is overlap among the three global observing systems and stressed that coordination in the area of data and information management is particularly important. He summarized the tasks of GCOS, which are to: 1) collate data on observational systems; 2) define needs; 3) assess capabilities in scientific terms; 4) **define** the deficiencies of the observational systems; and 5) **define** improvements in the observational systems.

Prof. Townshend also described the structure of the GCOS JSTC including its panels and working groups, and noted recent activities. He explained that an ocean panel, to be jointly sponsored by GCOS, GOOS, and the World Climate Research Programme is proposed to play a role similar to that of the atmosphere and land panels. Also, in his view, the JSTC will have the responsibility to integrate the various observing elements and data management to provide a systematic approach for climate.

3. **PANEL CHAIRMAN' STATEMENT**

The Chairman provided background information on the DIMP and described the GCOS Data and Information Management Plan. He recalled that the JSTC had recognized the need for a comprehensive approach to GCOS data management activities and had established an ad hoc Data System Task Group as a response. The Task Group developed a GCOS data system plan and a work plan for near-term GCOS data system activities, and recommended the JSTC form a standing data system panel.

The Chairman stated that the Data and Information Management Plan, to be reviewed during this meeting provides a data system vision and strategy, a data policy, a system design, and responsibilities for coordinating and managing the programme. He explained that the data system supports full and open exchange of data and information. He said that while there is economic potential in the data and information there is also great scientific and operational need for the data and information and it is, therefore, important to make as much data and information available on the system as is possible.

The Chairman explained that the GCOS concept incorporates all global observations for climate. However, the GCOS data and information system should be a common system that accommodates data and products from the climate modules of GOOS, **GTOS**, and World Weather Watch (WWW). Non-climate programmes could adopt the GCOS architecture to ease the development of their distributed systems and provide users with a common data and information infrastructure.

4. **INVITED PROGRESS REPORTS**

The Chairman invited progress reports from the GCOS design panels, the Intergovernmental Oceanographic Commission (IOC) and WMO. He noted that these reports reflect how the GCOS tasks outlined earlier by Prof. Townshend are being carried out.

4.1 GCOS Atmospheric Observation Panel

Dr. Julian provided a progress report on the Atmospheric Observation Panel (AOP) activities. He recalled that one GCOS principle is to build on existing systems. He stated that the one system in the world that is most mature is the atmospheric observation system developed by WWW for purposes of numerical weather forecasting. It consists of data collection, data transmission, and data analysis. The WMO-sponsored Global Atmosphere Watch (GAW), which monitors the chemical composition of the atmosphere is also a complete system of atmospheric observations, including data quality, and data distribution functions.

Dr. Julian also explained that the AOP has made the point that some data and products from the National Weather Services are critical for climate analysis and climate applications, as well as for weather forecasting. This is reflected in other AOP recommendations to the JSTC, such as implementation of baseline networks for upper air and surface networks. The AOP also needs to determine the required enhancements and augmentations to the GAW to obtain atmospheric data and products for GCOS. In addition, he noted that the recommended Climate Data Assimilation System (CDAS) will involve the transformation of the operational NWP four-dimensional assimilation system to a similar one expressly designed to answer climate questions.

4.2 GCOSIGTOS Terrestrial Observation Panel

Prof. Townshend summarized the status of the GCOS/GTOS Terrestrial Observation Panel (TOP). He noted that the TOP recommendations focused on a limited range of topics aimed at building a supportive infrastructure for land studies. A four-level, hierarchical system of global surface observations was defined. He noted that for some levels of observation, there are only a few stations making appropriate ecological observations around the world. The TOP also considered requirements for general circulation models, biogeochemical and ecosystem models as well as the needs for hydrological data. The TOP has developed a set of terrestrial requirements and considered issues related to topography and digital elevation models.

4.3 GOOS linkage

Dr. Reeves provided an overview of the United States contribution to GOOS activities. He reported that GOOS has been defined in terms of five modules and that requirements panels have been established. An outline for a data management plan for GOOS was prepared and it focuses on operational analysis and products and converting research products to operational use. Dr. Reeves noted that data commercialization may be an issue in the future. He added that a summary of the existing ocean observing system is being developed and he would like to see the information made available over the network.

Dr. Scherer presented a conceptual diagram of GOOS and explained that the programme is driven by the ongoing science programmes. Of the five GOOS programme modules, the climate related module, which is the same as the GCOS ocean component, is the

most advanced. He stated that IOC has established an intergovernmental panel, the I-GOOS, and that its proposals are important to communicating requirements to national governments, enabling them to make commitments toward the global ocean observing system. He added that it is important to involve both developed and developing countries in the GOOS activities.

