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Report of the chair of the OPAG on Integrated Observing Systems

(Submitted by J. Purdom)

Summary and purpose of document

This document summarises the work of the expert teams and rapporteurs within the OPAG-IOS.

Summary Report of OPAG IOS, January 2001-December 2001

The OPAG IOS is composed of one implementation/coordination team (ICT) three expert teams (ETs) and Rapporteurs for four activities: Their memberships are given in Appendix A. Their Terms of Reference (TOR) are provided in the report below as major items a, b, c, etc. Memberships and TOR's may also be accessed via Internet using:

<http://www.wmo.ch/web/www/BAS/CBS-teams.html>

Reports received from three Expert Teams and three of the four Rapporteurs of the OPAG IOS show that they have been actively involved in completing their various tasks as described in their terms of reference. Below are summaries of those activities, under each TOR, as well as other items of interest where appropriate. Several appendices are attached, among them Appendix E which is a working paper that was presented by the OPAG Chair at CGMS XXIX on "WMO activities towards the redesign of the global observing system."

Implementation/Coordination Team on Integrated Observing Systems

Meeting planned second quarter 2002 is required. Some activities are underway as parts of the activities of the Chair, ET's and Rapporteurs.

- a. Monitor, report and make recommendations on the capability and utilization of composite observing systems comprising different observing networks to meet the requirements of the WMO Programs;
 - Refer to item (e) in the report on the Expert Team on Observational Data Requirements and Redesign of the GOS, below.
- b. Review deficiencies in coverage and performance of the existing GOS, in particular in the implementation of the Regional Basic Synoptic Networks, the GSN and GUAN (of GCOS) as well as related regional climate networks, on the basis of monitoring results and regional studies, and to make proposals to improve the availability of data to meet stated requirements;
 - Discussion point at OPAG MG Meeting.
 - i. As WMO representative at CGMS, I arranged for the possibility of a CGMS representative to attend the 2002 GUAN-GSN meeting. This important first step would allow for the CGMS representative to report back to CGMS on the relevance of the GSN and GUAN to satellite operators' plans and programs.
- c. Co-ordinate the development of standardized high-quality observing practices and prepare related recommendations;
 - Coordination of satellite related observing practices are routinely discussed and agreed upon at CGMS: CGMS XXIX's report should be available on the web in the near future.
 - Refer to report of the Expert Team on Requirements for Data from Automatic Weather Stations, below.
- d. Assess the impacts of introducing new technology systems into the GOS on the status of regional observing networks, particularly those affecting the role of developing countries.
- e. Consider and report on the issues of costing, joint funding and management of the GOS;
 - Satellite operators have contingency plans that have been agreed upon with respect to geostationary satellite coverage; there is also planning with regard to a joint polar system. Both are covered in the report of CGMS XXIX.
- f. In the area of strengthening collaboration between CBS and the regional associations by providing advice on possible solutions for newly identified requirements:
 - Refer to the report of the ET SDUP below.

