CGMS-XXXIII
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 document contains a review of events following CGMS-XXII discussion on a redesign of the WWW Global Observing System.

ACTION PROPOSED

CGMS is invited to consider the document and provide feedback, especially for other activities that should be noted in the progress sections.

1. Introduction

The seventh session on Expert Team on Observational Data Requirements and Redesign of the Global Observing System was held 12-16 July 2005, and the thirteenth session of the Commission for Basic Systems was held in February 2005, both following CGMS-XXXII. Results related redesign of the Global Observing System from these two sessions are presented below.

2. The seventh session of Expert Team on Observational Data Requirements and Redesign of the Global Observing System

The WMO/CBS/OPAG IOS Expert Team on Observational Data Requirements and Redesign of the Global Observing System (ET-ODRRGOS) met in Geneva, Switzerland on 12 – 16 July 2004 to proceed with the work assigned by CBS. The Chairman, Dr P. Menzel, set an agenda that included (a) updating the data bases of user requirements and observing system capabilities, (b) hearing the outcomes from the Workshop on Impact of Various Observing Systems on NWP (held March 2004) and the implications for the redesign of the GOS, (c) getting an update on WMO participation in various meetings (the WMO Consultative Meetings on High-level Policy on Satellite Matters, Co-ordination Group for Meteorological Satellites, GEO), (d) reviewing the observing system capabilities and user requirements and the associated statements of guidance with applications area experts, (e) reviewing field campaign and data assimilation task for THORPEX, (f) finalizing a draft implementation plan for the Redesign of the Global Observing System that was started at the last ET-ODRRGOS meeting, and (g) preparing for the Implementation and Coordination Team meeting in September 2004 and the CBS meeting in February 2005.

The group reviewed in plenary all 42 sections of the November 2003 draft ET GOS Implementation Plan. The team then split into two task teams to update the surface based and space-based systems. Considerable discussion and much rewriting produced the current version of the Implementation Plan (see Annex) that was endorsed at CBS-XIII.

3. The Thirteenth session of the Commission for Basic Systems (CBS-XIII)

1. This document summarizes some of the recent actions concerning the evolution of the space based sub system of the GOS as recommended in the implementation plan endorsed by CBS-XIII in St Petersburg, Russian Federation in February 2005.

2. CBS, at its thirteenth session held in St Petersburg, Russian Federation in February 2005 (CBS-XIII), noted with appreciation the work carried out by the Expert Team on Observational Data Requirements and Redesign of the GOS (ET-ODRRGOS), which focused on:

(a) The update of users requirements and observing system capabilities in ten application areas, including the Rolling Requirements Review (RRR) and the corresponding Statements of Guidance;

(b) The review of several Observing System Experiments (OSEs) that tested possible re-configurations of the GOS and the Third WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction (March 2004).

3. CBS-XIII recognized in particular the substantial work carried out in drafting the Implementation Plan for Evolution of Space- and Surface-Based Subsystems of the GOS. The Plan included 47 recommendations, as follows:

(a) Twenty recommendations address the space-based sub-system of the GOS. They build upon 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. Implementation of most of these recommendations would be realized through the WMO Space Programme working with space agencies, via CGMS;

(b) Twenty-two recommendations address the surface-based sub-system of the GOS. They include more complete and timely data distribution; improved data coding; enhanced AMDAR and TAMDAR especially over data sparse areas; optimized rawindesonde distribution and launches; improved upper tropospheric and lower stratospheric moisture measurements; operational use of targeted observations; inclusion of ground-based GPS, radars, and wind profilers; increased oceanic coverage through expanded Automated Shipboard Aerological Programme (ASAP), drifting buoys, and the Argo float programme, and development of some new observing technologies;

(c) Five recommendations address NWP interactions with data from evolving GOS, further study of observing system design and training issues.