Dr. **Scherer** stated that he did not believe it necessary to invent three data and information management systems for the three global observing systems. The meeting agreed that there must be one data management system and that GCOS has an opportunity to develop the model for the three programmes.

4.4 GCOS Space-based Observation Panel

Dr. Croom discussed the activities of the Space-based Observation Panel and the Panel's recommendations to the JSTC. He described GCOS participation in the Committee on Earth Observation Satellites (CEOS), noting the activities of the CEOS working groups on data, calibration/validation, and networks. He also described the CEOS Dossier which includes GCOS requirements.

4.5 IOC activities

Mr. **Withrow** reported on the status of IOC activities related to the GCOS data and information management activities. He stated that the ocean community is viewing data and information management systems very seriously. He related the ocean community's data and information management systems concept to that of the GCOS concept presented earlier by Mr. Withee. He said that the ocean community's data system is well integrated with other systems, including the World Data Centre (**WDC**) system.

In response to the Chairman's question as to what the DIMP can do for IOC, Mr. **Withrow** said that it can help to increase the number of users with Internet access and the national data centres connected to the Internet, so that more data is available.

4.6 WMO activities

Mr. Little summarized the status of WMO activities. He described the reorganization of the WMO Commission for Basic Systems (CBS) and the functions of its working groups and subgroups. He also described in detail WMO codes (data formats), including flexible-format codes. Mr. Little noted that because the operational community relies on continuity of the data record, it is typically slower to incorporate advanced technologies.

Mr. Little stated that the Global Telecommunication System (GTS) will be upgraded to provide **TCP/IP** functions as this capability is needed to support the planned distributed data system. He said that WMO wants to support ad hoc requests for data from all countries, with language independence, under the client/server model, and for the long term. The underlying needs are for a reliable transport layer (**TCP/IP**), a request-reply model, and global metadata standards.

5. DATA SYSTEM CONCEPTS/CURRENT PRACTICES/PROBLEMS AND RELATIONS TO GCOS

5.1 General concepts and demonstration

The Chairman reported that, at the Task Group meeting, it was decided that it would be helpful to demonstrate existing systems and tools to this meeting to show how the GCOS data and information management system might work, and as a means to stimulate discussion about how to make progress. He said that the demonstration would use existing systems, the Internet, client-server tools, and the World-Wide-Web as the hub architecture. He asked the participants to consider whether the model being demonstrated would be appropriate for the GCOS data system.

Ms. O'Donnell, of NOAA, conducted the demonstration and explained how to use the tools and system operations. A Hypertext Markup Language (HTML) NOAA home page has been created and Ms. O'Donnell showed how to access the NOAA home page, the **information** available, and data sets that could be downloaded to the local computer. The WMO prototype home page for the GCOS data and information management system was also demonstrated. It was noted that one problem with the GCOS home page is that there is at present no organized overall way to locate, order, browse, and download GCOS-related climate data sets. The home pages for the National Space Development Agency of Japan (NASDA) Earth Observation Center and GOOS were also accessed.

The following issues were raised in the course of the demonstration:

Whether GCOS data sets and products need to be identified to bound the search for data. This may be an important way to include individual **principal**-investigator data sets and products that would not normally make their way into the system.

Striking a balance between providing guidelines for how data is to be described, to help bound the data search and to support interdisciplinary users who often describe data differently as opposed to allowing users to find their own way around the Internet.

Determining the accuracy and currency of the data and information that is accessed.

Making data available on a full and open versus restricted basis.

Copyright violations and crediting the work of authors, data originators, and service providers.

Difficulty in comparing data and products prepared by different centres, in different countries.

Computer security (e. g . , viruses, crime)

Who is responsible for creating the pointers that link the various screens?

How can GCOS maintain such a system?

5.2 Asheville workshop

Dr. Karl summarized the outcome of the International Meeting of Experts on Long-term Climate Monitoring within GCOS. The meeting was attended by 94 participants from 10 countries. The experts made a range of recommendations aimed at improving the scientific basis of long-term climate monitoring and improving existing long-term climate products and observing systems. The clear message from the experts is that network operators, data managers, data analysts and modellers must become stakeholders in long-term climate monitoring if success is to be achieved.

