CGMS

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

WMO-WP-04 gives an overview on the development of the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP), which is a major component of the Rolling Requirements Review (RRR) process.

The new version of EGOS-IP is structured as a response to the Vision for the GOS in 2025, but it also aims to respond to the Implementation Plan for the Global Climate Observing System (GCOS-IP), and to emerging requirements of the Global Framework for Climate Services (GFCS) and of the Global Cryosphere Watch (GCW). Its purpose is to document a set of implementation actions which are required for incremental improvement of global observing systems towards the 2025 Vision.

The scope of EGOS-IP embraces space and surface-based observation, as well as cross-cutting considerations. The Expert-Team on Satellite Systems (ET-SAT) completed a thorough review of the satellite-related aspects of this plan. The comments from ET-SAT have been taken into account in the current version (v.10), which is available under: ftp://ftp.wmo.int/Documents/PublicWeb/www/gos/egos-ip/ .

The plan will be finalized for submission to the Commission for Basic Systems in September-October 2012.

Action/Recommendation proposed:

CGMS Members are invited to take note of the Implementation Plan for Evolution of Global Observing Systems (EGOS-IP) and to forward comments to the Space Programme office via their ET-SAT representative (or directly if they are not represented in ET-SAT).

Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP)

1. BACKGROUND

Under the auspices of the WMO Commission for Basic Systems (CBS) the Expert Team on the Evolution of Global Observing Systems (ET-EGOS) guides and monitors the evolution of global observing systems, through the "Rolling Review of Requirements" (RRR) process. The RRR process builds on the following elements:

Twelve **application areas** are currently considered in this process: global NWP, high-resolution NWP, nowcasting and very short-range forecasting, seasonal to inter-annual forecasting, aeronautical meteorology, ocean applications (including marine meteorology), atmospheric chemistry, agricultural meteorology, hydrology, climate monitoring (GCOS), climate applications, and space weather. Other application areas are added as necessary. For each application area a focal point is in charge of collecting and maintaining the requirements in consultation with other representative experts of the application area.

The **observing requirements database** contains quantified observation requirements from each of these application areas (See WMO-WP-13).

The **available/planned observation capabilities** are inventoried and evaluated in a critical review of their adequacy to meet the requirements. For space-based observation, this is recorded in the GOS-Dossier (See WMO-WP-16).

For each application area, the outcome of this critical review, i.e. the main deficiencies and priorities for improvements, are summarised in a **"Statement of Guidance" (SoG)**, which is updated on a regular basis.

The SoGs contribute to formulate a **"Vision for the GOS"**, which sets a medium or long-term high-level goal for the evolution. The Vision is adopted by CBS and approved by the Executive Council.

Finally, an **Implementation Plan** is developed to provide a roadmap for implementing the Vision. It contains a set of actions, the progress of which is monitored every year by the ET-EGOS, and by ET-SAT for its satellite aspects.

2. SCOPE OF THE IMPLEMENTATION PLAN

Following the adoption of the "Vision for the GOS in 2025" in 2009, a new Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) has been developed. Its purpose is to document a set of implementation actions which are required for incremental improvement of global observing systems towards full realization of the Vision for the GOS in 2025.

The new EGOS-IP is a comprehensive response to the new Vision and mirrors its structure. Placed within the framework of the WMO Integrated Global Observing System (WIGOS) it addresses key elements in the WIGOS strategy such as integration and interoperability. The new EGOS-IP also aims to respond to the new version of the Implementation Plan for the Global Climate Observing System (GCOS-IP), and to emerging requirements of the Global

Framework for Climate Services (GFCS) and the Global Cryosphere Watch (GCW). In this Plan, Actions are included to emphasize and propagate GCOS requirements for high-quality observations of Essential Climate Variables (ECVs) and the standards of observation set out in the GCOS Climate Monitoring Principles (GCMPs).

The new EGOS-IP describes the Actions needed for implementation as they are envisaged initially at the beginning of the decade 2010-2020, and it covers the period up to 2025. To monitor the Actions in this Implementation Plan, regular progress reports will be made available, using this EGOS-IP as reference.

The draft EGOS-IP has been reviewed by various WMO bodies in a process coordinated by ET-EGOS. Its satellite-related aspects have been reviewed in detail by the Expert Team on Satellite Systems (ET-SAT). An important objective of the review by ET-SAT was to ensure consistency of this EGOS-IP with the revised CGMS baseline (See WMO-WP-02) that reflects the plans that CGMS Members could agree to at this point of time. The relationships between the Vision, the Implementation Plan and the revised CGMS baseline are illustrated schematically in Figure 1.

