



Global Terrestrial Observing System

**Report of the GCOS/GOOS/GTOS
Joint Data and Information
Management Panel**

Third Session

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Report of the GCOS/GOOS/GTOS Joint
Data and Information Management Panel

I. Opening of the Session

i. Opening

The Global Climate Observing System (GCOS) / Global Ocean Observing System (GOOS) / Global Terrestrial Observing System (GTOS) Joint Data and Information Management Panel (JDIMP)¹ held its third session 15-18 July 1997 in Tokyo, Japan. The meeting was hosted by the Japan Meteorological Agency (JMA), the Science and Technology Agency (STA), and the National Space Development Agency of Japan (NASDA). The meeting was chaired by Mr T. Karl, who as Chairman-elect, was intending to assume the chairmanship during this session. He expressed the regrets of the Chairman of the panel, Mr G. Withee, who was unable to attend this session as a result of his new assignment. In his correspondence, Mr Withee expressed his continuing support for the work of the panel, and wished the meeting every success.

ii. Welcome and Conduct of the Meeting

The Chairman welcomed the participants (Annex I), and invited representatives of the sponsoring organizations to make opening remarks. Mr K. Nagasaka welcomed the participants on behalf of JMA. He observed that Japan has hosted several meetings on behalf of GCOS, and has been actively supporting the development of the G3OS (i.e., GCOS, GOOS, and GTOS) through participation in their planning and implementation activities. He noted in particular that the host organizations and the Japanese global change community recognize that global change is one of the most crucial issues for this and coming centuries and pointed out the importance of the G3OS in addressing this issue. In citing the need for cost-effective procedures to manage the extensive information required for global observation, he encouraged the panel to establish effective procedures to collect, access, and distribute data and information to the scientific community and to the governmental agencies involved with global issues.

Mr E. Muto of STA welcomed the participants to Japan. He expressed a similar sentiment as the representative of JMA when he noted the importance of global observations of the atmosphere, ocean, and land surface and complimented the G3OS in initiating important activities to provide appropriate information to the user communities. He cited the importance of interdisciplinary work, and noted the value of exchanging opinions on various data systems, programmes, and organizations. Mr Muto expressed his dismay at the loss of the Advanced Earth Observing Satellite (ADEOS-I). He told the attendees that investigations into the cause were underway, and he affirmed that the agency would do all in its power to ensure such an event does not recur.

Mr Y. Haruyama, member of the GCOS Joint Scientific and Technical Committee (JSTC) and representative of NASDA added his welcome to the participants. He informed the

¹ The former Global Climate Observing System (GCOS) Data and Information Management Panel is now sponsored by the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) and will be called the GCOS/GOOS/GTOS Joint Data and Information Management Panel (JDIMP).

panel that he would provide a comprehensive discussion of the recent problems encountered with the ADEOS mission later in the agenda (see 3.5). Participants expressed their disappointment with the loss of ADEOS, but complimented the Space Agency of Japan for the vast amount of information that was provided to the scientific community during the mission. The participants expressed their confidence in and support for future ADEOS missions.

The Chairman thanked the welcoming speakers for their gracious remarks and for their generous support of the meeting. He added his wish to that of earlier speakers for a productive meeting, and invited the participants to introduce themselves.

iii. Approval of the Agenda

The agenda was slightly modified and adopted (Annex 2).

iv. Terms of Reference and Scope of JDIMP

The Chairman briefly noted that since its last session, the panel has acquired the sponsorship of the GOOS and the GTOS. Consequently, its terms of reference are in need of review and possible modification. He proposed that the panel consider developing specific proposals to modify them at an appropriate place in the agenda. In a similar fashion, he noted that the scope of the panel was also an important subject for consideration. The Chairman suggested that the prior work and output of the panel since it was established on behalf of GCOS would provide a context in which the participants could review the future scope of work. He suggested these two issues be revisited after the series of updates and reports were provided.

II. Panel Chairman Statement

Mr Karl reviewed some of the background of the panel for the participants. He noted that, since its inception in 1994, the GCOS Data and Information Management Panel (DIMP), had collaborated with GOOS and GTOS, in particular as related to the climate elements from the ocean and land surface. The 'expanded' DIMP, the Joint Data and Information Management Panel, will now, in partnership with the G3OS, address the additional data and information management needs of the other modules within these two observing systems. This is a substantial new responsibility, and will require the cooperation, collective thought, and energy among all parties concerned to develop and implement an effective and coordinated observing system.

The Chairman noted that over the past years DIMP has had some success in meeting some of its goals, but at this juncture JDIMP must make a transition, re-examine its objectives in terms of the needs of all three observing systems, and prioritize the most expeditious course of action. At the present time, not only are GOOS and GTOS looking toward JDIMP for data management leadership, but the World Climate Research Programme (WCRP) projects, such as the Climate Variability and Predictability Study (CLIVAR), have publicly stated that they will use JDIMP to assist them with their data management issues. Although there are many users and a lot that could be done, the panel may have to examine, not only what would be good to do, but who will be a champion for each project. Without such champions, either individuals or institutions, even good ideas will not be effectively implemented.

The JDIMP has both a scientific and a technical role with respect to the terms of reference as currently written. The technical role is obvious with respect to data access, archival,

and distribution, but the scientific role is equally critical as it relates to providing data of adequate or known quality to address specific science questions. JDIMP has two basic responsibilities: first it has to ensure effective and efficient access to data, products, and information, and second it must ensure that the users are provided with the highest quality data, products, and information. This latter responsibility requires the application of scientific knowledge to adequately assess and build databases, products, and information sources.

He noted that based on past experience, data systems, even distributed ones, seem to work best when they are built for specific applications and users in mind. If true, the question JDIMP must address is to what extent must our data system(s) be generalized? Is the development of an "Information Center" (IC) the common denominator that links together a variety of systems? Then to what extent, if any, do we require common formats and protocols among the data systems comprising the data and information flow for the G3OS programmes?

How do we go about ensuring adequate data quality to the users of the G3OS databases? Again, this is likely to require knowledge of the user needs. Some applications will require long-time series with minimal time-invariant biases, while others may require dense observations with relaxed time-dependent observing biases. So, JDIMP may best serve its community of users through a variety of quality control schemes, but with strict adherence toward practices which ensure that all users are fully aware of the implications of the control upon the data, products, and information they receive through G3OS.

Since observations are not made without a purpose, perhaps one of the more important considerations for JDIMP at this stage should be an aggressive view toward our ability to provide critical data and information services to ongoing programmes such as the Intergovernmental Panel on Climate Change (IPCC), CLIVAR, the Global Energy and Water Cycle Experiment (GEWEX), the World Ocean Circulation Experiment (WOCE), and others. This is where the panel will need to have some serious discussion. Clearly there are many existing international data systems in place that are working quite effectively. How does JDIMP complement and build upon such activities? Working with the user communities is clearly necessary, but this first requires knowing who they are. Subsequently, we will need to identify their current and future needs.

Clearly, many challenges lie ahead for JDIMP. None will be overcome however without the identification of "champions" willing to take on specific challenges. JDIMP would be well served by ensuring we have such champions in mind as we identify our primary tasks.

III. Global Observing Systems Status and Update

i. Global Climate Observing System

The Chairman invited Dr T. Spence, Director of the Joint Planning Office (JPO), to update the panel on GCOS activities since its second session. Dr Spence provided a brief review of the stages in the development of GCOS. He noted the early concept whereby a comprehensive observing system for climate was envisaged to integrate elements from the atmosphere, ocean, and land surface, utilizing both remote and *in situ* techniques. In the early discussions it was clear that the GCOS would be based, to the degree possible, on existing systems and programmes. Thus, the JSTC for GCOS identified an Initial Operational System (IOS) to enable it to begin implementing key parts of the programme immediately. To date, elements from the atmosphere, ocean, and land surface have been incorporated at varying levels into the IOS. The IOS also included a

“comprehensive data system” which was intended to provide a structure and oversight for the voluminous streams of data that were anticipated from the various observing elements. Consequently, a data and information management structure was envisioned from the start. The current JDIMP is the latest innovation in the process of developing and implementing an effective system for the climate.

Although comprehensive plans for a data component for GCOS were developed, the components of an effective distributed data system as described in the plans is far from being realized. However, in the meantime, the need to consolidate the data functions of the G3OS became so apparent that the JSTC proposed that GOOS and GTOS join in the constitution of a single panel so that the data and information elements of the G3OS could be developed in a concerted fashion.

Dr Spence illustrated the structures of and the relationships among the three observing systems as they currently exist. He indicated several areas of cooperation that were being actively pursued through joint sponsorship (e.g., the GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC), the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC)) and noted a number of issues shared by the programmes.

He invited the panel to consider, during this session, how best to broaden its activities to support the data and information management activities of GOOS and GTOS. However, he urged it to continue to provide advice on some specific GCOS issues (e.g., the GCOS Surface Network (GSN) for which data management issues are arising; see 5.6). He observed that both programmes had indicated their willingness to participate in combined planning activities to the degree possible, but that a close cooperation will be required among the various steering committees, scientific panels, and other supportive groups, and finally, the user communities. He indicated several specific issues which the panel should consider.

ii. Global Ocean Observing System

Mr J. Withrow noted that the overview given by Dr Spence well described the structure of GOOS and its relation to the other global observing systems. He updated the panel on GOOS restructuring that, among other things, had resulted in the renaming of the Joint Scientific and Technical Committee for GOOS (J-GOOS) as the GOOS Steering Committee (GSC) and the incorporation in GSC of the former I-GOOS Strategy Sub-committee. Dr W. Nowlin, member of the JSTC, has been selected as the new chairman of the GSC. The GOOS Support Office was renamed the GOOS Project Office in view of its more pro-active role. The Intergovernmental Panel for GOOS (I-GOOS) remains in force under a new chairman, Dr A. McEwan, also a member of JSTC.

He referred participants to three documents under development for GOOS, the GOOS Principles, the GOOS Strategic Plan, and GOOS 1998. He noted that they will serve as key guiding documents for GOOS in the long, intermediate, and short term, respectively. Portions of the first two documents relevant to data and information management were provided for attendees. He noted that GOOS will work to implement several pilot projects, placing particular emphasis on capacity building, as it enters the next implementation phase. The recent meeting of the Intergovernmental Panel for GOOS considered Data Policy and organized an intersessional working group under the chairmanship of Dr D. Kohnke to develop a data policy statement.