5.3 Meteorology

Mr. Vent-Schmidt provided an overview of the climate module and some climate activities in Germany. He stated that climate data is made available monthly through WMO's World Weather Watch (CLIMAT code) and the Commission for Climatology (Ccl). CCl makes recommendations to WMO's World Climate Data and Monitoring Programme (WCDMP) in areas such as standards, quality control, and archives. CCl also assembles climate data products, oversees the **CLimate COMputer (CLICOM)** data system and publishes INFOCLIMA which provides information on climate data sets, inventories, and station data catalogues.

5.4 Oceanography

Dr. Keeley described the data system for the oceanography community. He reviewed the Integrated Global Ocean Services System (IGOSS) (real time delivery) and the International Oceanographic Data and Information Exchange (**IODE**) (delayed delivery) data flow. He explained that there was recognition a few years ago that this system was not meeting current demands and the Global Temperature/Salinity Pilot Project (GTSP) was created to explore improvements in the system and services.

The Chairman concluded that the GTSP has experiences to share with other disciplines. He suggested that one recommendation the Data Panel may make is that the GTSP experience be described, along with other models that function successfully (e.g., the CCl and pathfinder models). Ms. Maiden added that it may also be helpful to include descriptions of data access using GTS to further understanding of the GTS-Internet intersection.

5.5 Land and ecosystems

Prof. Townshend presented data and information management issues related to land and ecosystems, on behalf of Dr. Baumgardner who was unable to attend. He noted that there has been considerable improvement in the specification of land and ecosystems data sets through a variety of programmes. Much effort has been expended on generating the data sets, including extensive reprocessing in some cases. He said that one significant data management issue in the land and ecosystems area is heavy reliance on high-resolution spatial data because the data is so

voluminous. In addition, much of the high resolution data is owned by commercial entities and this frequently increases the cost of the data.

5.6 Specialized data centres

Mr. Vent-Schmidt described specialized regional and national data centres. These included centres associated with the Global Energy and Water Cycle Experiment (GEWEX), the Baltic Sea Experiment (BALTEX), El Niño-Southern Oscillation (ENSO), and the European Climate Support Network (ECSN), and the Drought Monitoring Centre, . He also described specialized data centres at the national level (e.g., those represented in INFOCLIMA) that have regional and global data sets. He illustrated that specialized data centres are distributed over the globe and demonstrated that responsibility is likewise distributed. He also described EUMETNET (which interconnects large European data centres for exchange of data for global research), the Global Precipitation Climatology Centre (GPCC), the Global Collection Centre (GCC) for ship observations, and the Global Runoff Data Centre (GRDC).

5.7 World Data Centres

Dr. Webster recalled that he described the WDC system in detail at the Task Group meeting and that he presented suggestions for involving the **WDCs** in GCOS. He explained that, although some **WDCs** are listed as GCOS participating data centres, there is no sense of a coordinated WDC system; each WDC is essentially a separate data system. He said that there is no central directory for the WDC, but that about a dozen **WDCs** are on the World-Wide-Web.

Dr. Webster stated GCOS needs to approach each WDC and explain what is needed for them to be tied to GCOS. He suggested that one way to involve the **WDCs** in GCOS is to propose a pilot project aimed at determining how the **WDCs** can be integrated into GCOS. This is addressed under recommendation 7.11 below.

5.8 Space-based observations

Mr. Kikuchi presented the National Space Development Agency of Japan (NASDA) earth observation activities and contributions to GCOS. He described the Earth Observation Research Center and the Earth Observation Information System, which provides data services, information services, and products and results. Satellite and in situ data are handled.

Mr. Kikuchi described in detail Japan's involvement in the Asian-Pacific Ground Station network and the mission planning network, which includes extensive involvement of international partners in Asia. He also noted the Global Observation Information Network, a joint Japan-US project. Japan is also very involved in the Committee of Earth Observation Satellites (CEOS) global network through the Working Group on International Network Services. Mr. Kikuchi noted that this relates to GCOS in that IOC, WMO, and other global observing system programmes are CEOS affiliates.

In response to a question from the Chairman concerning the Japanese agency responsible for contributions to GCOS, Mr Kikuchi explained that the Japanese Meteorological Agency (JMA) has strong intentions to participate in GCOS activities, and that NASDA also has strong intentions to participate through the activities that he described.

Dr. Rao summarized the GCOS integrating themes and the GCOS mission. With respect to implementing the GCOS data system, he suggested that parameters to be handled be narrowed to a critical few. He said that, for operational climate analysis, a commitment of at least ten years is required, due to the need for long-term observations.