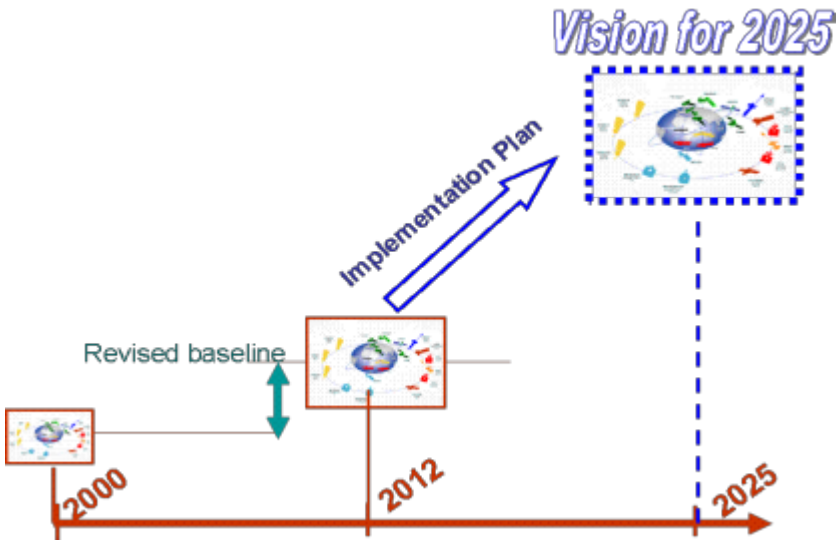

Figure 1: Schematic relationship between Vision, revised baseline, and EGOS-IP

The EGOS-IP is currently open for review and should be finalized for submission to CBS in September 2012. This comprehensive document of 82 pages is available on line: ftp://ftp.wmo.int/Documents/PublicWeb/www/gos/egos-ip/. For illustration purposes, only cross-cutting actions and space-related actions extracted from this plan are reproduced in the Appendix. It is recalled, however, that these actions are better understood in the context of the complete document.

3. CONCLUSIONS

CGMS is invited to note the process whereby an Implementation Plan is being developed in the framework of the RRR process, in consultation with space agencies' representatives in ET-SAT, to define actions towards full implementation of the Vision for the GOS in 2025.

This process is following an integrated approach encompassing both space and surface observations, and supporting all WMO-related programmes.

ACTIONS EXTRACTED FROM THE DRAFT EGOS-IP (V.10)

I. Cross-cutting actions

Action C1

Action: Set up an organizational framework for sustained operation of relevant research-based observing systems, once their validation has shown they are sufficiently mature enough and their cost-effectiveness has been assessed.
Who: All organizations operating component observing systems
Time-frame: Continuous
Performance indicator: Number of sustained systems

Action C2

Action: Ensure all operators producing observations are encouraged to adhere to the WIS standards[1];
Who: Organizations and agencies operating observing programmes
Time-frame: Continuous
Performance: Extent to which WIS standards are applied

Action C3

Action : Assess the impact of new observing systems (or changes to existing systems) through prior and ongoing consultation with data users and the wider user community.
Who: All organizations operating component observing systems
Time-Frame: Continuous
Performance Indicator: Extent to which user community concerns are captured.

Action C4

Action: Ensure sustained funding for the key marine/ocean observing systems (e.g. tropical moorings, Argo, surface drifters with barometers, as well as altimeter, scatterometer, microwave SST, sea ice measurements from ocean research satellite missions);
Who: NMSs, NMHSs and partner national institutions, in collaboration with international organizations, WMO Technical Commissions responsible for observing system coordination (e.g. JCOMM, CBS, and CIMO)
Time-scale: continuous
Performance Indicator: Percentage of observing networks funded through sustained mechanism.

Action C5

Action: For each relevant observing system, investigate the feasibility, cost-effectiveness and side effects on the continuity of climate data records of operating it in an adaptive mode, i.e. a process which would vary the observation set according to the meteorological situation.
Who: Organisations operating observing networks on a routine basis.
Time-frame: continuous reviewing process of the feasibility and cost-effectiveness assessments.
Performance indicator: Number of networks operated with some level of targeting.

Action C6

[1] See http://www.wmo.int/pages/prog/wis/

Action: Ensure time continuity and overlap of key components of the observing system and their data records, in accordance with user requirements, through appropriate change-management procedures.
Who: WMO commissions, JCOMM, regional associations, satellite agencies, NMSs and NMHSs, all organizations operating observing systems.
Time-frame: Continuous.
Performance indicator: Continuity and consistency of data records.