OS for the terms of reference for JDIMP:

- (i) There should be a mention of efforts to assist developing countries to build up their capacity to participate fully in the G3OS's;
- (ii) JDIMP should take on board responsibility for designing an end-to-end data and information management system, including the development of products and services;
- (iii) There should be specific mention of capitalizing on pre-existing data and information management systems to build the infrastructure of GOOS (and the other systems).

It was agreed that these would be addressed by an *ad hoc* group later in the session (see 7.1).

He added that GOOS will establish a Data and Information Service (DIS) with the following objectives to:

1. Implement the recommendations of DIMP to develop a distributed Data and Information Management System based on a hierarchy of local, national, regional and global institutions (e.g., a network of data centres);
2. Integrate these activities with those of existing oceanographic observing systems and programmes by appropriate means, through negotiation (e.g., the Integrated Global Ocean Services System (IGOSS), the Global Temperature and Salinity Profile Project (GTSPP), the Data Buoy Cooperation Panel (DBCP), the International Oceanographic Data and Information Exchange (IODE), the Global Sea Level Observing System (GLOSS), the volunteer Ship-of-Opportunity Programme (SOOP), and the WMO Commission for Marine Meteorology (CMM);
3. Coordinate the activities of the DIS;
4. Provide practical assistance in capacity building by working with developing Member States to identify appropriate data sets and demonstrate how these, either alone or in combination with others, may be turned into services and products valuable to local decision makers.

Mr N. Hasegawa, coordinator of the North-East Asian Regional GOOS (NEAR-GOOS), supplemented the comments on GOOS by describing some of the activities of this regional GOOS programme. NEAR-GOOS was initially begun in 1996. One of the first activities was to develop guidelines for data exchange which includes both real-time and delayed mode. Initially, issues were raised about the NEAR-GOOS data policy, but data will be provided free to all users interested in obtaining it and contributing to the database. Registration of users is required for security and to monitor utilization levels. Some further work is needed for the free exchange of some space-based data.

He noted that global oceanic data exchange is a relatively new concept, but it is hoped that projects such as NEAR-GOOS will encourage data sharing by convincing data providers of benefits of sharing information. NEAR-GOOS provides many opportunities and ways to provide data as indicated in the documents provided for the panel.

After being invited to note where JDIMP may be helpful, Mr Hasegawa suggested that JDIMP could be of assistance in filling gaps between regions, and in the exchange of data with other external activities and programmes. For example, little discussion has occurred between NEAR-GOOS and IGOSS or GTSP to date. NEAR-GOOS is interested in obtaining other relevant information from activities outside its region of influence that are not currently on the WMO Global Telecommunication System (GTS).

iii. Global Terrestrial Observing System

Mrs G. Martin, member of the GTOS Steering Committee (SC) reported on the GTOS. It was created to improve accessibility, quality and use of the data needed to better understand changes in the capacity of terrestrial ecosystems to support sustainable development and to make more informed decisions about how to manage change. Five priority issues have been identified -- changes in land quality, freshwater resources, pollution and toxicity, loss of biodiversity, and climate change.

GTOS is sponsored by FAO, ICSU, UNEP, UNESCO, and WMO. The implementation began in a serious way approximately 18 months ago with the completion of the GTOS Planning Group Report² which was accepted 'in principle' by the GTOS sponsors. A secretariat was established, hosted by FAO, and the SC first met in December 1996 in Rome. A subset of the SC met in a "coordination and implementation" meeting in May 1997 to consider a draft document identifying priorities, principles, roles, etc. This document is now being finalized.

Specific initiatives to this point include a report on the data needs of the conventions, and the formation of several working groups. Preparations are underway for cooperative work with the other observing systems such as this Panel and the TOPC, as well as two other data-related activities, the Terrestrial Ecosystem Monitoring Sites (TEMS) database and the GTOS Network Demonstration Study (see 4.6).

iv. Integrated Global Observing Strategy

Mrs L. Moodie described the initiative to develop and implement an Integrated Global Observing Strategy (IGOS). The IGOS is intended to improve the integration of global space-based and *in situ* observation activities. Mrs Moodie noted that an IGOS would provide an overarching strategy for observations allowing those involved in the collection of data to extend their contributions, and assisting those requiring information (e.g., the G3OS participants) to specify their requirements in a consolidated fashion. A successful IGOS should help nations make better decisions in allocating resources to meet their priorities by taking advantage of improved international collaboration and cooperation. Required is a synergistic partnership involving:

- (i) International, regional and national organizations with responsibilities for providing *in situ* observations;
- (ii) Space agencies;
- (iii) Science funding agencies; and
- (iv) Agencies with operational responsibilities.

² Global Terrestrial Observing System (GTOS): Turning a sound concept into a practical reality. UNEP/EAP.TR.95-08

Mrs Moodie informed the panel that the International Group of Funding Agencies for Global Change Research (IGFA) has joined the Committee on Earth Observation Satellites (CEOS) to consider the IGOS concept through the work of a Strategic Implementation Team (SIT). The SIT is composed of senior-level officials of space agencies and representatives of a number of international scientific and intergovernmental organizations (e.g., G3OS and their sponsoring organizations) which represent user communities. The purpose of the SIT is to advance the development of an IGOS. At the first meeting of the SIT it agreed to pursue six prototype projects intended to demonstrate the added value of working cooperatively in an IGOS framework. The panel took note that several of them will be of importance in its future work.

v. Global Data Management Activities in Japan

During the course of the meeting, several invited presentations were made on behalf of various activities in Japan. These reports included Mr Haruyama on the recent loss of the ADEOS satellite link, Mr Hasegawa on activities of the JMA, and Mr K. Takahashi on the GEWEX Asian Monsoon.

Mr Haruyama reported that ADEOS-I was confirmed to be lost on 30 June 1997. NASDA established a Task Team to identify the cause of the accident and to assess the impact on NASDA's Earth observation plan in the future. So far it has been found by the Task Team that there were some anomalous power losses associated with the solar panels. The loss of power was apparently not sudden, but gradual losses were noted prior to the complete failure on 30 June. It is believed that the solar panels may have collapsed robbing the satellite of its power. The Task Team will draw further conclusions when it issues a full report within a month. Mr Haruyama informed the panel that the ADEOS-II mission will be kept on schedule, and that any modifications required as a result of the ADEOS-I problem will be addressed prior to launch in 1999.

Mr Hasegawa gave a presentation on some activities of the JMA which are related to data and information management. JMA serves as the World Data Centre on Greenhouse Gases (WDCGG) and a Quality Assurance/Science Activity Centre (QA/SAC) within the framework of the WMO Global Atmosphere Watch (GAW) programme. The JMA holds a substantial marine meteorological data set known as Kobe Collection. It is currently being digitized for the benefit of the climate user community. The JMA has also contributed actively to the WMO Distributed Databases (DDB). The JMA server, which provides climate and other meta data/products, is found at [<http://ddb.kishou.go.jp>].

Mr Takahashi of the Meteorological Research Institute (MRI) of the JMA reported on the WCRP's GEWEX Asian Monsoon Experiment (GAME) which was formally started in 1996 to understand the role of the Asian monsoon in the global energy and water cycle and to improve the simulation and seasonal prediction of Asian monsoon patterns and regional water resources. He summarized the strategies, activities, and future implementation plans of GAME, in particular those related to data and information management. He described the GAME Archive Information Network (GAIN), in which the MRI actively participates.

IV. Invited Reports

Noting the broad constituency of the panel, the Chairman invited a number of participants to provide brief reports. He asked them to indicate specific activities which directly relate to the work of the panel.

i. G3OS Panel Reports

Mr K. Kuma, member of the TOPC, noted that it identified the required land surface variables to be observed and developed a nested hierarchy as an effective sampling design for these variables. Data policies remain to be worked out, since information will be coming from a variety of data providers. He noted that the TOPC will be involved with the IGOS Forest Cover Project (see 3.4), and that the JDIMP may be helpful in the connection of existing networks. It is not obvious what will encourage participation in GTOS. The question is: What will data suppliers receive in return for sharing data? He recalled that some information required by GTOS will be needed in near-real-time (24 hours).

Mr N. Sato, member of the GCOS Atmospheric Observation Panel (AOP), noted that it has not met since the last session of the panel. He invited Dr Spence to update the panel on recent implementation activities of the JPO on behalf of the AOP. Dr Spence first noted that the AOP will be identified in the future as the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC) to reflect the co-sponsorship by the WCRP. It will next meet in the UK in August 1997 under its new chairman, Dr M. Manton. He briefly summarized the situation with regard to the GCOS Upper-Air Network (GUAN) and the GSN, noting their adoption by many of the members of WMO. A number of data-related issues with the networks remain, but they should be resolved at the next meeting of AOPC. Mr Sato invited the participants to review the proposed modifications to the terms of reference of the AOPC to ensure there are no overlaps in responsibility, but the panel made no specific suggestions on them.

Due to the absence of representatives of the OOPC, Dr Spence reported on its second session which was held in Cape Town, South Africa. A summary report was distributed to participants. He reminded the panel that the OOPC is generally following the data procedures outlined in the report of the Ocean Observing System Development Panel (OOSDP) and is addressing the issues of data and information management in a systematic manner. Several global databases (e.g., drifting buoys, sea level) are being facilitated through the work of the OOPC, often through direct contact between members of OOPC and the implementing organizations themselves. Although unable to attend the JDIMP session, the Chairman of OOPC, Dr N. Smith, provided a few suggestions in writing for JDIMP. In particular, he noted that the OOPC has taken a lead role in the development of the Global Ocean Data Assimilation Experiment (GODAE), one of the six projects of the SIT (see 3.4), and suggested that the data management aspects of the project may offer opportunities for JDIMP to provide assistance. A meeting on GODAE next week may develop specifics in this regard.