**Summary of Activities for the
Expert Team on Observational Data Requirements and Redesign of the GOS**

- a. Update and report on observational data requirements of the WWW as well as other WMO and international programs supported by WMO;
 - Continuing activity.
- b. Review and report on the capability of both surface-based and space-based systems that are candidate components of the evolving composite Global Observing System;
 - **“Observing Systems Technologies and Their Use in the Next Decade, 2001, WWW-20, Technical Document WMO/TD No. 1040,”** details satellite and in situ observing system technologies planned for the next decade and is intended to foster exploration of the availability of alternative systems and the development of a strategy for a composite global observing system.
- c. Carry out the Rolling Requirements Review of several application areas using subject area experts (including atmospheric chemistry, marine meteorology and oceanography through liaison with JCOMM, aeronautical meteorology through liaison with CAeM, and seasonal to inter-annual forecasting as well as climate change detection through liaison with CCI and GCOS);
 - Completed the third iteration of the Rolling Review of Requirements and its corresponding Statement of Guidance on how well the combined satellite and in situ observing systems meet user requirements in six applications areas
 - a. Global NWP, regional NWP, synoptic meteorology, nowcasting and very short range forecasting, seasonal to inter-annual forecasting, and aeronautical meteorology.
 - b. The associated report was released in Jan 2001 as **“Statement Of Guidance Regarding How Well Satellite And In Situ Sensor Capabilities Meet WMO User Requirements In Several Application Areas, 2001, Sat-26, Technical Document WMO/TD No. 1052.”**
 - JCOMM and CCI have been invited to participate in Jan 2002 ET meeting to produce SOG in related applications areas.
- d. Review the implications of the Statements of Guidance concerning the strengths and deficiencies in the existing GOS and evaluate the capabilities of new observing systems and possibilities for improvements of existing observing systems to reduce deficiencies in the existing GOS; taking particular care to examine the implications of changes in observing technology, in particular changes to automated techniques (such as Automated Surface Observing Stations), on the effectiveness of all WMO Programs, and report on major consequences in a timely fashion;
 - The ET-ODRRGOS hosted a CGMS Workshop of Evolution of Satellite Component of GOS post 2015 (in April 2001) that generated concepts for evolving the capabilities of future geostationary and polar orbiting satellites. A report from this Workshop was posted on the WMO web-site <http://www.wmo.ch/hinsman/long-ter.htm>.
- e. Carry out studies of hypothetical changes to the GOS with the assistance of NWP centres;
 - The ET-ODRRGOS noted that the required resources for OSSEs are still so large that the limited resources for evaluating changes to the GOS would probably be better focussed on well-defined OSEs (see also Rapporteur report below).
 - Seven OSEs were suggested and eight NWP centers were engaged in conducting them. Reports on these OSEs will be heard at Jan and Jun 2002 meeting of ET-ODRRGOS and implications will be factored into future GOS suggestions.
 - OSEs
 - Impact of hourly SYNOPs,
 - Impact of denial of radiosonde data globally above the tropopause,

- Information content of the Siberian radiosonde network and its changes during last decades,
 - Impact of AMDAR data over Africa through data denial in a 4D-Var analysis and forecasting system,
 - Impact of tropical radiosonde data,
 - Impact of three LEO AMSU-like sounders, and
 - Impact of AIRS data.
- NWP Centers
- ECMWF
 - Canadian AES,
 - Univ St Petersburg,
 - NCEP
 - Meteo France
 - JMA
 - Met Office (UK)
 - BMRC (Australia)
- f. Prepare a prioritized list of proposals for modification to the GOS that are both practicable and amenable to testing, and propose mechanisms for testing them; offer redesign options for CBS consideration;
- Jan 2002 ET meeting to develop a draft proposal for the redesign of the GOS
- g. Develop criteria for dealing with design issues of the composite GOS, paying particular attention to developing countries and the southern hemisphere.
- Guidelines for OSEs and OSSEs in the Final Report of 23-27 April 2001 ET meeting. Criteria for redesign of GOS to be discussed further in the coming year.
- h. Prepare a document to assist Members, summarizing the results from the above activities.
- Document to be prepared in time for CBS 2002.

Other Items for Consideration:

1. Invite OPAG IOS Chair to reiterate to CBS the need to make more R&D satellite data available in real time for operational use,
2. Communicate to US that early evaluation of WindSat is necessary to prepare for NPOESS passive techniques of surface wind vector determination. To facilitate this, early access to WindSat data at operational NWP centers is encouraged,
3. To support near real time processing of radio occultation data, invite OPAG IOS Chair to initiate discussions for international sharing of relevant ground network to distribute precise orbit determination data.
4. from Report on CGMS XXIX)

As international contributions to the global observing system increase, the monitoring of product distribution is becoming more complex. In the near future many new satellite operators will be producing and distributing satellite data and products especially over the GTS but a future monitoring policy has not yet been developed. Such a future monitoring policy could require that co-centers (or several centers) for the monitoring of satellite data and products be established.

Thus, CGMS XXIX felt it would be appropriate for a CBS expert meeting of relevant lead centers where procedures and responsibilities could be discussed should be organized. The focus of the meeting would include satellite data and address the issues and recommend procedures for monitoring the quality of these types of observations. The participation of satellite product generating institutions will also facilitate implementation.