Ms. Maiden provided a status report on the Earth Observing System Data and Information System (EOSDIS) programme. She observed that EOSDIS provides “one-stop shopping” and that EOSDIS data access functions are very similar to those demonstrated earlier in this meeting. She reported that NASA and some CEOS agencies believe that the Common Object Request Broker Architecture (CORBA), a planned network protocol, may replace Mosaic and World-Wide-Web in the future. She said that there is an opportunity to make a great deal of data, computing power, and new technology available to the climate community and that the Panel needs to think about how EOSDIS, CEOS, and others will contribute to, or connect with the GCOS data system, and how to move data over the GTS of WMO.

5.9 Developing countries

Dr. Jose provided an overview of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) programmes and vision. She reported that the Philippine involvement in the WMO technical commissions and in selected data management activities has been significant. Dr. Jose summarized the information technology resources and facilities of the Philippines, including a GOES satellite receiving system, a NOAA AVHRR receiver system, a flood forecasting and warning system, the Agrometeorological Automated Environmental Monitoring System, and the meteorological telecommunication system, set to become operational in March 1995.

Regarding GCOS implementation at the national level, Dr. Jose indicated that a problem is lack of awareness of the scientific community and policy decision makers and the need to develop a mechanism for national commitment to GCOS operations. She noted that one approach would be to prepare an inventory of prospective scientific community participants in GCOS, existing resources, and data and information needs now and for the future. Other possibilities for GCOS participation could be through the International Geosphere-Biosphere Programme (IGBP) START network of Regional Research Centres and establishment of an operational regional application centre for short-term climate variability forecasts for the Asia-Pacific region.

Mr. Mwangala, of the Zambia Meteorological Department (ZMD), described specific issues related to southern African participation in GCOS related activities. He noted that developing countries are at various levels of technology. He said that emerging climate data needs in agriculture, water resources, environment, and other sectors have exerted great influence on the meteorological services in southern African countries and this has, in turn, compelled them to pay attention to climate data management. He also noted that many countries rely on CLICOM facilities and that there is a need to upgrade these resources because many are outdated and inadequate.

In response to the Chairman's question as to the value of the CLICOM system to Zambia and the Philippines, Dr. Jose and Mr. Mwangala agreed that CLICOM is useful for data capture, but other applications must be used to analyze the data.

5.10 Other approaches

Dr. Cornillon presented the Distributed Oceanographic Data System (DODS) concept. He said that, in his view, the primary issue before the DIMP is to make data freely and openly available. He suggested that the DIMP needs to be careful not to model the future on what has happened in the past because the data and information environment changes so rapidly.

Dr. Comillon said that there are two options to move data across the network -- by FTP or dedicated client-server system (e.g., **XBrowse** and Mosaic). The **DODS**, based on the latter option, provides an approach to dealing with different data formats and a **researcher-oriented** interface, which is the researcher's own data analysis software package. He explained that the DODS approach uses the University of Rhode Island developed translators which convert data from the source data format into an intermediate structure which is then reconverted on the receiving end of the network into a form that can be used by the researcher's data analysis program. Dr. Comillon reported that the University of Rhode Island has written a translator for **netCDF**, is working on one for the Joint Global Ocean Flux Study, and proposes to write one for HDF.

5.11 Data exchange issues

During its deliberations, the Panel discussed the **WMO's** proposed new practice for data exchange. The group noted **that** the new practice recommends that data necessary to describe climate should be categorized as Tier 1 and agreed that climate, climate data and climate products should be defined as broadly as possible. Furthermore, the panel recommended that real-time data exchanged as Tier 2 should revert to Tier 1 after a reasonable time period (i.e., once its commercial utility for real-time purposes has expired).

The group noted that, in general, the new practice does not place restrictions on exchange of data for scientific and educational purposes. Nonetheless, there was considerable concern expressed that the operational implications would greatly restrict the availability of data. For example, since WMO Members are to ensure that the data are not reexported for commercial purposes, presumably the data could not be made available on open Internet servers which are now one of the primary mechanisms for scientific exchange. Again, conversion of Tier 2 data to Tier 1 after a certain time had passed could help to mitigate this potential problem.

Given the possible impact that the proposed new practice could have on exchange of GCOS-relevant data, the panel recommended that its concerns on this matter be expressed to the WMO Congress (see paragraph 7.14 below).

6. DEVELOPMENT OF IMPLEMENTATION PLANS

6.1 Review of JSTC action items

The Chairman reviewed the GCOS vision, the history of earlier data-related activities, the JSTC action items, and the Data Task Team's recommendations to the JSTC. He asked the participants to consider, in working group sessions, all these elements and the near-term steps that need to be taken to implement the GCOS data system. He also asked the participants to consider, in the working group sessions, whether there are appropriate pilot projects they can recommend.