Mr J. Morgan, Chairman of the newly reconstituted GCOS/GOOS/GTOS Global Observing Systems Space Panel (GOSSP)³ was unable to attend the session. Dr Spence updated the panel on developments regarding GOSSP. First, he noted the agreement of GOOS and GTOS to become co-sponsors of the space panel, and that it has had two meetings since the last session of DIMP. The published version of the first meeting (GCOS-29) and a draft report of the second

³ Formerly the GCOS Space-based Observation Panel

meeting⁴ were provided to JDIMP participants as part of their documentation. At the first meeting, held in Geneva in September, 1996, the GOSSP considered its broadened remit and agreed to carefully consider the observational requirements of each of the three observing systems. A method to compare these requirements with the capabilities of the space data providing agencies was illustrated and adopted. The GOSSP also agreed to undertake a major revision of the GCOS Plan for Space-based Observations. A draft outline was developed. At the more recent session of GOSSP held in UNESCO headquarters in Paris in May 1997, the panel reconsidered the overall requirements for the G3OS and specifically those associated with five of the six SIT projects it considered relevant to the G3OS. It provided input for the Chairman to deliver to the Analysis Group Workshop in Tokyo which immediately follows the JDIMP meeting next week, and the SIT which meets in UK in September (see 3.4). A number of small *ad hoc* groups were identified to work intersessionally to develop elements of the second version of the space plan, and to accomplish some of the other recommended activities of the panel.

ii. WMO Data Management Activities

Mr P. Scholefield reported on recent WMO World Climate Data and Monitoring Programme (WCDMP) activities. The purpose of WCDMP is to make the best possible use of existing climate data to ensure that WMO Members have access to reliable, timely climate data and products in formats suitable for their use. He noted that the activities of the WCDMP, which nicely complement those of GCOS, transcend WMO programme boundaries, some falling within the scope of the climate components of a number of other international organizations. The ultimate aim is to address the data requirements for climate change detection, climate applications, monitoring and research, the assessment of impacts on climate, the validation of climate models and forecasts, and the development of strategies to mitigate potentially adverse effects of climate variations and change.

The WCDMP is structured into five projects:

1. The Climate Change Detection Project (CCDP): To provide regular assessments and authoritative statements on the interpretation and applicability of databases for the detection of climate change on global and regional scales. The WMO Commission for Climatology (CCI) Working Group on Climate Change Detection (WGCCD) plays a lead role in the implementation of this project. This WG has implemented annual WMO statements on the status of the global climate and, with GCOS and the Commission for Basic Systems (CBS), has established the GCOS Surface Network. The WG will likely become a joint CCI/CLIVAR working group at CCI-XII in August 1997⁵, and will address the data needed for the development of indices to monitor and detect climate change. The GCOS programme should continue to be involved with this WG.

2. The Climate System Monitoring (CSM) Project: To provide Members with timely information on large-scale climatic fluctuations and facilitate interpretation and dissemination of this information. Monthly CSM bulletins and biennial global climate system reviews are the principal output from the project. Work has begun on a publication on the climate of the 20th century.

3. The Climate Computing (CLICOM) and the World Climate Data Information Referral Service (INFOCLIMA) Projects: To coordinate the implementation, maintenance and upgrading

⁴ Now published as GCOS-37.

⁵ The joint CCI/CLIVAR Working Group was established at CCI-XII.

of automated climate data management procedures and systems in WMO Member countries and provide information on the availability of climate data sets. CLICOM software now is available in 130 countries and initiatives to improve it are underway. An internet version of INFOCLIMA is being developed.

4. Climate Databases Project: To coordinate the preparation and accessibility of global and regional databases required for climate change detection, climate prediction research, monitoring, diagnostic studies and applications.

5. Assistance to Members to Improve the Climate Data Management Project: To coordinate efforts to rescue and preserve climate data and make it available in a computerized format; to prepare technical guidelines; and to support developing countries in implementing climate data management systems and networks. The Data Rescue (DARE) project in Africa has resulted in the rescue of nearly 5 million climate data documents on microfiche.

Mr Scholefield noted that the optimal opportunities for interaction and possibly integration of WCDMP activities with JDIMP are with the INFOCLIMA project, the development of climate change detection indices and support to the Climate Information and Prediction Services (CLIPS) activities including the production of Climate System Monitoring (CSM) products.

iii. WCRP Data Management Activities

No specific report was provided on this issue, but both the JDIMP Chairman and the GCOS JPO Director addressed some of the relevant issues associated with WCRP cooperation.

The Chairman noted that the WCRP is conducting an assessment of its activities in Geneva, 25-28 August 1997. One of the important contributions to JDIMP is to ensure that we provide the data and information management capability for scientific programmes to leverage their work and that we enhance the operational capacity of the G3OS from ongoing science programmes. The WCRP review provides an opportunity for JDIMP to extend this message to WCRP. Although the formal WCRP review programme has already been set, it may be appropriate for the JDIMP to inform the Executive Office of WCRP prior to the August meeting of our desire to work closely with the various WCRP programmes such as CLIVAR, GEWEX, WOCE, etc.

The JPO Director informed the panel of recent discussions held at the Joint Scientific Committee (JSC) of WCRP concerning WCRP data sets. The Chairman of the GCOS JSTC, noting that a number of the WCRP programmes have developed high-quality data sets which are not a decade or more in length, invited the JSC to consider the potential transfer of responsibility to a more operationally-oriented programme. Both the JSTC and the JSC have agreed to consider mechanisms which would advance this concept. It will be an agenda item for JSTC-VII.

iv. IGBP Data Management Activities

Dr G. Szejwach, Director of the International Geosphere-Biosphere Programme Data and Information System (IGBP-DIS), provided a brief update on the work of the DIS. It was established in recognition of the importantly increasing role of data issues in support of global change research and for the benefit of scientists working in the framework of the IGBP Core Projects. IGBP-DIS activities cover the following areas:

- (i) Production of global data products for the benefit of several Core Projects. Examples of such products are: DIScover (the classification of the land surface from the 1 kilometer Advanced Very High Resolution Radiometer (AVHRR) global product), a global FIRE product and global soils products;
- (ii) Support to Core Projects in the development of their data and information management systems;
- (iii) Establishment and implementation of a general IGBP data management plan.

IGBP-DIS Focus 1 covers point (i) while Focus 2 covers points (ii) and (iii).

The activities indicated above need to be integrated or make use of existing capabilities and similar/related international initiatives. This aspect is covered by Focus 3. Dr Szejwach related these activities to similar ones for JDIMP.

v. CEOS Working Group on Information Systems and Services

Dr M. Maiden was invited to provide an in-depth report on the CEOS Working Group on Information Systems and Services (WGISS) on behalf of the Chairperson, Mrs H. Wood, who was unable to attend. Dr Maiden informed the participants that WGISS was formed about 2 years ago from two existing working groups of CEOS. She noted that WGISS is, in a very real sense, a 'sister' organization to JDIMP. WGISS functions as the 'harmonization' group for data generated by Earth observing satellites and other sources. An informative document was available for participants.

The Vice-chair of WGISS is Mr T. Moriyama of STA/NASDA who will become Chairman at the CEOS Plenary in December. At that time Mr P. Churchill of the European Union/Centre for Earth Observations (EU/CEO) will become Vice-chair. The Vice-chair for Users of WGISS is Dr Szejwach of IGBP-DIS - underlining the CEOS goal of improving responsiveness to the user community.

WGISS is structured with three subgroups (i.e., access, data and network) to oversee technical work done by tasks in task teams, which may cross subgroups. The WGISS Five Year Plan contains seven themes that map to the work plans of WGISS, its User Panel and its subgroups. Activities are similar to the JDIMP, but one very real difference is that many of the WGISS members are also agency representatives having substantial resources devoted to data management activities - and therefore they are also the "champions" of tasks that the JDIMP chair mentioned (see section 2). The result is that WGISS does a substantive amount of real work by contributions and participation of these agencies.

Dr Maiden highlighted some of the tasks of WGISS. First, access tasks of interest include the CEOS International Directory Network (IDN), the CEOS Inventory Interoperability Experiment (CINTEX), and the Catalogue Interoperability Protocol (CIP) development. the CEOS IDN is an on-line data information directory service that allows users to access information on world-wide scientific data sets. A user can search by geographical region, by parameters such as "ocean surface temperature", and get a list of appropriate remote sensing and *in situ* data providers and archives. CINTEX provides a test bed for an interoperable data order and delivery system. An

inventory search allows a user to select specific satellite images from any data set searched, and the search is across all data systems comprising the interoperable system, allowing the user a "one-stop-shop" session. A new CIP is being developed within WGISS to provide the interoperability protocol for the next generation CEOS system.

Second, in the data area, WGISS provides data management monitoring for the Global Land One-km Data Set Project. Since 1 April 1992, data have been collected, acquired, archived, processed into products under the guidance of IGBP requirements, and distributed to the international science community. A set of more than 40,000 AVHRR images has been archived and is available from United States Geological Survey (USGS) and from the European Space Agency (ESA). The Global Land One-km Base Elevation (GLOBE) project was initiated by CEOS to develop an integrated 1-km resolution, gridded quality-controlled global digital elevation data set from multiple sources. The final product is scheduled for release in 1997 and will probably be released on CD-ROM. In the data area, WGISS is also developing global mapping standards to facilitate use of mapped data.

WGISS has developed a virtual CEOSnet, whose architecture is described on the CEOS Information System homepage [<http://ceos.esrin.esa.it/ceosinfo>]. A network task on performance measurement allows monitoring of routing and data transfer rate. When testing reveals a problem with routing of messages, it is sometimes possible to find rerouting solutions that can dramatically increase performance with no additional monetary resources needed.

WGISS is instituting a strategic planning effort and will continue to focus on user and provider requirements, improving data and information interoperability, harmonizing information access activities, and improving global network performance. WGISS is very interested in understanding G3OS data and information user requirements and implementing, as a real part of the G3OS system, data and information activities that help this integrating effort.

vi. GOOS and GTOS Data Activities

Mr J. Guddal, President of the WMO Commission for Marine Meteorology (CMM), discussed the end-to-end concept where a clear sequence from observations through to products for the user community is developed. The observing systems should provide services to industry, authorities, and the public. Using the example of ocean services, he noted that they serve a wide array of customers and end users. What is missing in his view is the linkage and infrastructure support. He noted that all programmes have functions which relate both to international and regional levels, and to national and local levels. The infrastructure at international and regional levels should provide services/products for use at the national and local levels. Examples of such products could be:

Major database services (e.g., global ocean profile data sets);

Information on data availability (e.g., data sets that can be provided from one global observing system to another);

Technical advice with regard to tools to communicate and transmit data.

