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COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMMME AREA GROUP ON
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INTER PROGRAMME EXPERT TEAM ON OBSERVING SYSTEM DESIGN AND EVOLUTION (IPET-OSDE)
First Session

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IMPLEMENTATION PLAN FOR THE EVOLUTION OF GLOBAL OBSERVING SYSTEMS (EGOS-IP)

RETROSPECTIVE ANALYSIS OF PROGRESS AGAINST OLD EGOS-IP (2015)

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SUMMARY AND PURPOSE OF DOCUMENT

The document provides a retrospective analysis of progress against Actions in the [old] Implementation Plan for Evolution of Space- and Surface-based Sub-systems of the Global Observing System (old EGOS-IP, responding to the Vision of the GOS in 2015), which was approved by CBS-13 in 2005 and against which progress was monitored by ET-EGOS between 2005 and 2012. The analysis is intended to be informative to IPET-OSDE in its consideration of the new EGOS-IP and its proposals to facilitate effective action on the implementation of the new Plan.

ACTION PROPOSED

The Meeting is invited to note the information contained in this document when discussing how it organises its work and formulates its recommendations.

References: WMO/TD No. 1267, Implementation Plan for Evolution of Space- and Surface-based Sub-systems of the Global Observing System (responding to the vision of the GOS in 2015) – http://www.wmo.int/pages/prog/www/OSY/Publications/TD1267_Impl-Plan_Evol-GOS.pdf

Appendix: A. Review of original EGOS-IP (version approved by CBS-XIII, 2005) - Progress against Actions. Version dated 8 March 2013.

DISCUSSION

1. At ET-EGOS-7 (May 2012), one of the main topics for discussion and action was the finalisation of the details of the "new" Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) responding to the "Vision for the GOS in 2025". This document was prepared for presentation to ICT-IOS and subsequently for endorsement by CBS and approval by EC. In addition at ET-EGOS-7, it was agreed that it would be both informative and good practice to conduct a retrospective analysis of progress against the "old EGOS-IP", i.e. the version of the Implementation Plan for Evolution of Space- and Surface-based Sub-systems of the Global Observing System (WMO/TD No. 1267) that was approved by CBS-13 in 2005, and responding to the "Vision for the GOS in 2015". Following ET-EGOS-7 such a review was conducted, led by the Chair of ET-EGOS with contributions from the Secretariat, from ET-EGOS members and from other stakeholders.

2. The outcome of the analysis is presented at Appendix A. It sets out all the Actions in the original EGOS-IP and summarises progress against them at the assessment date in 2012. It also scores the progress as GREEN (good progress), AMBER (some progress) or RED (little or no progress).

3. This analysis is presented for consideration at IPET-OSDE-1. At this meeting we will, for the first time, be considering progress against the new EGOS-IP. Although the old EGOS-IP was shorter and less systematic than its successor, it was a plan of the same type, and progress against it was monitored regularly by ET-EGOS. It is therefore informative to know in which areas good progress was made and in which it was more difficult to achieve. This information should be helpful to IPET-OSDE when monitoring the new EGOS-IP and when performing and recommending activities to facilitate effective actions to implement the new Plan.

APPENDIX A

Version dated 8 March 2013

Review of original EGOS-IP
(WMO/TD No. 1267, version approved by CBS-13, 2005)

Progress against Actions

Key:

G(reen) Good progress

A(mber) Some progress

R(ed) Little/no progress

	Original Action	Progress + new EGOS-IP ref.	
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.	Considerable progress on planning and implementing GSICS. 6.2.3 S6,S7	G
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.	Current plans of agencies represent good progress - by 2025, an increased space/time resolution is expected for most GEO imagers. 6.3.1.1 S9	G
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).	Current plans of agencies represent good progress - by 2025, IR sounders will be flown on some GEOs. 6.3.1.2 S11	A
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.	Good progress – a system of 6 GEOs is planned, and work continues to optimise their spacing in longitude 6.3.1 S8	A
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	Excellent progress achieved via the RARS network. 6.3.2 S14,15	G