6.2 Review of the GCOS Data and Information Management Plan

Mr. **McGuirk** noted that the plan was reviewed and accepted overall by the JSTC, with a request that detail be added to the plan. He recalled that the Panel had agreed that GCOS data system users are researchers, operational users, and integrator/assessors, with focus to be placed on the first two. He stressed that the working groups should focus on providing implementation details for Annex I of the plan, The Next 3 Years.

6.3 Assignment to discussion groups

The Chairman proposed that three working groups be formed to address GCOS implementation: 1) a group to focus on data system issues (the Data Collection and Dissemination Working Group to be chaired by Dr. Keeley); 2) a group to focus on science issues (the Data Processing, Documentation, and Evaluation Working Group to be chaired by Dr. Karl); and 3) a group to focus on administrative and organizational aspects (the Data Centre Concepts and Implementation Working Group to be chaired by Ms. Maiden).

6.4 Discussion group reports

The three working groups prepared preliminary tasks, recommendations, and pilot projects. The working group chairpersons presented them in plenary session and received feedback from the participants. Several changes and refinements to the preliminary tasks, recommendations, and pilot projects were made during these discussions. The participants were able to interrelate the proposals of the three working groups to assure they were consistent, **refine** tasks and recommendations in terms of the key GCOS issues, vision, and strategy, and clarify the appropriate persons, organizations, and processes to accomplish tasks.

7. RECOMMENDATIONS AND PROPOSED PILOT PROJECTS

Based on the findings of the working groups, the following recommendations and pilot programmes were developed:

7.1 **Recommend all GCOS sponsoring organizations encourage data centres operated by their members to put inventory information on-line via Internet.**

Assignment: JPO to contact sponsoring organizations,
Milestone: April 1995.

7.2 Improve global access to CLICOM data.

Task A: Assemble CLICOM data sets (including inventories) on CD-ROM. The CD-ROM and a CD drive will be returned to data providers. In addition, other CD-ROMs of interest to global climate issues to be provided to the participating centres as an added incentive for them to contribute to this effort. The Assembly Centre responsible will also put the CLICOM data acquired in this fashion on-line.

Assignment: JPO to seek volunteers, such as the US National Climatic Data Center, to carry out this task.

Milestone: Identify volunteers by April 1995.
Issue CD-ROMs by mid 1996.

Task B: Fund Internet connections to the most productive data centres in developing countries (productivity here is defined by both the volume of GCOS-relevant data rescued as well as the willingness to make these data available to the community at large). In order to bound the funding liability associated with this proposal, the data **centre(s)** to receive the connection might receive a fixed number of hours of free access time, e.g., 5 hours per month. Usage beyond this base amount would be the financial responsibility of the participating centre .

Assignment: JPO to contact WMO VCP, EU, UNEP, IOC and CEOS to seek volunteers to fund or undertake this project.

Milestone: First request mailing by mid 1995

Task C: Publish a version of INFOCLIMA on CD-ROM

Assignment: JPO to see if the WCDMP will undertake this task.

Milestone: CD-ROM published by late 1995.

7.3 Develop functional guidelines for the GCOS access system.

This would include descriptive text and examples describing the functions provided at a level of detail sufficient to guide the efforts of participants developing data systems. This would include, as a minimum, information on directories, inventories, guides, etc, and would include descriptions of system architecture and issues of language independence. The system described in the GCOS Data and Information Management Plan and in the report of the First Inter-Programme Data Management Meeting will be expanded.

Assignment: JPO to develop provisional functional guidelines with evaluation/input by CBS WGDM, CCI, IOC, CEOS, UNEP and others.

Milestone: July 1995.

Assignment: The directory guidelines will be passed to the Global Change Master Directory (GCMD) and their feedback solicited.

Milestone: October 1995.

Assignment: GCOS DIM Panel to ensure a review of directory structures (GCMD, INFOTERRA, MEDI, INFOCLIMA, . . .) to provide an evaluation of how these meet GCOS requirements. NASA and NOAA to consider sponsoring a workshop on this issue, perhaps as a side meeting to the next International Directory meeting.

Milestone: Report by January 1996.

7.4 Prepare a general discussion of the communications needs to meet GCOS data exchange requirements.

The text should be included in the next version of the GCOS Data and Information Management Plan.

Assignment: Dr. Comillon.

Milestone: April 1995.

7.5 Sponsoring agencies and CEOS to be asked to identify which of their technical committees are available to investigate and answer questions of joint interest.