He said the challenge is for JDIMP to assist in facilitating global infrastructure functions in support of the end-to-end concept, support metadata needs, and to advise on technical solutions where possible.

Mr Withrow reviewed a couple of points from the document submitted by the GOOS Project Office concerning the terms of reference of the panel. The particular issue was the suggestion that “JDIMP should take on board responsibility for designing an end-to-end data and information management system, including the development of products and services”. In subsequent discussion, it was determined that the various modules of GOOS should be involved with the specific development of an ‘end-to-end’ system, whereas JDIMP should provide overall guidance and context of the data/information management elements. The JDIMP should treat specialized data as a commodity to be collected, exchanged, and archived. It would not be able to work at the level of the ‘technical content’ of the data/information. Mr Withrow noted that, in addition to a G3OS Data and Information Management Plan, a GOOS Data Management Plan was still likely be needed.

Mrs Martin, member of the GTOS Steering Committee (SC) informed the panel that the SC is in the process of establishing a set of principles, several of which relate directly to data and information management. These are in varying stages of development, but in general, follow similar lines to those put forward by GCOS and GOOS. They concern:

- Data ownership and distribution -- GTOS will facilitate access and use (i.e., have a knowledge of what data exist, where they are held, and what conditions govern access to them);
- Data quality assurance -- An indication of the quality of data is required, but how best to achieve it has not been resolved;
- Harmonization -- data needs to be made comparable and compatible to be used in an integrated fashion.

Metadata will play an important role in achieving GTOS goals.

She noted the specific data-related activities of GTOS undertaken to date include the operation of the TEMS metadatabase (which can be accessed and queried through the GTOS and GCOS homepages), and the recently initiated GTOS Network Demonstration Study with its elements of data sharing and exchange.

vii. IGOSS and IODE Data Activities

Mr R. Keeley, representing the Chairman of IGOSS, informed the panel that IGOSS accomplishes its goals through the support of its members. The following activities provide examples of the support of end-to-end data and information management within IGOSS. One example of a prototype G3OS data and information management system is the combination of SOOP and GTSP. IGOSS has been central in moving the research based SOOP to an operational status. It has developed and maintained a number of code forms for sending ocean data over the GTS. An IGOSS supported Task Team organized intercomparisons between Expendable Bathythermographs (XBTs) and Conductivity-Temperature Depth instruments (CTDs) to investigate discrepancies between the two instruments. Manuals produced by IGOSS recommend data quality assessment practices both before and after the data are exchanged. A GTSP centre

tracks the timeliness of delivery of data to users. Processed data (includes removal of duplicates and assessing data quality) are distributed to users within 2 days of reception if required. The GTSP has participated in a special monitoring exercise recently set up by WMO to confirm proper transfer of data on the GTS. Data quality is monitored by GTSP monthly and a report is issued to data collectors detailing any problems that arise. Examples of some of the products created using data sent through IGOSS can be found in the IGOSS Products Bulletin [<http://rainbow.ldeo.columbia.edu>]. These include maps of surface and subsurface temperatures, ocean currents and sea level. These are produced for a variety of clientele from fishermen to shipping companies to scientists.

The Chairman of the IODE, Mr B. Searle, gave a brief presentation on its activities. He informed the panel that IODE, in existence since the early 1960's, now consists of 65 member countries. IODE is structured with National Coordinators, Designated National Agencies, and National Oceanographic Data Centres which coordinate and manage data in the national interest and provide the focal point for international data exchange through the IODE system. At the international level there are a number of Responsible National Oceanographic Data Centres for various regions and for specific data types.

Data through these IODE mechanisms then pass to the World Data Centres (WDC) (Oceanography and Marine Geology and Geophysics) where they are archived and made available according to the IODE and International Council of Scientific Unions (ICSU) data policies.

Among the number of programmes operated by IODE is the GTSP operated jointly with IGOSS as noted above, and the Global Ocean Data Archeology and Rescue (GODAR), an important initiative which has increased global ocean information by nearly 3 million observations. A new series of CD-ROMs is being issued by WDC-A later in 1997. OceanPC, another project of IODE, consists of a suite of software for the management and processing of marine data and is in use at over 300 sites.

Mr Searle noted that IODE has a very well-established data and information structure that is in a position to address many of the ocean data and information management needs of the G3OS. It has demonstrated ability its to work with the scientific community and other programmes. He encouraged the close cooperation between JDIMP and IODE to continue.

In subsequent discussion, it was noted that the G3OS (GOOS in particular) must specify how they intend to build upon existing systems. The requirements must be stated to enable the operators of existing programmes to know what should be maintained, what should be improved, or what should be replaced. Additional guidance is required now to enable the existing systems and programmes to be responsive to the needs of the G3OS. In addition, it was noted that there are several data sets and databases which do not currently have a 'home'. The G3OS should attempt to establish responsible organizations to maintain such data sets and databases on behalf of the user communities.

viii. Other Reports

Dr V. Razuvaev provided information about the state-of-the-art in preparation of high-quality meteorological data sets in WDC-B which can be identified as GCOS data sets. The development of data processing techniques and the use of advanced computing facilities make it possible to create a baseline precipitation data set for Russia. It can be used both for studying precipitation within Russian national climate programmes and for various international projects. In

this connection, the baseline data set is supposed to contain primarily daily precipitation totals for the period from 1966 to the present for about 2000 stations. Special attention will be given to data quality in this data set. Most of the proposed procedures to control and improve data quality have been tested and used in the daily precipitation data set for 223 stations of the former USSR which are available for scientific community use, and may be considered as a core set for the baseline data set. Although creating a baseline data set is a vital stage in the research of precipitation, many problems remain to be solved (e.g., solid precipitation, snow, hail). Nonetheless, the precipitation data set is considered a part of the work underway to produce the National Data Bank for Precipitation. It will contain all existing datasets including information on the values of meteorological elements used in precipitation control and appropriate metadata. A separate effort consists in analyzing the compatibility of precipitation data in Russia in the framework of international projects such as the Arctic Climate System Study (ACSYS) and GAME.

Prof. Zhai Panmao introduced China's global climate monitoring system and the usefulness of it in environmental predictions in China. He expressed the particular need for ocean and cryosphere data in China. Prof. Zhai emphasized the importance of metadata for the G3OS data sets by reviewing the biases in the historical surface and upper-air data in China and upper-air data from the U.S.

Dr R. Heino described regional climate data activities in Europe. They include the creation of the North Atlantic Climatological Data set (NACD) and the European Climate Support Network (ECSN) engaged in collecting Western European climate information. These data sets should be listed among the G3OS data sets.

V. Review of Recommendations and Actions

i. Review of DIMP Action Items

The JPO Director briefly reviewed the seven actions originating from the previous DIMP meeting, and noted where progress had been made, and where attention is still required. For example, the issues of a GCOS Data and Information System and the registration of data sets remain items for discussion (see 5.5). Several of the action items were addressed through the development of specific proposals during the intersessional period. Unfortunately the two submitted (e.g., a workshop for data centres, an information centre) were not funded during the year. Dr Spence invited further discussion on them later in the meeting. With regard to the item on data principles, the participants accepted and endorsed the guidelines proposed by the Chairman at earlier meetings (see Annex IV). A potential project on quality control for ocean observations was developed during the interim, but not submitted as yet (see 5.4). The various other items raised by the Director were dealt with in appropriate agenda items to follow.

ii. Review of JSTC Data-related Action Items

The JPO Director noted the discussions on DIMP at the two most recent meetings of the JSTC. Their recommendations to DIMP had mostly been addressed, although a continuing close interaction between the two groups was stressed. He invited the participants to consider mechanisms whereby the panel provides its recommendations to the G3OS. For the GCOS JSTC, the panel Chairman plans to attend a special session at which the various GCOS panel chairmen will report their progress, plans, and problems, which will be tabled for discussion at the JSTC

plenary session on subsequent days. Reports by the Chairman to the GSC and GTOS SC were encouraged.

iii. Workshop on Indices and Indicators for Climate Extremes

The Chairman reported on the workshop on “Indices and Indicators for Climate Extremes”, that was proposed at DIMP-II. The workshop, sponsored by CLIVAR, GCOS and WMO, was hosted by the U.S. National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), in Asheville, NC, 3-6 June, 1997. Nearly 100 scientists and specialists from the insurance and reinsurance industry from 23 countries participated in the meeting. It addressed a number of issues including:

- Generating more comprehensive and reliable information for the IPCC (Year 2000) assessment of climate change related to the question “Is the climate becoming more extreme?”;
- Identifying critical data sets required to address changes in climate extremes;
- Identifying, suggesting, and finding ways to correct inhomogeneities in the databases required to address the question of changing climate extremes;
- Identifying specific indices or indicators that capture the multidimensional aspects of changes in climate extremes and can be easily calculated and readily understood;
- Finding ways to ensure that access to high-quality observations continue for those indices and indicators of primary interest;
- Identifying the type of information the insurance and reinsurance industry requires regarding changes in climate extremes.

The Chairman reported that the meeting accomplished a number of specific and tangible goals. About 20 papers were identified for publication in *Climatic Change* (pending peer review) and a reference textbook. Publication is scheduled for September 1998. Agreement was reached on a minimum set of indicators of climate extremes and the data required to calculate them. Regional rapporteurs and working groups were established for developing data sets and coordinating calculation of indices and indicators. The assistance of the CCI/CLIVAR Climate Change Detection Working Group was obtained to address special data homogeneity needs and to resolve research issues needed to calculate the indices and indicators agreed at the meeting.