	areas (e.g. regional NWP).		
S6	**LEO temporal coverage** - Coordination of orbits for LEO missions is necessary to optimize temporal coverage while maintaining some orbit redundancy.	Coordinated planning is in place. Plans for coverage with redundancy in two orbital plans. Work continues concerning early a.m. orbit. 6.3.2 S13	A
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.	Current plans foresee operational scatterometers in two orbital planes 6.3.3.1	G
S8	**LEO altimeter** - Missions for ocean topography should become an integral part of the operational system.	A constellation is planned with two altimeters in sun-synchronous orbits plus one reference mission. Some resourcing issues to be resolved. 6.3.3.3 S23	A
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.	Future missions are planned but concerns still remain over continuity of record. 6.3.3.8 S28	A
S10	**LEO Doppler winds** - Wind profiles from Doppler lidar technology demonstration programme (such as ADM-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.	ADM-Aeolus mission delayed and not yet launched. 6.3.4.1(a) S30	R
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.	Several missions contributing to GPM are planned, with appropriate data dissemination plans. Continuity and completeness not yet assured. 6.3.3.7 S25,S26,S27	A
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.	Excellent progress on use of RO data and on international coordination. Work continues to assure an enhanced operational network for the future.	A

		6.3.3.2 S21,S22	
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.	No substantive progress. 6.3.4.3 S33	R
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.	Demonstrations implemented: ESA's SMOS and NASA's Aquarius 6.3.4.2 S32	G
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.	The ESA/EU Sentinel-1 mission is foreseen in 2013. The Radarsat Constellation mission of Canada is in good progress towards launch in 2018 and open data access. 6.3.3.10	A
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.	Calipso was launched in 2006, and Earthcare is planned for 2015 6.3.2.3 S19?	A
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.	Calipso was launched in 2006. 6.3.4.1(b) S31	A
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.	Research mission originally requested, but not yet achieved. Focus for cirrus monitoring now on sub-mm (e.g. ICI on Metop-SG). [Note: no specific ref to ice-cloud or cirrus in new EGOS-IP – gap in Vision?]	R
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.	Some data from current missions made available to operational NWP centres. Plans for future limb sounding missions are of concern. 6.3.3.9 S29	A

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.	No substantive progress. 6.3.4.1(c)	R
G1	**Distribution** - Some observations made routinely are not distributed in near real-time but are of interest for use in meteorological applications. (a) Observations made with high temporal frequency should be distributed globally at least hourly. (b) Observational data that are useful for meteorological applications at other NMHSs should be exchanged internationally, taking into account Res. 40 (Cg-XII). Examples include high resolution radar measurements (i.e. products, both reflectivity and radial winds, where available) to provide information on precipitation and wind, surface observations, including those from local or regional mesonets, such as high spatial resolution precipitation networks, but also other observations, such as soil temperature and soil moisture, and observations from wave rider buoys. WMO Members summarize the data available in their regions and strive to make these data available via WMO real time or near-real-time information systems, whenever feasible.	(a) Some hourly observations are now exchanged internationally, but further progress needed. 5.2 G2 (b) Increased exchange of radar data and some other observations, but further progress needed. 5.2 G2,G4.	A A
G2	**Documentation** - All observational data sources should be accompanied by good documentation including metadata, qc and monitoring.	ICG-WIGOS Task Team on Metadata was formed and will address this action at its first meeting to be held in March 2013. In addition, CBS will support this action through the IPET-WIFI Sub-group on Metadata that will also meet later this year. 2.1, 3.6, 5.3.1.1.2 G11, 5.3.1.1.4 G14, 5.3.2.1 G32, 5.3.2.5 G40, 5.3.6.3	A
G3	**Timeliness and completeness -** There should be a timely distribution of radiosonde observations with all observation points (not just mandatory levels) included in the message (together with the time and the position of each data point; information on instrument calibration prior to launch, and information on sensor type and sub-sensor type). Appropriate coding standards should be used to assure that the content (e.g. vertical resolution) of the original measurements, sufficient to meet the user	Work has begun to communicate high-resolution data in BUFR, but further progress needed. 5.3.1.1.4 G14	A