Assignment: Letter from JPO to each of the sponsoring agencies and CEOS.

Milestone: July 1995.

7.6 GCOS data set assessment guidelines and initial data set assessments.

GCOS requires guidelines to help users assess the relevancy of specific data sets to meet their needs. The Data Panel, with the assistance of interested scientists, to develop guidelines to be tested in a limited number of well-established GCOS-relevant data sets. The guidelines will be used by a group of Data Panel-selected rapporteurs who will assess the data sets. The Data Panel to evaluate the adequacy of the guidelines based on comments of the rapporteurs. It is anticipated that the rapporteurs' assessments will be accepted as peer-reviewed journal articles whose page-charges will be considered for support by the NOAA/NESDIS. This information will also be included in GCOS directories. A preliminary list of candidate data sets and potential rapporteurs are presented in Annex IV.

Assignment: Develop guidelines to help users evaluate the relevancy of GCOS data sets for their use (Data Panel members Dr. Karl, Dr. Koltermann, and Ms. Maiden). Recommend rapporteurs implement the guidelines on a limited sample of data sets to test their effectiveness.

Milestone: Guidelines - June 1995.

Final list of rapporteurs • June 1995.

Assignment: Letter from chair of JSTC to rapporteurs inviting their participation.

Milestone: July 1995.

Assignment: Data sets evaluated and paper submitted for publication.
Milestone: December 1995.

7.7 Combination/blending of satellite and in-situ data.

Task A: GCOS should sponsor a workshop to explore the scientific and data management possibilities and difficulties in combining the relevant satellite and in-situ cloud data into a useful data set.

More robust data sets, which combine the best features of satellite data and in situ data, have been identified by GCOS as a worthy objective. One such possible data set, which would be of immediate interest to the Intergovernmental Panel on Climate Change (IPCC), would be one combining cloud data. Relevant satellite observations look from the atmosphere down to the clouds, while ground-based observations measure from the ground up to the clouds.

Assignment: With concurrence of the JSTC, JPO to explore sponsoring a workshop
Milestone: JPO to seek input of JSTC by May 1995
Decisions on sponsorship by September 1995
Target for workshop to be held by February 1996

Task B: Conduct a pilot project comparing high-resolution land surface satellite data with land surface reference stations.

The Panel recognized the importance of data set blending of satellite and in situ data and suggested a pilot project to investigate the problems and opportunities of this topic. The proposed pilot would also provide information to help to assess the degree of urbanization and desertification and other man-made and natural land surface characteristics affecting the reference station at the present time and for previous years.

Assignment: Chair of the DIMP to present this idea at JSTC-V
Milestone: October 1995

7.8 To promote the availability of some high-priority, long-term data sets of relevance to GCOS.

Task A. There is a proposed workshop on "Climate Change Data and Detection in South America," the date of which is to be determined. The organizers are seeking support from GCOS and the Inter-American Institute (IAI) for Global Change Research. The workshop will identify climate-related data sets for rescue and assembly. The workshop provides an opportunity for GCOS sponsorship.

Task B. A second workshop on Long-Term High-Altitude Observations, to be held in Switzerland in October 1995, also provides an opportunity for GCOS to co-sponsor a forum to evaluate the various measurements (e.g., atmospheric constituents) that have been taken under the uncontaminated conditions of high-altitude observations, as well as an opportunity for GCOS to have its needs made known with regard to the disposition of these data (quality control, archiving, dissemination).

Assignment: The JPO will explore the advisability of support with JSTC members.
Milestone: March 1995.

7.9 **Re-analysis efforts of Atmospheric General Circulation Models (AGCMs).**

For the reanalysis of AGCMs, procedures are set up and developed to use in the four-dimensional assimilation of input data of different and changing composition. It was felt that this will affect the resulting re-analysis climatologies to an unknown extent, particularly in the time and space scales of interest to the climate community.

The Atmospheric Observation Panel is asked to consider these concerns and ensure adequate input to the formulation of the re-analysis efforts, through perhaps a workshop.

Assignment: Dr. Julian to present these issues at the next Atmospheric Observation Panel meeting.

Milestone: March 1995.

7.10 **Leading Indicators.**

Leading indicators are important to the GCOS goal of national economic development. This involves blending of scientific data with socio-economic data to develop appropriate indicators of climate change, climate extremes, water availability, health of ecosystems, etc.

The Data Panel recommends that JSTC arrange for a workshop to identify data required to develop appropriate indicators. This workshop should include physical scientists, socio-economic scientists, and impact experts and could be jointly sponsored by GCOS, World Bank, UNEP, and possibly others.