Action C7

Action: For new observing systems, including satellite systems, ensure continued adherence to WMO data sharing principles irrespective of origin of data, including data provided by commercial entities.
Who: WMO Members, space agencies.
Time-frame: Continuous.
Performance indicator: Continued availability of all essential observational data to all WMO members.

Action C8

Action: To evaluate the future evolution of data volumes to be exchanged and handled, based on the projected data volumes generated by the future satellite and terrestrial sources.
Who: WMO/WIS, WMO commissions, JCOMM, regional associations, satellite agencies, NMSs and NMHSs, all organizations operating observing systems.
Time-frame: Continuous.
Performance indicator: evolution of the data volumes handles and exchanged.

Action C9

Action: Ensure timely, efficient and quality-controlled flow of all essential data to processing centres and to users; ensure also timely flow of feedback to observing network management from monitoring centres.
Who: Data processing centres coordinated by appropriate technical commissions and international programmes.
Time-frame: continuous
Performance indicator: usual monitoring criteria[2]

Action C10

Action: Ensure a continuous monitoring of the radio frequencies which are needed for the different components of WIGOS, in order to make sure they are protected against other utilizations.
Who: WMO / SG-RFC in coordination with NMSs, NMHs and national organizations in charge of radio frequency management.
Time-frame: continuous
Performance indicator: observation frequency bands protected / not protected.

Action C11

Action: Establish capacity building strategies in developing countries. This may include establishing training programmes through engagement within the targeted country, e.g., data management, observing practices, and seasonal prediction. Use the regional climate centre concept to provide access to specialists who could conduct training and maintenance of more complex systems including AWS.
Who: NMSs/NMHSs with RA, CBS, CCl in collaboration with international programmes.
Time-frame: continuous

[2] Http://www.wmo.int/pages/prog/www/ois/monitor/introduction.html

Performance indicator: capacity building development in these countries.

II. Space related actions

Note: the EGOS-IP matches the structure of the Vision for the GOS in 2025. In general one action is identified for each item of the Vision. In some cases, however, if the plans are considered to satisfy the requirements with no need for a formal action, a statement is indicated in italic instead, as a place holder.

Action S1

Action: Maintain and develop the GSICS inter-comparisons and inter-calibrations between GEO and LEO sensors on an operational basis.
Who: GSICS.
Time-scale: continuous.
Performance indicators: quality of the calibrated satellite data as judged by the standard monitoring indicators.

Action S2

Action: Ensure continuity and overlap of key satellite sensors, keeping in mind both real-time processing and processing in delayed mode for consistency of climate records, re-analyses, research, recalibration or case studies.
Who: CGMS with WMO commissions, satellite agencies and satellite data processing centres.
Time-frame: Continuous.
Performance indicator: Continuity and consistency of data records.

Action S3

Action: Ensure and maintain a distribution of at least 6 operational geostationary satellites along the equator, separated by no more than 70° of longitude. Improve the spatial and temporal coverage with GEO satellites over the Pacific.
Who: CGMS with WMO commissions, satellite agencies and satellite data processing centres.
Time-frame: continuous.
Performance indicator: quality of the global coverage by the different instruments of operational geostationary satellites.

Action S4

Action: On each operational geostationary satellite, implement and maintain at least one visible / infra-red imager with at least 16 channels providing full disk coverage, with a temporal resolution of at least 15 minutes and a horizontal resolution of at least 2km (at sub-satellite point).
Who: CGMS with WMO commissions and satellite agencies.
Time-frame: Continuous.
Performance indicator: number of geostationary satellites equipped with high resolution imagers.

Action S5

Action: For each geostationary satellite, organize the scanning strategy and the processing of the imagery (together with other instruments or other sources of information) in order to produce AMV with at least a 1h frequency.
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous.

Performance indicator: number of geostationary satellites producing AMVs operationally.

Action S6

Action: All meteorological geostationary satellites should be equipped with hyper-spectral infra-red sensors for frequent temperature and humidity soundings, as well as tracer wind profiling with adequately high resolution (horizontal, vertical, time).
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous for the mission planning and preparation; 2015-2025 for making the instruments operational.
Performance indicator: number of geostationary satellites equipped with hyper-spectral sounders.

Action S7

Action: All meteorological geostationary satellites should be equipped with a lightning imager able to detect cloud-to-cloud and cloud-to-ground strokes.
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous for the mission planning and preparation; 2015-2025 for making the instruments operational.
Performance indicator: number of geostationary satellites equipped with a lightning imager.