4. The complete Implementation Plan for Evolution of Space- and Surface-Based Subsystems of the GOS is contained in WMO/TD No. 1267 available at the following:

http://www.wmo.int/web/www/OSY/Publications/TD1267_Impl-Plan_Evol-GOS.pdf

5. For purposes of this document, the following are the recommendations for the Space-based Subsystem of the GOS only. Immediately following each recommendation is the latest status.

Recommendations for the evolution of Space-based Sub-system of GOS

Calibration

S1. Calibration - There should be more common spectral bands on GEO and LEO sensors to facilitate inter-comparison and calibration adjustments; globally distributed GEO sensors should be routinely inter-calibrated using a given LEO sensor and a succession of LEO sensors in a given orbit (even with out the benefit of overlap) should be routinely inter-calibrated with a given GEO sensor.

Comment: A major issue for effective use of satellite data, especially for climate applications, is calibration. The advent of high spectral resolution infrared sensors will enhance accurate intercalibration.

Progress: CGMS-XXXI (2003) discussed GCOS Climate Monitoring Principles, inter-calibration of visible sensors, and inter-calibration of IR sensors on all GEOs with HIRS and AVHRR (reporting on the last item remains as a permanent action of CGMS). CGMS-XXXII (2004) considered improved infrared inter-calibration capabilities using AIRS data; the implications for GCOS Climate Monitoring Principles were discussed. The WMO Space Programme hosted a workshop in July 2005 in Darmstadt, Germany where a strategy for a global space-based inter-calibration system was drafted; it will be presented to space agencies for consideration, endorsement, and possible implementation. It was noted that the building blocks for a calibration / validation system include (1) on-board calibration devices (e.g., black bodies, solar diffusers), (2) in situ measurements of the state of the surface and atmosphere (e.g. the Cloud and Radiation Testbed (CART) site, aircraft instruments with NIST calibrations), (3) radiative transfer models that enable comparison of calculated and observed radiances, and (4) assimilation systems that merge all measurements into a cohesive consistent depiction of the earth-atmosphere system. A strategy was drafted.

Schedule: CGMS will continue inter-calibration activities with current sensors (e.g. AVHRR, HIRS, AIRS) and expand to IASI in 2006. The WMO Space Programme will present at CGMS in November 2005 a strategy for achieving operational intercalibration of the space component of the global observing system that addresses the climate and weather forecasting needs. Discussion and planning with space agencies will be continued via CGMS. Please see CGMS-XXXIII WMO WP-21 on a Global Space-Based Inter-Calibration System (GSICS).

GEO satellites

S2. GEO Imagers - Imagers of future geostationary satellites should have improved spatial and temporal resolution (appropriate to the phenomena being observed), in particular for those spectral bands relevant for depiction of rapidly developing small-scale events and retrieval of wind information.

Progress: The following geostationary satellite operators have reported at CGMS that they will have SEVIRI-like capability by 2015: NOAA (2012), EUMETSAT (present) and Russian Federation (2007).

Schedule: WMO Space Programme will continue discussions with space agencies, via CGMS especially with IMD, CMA and JMA.

S3. GEO Sounders - All meteorological geostationary satellites should be equipped with hyper-spectral infrared sensors for frequent temperature/humidity sounding as well as tracer wind profiling with adequately high resolution (horizontal, vertical and time).

Comment: This was to be demonstrated by GIFTS. However, for budgetary reasons, NASA has recently curtailed the GIFTS mission to assemble and vacuum test Engineering Design Unit; realization of a GIFTS demonstration in geostationary orbit is a task to be undertaken by the international community, possibly within the International Geostationary Laboratory (IGeoLab).