Assignment: JPO to bring this issue to the attention of the JSTC. With the concurrence of the JSTC, JPO will explore workshop sponsorship with countries and other appropriate agencies.

Milestone: May 1995 (JSTC to decide).

June 1996 (workshop, if desirable).

7.11 **Develop GCOS data centre functions.**

Task A: Identify the degree to which existing centres of satisfy requirements for GCOS centres.

Assignment: Mr. Vent-Schmidt and Dr. Webster to explore the possibility of holding a meeting of representatives of **WDCs** and Specialized Data Centres with representatives of GCOS disciplinary panels to examine the data centre functions.

Milestone: May 1995.

Task B: Based on results of Task A, **refine** the GCOS Data and Information System centres model (draft given in Annex V). Check functionality, test existing centres against the proper functionality.

Assignment: GCOS JPO to hold an expert meeting with representatives from meteorological, oceanography and terrestrial sciences as necessary, preferably prior to JSTC-V.

Milestones: August 1995.

Task C: Recommend JSTC submit a formal recommendation to **WMO/IOC/UNEP/ICSU** to formally adopt the data centre and management structure and to seek support from Member states, CEOS and other relevant bodies (see Annexes V and VI).

Assignment: Chair DIMP to submit this recommendation to JSTC-V.

Milestone: October 1995.

7.12 JSTC to formally recommend establishing a GCOS Information Centre as outlined in Annex V.

Assignment: GCOS JPO to set up the initial functions.

Milestone: As soon as possible.

7.13 Test data centre functionality with developing countries.

Assignment: Mr. **Withrow** and Ms. Jose to work with Dr. Bengtsson, chairman of the Atmospheric Observation Panel to more fully develop an ENSO pilot project design which involve developing countries, preferably in time for consideration by JSTC-V.

Milestone: September 1995.

7.14 JSTC to send a senior representative to WMO Congress to support a policy of full and open data exchange for GCOS.

Assignment: Chair of DIMP to work with GCOS JPO and Chair of JSTC to select representative.

Milestone: May 1995.

7.15 Develop pilot(s) to exercise the end-to-end data flow including exercise of a full and open data exchange policy.

Any pilot should include an evaluation of how the system performs, stating what aspects performed well and which ones performed poorly in meeting the needs of users. Data Panel representatives should work with GCOS science panels to develop the atmospheric, ocean, and terrestrial pilots in such a manner as to be viewed as an integrated pilot.

Assignment: JPO and Chair of DIMP to nominate representatives.

Milestones: Proposed pilot to be submitted to JSTC-V.

7.16 Request JSTC to strengthen links between GCOS and IPCC.

Assignment: Chair of DIMP to brief JSTC-V.

Milestone: October 1995.

8. CLOSURE OF MEETING

The Chairman thanked Panel members for their active participation in the discussions, and he also recorded the Panel's appreciation for the excellent facilities provided by NOAA.

The meeting closed in the afternoon of 10 February 1995.

Annex I

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Annex II

Terms of Reference

Background:

Recognizing the need for a comprehensive approach to formulate, implement, and oversee the GCOS data and information management system, the JSTC establishes a Data and Information Management Panel.

As the GCOS data and information system should be developed to be a common system that accommodates data and products from the climate modules of GOOS, GTOS, and the WWW, the DIMP must include representatives of these programmes. Furthermore, the DIMP should be constituted of a core group of members (6-8) representing the different GCOS communities, and a number of representatives from related backgrounds and disciplines. The DIMP should possess a broad range of expertise including research scientist who use and understand GCOS data sets, and data management experts responsible for significant components of the overall GCOS information management system. The DIMP should be a highly focused “problem solving” group, concentrating on resolving crucial issues affecting the quality of GCOS data sets, and access to them. Individual agenda items could require additional participants as well.

Terms of Reference:

- o In concert with GCOS science panel requirements and the GCOS user community, formulate and develop the GCOS Data and Information Management Plan;
- o Monitor the overall implementation of the GCOS Data and Information Plan;
- o Make reports and present recommendations, as required, to the JSTC on information management issues.

The DIMP has the following specific responsibilities:

- o Based on requirements from the GCOS science panels and the climate community, to solicit data sets relevant in meeting GCOS objectives;
- o To identify gaps in available GCOS data sets and co-ordinate efforts to redress data deficiencies;
- o To consider and develop a process whereby data sets be identified and included as GCOS Data Sets. The process should include an assessment addressing, ***inter alia:***

that the data quality meets standards acceptable to peers of the submitting scientists using that type data,

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that the data contain documentation (metadata) of a standard acceptable to peers using similar data;

- o To review and provide oversight of the GCOS information management system to ensure:

that deficiencies in data sets are addressed,

that access to data and products is provided as required,

that archiving activities are adequate.