	requirements, is retained during transmission.		
G4	**Baseline system** - Provide comprehensive and uniform coverage with at least 12-hour frequency of temperature, wind, and moisture profiles over mid-latitude continental areas and coastal regions. In tropical regions the wind profile information is particularly important.	Profile coverage has been improved and optimised in some Regions, mainly through growth of AMDAR coverage (see G9). However, in many parts of the world there has been no progress and some reduction. 5.3.1.1.1 G7,G8,G10	A/ R
G5	**Stratospheric observations** - Requirements for a stratospheric global observing system should be refined. The need for radiosonde, radiance, wind, and humidity data should be documented, noting the availability and required density of existing data sources, including GPS sounders, MODIS winds, and other satellite data.	Studies have been made of the impact of satellite data (passive sounder and RO) on stratospheric analyses. Further work needed to analyse the implications of this for future in situ observations of the stratosphere. 5.3.1.1.5 G15,G16	A
G6	**Ozone sondes** - Near real-time distribution of ozone sonde data is required for calibration and validation of newly launched instruments and for potential use in NWP.	Some ozone sonde observations now exchanged in NRT. 5.3.1.4 G25	A
G7	**Targeted observations** - Observation targeting to improve the observation coverage in data sensitive areas for NWP should be transferred into operations once the methodology has matured. Non-linear methods in targeting have been studied and should also be considered. The operational framework for providing information on the sensitive areas and responding to such information needs to be developed.	Progress on understanding targeting methodology via THORPEX. Value of routine targeting for TCs demonstrated, with some implementation. 3.1 C6, 5.3.1.1.1 G9	A
G8	**Radiosondes** - Optimize the distribution and the launch times of the rawinsonde sub-system (allowing flexible operation while preserving the GUAN network and taking into consideration regional climate requirements of the RBCN). Examples include avoiding duplication of Automated Ship-borne Aerological Program (ASAP) soundings whenever ships are near a fixed rawinsonde site (freeing resources for observations at critical times) and optimizing rawinsonde launches to meet the local forecasting requirements.	Progress in some Regions (e.g. under EUCOS) but further progress needed. 5.3.1.1.1 G9	A
G9	**AMDAR technology** should provide more ascent/descent profiles, with improved vertical resolution, where vertical profile data from radiosondes and pilot balloons are sparse as well as into times that are currently not well observed such as 2300 to 0500 local times.	A large expansion has been achieved since 2005. Further progress needed. 5.3.1.3 G19,G20,G21	G

G10	**Transmission of AMDAR reports** - Optimize the transmission of AMDAR reports taking into account, en route coverage in data-sparse regions, vertical resolution of ascent/descent reports, and targeting related to the weather situation.	Optimization studies conducted and implemented in some Regions. 5.3.1.3 G20	A
G11	**Humidity sensors on AMDAR** - Further development and testing of water vapour sensing systems is strongly encouraged to supplement the temperature and wind reports from AMDAR.	Data from humidity sensors are available operationally from an increasing number of aircraft in some Regions. Further progress needed. 5.3.1.3 G22	A
G12	**TAMDAR & AFIRS** - To expand ascent/descent profile coverage to regional airports, the development of TAMDAR, and use of AFIRS should be monitored with a view towards operational use.	Results from test data sets are encouraging. Some data policy issues need to be overcome. 5.3.1.3 G24	A
G13	**Ground GPS** - Develop further the capability of ground-based GPS systems for the inference of vertically integrated moisture with an eye toward operational implementation. Ground based GPS processing (ZTD and precipitable water, priority for ZTD) should be standardized to provide more consistent data sets. Data should be exchanged globally.	Some progress in expansion of networks and in international distribution of data. Further progress needed. 5.3.1.5 G26,G27,G28	A
G14	**More profiles over oceans** - Increase the availability of high vertical resolution temperature, humidity, and wind profiles over the oceans. Consider as options ASAP and dropsondes by designated aircraft.	The EUCOS-led E-ASAP programme for the N.Atlantic has been successful. Similar programmes needed for other oceans. No plan for North Pacific and Indian Ocean 5.3.5 G49	A
G15	**Telecommunications (for ocean observations)** - Considering the expected increase in spatial and temporal resolution of in situ marine observing platforms (from include drifting buoys, profiling floats, XBTs for example) and the need for network management, the bandwidth of existing telecommunication systems should be increased (in both directions) or new relevant satellite telecommunications facilities should be established for timely collection and distribution.	JCOMM increasingly using Iridium 5.3.6.4	G
G16	**Tropical moorings** - For both NWP (wind) and climate variability/climate change (sub-surface temperature profiles), the tropical mooring array should be extended into the tropical Indian Ocean at resolution consistent with that presently achieved in the tropical Pacific and Atlantic Oceans.	Progress limited due to piracy in West Tropical Indian Ocean 5.3.6.4 G54	R

