WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP
ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON OBSERVATIONAL DATA REQUIREMENTS
AND REDESIGN OF THE GLOBAL OBSERVING SYSTEM

FOURTH SESSION

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REPORT OF THE CHAIRMAN

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Summary and Purpose of Document

This document summarizes the events concerning the ET-ODRRGOS which have taken place since the third meeting (Geneva, 19 – 23 June 2000) and the fourth meeting of a sub-group of the ET (Geneva, 25 – 27 Apr 2001), notes progress on the ET terms of reference, and outlines the goals for the current meeting.

ACTION REQUIRED

The meeting is invited to take the views and comments, contained in this document, into account during its discussion.

REPORT OF THE CHAIRMAN

Past Activities

1. The ET-ODRRGOS has been studying user requirements versus observing capabilities (for the combined space based and in situ observing systems) and considering options for redesign of the GOS towards more comprehensive observations for the World Weather Watch and other WMO programmes. It has met three times (June 1999 in Madison, December 1999 in Geneva, and June 2000 in Geneva).

2. At the June 2000 meeting, ET-ODRRGOS realized significant progress in several areas. (a) An expanded data base of user requirements in several applications areas and of satellite and in situ observing system capabilities for associated measurements was established after considerable review. (b) Candidate Observing Systems for the GOS were updated, documented, and made available in *Technical Document WMO/TD No. 1040*. (c) Several applications areas (including Numerical Weather Prediction, Nowcasting, Seasonal to Inter-annual Forecasting, and Aeronautical Meteorology) were reviewed with regard to observing system capability for meeting user requirements; a report of the outcomes from that review was made available in *Technical Document WMO/TD No. 1052*. (d) Some guidelines for Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs) were established and criteria for evaluating success or failure of redesign options were discussed. (e) A workplan was drafted and subsequently presented by OPAG IOS chairman, Dr. James Purdom, at the November 2000 meeting of the Commission for Basic Systems (CBS) where it was adopted in large part.

3. In late April 2001, a sub-group of the ET ODRRGOS met in Geneva currently with a Coordination Group for Meteorological Satellites (CGMS) Workshop on long-term future of the basic satellite sounding and imaging missions. That workshop brought together experts from around the world to address questions concerning whether important gaps exist in the post-2000 satellite-based component of the Global Observing System (GOS), how they could be filled, and how to prepare for the replacement of the current satellite systems with the next generation satellite systems in the post-2015 era.

4. The CGMS workshop presentations included concepts for evolving the GEOs with high spectral resolution IR sounding, faster VIS/IR imaging; and microwave for precipitation and cloud studies; enhancing the LEOs for atmospheric chemistry studies and sea/land/ice surface feature discrimination; and supplementing both with mini- and small-satellites for ocean topography, clouds and radiation, ocean salinity and soil moisture, along with a constellation of satellites for special measurements (radio occultation sounding, sea state, convective precipitation), and clear air winds.

5. One goal suggested for the GOS of 2020 is for all citizens of the planet to have “weather in the palm of their hands.” This would require (a) international coordination to achieve (b) observing systems that utilize low earth orbiting (LEO) and geostationary earth orbiting (GEO) remote sensing advantages along with in situ systems whose data and information are distributed by (c) communication systems to (d) computer systems capable of continuous real-time 4-d assimilation of global data with (e) accurate modeling of atmospheric and earth surface processes on all scales using (f) synergistic multi-satellite/multi-sensor processing algorithms. LEO observations would provide global coverage, high spatial resolution, microwave sounding, GPS density profiles, Doppler LIDAR winds, and water vapor while GEO

observations would provide high temporal resolution (weather dynamics), tracer wind velocities, synergism with ground-based observations, lightning measurements, and microwave precipitation determinations.

6. The workshop discussed whether or not compliance with WMO user requirements would require the GOS-proper (defined as the satellites operationally supported by CGMS members and those anticipated by adoption from R & D space agencies after their initial demonstration) to be augmented. It was suggested that a minimum performance level of GEOs (and LEOs) needs to be established, replacement strategies need to be determined, orbit overlaps need to be orchestrated, a possible role for small satellites supplementing the GOS needs to be studied further, and those missions which have operational long-term perspective need to be identified.