Action S8

Action: Ensure the orbit coordination for all core meteorological missions in LEO orbit, in order to optimize temporal and spatial coverage, while maintaining some orbit redundancy. The LEO missions should include at least 3 operational sun-synchronous polar orbiting satellites with ECT equal to 13:30, 17:30 and 21:30.
Who: CGMS with WMO technical commissions and space agencies.
Time-scale: continuous.
Performance indicators: number and orbit distribution of contributing LEO satellite missions.

Action S9

Action: Improve timeliness of LEO satellite data, especially of the core meteorological missions on the three orbital planes, by developing communication and processing systems which achieve delivery in less than 30 minutes (as done with the RARS network for some data sets).
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous.
Performance indicator: timeliness of LEO satellite data, as judged by the usual monitoring scores.

Action S10

Action: Improve local access in real-time to LEO satellite data, especially to the core meteorological missions on the three orbital planes, by maintaining and developing direct read-out communication and processing systems.
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous.
Performance indicator: volumes of LEO satellite data accessible by direct read-out.

Action S11

Action: Design the ground segments for hyper-spectral infra-red sounders in order to define and implement a data reduction strategy which optimizes the information content accessible within the timeliness and cost constraints, whilst addressing the needs of different user communities.
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: volume and timeliness of the different data sets distributed to the users of hyper-spectral sounders.

Action S12

Action: Fill the gap in planned coverage of microwave sounders in the early morning orbit.
Who: CGMS with WMO commissions and satellite agencies.
Time-frame: Continuous.
Performance indicator: number of microwave sounders planned for satellites in early morning orbit.

Action S13

Action: Use the imagers of all operational polar orbiting platforms to produce AMVs from the tracking of clouds (or water vapour features)
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous.
Performance indicator: volume and timeliness of the different data sets produced operationally on the polar caps.

Action S14

Action: Implement a water vapour channel (e.g. 6.7 µm) on the imager of all core meteorological polar-orbiting satellites to facilitate the derivation of polar winds from water vapour motion.
Who: CGMS with WMO commissions, satellite agencies and data processing centres..
Time-frame: Continuous.
Performance indicator: number of core meteorological polar-orbiting satellites with a water vapour channel in its imager.

(No action recorded on scatterometer missions: At least two satellites flying on well-separated orbits with a scatterometer onboard are needed and should be maintained in the future. According to the present plans the requirements are expected to be met.)

Action S15

Action: Ensure and maintain a radio-occultation constellation of at least 8 GNSS receivers onboard 8 platforms on different orbits, and organize the real-time delivery to processing centres.
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: number of satellites providing GNSS signals in real-time.

Action S16

Action: Perform an Observing System Simulation Experiment (OSSE) to evaluate the impact of different numbers of platforms in a GNSS constellation, and to estimate the optimal number of platforms required.
Who: NWP centres, in coordination with CBS/ET-EGOS and CAS/THORPEX
Time-scale: Before 2013 (end of THORPEX)
Performance indicators: A number of OSSEs carried out.

Action S17

Action: Implement an altimeter constellation comprising a reference mission on high-precision, not sun-synchronous, inclined orbit, and two instruments on well separated sun-synchronous orbits.
Who: CGMS with WMO commissions, JCOMM, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: number and orbit geometry of satellites providing altimetry in real-time.

Action S18

Action: Ensure and maintain in operations at least one infra-red dual-angle view imager onboard a polar orbiting satellite in order to provide SST measurements of climate monitoring quality.
Who: CGMS with WMO commissions, JCOMM, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: operational availability of dual-angle view imagers.

(No action recorded on narrow-band VIS-IR imagers: The narrow-band imagers operated in the visible and near-infra-red are also useful for observing the vegetation (including the monitoring of burnt areas), the surface albedo, the aerosols and the clouds. This narrow-band mission is currently well covered by LEO satellites.)

(No action recorded on High-resolution multi-spectral visible / infra-red imagers: It is essential to continue this type of mission in the future on order to guarantee the continuity of the existing series. This is important for agrometeorology, hydrology, land use, careful monitoring of disasters (floods, fires) and the very high-resolution imagers will have several other specific utilizations.)

Action S19

Action: In support of GPM, implement at least one passive MW mission on a low-inclination orbit
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: availability of one passive MW satellite mission on a low-inclination orbit.

Action S20

Action: Organize the delivery of GPM data in real time to support nowcasting and operational hydrology requirements.
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: continuous.
Performance indicator: extent to which availability requirements for nowcasting and operational hydrology are met by the GPM mission.