The following action was suggested:

ACTION: CGMS Members are asked to note the WMO policy for monitoring satellite data. The Chairman OPAG IOS is asked to bring to the attention of the CBS Management Group the need for a designated CBS Group with responsibility for the monitoring of satellite data as well as the need for an expert meeting to discuss associated issues. CGMS members are asked to indicate their willingness, as appropriate, to participate in such a WMO planning meeting.

Rapporteurs on Scientific Evaluation of Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs)

A detailed report by Mr Jean Pailleux, Rapporteur for Global Scale, is appended to this report as Appendix B. That report closely parallels much of the input from Dr Nobuo Sato, Rapporteur for Regional Scale. The items within the TOR are being addressed in coordination with the Expert Team on Observational Data Requirements and Redesign of the GOS. Of interest is the conclusion of both the ET and Rapporteur concerning OSSEs and OSEs. Specifically, when addressing OSSEs in the global context, that Rapporteur states:

The current documents appended to this report contain plans and suggestions on OSEs only, nothing on OSSEs. This is because OSSEs are not believed to be very important for defining the future GOS, at least less important than OSEs. The reason is related to basic limitations of OSSEs already discussed in several workshops and working groups: difficulty for an OSSE to anticipate and model all the error sources of a non-existing observing system, expensive in computer and scientist resources, difficult to interpret, etc... It is known that some OSSE tasks are (and will be) carried out, for example for future satellite Doppler Wind Lidars as mentioned in section 3. However they are not seen as crucial for a WMO plan on the future GOS.

Although some OSEs might well be cast in the context of an OSSE when considering their potential impact on redesign, or reconfiguration of the GOS.

A mechanism is proposed (Appendix B), which will keep under constant review the planning, the execution and the evaluation of impact studies. This subject is one important preoccupation of two existing working groups: the Expert Team (ET) on Observing Data Requirement and Redesign of the Global Observing System (ODRRGOS), working under the auspices of the OPAG IOS, and the Scientific Evaluation Group (SEG) working under the auspices of the Coordinating Group for COSNA. The ideal organisation is still beyond the task of two Rapporteurs. At least for the organisation of workshops on impact studies organisation could be described as a small committee representing:

- all the different regions;
- different types of expertise;
- both the CAS and CBS aspects of WMO

A suggestion along these lines could be to have a small ad-hoc committee with this mixed expertise, with a composition worked out by CBS (and CAS).

In discussing **Priorities for the GOS optimisation**, the Rapporteur presents several important items for consideration:

- For the optimisation of the future GOS, the more important and urgent task is to design and carry out impact studies helping to define **an optimal network of radiosonde and aircraft observations**.
- The satellite based observing systems can almost be taken as “boundary conditions” to the problem of “optimising the conventional upper-air network”.
- Radiosonde and aircraft studies must include experiments addressing some “targeting strategies”.

- a. Prepare and maintain reviews of OSEs and OSSEs that are being undertaken by various NWP Centers around the globe and provide information for consideration by the OPAG IOS.
 - Refer to item (e) of the report on the Expert Team on Observational Data Requirements and Redesign of the GOS. The appended report goes into each of these areas in detail.
- b. Develop proposals and guidance for specific OSE/OSSEs in consultation with the Expert Team on Observational Data Requirements and Redesign of the GOS that are required for the redesign of the GOS.
 - This is addressed in the appended report.

Summary from Rapporteur on GCOS Matters

- a. Liaise with the existing data quality monitoring centers of CBS and GCOS, regional Rapporteurs on the GOS and GCOS to review, and provide information back to Members, as to how existing formal and informal arrangements can be used to improve the monitoring of CLIMAT and CLIMAT TEMP messages.
- b. Provide a brief report to the 2002 session of CBS describing, (1) changes, to the extent possible, in the exchange of CLIMAT and CLIMAT TEMP messages over the 1996 – 2002 period and (2) advice provided to Members in relation to this matter.
- c. Continue preparation and maintenance of reviews of observing systems that are being designed under the auspices of GCOS (e.g., GUAN, GSN).