G17	**Drifting buoys** - Adequate coverage of wind and surface pressure observations from drifting buoys in the Southern Ocean in areas between 40S and the Antarctic Circle should be assured using an adequate mix of SVPB (surface pressure) and WOTAN technology (surface wind). The pressure observations are a valuable complement to the high-density surface winds provided by satellite.	Since 2005, the network has been maintained and expanded. There is continuing pressure on funding to maintain the network, but the risk is more for reducing the number of the drifters in tropical regions (evaluation of impact underway). 5.3.6.4 G52,G53	G
G18	**XBT and Argo** - For ocean weather forecasting purposes, improve timely delivery and distribute high vertical resolution data for sub-surface temperature/salinity profile data from XBTs and Argo floats.	Substantial progress in the coverage and dissemination of Argo data. It remains a challenge to maintain the network and make it operational. 5.3.7.1 G57	G
G19	**Ice buoys** - For NWP purposes, coverage of ice buoys should be increased (500 km horizontal resolution is recommended) to provide surface air pressure and surface wind data.	Plans for 50 buoys deployed per year. Eurasian section continues to be data-sparse. 5.3.6.5 G55	R
G20	**More profiles in Tropics** - Temperature, wind and if possible humidity profile measurements (from radiosondes, PILOTs, and aircraft) should be enhanced in the tropical belt, in particular over Africa and tropical America.	Where profile coverage has improved, it has mainly been through growth of AMDAR coverage (see G9). However, in most parts of the Tropics there has been no progress and some reduction. 5.3.1.1.1 G7	A/ R
G21	**AWS** - Noting the widespread adoption of AWS, there should be coordinated planning that includes: • appropriate codes and reporting standards, • global standard for quality management and the collection / sharing of metadata, and • expanded range of measured parameters;	• BUFR code was adapted to report all variables as specified in the Functional specification for AWS adopted by CBS-XV. • Standards for quality management are developing through WMO QMF and respective ICG-WIGOS and CBS teams, namely: ICG-WIGOS TT on Quality Management and CBS IPET-WIFI SG on Quality	G

		Management. • Expanded range of variables to be measured were defined in the Functional specification for AWS adopted by CBS-XV. 5.2 G1, G2, G3, G4 [note: surprisingly few refs to AWS in new EGOS-IP]	
G22	**New systems** - In the context of THORPEX, the feasibility of new systems should be demonstrated as much as possible. These possible operational sub-systems include but are not limited to: • ground based interferometers and radiometers (e.g. microwave) that could provide continuous vertical profiles of temperature and humidity in selected areas; • unmanned aeronautical vehicles (UAVs); • high altitude balloons; • lidars.	Regular wind profiler and weather radar technologies, passive microwave T and RH, some lidars (Raman T and RH), wind lidar and aerosol backscatter lidar are different methods of observation “very close” to real operational tools for Met Services. To track this evolution, CIMO have “Testbed sites” where yearly reports are issued about the latest developments related to these technologies. For novel ground-based remote sensing technologies no significant progress to report. 5.3.8	A
N1	**New data types** - NWP centres should receive early (advance) information about and experience with new data types; this includes: (a) early access to test data and observations during the cal/val phase to prepare for the operational use of the data; and (b) information on the characteristics of the data and products (e.g. AMVs which may be representative of atmospheric layers rather than just one level over layers).	Good practice is emerging in this area, particularly between some space agencies and NWP centres. Further progress needed. 3.1 C4	A
N2	**Data from research satellites** – R&D systems provide valuable data for NWP, which should be made available in a timely fashion. Research satellite data provide NWP centres with an excellent opportunity to prepare for new satellite data streams, which will become part of the operational global observing system. Effective learning of how to make use of new data types can best be achieved through operational use of any experimental data streams.	Good practice is emerging in this area, particularly between some space agencies and NWP centres. Further progress needed. 3.1 C4	A

N3	**Timely data delivery** – Data processing and delivery systems should strive to meet NWP requirements of 30 minutes as much as possible.	Some progress, e.g. WMO RARS system (see S5). Further progress needed. 3.1, 3.2, 4., and many specific Actions concerned with improved timeliness	A
O1	**Observing system study** - Support well-resourced studies of re-designed observing systems. This is an ongoing process.	Some progress, exemplified by impact studies presented at WMO Impact Studies Workshops in 2008 and 2012. Explicitly in 5.3.1.1.1 G8, 5.3.1.1.5 G15,G16, 6.3.3.2 S22, and implied in support of many other activities	A
T1	**Training and information exchange** for GOS utilization – Support for sustained training must be realized as a primary means to assist WMO Members towards full exploitation of surface-based and satellite-based sub-systems of the GOS. Training must address data access, data use, and training of trainers. Networks for information exchange toward improved utilization of the GOS must be encouraged.	A number of training activities are conducted every year in support of sustained operations of the basic components of WWW. Through the implementation of WIGOS focus will be also on the capacity development. National implementation plans will specify the needs. Explicitly in 3.1 C4, 4. C13, 6.2 S1,S4, and implied in support of many other activities.	G