A number of action items remain for follow-up. These include to:

- Formalize regional task groups and rapporteurs with a letter from the GCOS/CLIVAR offices;
- Solicit the cooperation of projects such as the System for Analysis, Research and Training (START), the Asia-Pacific Network for Global Change Research (APN), the Inter-American Institute for Global Change Research (IAI), and WMO’s DARE to enhance data coverage within several data-sparse regions (e.g., South America, Africa, Southeast Asia, etc.);

- Identify location and sponsorship (funding sources) for a follow-up workshop in early 1999;
- Identify computation and data archive centres for indices and indicators;
- Continue the communication with and encourage the active participation of the insurance and reinsurance industry.

Mr Scholefield updated the panel on discussions held in Melbourne the preceding week at an informal meeting of WGCCD. The WG endorsed the outcome of the indices workshop and particularly supported the development of indices for climate change.

In the following discussion, participants urged that non-meteorological indices also be considered, and that industrial contacts be made judiciously. Additionally, it was noted that the OOPC is developing a suite of brochures to describe the products of use to users, and some of them will incorporate indices. The meeting, *In situ* Observations for the Global Observing Systems (GCOS-28), flagged indicators and indices as important elements to ensure the end users receive useful information. The role of the JDIMP should be to ensure that the appropriate data are available for use in developing the indices.

iv. DIMP/OOPC Data Quality Assessment Proposal

Mr Keeley noted that the last DIMP meeting discussed a project to assemble an integrated time series of Sea Surface Temperature (SST) from a number of sources. The proposal was presented to WOCE Panels and to the Chairman of the OOPC. The response was somewhat subdued. The Chairman of OOPC suggested an alternate theme -- to quantify the value added to SST data as a result of quality control. This SST project was developed further resulting in the suggestion of a workshop to determine how such a valuation could be done. This idea was re-circulated once more and was more favourably received. Two members of the WOCE Upper Ocean Thermal group volunteered to undertake such a study in the limited domain of work they were starting. Some preliminary results from one of the studies undertaken by Dr R. Molinari of the NOAA Atlantic Ocean Marine Laboratory (AOML) in Miami were noted. He first calculated mean vertically averaged temperatures in 2 x 2.5 degree rectangles in the North Atlantic. The calculations used data with no quality control applied, but outliers removed by a 2- test. Then he made the same calculation using data that had received quality control. Anomalies from these means were then calculated for each box. As might be expected, results using these two techniques did not differ greatly. The main difference was that the data with quality control applied tended to show greater variation and more abrupt changes from positive to negative anomalies (and *vice versa*). More work is required to further quantify these results and to evaluate the differences for this and for other products. Factors which could be considered in future studies include: 1) the impact of quality control on the definition of space and time scales, and 2) uncertainties in these derived from data with and without quality control applied. It is expected that there may be no single alternative to quality control, such as removal of outliers by a 2- test⁶, but the value of quality control may be dependent on the products to be generated.

It was agreed that no immediate action by the panel is needed. Further studies are expected to be done by others and reports of these results will be made to the next meeting. After this work is completed, the panel may wish to reconsider the need for a workshop to more fully

⁶ It was noted that the 'ozone hole' was not identified earlier due to the use of such criteria.

explore this question, or simply to request a document that expresses the principles that apply when data with or without quality control are used for a variety of products. One agreed principle was stated -- original data must be retained to enable future work to be done effectively.

v. GCOS Data System Issues

At the DIMP-II meeting, a project was proposed to begin implementation of an on-line “data system” for climate data. One of the goals of the project was to implement a data system from a list of candidate systems through a workshop ‘vetting’ approach. Although such a process may provide some desirable learning opportunities, the Chairman noted that it now seems quite bold to have planned to select a single “data system”. At this time, he observed that there had been limited progress in moving forward on this workshop and with the new responsibilities of JDIMP, noted that it may be undesirable to carry through with it. Past experience with major data systems (e.g., the National Aeronautics and Space Administration (NASA) Earth Observation System Data Information System (EOSDIS) was focused on a single set of complementary space-based measurements and was much more limited in data sources than is currently of interest to JDIMP) has made it clear that it is very difficult to tie any computer data management system to existing technology or data transfer protocols, especially since data translation software is now abundant and inexpensive. The Chairman posed the issue: What do we mean by a “data system”? The one outlined in the GCOS Data and Information Management Plan was quite generic and included a variety of approaches with appropriate linkages. He invited the panel to discuss the issue and decide whether it wants to provide the oversight for linkages and capabilities among existing data systems or to encourage development of a distributed system with common software. He noted the difficulty and suggested that the latter approach may not be desirable. He challenged the panel to decide whether the workshop proposed at DIMP-II remains viable for JDIMP.

Participants noted that using the term “data system” served to delineate what was in the system and what was not. Since the G3OS are building from existing components, it may be counterproductive to be exclusive. Rather, what should be developed is an effective linkage among the various data sources and providers to serve the users’ needs. Thus, a more “integrative” approach was supported. In particular, a workshop as proposed earlier was not supported by the panel.

Dr F. Webster described the proposal made to establish a GCOS Information Center (IC). He began with a review of the recommendations from DIMP-II where it was envisioned that such a unit would be part of a distributed data and information system. It would allow users to locate and access data and information holdings at participating centres. The IC would provide search capabilities and access to a world-wide set of observations and information; it would point to other centres and systems; it would provide access to data, but would not hold data itself. He argued that the time is ripe to start such an activity, as it would provide immediate evidence of a G3OS data system. He noted that the data centres are ready and would agree to serve as a core for the system development. Once having it in place, others would be encouraged to join. As it evolves, the services would broaden. The specific proposal included the tasks of establishing an internet site which would contain information about data centre holdings, and would provide an ombudsman to assist users as appropriate. Dr Webster invited the panel to comment on these needs and to determine if a project for an IC should be advanced, and if so, how it should incorporate the non-climate elements of GOOS and GTOS.

Participants noted that spokespersons for the non-climate elements should be invited to comment on the proposal, and in fact, the various panels and working groups of GOOS and GTOS

should be invited to review the proposal and make comments before it is submitted for funding. Particular issues were raised with the prospect of an ombudsman function, the diversity of data sets to be incorporated from the GTOS perspective, and with the potential for the IC to enjoy a long-term commitment and truly be 'operational'.

After considerable discussion, it was agreed that Dr Webster would modify the proposal to incorporate non-climate aspects, and that it would be circulated to principals of GOOS and GTOS for their input. A discussion of the proposal would be scheduled at the JSTC-VII and a final decision taken on the project.

vi. JDIMP Role in GSN and GUAN

Mr V. Vent-Schmidt provided information on the status of the implementation of the GSN and reported on the second CBS/CCI expert meeting which took place at De Bilt in the Netherlands, 25-27 June 1997. The proposed network of about 1000 stations had been distributed to the National Meteorological and Hydrological Service (NMHS) to obtain their agreement and commitment. The experts reviewed the available responses from WMO Members which generated a number of questions such as the automation of stations, and the use of data from cooperative stations. The experts felt it necessary in future correspondence to clarify the requirements for a GSN station such as the routine monthly transmission via the GTS (e.g., using the report of monthly means and totals from a land station (CLIMAT) messages), and the provision of historical records together with appropriate metadata.

The experts accepted the proposal of member countries for substitution of and/or additional stations if they meet the requirements. The experts made specific recommendations to be discussed at the Panel meeting and the CCI meeting in August 1997. These include the establishment of a website for the GSN and the designation of a site as a repository of the historical climate data. The experts also felt it necessary to ensure the status of the GSN data as being "essential data" to be certain it is covered by the provisions of WMO Resolution 40.

The revised version of the GSN will be presented by the relevant rapporteur to WMO and the WMO Regions for approval. As far as data handling is concerned, Mr Vent-Schmidt proposed that the Deutscher Wetterdienst monitor the GSN data flow and include considerations of data availability and data quality with special regard to precipitation. A back-up centre should be invited to provide a similar service with regard to air temperature. The draft report of the meeting prepared by the rapporteur was available at the meeting⁷.

The GCOS Upper-Air Network, consisting of about 150 stations, has been agreed upon by the appropriate National Meteorological Services through the WMO. The collection of data is being monitored on behalf of GCOS by the European Centre for Medium-range Weather Forecasts (ECMWF). Further discussion will occur at the AOPC-III in the UK in August.

vii. Asia-Pacific Data Project

Dr A. Jose reminded the panel that one of its key issues in the strategy for GCOS is the increased participation of developing countries. She also recalled that during the DIMP-II, it was recommended that a seminar/workshop be held in the Southeast Asian Region. A project document on this topic was to have been prepared, but little progress has been made. Dr Jose

⁷ The final report (GCOS-35) is now available on the GCOS homepage or from the JPO.

encouraged the panel to revitalize and support this project. She noted that prospective participants would be end-users of data products and information, particularly the socio-economic sectors, policy-makers, and environmental scientists. At national levels, this awareness activity would enhance support for their own governments in improving existing observation systems and possible eventual participation in the G3OS. Dr Jose provided the participants with some information on initiatives existing in the Southeast Asian Region which may be useful toward development of the seminar proposal.

In discussion, it was noted that the G3OS programmes must promote capacity building in developing countries. However, it was noted that all of the G3OS sponsoring organizations have active and effective programmes to address specific issues for their member states and constituencies. These, along with programmes such as START, APN, and IAI, should be utilized by the G3OS as the foundation for work on behalf of developing countries.

VI. Plenary Review of Issues

Following the extensive suite of presentations, the Chairman invited the panel to consider the issues in plenary, and to develop guidelines for a few *ad hoc* groups to work separately to develop positions on these issues for resolution by the entire panel. To expedite the discussion, the Chairman invited several individuals to provide brief restatements of the central issues for the meeting: 1) data and metadata quality; 2) data systems and information centre; 3) specific projects needing development; and 4) relationships with other groups. He reminded the participants that the revision of the Data and Information Management Plan and the terms of reference of the panel should be revisited by the *ad hoc* groups to provide advice to plenary.

i. Data and Metadata Quality

Dr R. Heino, the CCI Rapporteur on Metadata, discussed metadata and their role in data homogenization. Data homogeneity is important for climatology, especially in the study of climate change. Long-term change due to causative factors have been small and slowly varying, hidden in large year-to-year variability. Climate records, at least those which are readily available, are normally mixtures of both real and apparent variations.

