

THE SPACE-BASED GLOBAL OBSERVING SYSTEM IN 2008 (GOS-2008)

This document continues the series submitted by WMO at yearly intervals, aiming at reviewing the status of satellite programmes and analyzing particular aspects. It introduces a dossier on the space-based component of the Global Observing System (GOS) comprising an introduction and four volumes:

Volume I, “Satellite Programme Description”, gathers information on satellite programmes from operational and R&D agencies. The number of space agencies and the nature of the programmes considered have been greatly extended in respect of previous issues.

Volume II, “Earth observation satellites and their instruments”, gathers instrument descriptive tables for instruments that are currently operating, or close to be operating, or at an advanced stage of their approval process. It has also been greatly extended.

Volume III, “Gap analysis in the space-based component of GOS”, is based on the current schedule of current and planned programmes up to year 2025, and contains a gap analysis with respect to user requirements, taking into account the suitability of the technological level of current or planned instruments to meet these requirements. It is an update and expansion of a similar document presented to CGMS-35. The analysis is complemented by recommendations.

Volume IV, “Estimated performance of products from typical satellite instruments”, is entirely new material. For 98 user required geophysical parameters, it evaluates the data quality potentially achievable by those instruments in a typology of 29 instrument categories that are relevant for observing the parameters.

This dossier is provided in electronic form with hyperlinks enabling navigation across the four volumes, provided that the volumes are saved in the same folder. It is expected to be a useful reference for planning purpose and for a number of other exercises. Its regular updating requires cooperation of CGMS members.

Action/recommendation proposed

- 1) CGMS-36 is invited to note the dossier on the space-based GOS and comment on its usefulness and applicability.
- 2) Proposed permanent action: CGMS to review at intervals the dossier on the space-based GOS and submit any updates to the WMO Space Programme at any relevant occasion and at the latest before each CGMS future session.

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INTRODUCTION

1 BACKGROUND

This dossier on the space-based component of the GOS, hereafter referred to as the “Dossier”, is an evolution of the document “Status of the Space-based Component of GOS”, that was first issued at CGMS-32 (Sochi, 17-20 May 2004) (WMO WP-26). It included only meteorological satellites in GEO and LEO, and a short gap analysis limited to the current situation (2004) and two years ahead (2006).

The second issuance was presented to CGMS-33 (Tokyo, 1-4 November 2005) (WMO WP-23). A number of R&D programmes were then included. The short gap analysis was still limited to meteorological satellites, considering the current situation (2005) and two years ahead (2007).

The third issuance was presented to CGMS-34 (Shanghai, 2-7 November 2006) (WMO WP-25). The number of R&D programmes was extended. The gap analysis was still limited to meteorological satellites, considering the current situation (2006) and two years ahead (2008).

The fourth issuance, presented to CGMS-35 (Cocoa Beach, 2-7 November 2006) (WMO WP-05) was entirely focused on gap analysis. Both operational meteorological and R&D programmes were merged. Gap analysis was structured by “missions” and covered from current (2007) to 2020.

Each of these documents included annexes with tables of instrument descriptions (157 instruments in 2007). These annexes are now grouped in a stand-alone volume entitled “Earth observation satellites and their instruments” which now contains 215 instrument tables related to 195 different programmes. The present Dossier is significantly expanded with respect to previous versions because additional programmes have been considered, mainly in the R&D category, as well as a number of missions run on a commercial basis.

In the present issue of the Dossier (GOS-2008) information has been split into four volumes connected by hyperlinks. Three of these volumes are updates of previous contents (programmes, instruments and gap analysis). The fourth one is entirely new and deals with estimates of the quality of the products that could potentially be retrieved from typical instruments thought to be feasible in the post-2020 timeframe.

2 PRESENTATION OF THE DOSSIER

2.1 The document package

The Dossier includes this introduction followed by four volumes:

Volume I, Satellite Programme Description (*file: “Programmes”*) describes programmes and satellites. It is now considerably extended in respect of previous versions, since more space agencies are now potentially contributing to the GOS.