With regard to the TORs above, the following activities are underway or planned:

- The first Meeting on Coordination of the GSN and GUAN (MCGG), which initially was planned for September 2001, had to be postponed and is now being planned for II/2002.
- Monitoring activities concerning CLIMAT reports are continued at JMA and DWD and a 5th GSNMC Monitoring Report is being prepared. The same is valid for CLIMAT TEMP reports, which are monitored at ECMWF.
- WMO/WWW has started action to contact Members concerning not received CLIMAT stations. Some progress may be reported, but outcome should be seen in the GSNMC monitoring results during the coming months. WMO recently distributed GSNMC Monitoring Report No. 3 to WMO Members. Some contacts on the working level have been made in order to address problems the GSNMCs have with receiving and/or decoding certain CLIMAT reports.
- At COP7, Mr. Rösner was involved in discussions on GCOS within the 15th session of the Subsidiary Body for Scientific and Technological Advice (SBSTA of the COP to the UNFCCC) as member of the German delegation. GCOS will remain on the Agenda of SBSTA and it is anticipated to draft some actions at the next session of SBSTA in June 2002 in Bonn, Germany.

Summary of Activities for the Expert Team on Satellite Utilization and Products

ET Meetings 2001-2002

M2001: Restricted Meeting 10-12 December 2001, Geneva

M2002: Full Meeting 1 week btw 22 April – 4 May 2002, TBD

- a. Evaluate results of projects identified through the use of the questionnaire and guidelines;
 - The new cycle (1999-2000) of the Questionnaire and Progress Reports on the Application of Satellite Technology are being reviewed. They will be further

- discussed at M2001 and prepared for recommendations and development of new action plan at M2002.
- b. Assist the OPAG PWS in the development of appropriate materials for use in the PWS Programs;
 - No requirements obtained from PWS Lannion. Contact to be taken up by Chair of the ET-SSUP and tasks to be assigned for review at M2002.
 - c. Working with WMO Members promote the development of web-based tutorials and computer based modules which deal with improved utilization of satellite data for use within the Virtual Laboratory;
 - The Virtual Laboratory Focus Group met in Darmstadt, Germany, at EUMETSAT in May 2001. This meeting established the terms of reference and milestones for the VL. The meeting was significant in that it included representatives from each of the sponsoring satellite agencies and associated RMTCs/Centers of Excellence. A report on the VL meeting was published in the WMO Bulletin. In October, CGMS XXIX approved the terms of reference for the VL and established a reporting mechanism for the VL focus group. A working paper from CGMS describing the VL is attached as Appendix C.
 - d. Based on analyses of the questionnaire, identify new application areas for satellite data and needs for new satellite data products;
 - The VL focus group established a methodology for review of the questionnaire by the ET-SSUP, as well as the relevant Center of Excellence, to determine new application areas and the need for new satellite data products.
 - The VL focus group had linked to established satellite working groups to formulate science and application development questions to them. This includes the International TOVS working group (ITWG), the CGMS Working Group on Satellite Derived Winds (IWWG), and the newly established International Precipitation Working Group (IPWG), which was formally adopted at CGMS XXIX. A working paper from CGMS describing the IPWG is attached as Appendix D.
 - e. Provide guidance on migration of low-cost satellite receiving stations to LRIT/LRPT;
 - Publication of Technical Document: SAT-27, Migration of Satellite Receiving Stations to the New Meteorological Satellite Digital Data Broadcast Services, 2001 (WMO/TD No. 1057)
 - f. Complete the review of the concept of direct broadcast from the space-based global observing system; recommendations to satellite operators (CM) for a consolidated direct-dissemination strategy including alternative ways of dissemination s for smooth migrations paths to future systems;
 - This topic has been enhanced through the recent consideration given by the Consultative Meeting and WMO EC to also include data from R&D satellite into operational activities of the NMHSs.
 - Météo-France, the UK Met. Office and the Deutscher Wetterdienst organized in Paris, on 6 November 2001, a workshop on the distribution of meteorological data through telecommunication satellites, which was attended by the Chair of the ET-SSUP.
 - The topic will be taken up by ET2001 and tasks identified to be finalized during M2002. The discussion and recommendations will include a review of schedule changes of migration from analog to digital broadcast and their impact on the user, considerations on alternative dissemination paths for raw and pre-processed data (networked ground stations), processing level required by user, integration of R&D satellite data streams.
 - g. Update WMO Satellite Activities Technical Document "A description of a standard ground station for use by WMO Members", (WMO/TD-No. 660 (SAT-13));
 - This is pending conclusion from discussion (see above).
 - h. Develop implementation goals for ground receiving equipment for the space-based component of the Global Observing System (GOS);
 - This is pending conclusion from discussion (see above).