He noted that information on the history of the measurements and the stations (termed 'metadata') is essential for a successful study of the data homogeneity. Some attempts to create computerized metadata files have been made. The NOAA NCDC has a comprehensive file system for the U.S., and an ongoing activity to form a global file for the Global Historical Climatology Network (GHCN). Metadata of basic stations in the former Soviet Union is also available. Future work is planned for the European Climate Support Network (EUMETNET). The WMO inventory of climatological stations (INFOCLIMA) can also be regarded as a massive metadata file. Dr Heino suggested the role of the G3OS, and of the panel, should be to increase the awareness of the importance of metadata, and to encourage improved documentation and usage of metadata world-wide.

Mr Searle informed the panel that IODE was doing a pilot metadata project on ocean data in Europe and Australia. The project is intended to serve those users outside the specific domain of expertise of the data. He noted that some software was developed for metadata purposes, and could be used by JDIMP in a larger-scale project.

The Chairman reviewed the previous work of the panel on metadata, and it was determined that an *ad hoc* group should consider the issue in more detail and report its recommendations for plenary discussion.

ii. Data Systems/TAG/Centres

The Chairman noted his earlier remarks (see 5.5) concerning the GCOS Data and Information Management Plan, and suggested that one of the *ad hoc* groups should consider a work plan to prepare Version 2.0 on behalf of the G3OS. In addition, he requested that the concept of a 'data system' itself be reconsidered. One of the earlier proposals was for a workshop for a climate data system. He noted the limited progress in obtaining support for the workshop, and invited the panel to consider if it should be pursued. In addition, the *ad hoc* group could review the concept of a "Technical Advisory Group" (TAG), and consider the proposal to establish a G3OS Information Center (see 5.5).

iii. Projects for Consideration

The Chairman noted the earlier discussions about various projects that had been proposed, and invited an *ad hoc* group to consider specifically how the panel should proceed.

iv. Relationships with Other Groups

During the session many references to the work of related data and/or information groups were made. The Chairman noted that the members of the panel and the invited representatives provide good links to most of the groups that are concerned with issues similar to the panel. He invited participants to provide their suggestions for improved cooperation with such groups. In particular, he invited the groups to consider the differing perspectives of the G3OS.

v. Establishment of Ad Hoc Groups

Based on the earlier discussions, three *ad hoc* groups were set up to address some of the specific items.

Ad hoc Group 1 (Maiden, Martin, Moodie, Szejwach, Withrow) was asked to:

- Articulate the implications of the new responsibilities of JDIMP given its expanded charge to accommodate GOOS and GTOS data and information management issues in conjunction with the needs of the climate elements of GCOS, GOOS, and GTOS;
- Review the present terms of reference of the panel, and propose consistent and coherent modifications to them in light of the 'J' in JDIMP;
- Consider how JDIMP can be responsive to the needs of the science programmes;
- Consider how JDIMP will work to implement G3OS operational data needs into ongoing programmes.

Ad hoc Group 2 (Guddal, Hasegawa, Keeley, Kuma, Sato, Vent-Schmidt, Webster)

was asked to:

- Revisit the GCOS Data and Information Management Plan with close attention to the concept of a “data system” given the current observing systems and potential changes in them;
- Define the responsibilities of an Information Center in light of G3OS needs;
Ad hoc Group 3 (Heino, Jose, Razuvaev, Scholefield, Searle, Zhai) was asked to:
- Consider the role of JDIMP regarding metadata, data quality, and the environmental monitoring principles;
- Provide specific advice on how to implement this role;
- Specify the role of JDIMP in identifying gaps in data availability and problems with data access;
- Identify particular projects (e.g., indices, data quality, metadata templates, etc.).

VII. Recommendations and Proposed Way Forward

The *ad hoc* groups reported their preliminary findings, and with some modifications in their topics, were invited to reconvene to prepare final recommendations.

i. Ad hoc Group 1

The first group developed a few specific proposals for revising the JDIMP terms of reference (see Annex III), and provided a framework to discuss some of the procedural issues facing the panel.

The group reviewed the GOOS DIS concept whereby day-to-day data issues would be addressed. Such a group is needed since the modules of GOOS have very disparate data content which requires special consideration. With regard to GTOS, it was noted that the information will mainly reside with networks (of sites) which will be under the control of a Network Panel. A DIS-type concept is not envisioned at this time. Regarding GCOS, it has relied upon the work of DIMP to address its data issues. This special function toward climate data, since it is the integration of elements of atmosphere, ocean, and land, should remain a special purview of JDIMP. On the basis of these observations, the group was able to formulate a ‘strategic’ concept of JDIMP whereby it would identify common elements among the G3OS and provide an overarching data management structure support to them. It was particularly noted that JDIMP should look to the integration of space-based and *in situ* observations for the three.

ii. Ad hoc Group 2

In reviewing the overall G3OS plan, the group first agreed that the concept of a "data system" is still valid in that it provides a vehicle for cooperation and linkages, and can contain regional and global elements. However, it advised that the plan should not be ‘rigid’, but accommodate changing needs. It determined that a substantive revision is needed and a simple

substitution of 'G3OS' for 'GCOS' is not acceptable. It recommended that the plan clearly differentiate between 'data' and 'information'. The group reviewed the current plan and made comments chapter-by-chapter:

- Chapter 1
 - Stress linkages to the science programmes;
 - Provide for feedback from users.

- Chapter 2
 - GCOS data *and information* principles (agreement with GOOS & GTOS ones);
 - Add a new scenario that cuts across the 3 programmes;
 - Give an example of feedback in one of the scenarios.

- Chapter 3
 - Add section on system performance controls including:
 - monitoring and feedback,
 - linkage between system components,
 - note and correct deficiencies in system (e.g., Does calibration support the data? Has a station stopped reporting? Do data go on the GTS and vanish?),
 - Emphasize linkages:
 - extend the GHOST concept to the data system,
 - link small, regional centres and larger global centres in a hierarchy of centres.

- Chapter 4
 - Add periodic system reviews.

- Chapter 5
 - Consider the need for this chapter.

- Annex I
 - Prepare a new three-year plan;
 - Develop separate plans for each component;
 - Emphasize linkages.

- New Annex to describe where we are now, to include information on existing elements.

The group initially recommended that the three project offices prepare a revised draft *Plan* for submission to the next JDIMP meeting. However, after some discussion, the JDIMP Chairman and Mr Keeley agreed to contribute with the project office assistance and support.

The group also considered the role of the "Information Center" (IC) and determined that it should be a pilot activity whose goal is to evaluate the IC as an effective source of information for the G3OS, and as a potential long-term G3OS element. If evaluation is positive, the IC should be transferred to an institution that can provide long-term support. During the pilot phase, the IC will:

- Focus on information systems;
- Point to other centres and information systems;

- Provide access, but will not hold data,
- Present information as held in the centres, without either creating or modifying the presentation.

The group agreed that to meet the diverse needs of the G3OS needs, the IC must have considerable scientific input and collaboration with the GOOS and GTOS communities.

The participants discussed the development of the plan as recommended by the group, and agreed with its assessments. The project offices will be asked to develop a timetable to prepare Version 2.0 in a timely fashion so it may be reviewed by members of the panel. The participants also agreed with the need for an IC. Further, it was agreed that Dr Webster would revise the existing document about the IC, and submit it to the JPO for distribution to the principals of the G3OS for comments and advice. The JSTC-VII meeting in September was recognized as the optimal opportunity for discussion and final resolution by the principals. Dr Spence agreed to have the proposal tabled at JSTC.

iii. Ad hoc Group 3

The group decided first that it was important to define what is meant by the term “metadata” and proposed the following definition which it felt was broad enough to be applied to all G3OS data sets:

Metadata: The information about the data contained in data sets which is needed to understand the content and optimize the usefulness of the data set.

For example, metadata should answer questions such as:

- What are the elements observed?
- What is the station name and type?
- What is the current location? Has there been a relocation?
- What is the site description?
- What are/were the periods of observation?
- What instrumentation is/was in use?
- What are/were the observing practices?
- What conversion algorithms are/were used?
- Is it original (raw) data? Is it quality controlled? Is it homogenized?
- What code/format was used? What code/format is being used now?
- What is the availability/access of the data?

The group felt that it was not appropriate for JDIMP to get involved in trying to determine the quality of data sets or to ‘certify’ data sets but proposed instead to ‘register’ data sets based on the available metadata associated with each data set. The data sets would be selected from the domains of the G3OS but should not be tagged as being associated with any one of the G3OS. Also, data sets that are not global in nature but are of global interest may be included. In developing this registration procedure, existing cataloguing and data set referencing systems such as INFOCLIMA should be taken into account. This proposed data set registration process was viewed in three stages or levels:

1. Creation of a high-level catalogue system for G3OS data sets on the World Wide Web;
2. Development and inclusion of a guide to potential users of the G3OS data sets;
3. Development of a set of guidelines for the preparation of detailed metadata for G3OS

data sets that would be held with the data sets.

The group reviewed the Principles of Environmental Monitoring that were presented to the meeting on *In Situ* Observations for the Global Observing Systems held in Geneva from 10-13 September 1996. They agreed that they were important and could be promoted through JDIMP. Several minor modifications were proposed for a few of them (see Annex IV).

The group made the following recommendations:

1. JDIMP should adopt a strategy to register selected data sets. As part of this process, metadata guidelines for G3OS data sets should be promulgated to specify metadata at the data directory level, provide basic information for a "guide" to the use of the data set, and promote metadata rescue and the development of comprehensive metadata on G3OS data sets which would be referenced in the "guide".
2. JDIMP should further review the revised Principles of Environmental Monitoring in the context of the G3OS and then combine them with existing data management principles to include such principles as promoting the long-term archiving of climate data in digital format.

The group developed a pilot project to test the feasibility of registering selected existing data sets based on the development of a directory level of metadata and a "guide" to the use of the data set. The guide would be based on the results of the most recent questionnaire contained in the conceptual model on documenting climatological data sets.

