CGMS-XXXI
WMO WP-7
Prepared by WMO
Agenda item: E.1

REDESIGN OF THE WWW GLOBAL OBSERVING SYSTEM

(Submitted by WMO)

Summary and purpose of document

The Chairman of the CBS/OPAG-IOS Expert Team on Observational Data Requirements and Redesign of the Global Observing System (ET-ODRRGOS) reports on progress attained by ET-ODRRGOS and introduces appropriate proposals and recommendations developed by ET-ODRRGOS.

ACTION PROPOSED

CGMS is invited to consider the ET-ODRRGOS proposals and provide feedback

1. Introduction

1.1 As reported at previous CGMS meetings, the WMO/CBS/OPAG IOS Expert Team on Observational Data Requirements and Redesign of the Global Observing System (ET-ODRRGOS) has been given two main tasks: (a) to continue the Rolling Requirements Review (RRR), under which requirements for observations to meet the needs of all WMO programmes are compared with the capabilities of present and planned observing systems to provide them; and, (b) to make recommendations to the Commission for Basic Systems (CBS) of WMO on the "re-design" of the Global Observing System (GOS).

1.2 The ET-ODRRGOS has been meeting since summer 1999 during which time the following has been accomplished.

1. Users Requirements and Observing System Capabilities were charted in ten application areas (after engaging ocean and climate communities). The Rolling Review of Requirements was pursued, and Statements of Guidance were issued in all ten areas (available in several WMO technical documents (WMO/TD 913, 992, 1052) and summarized in the final report of the July 2002 ET-ODRRGOS meeting).
2. Several Observing System Experiments were pursued to test possible re-configurations of the GOS (these have been summarized in the final report of the July 2002 ET-ODRRGOS meeting).
3. Candidate Observing Systems (space-based and ground-based) for the coming decade were studied and a WMO technical document (WMO/TD 1040) was published.
4. Recommendations for the evolution of space-based and surface-based components of the GOS were drafted, reviewed, and submitted to CBS. An eleven-page document summarizes the most pressing observational needs and recommendations for the most cost-effective actions for meeting them in the near term and 10-15 years from now (see Annex I).
5. A vision for the GOS of 2015 and beyond was drafted (included in Annex I).

1.3 Significant findings of ET-ODRRGOS are:

(a) The Rolling Requirements Review (RRR) is readily applied to a diversity of applications areas, provided the data base of user requirements and observing system capabilities is accurate;

(b) Working with the Rapporteurs of Regional and Global OSEs, it was found that hypothetical changes to the GOS can be explored in Observing System Experiments (OSEs) with NWP centre assistance, provided data assimilation procedures are well understood and impact studies are conducted in a statistically significant way. Further it was made apparent that Observing System Simulation Experiments (OSSEs) require huge human and computer resources and were beyond the available resources;

(c) The future GOS should build upon existing components, both surface and space based, and capitalize on existing and new observing technologies not presently incorporated or fully exploited; each incremental addition to the GOS will be reflected in better data, products and services from the National Meteorological and Hydrological Services (NMHSs);

(d) The scope of the next decades changes to the GOS will be so massive that new revolutionary approaches for science, data handling, product development, training, and utilization will be required. There is an urgent need to study comprehensive strategies for anticipating and evaluating changes to the GOS.

2. Recommendations for the Evolution of the GOS from ET-ODRRGOS

2.1 The evolution of the GOS has been framed in 42 recommendations found in the OPAG IOS ICT report for 14-18 October 2002. Those recommendations for evolution of the GOS reflect

- Statements of Guidance in eleven applications areas (available in WMO/TD No. 913, 992, 1052 and summarized in ET-ODRRGOS Meeting Report 1-5 Jul 2002);
- Results from regional programmes such as COSNA, EUCOS and NAOS;
- Conclusions from the Toulouse Workshop on Impact of Various Observing Systems on NWP (see WMO/TD No. 1034);
- OSEs prompted by suggested changes to the GOS (see OPAG IOS ICT report for 14-18 Oct 2002).

2.2 The 22 recommendations for the surface-based component of the GOS include: more complete and timely data distribution; enhanced AMDAR especially over data sparse areas; optimized rawindesonde launches; targeted observations; inclusion of ground based GPS, radars, and wind profilers; increased oceanic coverage through expanded Automated Ship balloon observations, drifting buoys, and ARGO; and possible use of Unmanned Aeronautical Vehicles.

2.3 The 20 recommendations for the space based component of the GOS (9 for operational geostationary and polar orbiting, 11 for R&D satellites) build upon the known plans of the operational and R&D satellite operators and call for rigorous calibration of remotely sensed radiances as well as improved spatial, spectral, temporal, radiometric accuracies. The wind profiling and global precipitation measurement missions were singled out for their importance to the GOS.