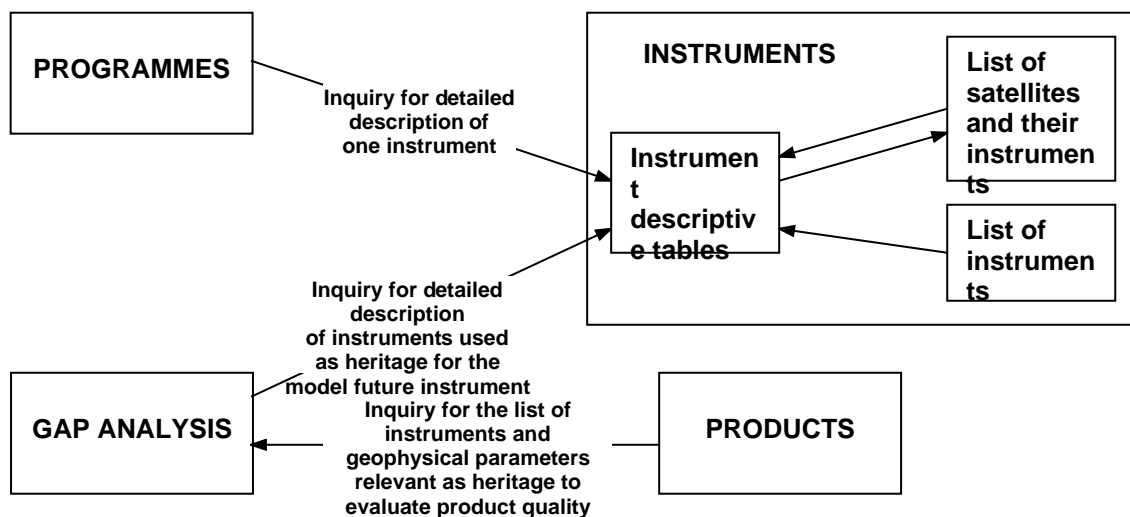
Volume II - Earth observation satellites and their instruments (*file: “Instruments”*) gathers the descriptive tables of the instruments (215 in total) referred to in the other documents.

Volume III - Gap analysis in the space-based component of GOS (*file: “GapAnalysis”*) contains the gap analysis, from current time (2008) to post-2020. It is extended in respect of the previous version since more programmes (especially R&D or commercial) have been considered.

Volume IV - Estimated performance of products from typical satellite instruments (*file: “Products”*) is a new undertaking. It provides estimates of products quality as a function of the performance of typical instruments utilized to generate the product.

2.2 Hyperlinks

The four volumes are provided in electronic form as four files contained in a single zipped folder. The files are connected by hyperlinks. The following figure shows the hyperlinks and in which direction they flow. It is noted that the file “Instruments” contains internal hyperlinks. Details on the use of the hyperlinks are recorded in the individual volumes.



In order to maintain the capability to navigate with hyperlinks among the volumes, the following instructions should be followed when unzipping the files:

The four files shall be extracted all at once (Use “Extract all files” command)

The four files shall be saved in a single folder. This folder can be named for instance “**GOS-2008**” and can be given a date or version number.

Never change the name of a file itself, otherwise, the hyperlinks from or to that file would be lost. Only internal hyperlinks would still work.

When working with hyperlinks between two files, it is recommended to keep both files open: in this case the link will be immediate, otherwise it will be slow.

3 INFORMATION SOURCES

3.1 Programmes, satellites and instruments

The main information source for satellite programmes consists of the reports made available at the various CGMS sessions, at the Consultative Meetings on High-level Policy on Satellite Matters (CM) and at other WMO meetings in which space agencies are represented. In addition, there are occasional communications from space agencies to the WMO Space Programme office (e.g., when a new satellite is launched). (See <http://cgms.wmo.int> and select "Latest satellite status".)