Mr Searle offered to be the focal point for the pilot project which will be based on an existing system in use in Australia. He will review a number of existing directory level metadata formats and propose a recommended format to be used for the G3OS. He will make necessary modifications to the existing software that would be used to catalogue existing G3OS data sets at this directory level format. Mr Scholefield will distribute a package of information describing INFOCLIMA, particularly its directory entry level of cataloguing to the participants. Potential G3OS data sets include those on a listing produced by the last DIMP meeting in Ottawa. Messrs Heino, Zhai, and Razuvaev each offered to provide input on a data set with which they were familiar. Another possible candidate would be the GSN now being established. Mr Searle will provide each member of the group with a copy of the software (based on Microsoft ACCESS software) so they can use it to input appropriate data set directory information and return the completed information to him on a diskette or by e-mail. He will put the results of the pilot project on the existing "Blue Pages" information system in Australia [URL: <http://www.aodc.gov.au>]. Detailed actions pertaining to the first component of the data set registration process and a schedule are listed below in Table 1. Regarding the second component, Mr Scholefield will get the most recent version of questions from the conceptual model for the guide and distribute them to other participants in the pilot project to see how it might be incorporated into the pilot project.

The plenary discussion was very supportive of these specific activities. Participants pointed out that there are two levels of metadata, those that: 1) characterize the datasets for users to obtain an overall concept of their contents (i.e., directory level); and (2) characterize the data at the level of the observations themselves (i.e., data content level). The latter information would not be appropriate in the IC or other directories, but would be essential when examining the data for specific uses. The project above and the IC address level 1).

Table 1

JDIMP Metadata Pilot Project Implementation Schedule

Actions	Time	Person(s)
1. Investigation of other cataloguing systems including INFOCLIMA	Ongoing	Scholefield & Searle
2. Install data capture software (from Web site) and distribute to Group 3 prospective data set proprietors	31/8/97	Participants
3. Propose G3OS data sets for consideration; submit comments on categories, key words and themes to Dr Heino.	30/10/97	Participants
4. Propose key words and themes to Mr Searle	15/10/97	Dr Heino
5. Produce JDIMP Web site prototype	31/10/97	Searle
6. Incorporate keywords/themes and data set information into the prototype	30/11/97	Searle
7. Solicit comments on the prototype and additional data sets information from other JDIMP participants	15/1/98	Heino
8. Incorporate comments and data set information from JDIMP participants	15/2/98	Searle
9. Prepare report on implementation of the prototype along with proposal for JDIMP	15/3/98	Searle & Heino

In addition to the explicit proposals developed in the *ad hoc* groups, Messrs Hasegawa and Keeley developed a recommendation related to the NEAR-GOOS and IGOSS/IODE activities. In outline, it was observed that since:

- i) IGOSS/IODE, through the GTSP, collects and distributes temperature and salinity profile data (see 4.7) and
- ii) NEAR-GOOS expects to incorporate more real-time and delayed mode profile data of interest to GTSP (see 3.2);

JDIMP should request that GTSP and NEAR-GOOS (recognizing project differences) explore points of common interest to increase cooperation and decrease potential duplication of effort.

The recommendation was made that funding be solicited for a workshop to be held in the South-East Asia region to examine end-user data, information, and products for environmental scientists and policy-makers, particularly in key socio-economic sectors. No specific action was identified to advance the proposal.

iv. Other Issues

In plenary discussions, several overarching issues were discussed including a 'template' to guide the work of the JDIMP. The template (Figure 1) outlined the principal stages in the development of products. The sequence of stages included:

1. Development of the science issues based on political drivers and conventions;
2. Identification and specification of variables to be observed;
3. The methods of collection, calibration, and quality control and data consistency;
4. Mechanisms, formats, and codes for transfer of the data;
5. Processing of observations, including gridding and analysis;
6. Archiving of data, information, and products as appropriate; and
7. Development of end-user products.

Throughout the template, responsibilities for oversight are noted. The final element also includes the role of evaluation of the overall process including problem solving, feedback, and documentation.

It was agreed that (1) and (2) should not be the purview of the JDIMP, but that elements of (3), (4), and (6) definitely should be. Knowledge of items (5) and (7), while not the primary concern of the panel, should be considered to provide a comprehensive approach to information management. In addition to considering this paradigm for JDIMP, the panel agreed to consider its specific oversight roles -- i.e., How does the data and information process really function? What can and should be done to ensure effective management of the information? What constitutes adequate documentation?

The plenary session also considered the membership of the panel and related administrative issues. The JPO Director provided a description of the process to develop the list of participants for the meeting: (1) the original membership of DIMP was reviewed and those able to attend were invited; (2) the GOOS and GTOS were invited to recommend individuals; (3) the chairmen of joint panels (AOPC, OOPC, TOPC, GOSSP) were invited to attend or designate representatives, and (4) representatives of other relevant organizations were invited. Although the procedure was sound, the intended balance was not completely achieved. Representation from GTOS and GOOS should be strengthened, and the number of former DIMP members should be diminished. The representation from related organizations should be 'cycled' to enable liaison with

them. It was agreed that the final list of members would be designated at the JSTC meeting where joint G3OS panel issues will be addressed.

It was agreed that the next meeting should be held in spring 1998.

VIII. Closure of the Session

The Chairman thanked the participants for attending the session, and expressed appreciation on behalf of all the participants for the excellent hospitality shown by our Japanese colleagues. He also thanked the support staff for their personal attention and effective support during the meeting. He closed the meeting at 16:00 hrs on 18 July.

Annex 1: List of Participants

Mr Thomas KARL (Chairman)
National Climatic Data Center, NOAA
151 Patton Avenue, Room 516E
ASHEVILLE, NC 28801-5001, USA

Tel: +1 704 271 4319
Fax: +1 704 271 4328
Email: tkarl@ncdc.noaa.gov

Mr Tadashi ASOH
Oceanographical Division
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3212 8341 ex. 5165
Fax: +81 3 3211 3047
Email: tadashi.asou-a@hq.kishou.go.jp

Mr Johannes GUDDAL
Regional Manager
Norwegian Meteorological Institute
Allegaten 70
5007 BERGEN, Norway

Tel:+47 55 23 66 31
Fax:+47 55 23 67 03
Email: j.guddal@dnmi.no

Mr Yukio HARUYAMA
Earth Observation Planning Department
National Space Development
Agency of Japan
2-4-1, Hamamatsu-cho, Minato-ku
TOKYO 105 Japan

Tel: +81 3 5401 8687
Fax: +81 3 5401 8702
Email: haruyama@rd.tksc.nasda.go.jp

Mr Naoyuki HASEGAWA
El Niño Monitoring and Prediction Center
Japan Meteorological Agency
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3212 8341 ex. 5135
Fax: +81 3 3211 3047
Email: hasegawa@umi.hq.kishou.go.jp

Dr Raino HEINO
Head, Climate Research
Finnish Meteorological Institute
P.O. Box 503
FIN-00101 HELSINKI, Finland

Tel:+358 9 1929 4120
Fax: +358 9 1929 4129
Email: raino.heino@fmi.fi

Mr Shinichiro HORIGUCHI
Earth Science and Technology Organization
2-4-1, Hamamatsu-cho, Minato-ku
TOKYO 105 Japan
Mr Masaki ICHIHASHI

Tel: +81 3 3438 6346
Fax: +81 3 5401 8702
Email: Horiguchi.Shinichiro@nasda.go.jp

Earth Observation Planning Department
National Space Development
Agency of Japan
2-4-1, Hamamatsu-cho, Minato-ku
TOKYO 105 Japan

Tel: +81 3 3438 6348
Fax: +81 3 5401 8702
Email: Ichihashi.Masaki@nasda.go.jp

Dr Aida JOSE (Ms)
Philippine Atmospheric, Geophysical and
Astronomical Services Administration (PAGASA)
1424 Quezon Avenue
QUEZON CITY, Philippines

Tel: +63 2 922 7282
Fax: +63 2 922 7813
Email: cab@philonline.com.ph

Mr Robert KEELEY
Marine Environmental Data Service
Department of Fisheries and Oceans
1202-200 Kent Street
OTTAWA, Ontario K1A 0E6, Canada

Tel: +1 613 990 0246
Fax: +1 613 993 4658
Email: KEELEY@ottmed.meds.dfo.ca

Mr Ken-ichi KUMA
Numerical Prediction Division
Japan Meteorological Agency
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3212 8341 ex. 3315
Fax: +81 3 3211 8407
Email: kenkuma@npd.kishou.go.jp

Dr Martha MAIDEN (Ms)
Program Integration Manager
Mission to Planet Earth Program Office,
Code 170
NASA/GSFC
GREENBELT, MD 20771, USA

Tel: +1 301 286 0012
Fax: +1 301 286 1671
Email: Martha.Maiden@gsfc.nasa.gov

Ms Gwynneth MARTIN
The Orbis Institute
P.O. Box 20185
OTTAWA, Ontario K1N 9P4, Canada

Tel: +1 613 744 5653
Fax: +1 613 725 0643
Email: gmartin@cyberus.ca

Ms Linda MOODIE
Office of International and Interagency Affairs
NOAA/NESDIS
1315 East West Highway, Room 3620
SILVER SPRING, Maryland 20910-3282, U.S.A.