7. The sub-group of the ET-ODRRGOS discussed studies carried out by NWP Centres on changes in the GOS that have occurred during the past decade and their impact on the skills of NWP both regionally and globally. ECMWF reported on NWP impact studies using satellite sounding data (both infrared and microwave instruments), cloud-drift winds from geo-satellites, and wind scatterometer data from ERS, NSCAT and QuikSCAT. Notable was the positive impact of two AMSUs over that achieved by just one as well as the positive impact of scatterometer data. The Met Office reported on systematic “data denial” experiments testing the impact of satellite atmospheric motion vectors (AMVs), ERS-2 scatterometer data, and ATOVS data. The ATOVS results showed an impact of two AMSUs consistent with the ECMWF results; the use of tropospheric ATOVS data over land is also showing positive impact. MeteoFrance showed examples of degradation of forecasts for Europe from satellite derived AMVs in the region of 50° N and 35° W; additionally it was noted that errors in winter-time forecasts for the European area have often been traced back to a lack of observations in the polar areas. NOAA/NCEP provided information on impact tests with targeted observations in the North Pacific Ocean (overall 70% of the additional observations showed clear improvement with rms error reduction of 10 to 25% in to the 24 to 96 hr forecast). NESDIS/CIMSS presented 24-hour forecast results for North America indicating that removal of satellite data (NoSAT) has a bigger impact on the model forecasts of temperature and moisture than removal of conventional RAOB data (NoRAOB); isolating the impact of the GOES Sounder revealed that summer GOES moisture information has up to five times more impact than RAOBs. The South African Weather Bureau submitted AMDAR impact for 50 cases; early subjective evaluations are indicating the positive impact in a majority of the cases, although not uniformly so. The WMO presented a “Statistical Analysis of Forecast Verification Scores from Six Forecast Centres, 1991-2000;” significant improvement skill was evident at all NWP centres and anomalous poor performance was evident in 1999, but it could not be traced with certainty to the reduction in the Russian Federation radiosondes.

8. ET-ODRRGOS also discussed a coordinated development and utilisation of a comprehensive software tool for carrying out Observing System Simulation Experiments (OSSEs) as well as preparation, maintenance, evolution of a realistic OSSE data-base with user-friendly access. Scientists often abandon undertaking an OSSE because of the huge human and computer resources required; this suggestion was aimed at leveraging and coordinating individual investments to facilitate more and better OSSEs. After some debate, 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 Observing System Experiments (OSEs).

9. ET-ODRRGOS then suggested seven OSEs for consideration by NWP centres and asked the OSE/OSSE rapporteurs to engage as many as possible in this work. They include studying the

- 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
- Impact of AIRS data

Eight NWP centers (ECMWF, Canadian AES, Univ of St Petersburg, NCEP, Meteo France, JMA, Met Office (UK), BMRC (Australia)) are engaged in conducting them.

Progress on ET-ODRRGOS Work Programme

10. The tasks assigned to the ET-ODRRGOS are listed below along with the chairman's summary of progress in each area.

10a. Update and report on observational data requirements of the WWW as well as other WMO and international programmes supported by WMO;

Observational data requirements have been reviewed by applications area experts and minor adjustments resulted.

10b. 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;

ET-ODRRGOS completed a report released in Jan 2001 on *Observing Systems Technologies and Their Use in the Next Decade, 2001, WWW-20, Technical Document WMO/TD No. 1040.* The document 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.

10c. 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 CCl and GCOS);

ET-ODRRGOS 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 (global NWP, regional NWP, synoptic meteorology, nowcasting and very short range forecasting, seasonal to inter-annual forecasting, and aeronautical meteorology). This review utilized a maturing database of satellite and in situ capabilities and user requirements. An objective critical review produced evaluation charts. A subjective interpretation of these charts by user and satellite experts generated statements of guidance in these applications areas. 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.

10d. 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 Programmes, 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 the future satellite part of the GOS. See paragraphs 2 – 6 above. A workshop report was posted at http://www.wmo.ch/hinsman/long-ter.htm.

10e. Carry out studies of hypothetical changes to the GOS with the assistance of NWP centres;

The ET-ODRRGOS suggested seven OSEs and eight NWP centers are engaged in conducting them. See paragraphs 8 and 9 above.

10f. Prepare a prioritised 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;

ET-ODRRGOS meeting in Jan 2002 has on the agenda to develop a draft proposal for the redesign of the GOS.

10g. 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 were drafted and can be found in the Final Report of 23-27 April 2001 ET-ODRRGOS meeting. ET-ODRRGOS will discuss criteria for redesign of GOS further in the coming year.

10h. Prepare a document to assist Members, summarising the results from the above activities.

ET-ODRRGOS will prepare this document in time for the next CBS.

10i. Actions suggested to CBS at ET-ODRRGOS and CGMS XXIX meetings

- Encourage CBS to emphasize utility of R&D sat data in real time
- Encourage early access to WindSat by user community (esp NWP centers to assist with debugging)
- Encourage international sharing of relevant ground network to distribute precise orbit determination data for GPS systems
- Encourage CBS to form group responsible for monitoring satellite data and products in era of more contributors to GOS

Plans for this meeting

11. The Jan-Feb 2002 meeting of the ET- ODRRGOS will

- Discuss addition of R&D satellites to GOS (EC request to CBS, CGMS perspectives) and review potential near term contributions
- Hear about progress on non-satellite components to GOS (esp. in situ ocean observations)
- Plan for the updating of the observing system technologies available in the next decade
- Review satellite and in-situ observing system Statements of Guidance (SOGs) and their implications for redesign of GOS
- Introduce new applications areas to the SOG (e.g. atmospheric chemistry)
- Interact with AOPC to revise the seasonal to interannual SOG
- Review OSEs and their implications for the GOS
- Develop a draft proposal for the redesign of the GOS