Progress: All operators reported plans at CGMS in 2004: NOAA has firm plans including this capability for the GOES-R series; EUMETSAT has it under consideration for the MTG series; China and India have plans for capability similar to current GOES sounder before 2010. CGMS endorsed the concept of the International Geostationary Laboratory (IGeoLab) that would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities. GIFTS is one of two systems being considered for IGeoLab. Roshydromet and Roskosmos are negotiating with NOAA the possibility to install GIFTS on board of the subsequent geostationary satellite “ELEKTRO”. A task team evaluating two test instrument proposals for IGeoLab met in early June 2005 in Silver Spring, MD. This meeting was the outgrowth of an action from the Consultative Meetings on High-level Policy on Satellite Matters (CM) hosted by WMO in January 2005, where the Space Agencies endorsed the concept of IGeoLab and requested that the two proposals (the Geostationary Imaging Fourier Transform Spectrometer – GIFTS and the Geostationary Observatory for Microwave Atmospheric Sounding - GOMAS) be further explored. These two instruments in geosynchronous orbit are high priority and necessary enhancements to the Global Observing System (GOS) for meeting existing user requirements in numerical weather prediction (NWP), nowcasting, hydrology and other applications areas. In September 2005 thermal vacuum testing of the GIFTS Engineering Design Unit (EDU) was started in Logan, Utah. This will demonstrate several key technologies working together (active cooling, Focal Plane Array detectors (FPA), Fourier Transform Systems (FTS), high speed Analog to Digital converters (A/D), lightweight optics, operation at cryogenic temperatures). Information from the GIFTS TV will be shared with international community to help with instrument performance specifications. Please see WMO WP-22 on the International Geostationary Laboratory for more details.

Schedule: WMO Space Programme is continuing pursuit of a GIFTS demonstration on IGeoLab with space agencies. See note in Schedule for S-13. Additionally, plans from all space agencies for hyperspectral geostationary sounding should be in place by CGMS 2006.

S4. GEO Imagers and Sounders - To maximize the information available from the geostationary satellite systems, they should be placed "nominally" at a 60-degree sub-point separation across the equatorial belt. This will provide global coverage without serious loss of spatial resolution (with the exception of Polar Regions). In addition this provides for a more substantial backup capability should one satellite fail. In particular, continuity of coverage over the Indian Ocean region is of concern.
Comment: In recent years, contingency planning has maintained a 5-satellite system, but this is not a desirable long-term solution.

Progress: WMO Space Programme will continue to discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, the strategy for implementation towards a nominal configuration with attention to the problems of achieving required system reliability and product accuracy.

Schedule: Plan should be available by CGMS in 2006

LEO satellites

S5. LEO data timeliness - More timely data are needed. Improved communication and processing systems should be explored to meet the timeliness requirements in some applications areas (e.g. Regional NWP).

Progress: EARS data are now available with a delay of less than 30 minutes; the data are used operationally at some NWP centres and planned at others. NPOESS plans are for data delivery in less than 30 min and thus consistent with this requirement. The successful EUMETSAT ATOVS Retransmission Service has been renamed the EUMETSAT Advanced Retransmission Service and will carry AVHRR and ASCAT products in addition to ATOVS. Planning has begun for other Regional ATOVS Retransmission Systems (RARS) in Asia, Australia, and South America with a goal for an Integrated Global Data Dissemination Service (IGDDS). Please see CGMS-XXXIII WMO WP-19 on "Towards An Integrated Data Dissemination Service" for more details.

Schedule: WMO will host a global RARS Workshop in December 2005 with participation by Europe/Americas and Asia-Pacific. WMO Space Programme is planning, with Members and CGMS, the development of Advanced Dissemination Methods (ADMs) and an Integrated Global Data Dissemination Service (IGDDS), to include: (1) the extension and enhancement of EARS; (2) the implementation of similar systems, with a goal of achieving timely retransmission of local data sets covering the globe; (3) an equivalent system for NPP data; (4) expansion of EARS and equivalent systems to include IASI data; and (5) establishment of equivalent systems for the LEO data from satellites of other agencies.

S6. LEO temporal coverage - Coordination of orbits for LEO missions is necessary to optimize temporal coverage while maintaining some orbit redundancy.

Progress: This is now the subject of a permanent action of CGMS. WMO Space Programme will collaborate with space agencies, via CGMS, on a target system that will be implemented and to take steps towards achieving it. Matters related for contingency planning in the AM and PM polar-orbits will be included.