- i. Develop further guidelines for the Strategy to Improve Satellite System Utilization;
 - One major activity under this topic is the linking of satellite based science groups to the Virtual Lab (see above).
 - Guidelines for alternative dissemination schemes for satellite data distribution are being investigated in the context of an evolving satellite component of the GOS that will incorporate data from both research and operational satellites (see above).
- j. Review WMO Publication No. 258 based on experiences indicated in the questionnaire and within the Virtual Laboratory;
 - This is pending receipt and analysis of the questionnaire.

**Summary of Activities for the
Expert Team on Requirements for Data from Automatic Weather Stations**

- a) Review the functional requirements for Automated Weather Observing Systems (AWOS) for all WMO Programs, in order to provide functional specification for BUFR/CREX Table driven codes and make proposals for new BUFR/CREX descriptors and ensure the validation of BUFR/ CREX templates for AWS data.
 - Examination of functional specifications was performed. Proposed specifications were submitted to all WMO Technical Commissions for review and validation. So far only response from CAgM was received.
 - The document "Draft Functional Specifications," was also submitted and presented at the session of CIMO WG on Surface Measurement (Geneva, 27-31 August 2001) to seek the comments and to finalize the work on functional specifications. The Session agreed on submitting proposals to the chairman of the ET/AWS not later than 30 October 2001.
 - Work is going on the finalization of functional specifications for Automatic Weather Stations so that the table of specifications is approved by ET/AWS on March 2002 and submitted to both CIMO-XIII and CBS-Ext. in 2002.
 - ET/AWS and ET/DR&C members a revised version of BUFR template for AWS data was submitted and presented at the ET/DR&C Session (working document: Doc3-1-1, Toulouse, 23-27 April 2001). The document presented the set of new BUFR descriptors for AWS data developed by the chairman of ET/AWS and Dr. I. Zahumenský (the former member of the ET/AWS Team). Close collaboration of ET/DR&C and ET/AWS with the WMO Technical Commissions concerned and other relevant international bodies, in particular with EUMETNET, will be necessary in finalizing the above proposals, especially concerning the new descriptors for the AWS. They will be re-examined after validation by ET/AWS as well as by ET/DR&C on their sessions in 2002.
 - The document on BUFR template for AWS data (working document: W_SUR_12-1-Doc07) was also submitted at the session of CIMO WG on Surface Measurement (Geneva, 27-31 August 2001) with the aim to review and consider these proposals from point of view of CIMO.
- b) Review requirements for automated observations of "present weather", clouds, water vapor and the "state of the ground" in order to identify the necessity to develop or refine quantitative definitions and report on it.
 - No action taken by the person responsible for this Task.
- c) Review and refine practices for reporting the instantaneous precipitation intensity, total cloud amount and cloud height, taking into account user recommended measurement practices and report on it.
 - No action taken by the person responsible for this Task.
- d) Make suggestions on possible replacement of manually observed types of clouds using automated technology.

- Document on available and near future technology for direct and indirect measurement of types of clouds was drafted and will be soon put into circulation among ET/AWS members.
 - Suggestions on possible replacement of manually observed types of clouds using automated technology may be submitted to the next meeting of ET/AWS.
- e) Make proposals for improved Quality Control procedures for data from Automatic Weather Stations (AWS) for inclusion into the Guide on GDPS (WMO No. 305).
- No communication at all with the person responsible for this Task.
 - However a proposal of the concept of Quality Control Procedures for AWS data suitable in case of data transmission using BUFR was submitted and presented at the session of CIMO WG on Surface Measurement (Geneva, 27-31 August 2001, working document: W_SUR_12-1-Doc06). The concept was elaborated by the chairman of ET/AWS and Dr. I. Zahumenský (the former member of the ET/AWS Team). The CIMO WG was invited to consider this concept of Quality Control Procedures for AWS data and review it. Proposals from CIMO WG should be sent to the chairman of ET/AWS not later than 1 November 2001.
 - It is expected that suggestions on improvement in QC Procedures of AWS' data will be submitted to the meeting of WT/AWS in March 2002.