Tel: +1 301 713 2024 ex. 111
Fax: +1 301 713 2032
Email: Linda.Moodie@noaa.gov

Mr Takashi MORIYAMA
Earth Observation Planning Department
National Space Development Agency
(NASDA)
1-4-1, Hamamatsu-cho, Minato-ku
TOKYO 105-60, Japan

Tel: +81 3 3438 6332
Fax: +81 3 5401 8702
Email: moriyama.takashi@nasda.go.jp

Mr Eiichi MUTO
Director for Earth Science and Technology
Science and Technology Agency
2-2-1, Kasumigaseki, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3580 6561
Fax: +81 3 3581 7442
Email: tozaki@sta.go.jp

Mr Koichi NAGASAKA
Director, Planning Division
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
E-mail: inad-jma@hq.kishou.go.jp

Dr Hisao OHNO
Head, Office of International Affairs
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
E-mail: inad-jma@hq.kishou.go.jp

Dr Vyacheslav RAZUVAEV
Chief of Climatology Department
All-Russian Research Institute
of Hydrometeorological Information
6, Korolyov str., OBNINSK
249020 Kaluga Reg., Russian Federation

Tel: +7 095 255 21 94
Fax: +7 095 255 22 25
Email: razuvaev@storm.iasnet.com

Mr Nobuo SATO
Head, Office of Meteorological Satellite Planning
Japan Meteorological Agency
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3201 8677
Fax: +81 3 3217 1036
Email: cgms_jma@hq.kishou.go.jp

Mr Peter SCHOLEFIELD
World Climate Programme Department
World Meteorological Organization
P.O. Box 2300
1211 GENEVA 2, Switzerland

Tel: +41 22 730 8377
Fax: +41 22 734 8031
Email: Scholefield_P@gateway.
wmo.ch

Mr Ben SEARLE
Australian Oceanographic Data Centre
Maritime Headquarters
Wylde Street
POTTS POINT, N.S.W. 2011, Australia

Tel: +61 2 9563 4801
Fax: +61 2 9563 4820
Email: ben@aodc.gov.au

Mr Kuniyuki SHIDA
Office of International Affairs
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
E-mail: inad-jma@hq.kishou.go.jp

Dr Gerard SZEJWACH
IGBP/CNRM
42, avenue Gustave Coriolis
F-31057 TOULOUSE cedex, France

Tel: +33 5 61 07 85 81
Fax: +33 5 61 07 85 89
Email: gerard.szejwach@igbp.
cnrm.meteo.fr

Mr Kiyotoshi TAKAHASHI
Climate Research Development
Meteorological Research Institute (MRI)
1-1, Nagamine, Tsukuba-shi
IBARAKI 305 Japan

Tel: +81 298 53 8670
Fax: +81 298 55 2683
Email: ktakahas@mri-jma.go.jp

Mr Volker VENT-SCHMIDT
Head, Department Climate and Environment
Deutscher Wetterdienst
Frankfurter Strasse
D-63067 OFFENBACH/MAIN, Germany

Tel: +49 69 8062 2758
Fax: +49 69 8236 1493
Email: vvent@dwd.d400.de

Dr Ferris WEBSTER
College of Marine Studies
University of Delaware
LEWES, DE 19958, USA

Tel: +1 302 645 4266
Fax: +1 302 645 4007
Email: ferris@udel.edu

Dr Nobuo YAMAZAKI
Climate Research Department
Meteorological Research Institute (MRI)
1-1, Nagamine, Tsukuba-shi
IBARAKI 305 Japan

Tel: +81 298 53 8668
Fax: +81 298 55 2683
Email: nyamazak@mri-jma.go.jp

Mr Takashi YOSHIDA
Oceanographical Division
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3212 8341 ex. 5129
Fax: +81 3 3211 3047
Email: takashi.yoshida-a@hq.kishou.go.jp

Prof. ZHAI Panmao
National Climate Center
China Meteorological Administration
46, Baishiqiao Road
BEIJING 100081, China

Tel: +86 10 62172277 ex. 3175
Fax: +86 10 62176804
Email: gibm0978@info.iuol.cn.net

Secretariat:

Dr Thomas SPENCE
Joint Planning Office
Global Climate Observing System
c/o World Meteorological Organization
P.O. Box 2300
1211 GENEVA 2, Switzerland

Tel: +41 22 730 8401
Fax: +41 22 740 1439
Email: gcosjpo@gateway.wmo.ch

Mr Kazuto SUDA
Joint Planning Office
Global Climate Observing System
P.O. Box 2300
1211 GENEVA 2, Switzerland

Tel: +41 22 730 8361
Fax: +41 22 740 1439
Email: Suda_K@gateway.wmo.ch

Mr John WITHROW
Intergovernmental Oceanographic
Commission of UNESCO
1, rue Miollis
75732 PARIS cedex 15, France

Tel: +33 1 4568 4008
Fax: +33 1 4568 5812
Email: j.withrow@unesco.org

Local Secretariat:

Ms Junko HAYASHI
Mr Hiroshi ISHIGURO
Ms Yoko KISSHU
Ms Mayuko SHINDO
Mr Shuji TANAKA
Remote Sensing Technology Center of Japan
Roppongi First Building, 12F
1-9-9, Roppongi, Minato-ku
TOKYO 106 Japan

Email: hayashi@restec.or.jp
Email: ishiguro@restec.or.jp
Email: kisshu@restec.or.jp
Email: ada@restec.or.jp
Email: shuji@restec.or.jp
Tel: + 81 3 5561 4547
Fax: +81 3 5561 9541

Ms Kazuko MISAWA
Earth Observation Planning Department
National Space Development Agency of Japan
2-4-1, Hamamatsu-cho, Minato-ku
TOKYO 105 Japan

Tel: +81 3 3438 6334
Fax: +81 3 5401 8702
Misawa.Kazuko@nasda.go.jp

Mr Shinichi NAGATA
Planning Division
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
Email: inad-jma@hq.kishou.go.jp

Mr Tomoo OHNO
Office of International Affairs
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
Email: inad-jma@hq.kishou.go.jp

Mr Tomoaki OZAKI
Ocean and Earth Division
Science and Technology Agency
2-2-1, Kasumigaseki, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3580 6561
Fax: +81 3 3581 7442
Email: tozaki@sta.go.jp

Mr Ryuji YAMADA
Office of International Affairs
Japan Meteorological Agency (JMA)
1-3-4, Otemachi, Chiyoda-ku
TOKYO 100 Japan

Tel: +81 3 3211 4966
Fax: +81 3 3211 2032
Email: inad-jma@hq.kishou.go.jp

Annex 2: Agenda

1. Opening of the Session
 - 1.1 Opening
 - 1.2 Welcome and Conduct of the Meeting
 - 1.3 Approval of the Agenda
 - 1.4 Terms of Reference and Scope of JDIMP
2. Panel Chairman Statement
3. Global Observing Systems Status and Update
 - 3.1 Global Climate Observing System
 - 3.2 Global Ocean Observing System
 - 3.3 Global Terrestrial Observing System
 - 3.4 Integrated Global Observing Strategy
 - 3.5 Global Data Management Activities in Japan
4. Invited Reports
 - 4.1 G3OS Panel Reports
 - 4.2 WMO Data Management Activities
 - 4.3 WCRP Data Management Activities
 - 4.4 IGBP Data Management Activities
 - 4.5 CEOS Working Group on Information Systems and Services
 - 4.6 GOOS and GTOS Data Activities
 - 4.7 IGOSS and IODE Data Activities
 - 4.8 Other Reports
5. Review of Recommendations and Actions
 - 5.1 Review of DIMP Action Items
 - 5.2 Review of JSTC Data-related Action Items
 - 5.3 Workshop on Indices and Indicators for Climate Extremes
 - 5.4 DIMP/OOPC Data Quality Assessment Proposal
 - 5.5 GCOS Data System Issues
 - 5.6 JDIMP Role in GSN and GUAN
 - 5.7 Asia-Pacific Data Project
6. Plenary Review of Issues
 - 6.1 Data and Metadata Quality
 - 6.2 Data Systems/TAG/Centres
 - 6.3 Projects for Consideration
 - 6.4 Relationships with Other Groups
 - 6.5 Establishment of *Ad Hoc* Groups
7. Recommendations and Proposed Way Foreword
8. Closure of the Session

Annex 3: Terms of Reference

Recognizing the need for a comprehensive approach to formulate, implement, and oversee data and information management of the global observing systems, the JSTC of GCOS, the GOOS Steering Committee (GSC), and the GTOS Steering Committee (SC) have established a Joint Data and Information Management Panel (JDIMP).

The data and information management system for the global observing systems, G3OS, should be developed, to the degree possible, to accommodate data and products from the various components of the global observing systems. To do so, the JDIMP should consist of a core group of members representing the various global observing communities, as well as representatives from contributing disciplines, programmes, and agencies. The JDIMP should possess a broad range of expertise including research scientists, who use and understand global data sets, and data and information management experts responsible for significant components of existing operational and research global information management systems. The JDIMP should be a highly focused "problem solving" group, concentrating on resolving crucial issues affecting the quality and maintenance of global observing system data sets, and access to them. Particular agenda items may require additional experts be invited.

Terms of Reference:

- In concert with the G3OS science requirements and associated user communities, formulate and develop the G3OS Data and Information Management Plan(s);
- Monitor the overall implementation of the data-related elements of the plans;
- Make reports and present recommendations, as required, to the JSTC, GOOS, and GTOS SC on information management issues.

The JDIMP has the following specific responsibilities:

- Based on requirements from the science panels and user communities, to solicit data sets relevant in meeting the G3OS objectives;
- To identify gaps in available G3OS data sets and coordinate efforts to redress data deficiencies;
- To consider and develop a process whereby data sets may be identified and included as "G3OS 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, or to standards appropriate for specific applications,
 - that the data contain documentation (metadata) of a standard allowing adequate appreciation of the data quality;
- To identify the cross-cutting data and information management themes and establish a practical framework (e.g., metadata guidelines, information centre requirements, etc.) for these activities within the observing systems;
- To review, advise on, and provide oversight of the G3OS information management system(s) to ensure for example:
 - that access to data and products is provided as required,
 - that archiving activities are adequate.

Annex 4: Principles of Environmental Monitoring

The following principles have been developed by Mr T. Karl. They have been presented at numerous meetings on global observations, and have been widely discussed. *Ad hoc* Group 3 provided some modifications which were accepted by the JDIMP.

1. Assess the impact of new systems or changes to existing systems prior to implementation.
2. Require a suitable period of overlap for new and old observing systems.
3. Results of calibration, validation, algorithm changes, and data homogeneity assessments should be treated with the same care as the data.
4. Ensure a capability to routinely assess quality and homogeneity, including high resolution data and related descriptive information for extreme events.
5. Environmental monitoring products and assessments, like IPCC, should be well-integrated into global observing priorities.
6. Maintain long uninterrupted stations and observing systems.
7. Data-poor regions and regions sensitive to change should be given high priority for additional observations.
8. Network operators, designers, and instrument engineers must be provided long-term requirements at the outset of new system design and implementation.
9. Promote the conversion of research observing systems to long-term operations in a carefully planned manner.
10. Data management systems that facilitate access, use, and interpretation are essential.