Schedule: Target system agreed upon by CGMS in 2006.

S7. LEO Sea Surface Wind - Sea-surface wind data from R&D satellites should continue to be made available for operational use; 6-hourly coverage is required. In the NPOESS and METOP era, sea surface wind should be observed in a fully operational framework. Therefore it is urgent to assess whether the multi-polarisation passive MW radiometry is competitive with scatterometry.

Progress: 3 months of data has been made available to Windsat science team. Windsat data has been distributed to several NWP centres in 2005. Early assessments of its polarimetric capabilities to provide information on sea surface wind direction suggest that, while good information is available at high wind speed, this technology will not be competitive with scattering at low wind speed.

Schedule: The WMO Space Programme, via CGMS, will consider the implications for the GOS. WMO Space Programme will coordinate assessment of implications and provide feedback by late 2005.

S8. LEO Altimeter - Missions for ocean topography should become an integral part of the operational system.

Progress: Agreement has been reached to proceed with JASON-2.

Schedule: WMO Space Programme to discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, the continuity of operational provision after JASON-2. Plans for operational follow-on should be reported at CGMS in 2006.

S9. LEO Earth Radiation Budget - Continuity of ERB type global measurements for climate records requires immediate planning to maintain broad-band radiometers on at least one LEO satellite.

Comment: There are no current plans for ERB-like measurements after Aqua. There are also concerns about the continuity of absolute measurements of incoming solar radiation.

Progress: WMO Space Programme to discuss with space agencies, via CGMS. NPOESS has announced that the second NPOESS satellite will carry the CERES instrument (likely launch in 2013).

Schedule: WMO Space Programme will advise CGMS of this development. Possible gaps in coverage should be discussed at CGMS in 2005.

R&D satellites

S10. LEO Doppler Winds - Wind profiles from Doppler lidar technology demonstration programme (such as Atmospheric Dynamics Mission - Aeolus) should be made available for initial operational testing; a follow-on long-standing technological programme is solicited to achieve improved coverage characteristics for operational implementation.

Comment: Plans for Aeolus demonstration are proceeding on schedule, but there are no plans for operational follow on.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, to assure demonstration with Aeolus and initiation of operational systems for wind profile measurement. Plans for continuity of a Doppler Winds capability following Aeolus should be indicated by CGMS satellite operators in 2006.

S11. GPM - The concept of the Global Precipitation Measurement Missions (combining active precipitation measurements with a constellation of passive microwave imagers) should be supported and the data realized should be available for operational use, thereupon, arrangements should be sought to ensure long-term continuity to the system.

Progress: TRMM continues to provide valuable data for operational use. Early termination of TRMM after 2004 was averted after user community appeals for its continuation. NASA has assured continued operation into 2006. At CGMS-XXXII, NASA, ESA and JAXA reported plans for a GPM mission in 2008. In 2005, ESA's European GPM was not selected as the next Earth Observer Mission.

Schedule: WMO Space Programme is continuing discussions with space agencies, via CGMS and at CM-6 in 2005, regarding plans for a TRMM follow on.

S12. RO-Sounders - The opportunities for a constellation of radio occultation sounders should be explored and operational implementation planned. International sharing of ground network systems (necessary for accurate positioning in real time) should be achieved to minimize development and running costs.

Progress: CHAMP and SAC-C data have been available to some centres but not in near real time (NRT). NWP OSE has shown positive impact with small number of occultations. Climate applications are being explored. There has been good progress in planning for NRT distribution of METOP/GRAS and COSMIC data.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS, (1) the proposal to develop a shared ground network system and (2) operational constellations following COSMIC. Additionally, WMO will seek formal participation by CONAE in the space-based component of the GOS for the SAC-C mission and any relevant follow-on.

Schedule: Plan for shared ground network should be available by CGMS in 2006. Plan for operational follow-on should be drafted by CGMS in 2006.

S13. GEO Sub-mm - An early demonstration mission on the applicability of sub-mm radiometry for precipitation estimation and cloud property definition from geostationary orbit should be provided, with a view to possible operational follow-on.