The present issue has also exploited the provisional outcome of the joint WMO-CEOS survey that was undertaken in 2008 for the CEOS Earth Observation Handbook and the CEOS-WMO Database. This has enabled to extend the range of considered programmes beyond the traditional scope of CGMS (meteorology, oceanography, climate monitoring) to the wider range of programmes considered by CEOS (including environment and land observation).

For instrument descriptions, it has been often necessary to access the web site of the responsible agency or instrument management group. In most cases, the information was collected or complemented by direct contact with specific experts in the agencies or groups. In spite of the huge effort, the information on instruments still contains many gaps.

3.2 User requirements

The review of observational user requirements is not part of this Dossier. However, consideration of user requirements is underlying documents "Gap analysis" and "Products" in the sense that:

It has determined the list of geophysical parameters to be addressed (98 were finally selected);

It has enabled defining representative characteristics of "model" instruments potentially suitable to address these requirement by means of limited-scale processing (29 model instruments were finally defined).

The traceability from user requirements to model instrument is rather loose as:

User requirements depend on specific applications; but in an integrated approach, a blend must be adopted;

The model instrument is also constrained by the heritage of current and planned instruments, and the technological level reasonably expectable for year 2020;

The product quality depends on the retrieval scheme, which within limits can enhance one required feature at the expense of another.

This analysis is nevertheless expected to reflect the main requirements of a number of applications including, but not limited to, the application areas of WMO programmes and co-sponsored programmes such as weather forecasting (global and regional NWP, nowcasting, synoptic meteorology), climate monitoring (GCOS, and seasonal and interannual forecasting), applied meteorology (to agriculture and aeronautics), ocean applications, hydrology and atmospheric chemistry.

A major source of information on user requirements has been the EUMETSAT process for defining the missions of the satellites that will replace the current Meteosat Second Generation and MetOp (i.e. MTG and post-EPS). That process, that is the most recent and

includes consideration of previous similar efforts such as the NPOESS end-user requirement process and the GOES Users' Conference, span through applications to numerical weather prediction, nowcasting, cloud/precipitation and large-scale land surface imaging, ocean and ice, atmospheric chemistry and, transversal to all these, climate monitoring. WMO/CEOS requirements as tabled at <http://www.wmo.int/pages/sat/Databases.html#UserRequirements> have been taken into account in so far as they were in the background of the MTG, post-EPS, NPOESS and GOES - next requirements definition process.

The definition of "model instruments" potentially suitable to fulfil user requirements is the basis for gap analysis and products quality evaluation. Gap analysis implies consideration of both the satellite programme schedule and the suitability of the instrumentation to be flown. The evaluation of the potential product quality is, of course, a function of the performance of the adopted model instrument.

4 APPLICATIONS OF THE DOSSIER

The Dossier is both a record of factual information (the "Programmes" and the "Instruments" documents) and a tool for performing a number of exercises, among them the gap analysis and the estimation of product performances that are already part of the Dossier.

The gap analysis document highlights the needs for satellite programme continuation or implementation, and defines instrument models to be pursued. For each mission, recommendations are provided in respect of observing coverage and data quality.

The products document, although of speculative nature to a certain degree, is one possible input towards the formulation of realistic user requirements for future observing systems, or to appreciate to which extent technology-free user requirements can be approached by future instruments.

The Dossier does not address the compliance of the performance of future potential instruments with user requirements, since it would depend on each specific application or user community, and since the degree of compliance that can be accepted depends on possible alternatives and priorities, proper to any user.

5 CONCLUDING RECOMMENDATION

This Dossier represents a considerable effort and requires maintenance. The following is proposed as a CGMS permanent action:

CGMS Satellite Operators to regularly review the Dossier and submit any updates to the WMO Space Programme Office at any relevant occasion and at the latest before each CGMS future session.