Action S21

Action: Ensure the continuity of ERB type global measurements by maintaining operational broad-band radiometers and solar irradiance sensors on at least one LEO polar orbiting satellite.
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: number of polar orbiting satellites contributing to the ERB.

Action S22

Action: For atmospheric chemistry, monitoring of green-house gas and of air pollution, ensure the operational continuity of some ultra-violet / visible / near-infra-red sounders, including high spectral resolution ultra-violet sounders on GEO, and at least one ultra-violet sounder on 3 well-separated polar orbits. Ensure also the continuity of limb-sounding capability.
Who: CGMS with WMO commissions, satellite agencies and data processing centres.
Time-frame: Continuous.
Performance indicator: number of GEO and LEO ultra-violet / visible / infra-red sounders contributing to atmospheric chemistry.

(No action formally recorded on SAR: It is not feasible to obtain in real-time a global coverage of SAR data. In addition, the SAR processing delays are important, which often prevents a rapid delivery. However it is important to have at least one operational SAR satellite mission whose continuity is guaranteed, and integrated in the WIGOS, with proper mechanisms to ensure rapid delivery of data at the regional and local scales, in order to cope efficiently with high-risk phenomena and disaster management. Because of the local character of the SAR-targeted areas and of the high volume of data to process, it is actually desirable to have more than one satellite mission complying with these operational characteristics.)

Action S23:

Action: Use the experience of the ADM-AEOLUS demonstration mission to plan and design an operational observing system based on Doppler wind m easurements (providing a global coverage of wind profiles).
Who: CGMS with WMO commissions, ESA and other satellite agencies, data processing and NWP centres.
Time-frame: Shortly after the launch date of ADM-AEOLUS (2013) for initiating the data evaluation; from 2014 onwards for planning the operational phase.
Performance indicator: number of Doppler wind lidar profiles (made from space) available to the users.

Action S24

Action: Deliver cloud/aerosol lidar data produced from satellite missions to operational data processing centres and users. Use this experience to decide about a possible cloud/aerosol operational mission (integrated or not with an operational Doppler wind lidar mission).
Who: CGMS with WMO commissions, satellite agencies, data processing centres, forecasting and atmospheric chemistry users).
Time-frame: Continuous with a special effort phased with the EARTH-CARE mission.
Performance indicator: data volume produced by space-based cloud/aerosol lidars and used by operational applications.

Action S25

Action: Study the benefits brought by satellite demonstration missions like SMOS (missions based on low-frequency microwave radiometers) on atmospheric, hydrological and oceanic models, in a quasi operational context, and decide if a similar operational mission can be designed.
Who: CGMS with WMO commissions, JCOMM, satellite agencies, data processing centres, meteorological, hydrological and oceanic modelling centres.
Time-frame: As soon as possible for impact studies, from 2012 onwards to decide on new missions.
Performance indicator: improvement brought by using these microwave data on different models.

Action S26

Action: Plan and design a demonstration mission with microwave instruments onboard a geostationary satellite, aiming at a significant improvement in terms of real-time observation of clouds and precipitation.
Who: CGMS with WMO commissions, satellite agencies, data processing centres, meteorological and hydrological modelling centres.
Time-frame: As soon as possible, taking into account the maturity of technology.
Performance indicator: Success of a microwave instrument onboard a GEO satellite, then improvement brought by the data to meteorological and hydrological forecasting.

Action S27

Action: Plan and design a demonstration mission with high-resolution visible / near-infra-red instruments onboard a geostationary satellite, aiming at improving significantly the observation of ocean colour, vegetation, clouds and aerosols with multi-spectral narrow-band sensors.
Who: CGMS with WMO commissions, satellite agencies, data processing centres, meteorological, oceanic and environmental centres.
Time-frame: As soon as possible, taking into account the maturity of technology.
Performance indicator: Success of this type of instrument onboard a GEO satellite, then improvement brought by the data to meteorology, oceanography and environmental science.

Action S28

Action: Plan and design a demonstration mission with visible / infra-red instruments onboard a HEO satellite with a highly elliptical orbit and a high inclination over the equator, in order to target a polar area). The aim is to obtain the same environmental observations with a quality similar to those obtained from GEO satellites.
Who: CGMS with WMO commissions, satellite agencies, data processing centres, meteorological and environmental centres.
Time-frame: As soon as possible, taking into account the maturity of technology.
Performance indicator: success of a visible / infra-red instrument onboard a HEO satellite, then improvement brought by the data to meteorology and environmental science.