Annex II

Agenda

1. OPENING OF THE SESSION
 - 1.1 Welcome
 - 1.2 Approval of the agenda
2. GCOS STATUS AND UPDATE
3. PANEL CHAIRMAN STATEMENT
4. INVITED PROGRESS REPORTS
 - 4.1 GCOS Atmospheric Observation Panel
 - 4.2 GCOS/GTOS Terrestrial Observation Panel
 - 4.3 GOOS linkage
 - 4.4 GCOS Space-based Observation Panel
 - 4.5 IOC activities
 - 4.6 WMO activities
5. DATA SYSTEM CONCEPTS/CURRENT PRACTICES/PROBLEMS AND RELATIONS TO GCOS
 - 5.1 General concepts and demonstration
 - 5.2 Asheville workshop
 - 5.3 Meteorology
 - 5.4 Oceanography
 - 5.5 Land and ecosystems
 - 5.6 Specialized data centres
 - 5.7 World Data Centres
 - 5.8 Space-based observations
 - 5.9 Developing countries
 - 5.10 Other approaches
 - 5.11 Data exchange issues
6. DEVELOPMENT OF IMPLEMENTATION PLANS
 - 6.1 Review of JSTC action items
 - 6.2 Review of GCOS Data and Information Management Plan
 - 6.3 Assignment to discussion groups
 - 6.4 Discussion group reports
7. RECOMMENDATIONS AND PROPOSED PILOT PROJECTS
8. CLOSURE OF MEETING

Annex IV

Candidate GCOS-relevant Data Sets for Initial Evaluation

<u>Data Set</u>	<u>Possible Rapporteurs</u>
COADS	Chris Folland
U.K. Marine Data Set	Phil Jones
CARDS	Paul Julian
Surface Temperature (Jones)	Tom Karl
Global Historical Climate Network	David Parker
Reynolds SST	Max Planck Institute
MSU Pathfinder	John Christy
MSU • Spencer and Christy	Jim Hansen
Levitus Ocean Atlas	Peter Koltermann
Ozone	David Hoffman
ECMWF Reanalysis	ECMWF Advisory Panel member
GCM model data	Tim Barnett/Dave Karoly
Global Precipitation Climatology Project	Pavel Groisman
Keeling CO2	Liliane Merlivat
CMDL Trace Gas Data Set	Wolfgang Seiler
Land Surface (Terrestrial)	John Townshend to suggest
Socio-economic	Roberta Miller to suggest

Annex V

GCOS Data and Information System Centres

The following is an outline of functional rather than physical centres to support GCOS:

Global Assembly Centres

(Centres will likely be distributed, based on expertise)

Assembles climate information, data, and metadata

Carries out validation and quality assurance of data and metadata

Specialized/Research Centres

Develops methodologies

Develops application products

Produces analysis products

Identifies climate trends

Assesses climate impacts and provides socio-economic evaluations

Carries out research on methods

Disseminates specialized products

Operational Centres

Produces regular operational products

Makes climate forecasts and predictions

Detects climate events and prepares global alerts

Disseminates operational products, documentation, and publications

National/Regional Centres

Develops and distributes climate products to meet national and regional needs

Makes available national and regional data to Global Assembly Centres

Obtains specialized products and analyses from the global centres to meet national and regional needs.

Archive Centres

Preserves data, metadata, and information for future use

Disseminates climate data, products, and information

GCOS Information Centre

(Could be **centralized** or distributed activity)

Helps users; provides "Ombudsman" function

Provides access to a directory of climate data and information

Provides information on GCOS programmes and plans

Prepares documentation on the system

Establishes a bulletin board to facilitate communication between research and operational communities, including plans for data collection

Annex VI

Proposed Organizational Structure of the GCOS Data and Information System(DIS)

GCOS DIS Oversight Board

- Made up of GCOS constituents
- Establishes GCOS DIS policy
- Provides regular review of the GCOS DIS

GCOS Harmonization Office

- Coordinates the elements of the GCOS DIS
- Ensures the data flows
- Assures that users needs are met
- Maximizes the system effectiveness
- Acts as a system “tier”
- Identifies gaps and duplication
- Balances the elements of the GCOS DIS
- Establishes standards and formats, in cooperation with the Centres
- Reports to the Oversight Board