Progress: EUMETSAT, NESDIS and WMO prepared a paper for CGMS on the International Geostationary Laboratory (IGeoLab) that would be a joint undertaking to provide a platform for demonstrations from geostationary orbit of new sensors and capabilities. Geo sub-mm is one of two systems being considered for IGeoLab. A task team evaluated the IGeoLab possibilities for a Geostationary Observatory for Microwave Atmospheric Sounding (GOMAS) as well as other possible instruments. The GOMAS instrument in geosynchronous orbit is high priority and a necessary enhancement to the Global Observing System (GOS) for meeting existing user requirements in numerical weather prediction (NWP), nowcasting, hydrology and other applications areas. The task team is pursuing definition of feasible options for a geo sub mm instrument; the WMO Space Programme will seek partners for development of the recommended Geo sub mm instrument with space agencies and will report progress at CGMS. An IGeoLab Focus Group meeting will be held on 24 October 2005 and the results will be reported to CGMS XXXIII. Please see WMO WP-22 on the International Geostationary Laboratory for more details.

Schedule: WMO Space Programme will continue dialogue with space agencies, via CGMS. Progress toward IGeoLab will be discussed at CGMS in 2005.

S14. LEO MW - The capability to observe ocean salinity and soil moisture for weather and climate applications (possibly with limited horizontal resolution) should be demonstrated in a research mode (as with ESA's SMOS and NASA's OCE) for possible operational follow-on. Note that the horizontal resolution from these instruments is unlikely to be adequate for salinity in coastal zones and soil moisture on the mesoscale.

Progress: ERS data sets have provided monthly global soil moisture maps since 1991 at 50 km resolution.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS

S15. LEO SAR - Data from SAR should be acquired from R&D satellite programmes and made available for operational observation of a range of geophysical parameters such as wave spectra, sea ice, land surface cover.

Progress: WMO Space Programme to discuss with space agencies, via CGMS, (1) access by WMO Members to ENVISAT SAR data, and (2) continuity of such missions.

Schedule: Assessment of status and plans completed by CGMS in 2006.

S16. LEO Aerosol - Data from process study missions on clouds and radiation as well as from R&D multi-purpose satellites addressing aerosol distribution and properties should be made available for operational use.

Progress: Cloudsat will carry a R&D aerosol instrument. NPOESS has added an aerosol instrument. This issue has been referred to CGMS.

Schedule: WMO Space Programme will continue discussions with space agencies, via CGMS and CEOS.

S17. Cloud Lidar - Given the potential of cloud lidar systems to provide accurate measurements of cloud top height and to observe cloud base height in some instances (stratocumulus, for example), data from R&D satellites should be made available for operational use.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS.

S18. LEO Far IR - An exploratory mission should be implemented, to collect spectral information in the Far IR region, with a view to improve understanding of water vapour spectroscopy (and its effects on the radiation budget) and the radiative properties of ice clouds.

Schedule: WMO Space Programme to discuss with space agencies, via CGMS.

S19. Limb Sounders - Temperature profiles in the higher stratosphere from already planned missions oriented to atmospheric chemistry exploiting limb sounders should be made operationally available for environmental monitoring.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS, progress/plans for distribution of data from MIPAS and SCIAMACHY on ENVISAT, from MLS and HIRDLS on AURA, and from similar instruments.

S20. Active Water Vapour Sensing - There is need for an exploratory mission demonstrating high-vertical resolution water vapour profiles by active remote sensing (for example by DIAL) for climate monitoring and, in combination with hyper-spectral passive sensing, for operational NWP.

Schedule: WMO Space Programme will discuss with space agencies, via CGMS.

Next Meeting of ET-EGOS

6. The Expert Team on Evolution of the Global Observing System (ET-EGOS) will be meeting in 6-8 December 2005 to continue their work programme which includes maintaining and updating the Implementation Plan for Evolution of the GOS; and monitoring progress against the Plan. More information will be available after this meeting.