2.4 These recommendations were detailed at CGMS XXX in WMO-WP-7.

3. Vision for the 2015 GOS

The ET-ODRRGOS vision for the evolution of the GOS to 2015 and beyond includes

3.1 for the Space based component:

6 operational GEOs
- all with multispectral imager (IR/VIS)
- some with hyperspectral sounder (IR)

4 operational LEOs
- optimally spaced in time
- all with multispectral imager (MW/IR/VIS/UV)
- all with sounder (MW)
- three with hyperspectral sounder (IR)
- all with radio occultation (RO)
- two with altimeter
- three with conical scan MW or scatterometer

several R&D satellites serving WMO members
- Constellation small satellites for radio occultation (RO)
- LEO with wind lidar
- LEO with active and passive microwave precipitation instruments
- LEO and GEO with advanced hyperspectral capabilities
- GEO lightning
- Possibly GEO microwave

Improved intercalibration and operational continuity

3.2 for the Surface based component:

Automation to enable
- targeting of observatiojn in data sensitive areas
- optimal operation of
  - radiosondes
  - ASAP systems
  - aircraft in flight

Rawinsondes
- optimized utilization
- stable GUAN
- supplemented by
  - AMDAR ascent/descent
  - ground based GPS water vapour information
  - wind profilers
  - satellite soundings
- rawinsondes automatically launched
- computerized data processing
- real-time data transmission
- high vertical resolution

Commercial aircraft observations
- of temperature & wind plus humidity on some aircraft
- in-flight and ascent/descent data
- high temporal resolution
- available from most airports including currently data void airports in Asia, Africa and South America.
- possibly supplemented with UAVs

Surface observations
- automated systems
- land sensors at high spatial resolution, supporting local applications such as road weather
- ocean platforms (ship, buoys, profiling floats, moorings) in adequate number to complement satellite measurements

Radar observing systems measuring
- radial winds
- hydrometeor distribution and size
- precipitation phase, rate, and accumulation
- multiple cloud layers, including base and top height.

Data collection and transmission
- digital in a highly compressed form
- entirely computerized data processing
- role of humans in observing chain reduced to minimum
- information technology in all areas of life will provide new opportunities for obtaining and communicating observations
- for satellite data in particular
  - use of ADM including regional/special DCPC in the context of FWIS
  - DB for special local applications in need on minimal time delay and as backup

4. Presentation to CBS Ext (02)

4.1 At the December 2002 meeting of the CBS, the OPAG IOS chair presented these recommendations to CBS. The following sections detail the favourable response received.

4.2 The Commission was pleased to note the work carried out by the ET-ODRRGOS and noted in particular the significant findings (stated in section 1 of this paper). The Commission noted the vision for the redesign of the GOS (outlined in section 3 of this paper), agreed that four operational LEOs were required, and agreed that this should be reflected in the update to the Manual on the GOS.

4.3 The Commission agreed to the following ET-ODRRGOS actions as part of its future work programme:

(a) Given the massive changes anticipated for the GOS, to develop as soon as possible an infrastructure and implementation plan including a detailed time schedule within WMO to assure full utilization of the evolving GOS;

(b) Given the urgent need to study comprehensive strategies for anticipating and evaluating changes to the GOS, to support a focused funded activity for the study of observing system design should be started;

(c) Given the importance of system and user characterization, to continue updating the database of user requirements and observing system capabilities and include user reviewed R&D expected performances;

(d) Given the success of the RRR to guide GOS evolution, to continue the RRR process in application areas already started and expand into new areas relevant to missing disciplines;

(e) Given the importance of NWP OSE implications for GOS evolution, to facilitate organization of the next Workshop on Impact of Various Observing Systems on NWP during the first quarter of 2004;

(f) Given the urgency of many recommendations for the GOS, to pursue early implementation (with particular attention to the developing countries).

4.4 With regard to the impact of the redesign of the GOS on developing countries, the Commission agreed that the major issues reported to CBS-XII were still valid. They included: *(a)* difficulties facing some RBSNs in receipt and/or production of data and products; *(b)* deficiencies in the current RBSNs due to a variety of infrastructure related issues; and *(c)* under utilization of satellite systems.

4.5 The Commission recognized that the redesign of the GOS envisioned over the next 15 years should have a positive impact on developing countries. For example, PUMA and its follow-up, and similar activities in other regions with respect to satellite data reception, analysis and communications could provide a major step forward in capability. PUMA was a European Union funded project to provide RA I Members with high resolution satellite ground receiving stations for the reception of MSG data including appropriate training for satellite data use and applications. The Commission expressed its gratitude for the European Union's support which will enhance the capabilities in RA I. Training to ensure full utilization of those data including from R&D satellites was being addressed through the Virtual Laboratory for Education and Training in Satellite Meteorology. The proposed integration of alternate dissemination methods (ADM) into the FWIS vision would allow for the rapid dissemination of satellite information together with other data sets to developing countries. That would provide information that could be used to improve forecasts for daily and seasonal to interannual time frames.

4.6 It was noted that a stable GUAN/GSN in the context of the redesign presented above would allow for optimization in rawinsonde utilization. Some developing countries were implementing radar systems to improve the measurement of precipitation and for improved warnings. AMDAR regional projects should provide badly needed data on winds and temperature

profiles for use by NMHSs. Improvements in automatic weather stations, other remote data collection platforms, and marine observational programmes would allow for data in inaccessible regions to be available for a variety of applications.

4.7 The Commission stressed that the realization of the redesign would also require the implementation of strategic plans within the various WMO Regions. Those implementation plans should address the needs of developing countries and should include capacity building and support of basic infrastructure through upgrading, restoring and substitution of applicable WWW systems. It was noted that such implementation plans were currently under development in RA I and RA II.

5. ET-ODDRGOS plans for the coming year

5.1 ET-ODDRGOS will be meeting 3 – 7 November 2003 in Geneva, Switzerland to continue pursuing the work plan approved by CBS. The agenda includes updating the data bases, hearing from the climate and ocean communities on their evaluations of the GOS capabilities relevant to their user requirements, receiving presentations on recent Observing System Experiments, and planning the upcoming Third WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction (scheduled for Alpbach, Austria, 9 – 12 March 2004)

5.2 ET-ODDRGOS will met again in 2004 after the March Workshop.