Other Items for consideration

- Upon request of the President of CAeM an explanation letter was sent concerning the use of water equivalent as a means of expressing the intensity of all types of precipitation for aviation purposes together with three recommendations.
- The session of the CIMO WG on Surface Measurements asked CBS, particularly the ET/AWS, to comment on the Operational Accuracy Requirements and Instruments Performance as they are stated in the "CIMO Guide", WMO - No.8, Annex 1.B. Comments to the Annex 1.B were elaborated and put into circulation among ET/AWS members.

Rapporteur on Regulatory Material

- a. Review and update sections of the Manual on the GOS, and harmonize available material on the conventional (in-situ) and satellite components of the GOS.
- b. Arrange for the review of the revised draft of the Manual on the GOS by a consultant/small expert group with the aim of submitting the resulting text to the 2002 session of CBS.

No interim report was received by the OPAG Chair concerning this activity. This is most likely due to problems with exchange of information over Internet. It is the understanding of the OPAG Chair that this activity is moving along well.

Rapporteur on Improvement of Volume A

The Terms of Reference for the Rapporteur are: To work closely with lead centers and the WMO Secretariat to develop measures for improvement of the utility of WMO Publication No. 9, Volume A with emphasis on completeness, accuracy of the information and adding indications of operational performance as derived from monitoring results. Such measures may refer to:

- procedures for the exchange of information between individual Members and the WMO Secretariat;
- procedures for monitoring the information quality and initiating corrections;
- the layout of the information, including presentation;
- insertion of information from lead monitoring centers.

With regard to his activities, Mr. Daan submitted an extensive interim report. He is working closely with lead centers and the WMO Secretariat to develop measures for improvement of the utility of WMO Publication No. 9, Volume A. At the Lead Monitoring Centres of Nairobi, Montreal, Melbourne, Offenbach, Washington and Moscow, focal points have been designated for this activity. Regional Rapporteurs/Coordinators on Regional aspects of the GOS implementation have been invited to join in the process. Mr. Daan has spent a number of weeks in consultation with experts at the WMO Secretariat. This resulted in a "consulting group" of focal points, regional Rapporteurs and WWW experts in the Secretariat. The procedure so far has been composed of submitting a discussion paper to the consulting group and updating the paper upon the responses. Such iteration continues, with a final report expected early in 2002.

The Purposes of Volume A are being addressed, and while it is recognized that the defined purpose has not changed very much; its environment and context have changed, requiring rewording of the purpose. Thus, the following statement has been drafted is a redefined purpose.

The Volume shall contain all stations at fixed locations providing real-time meteorological observations for synoptic use. It shall include relevant information on the operations, on location and elevation, and on the observing programme. The data base contents will be preserved after closure of stations as to allow for archiving the meta-data for climatology.

The current **Procedures** for providing information by the Member States are not adequate for a quick and timely updating of the Volume and are being addressed. In addressing **Composition and lay-out**, inclusion of information not related to real-time use for operational meteorology is under question: in principle, only exception will be made for climatology. The specific attributes for aviation meteorology are still under discussion. It is foreseen that the current printed version will be replaced by a version on CD-ROM. Specific recommendations for the contents are being addressed as are Inclusion of monitoring information. As Mr. Daan points out:

“However, inclusion of monitoring information in VoIA raises two major problems:

- The organisation of input from an external source (LMC) into the database is complicated. Direct access to the data base by LMC's could be established, but is not recommendable from a point of view of maintaining integrity of the data base. Indirect input via the Secretariat would enlarge the work load.
- The monitoring data have by definition a limited validity, as opposed to the (semi-permanent) validity of station meta-data. The combination of these two types of data in one data base can be a source of conflicting situations.

Therefore, a recommendation will be made in a way where each of the parties (WWW Department and LMC's) retain their own responsibilities in the procedure.”