UPDATE ON THE WMO DOSSIER ON THE SPACE-BASED GLOBAL OBSERVING SYSTEM

CGMS-39 WMO-WP-16, Agenda item H.2

WMO Space Programme

The GOS-Dossier

- **Was conceived in support of CGMS (first issue at CGMS-32 in Sochi, 2004).**
- **Updated at least once a year**
  - **3 times/year in the recent past.**
- **Current version (GOS-2011-September) available on the *"Information Resources"* page of the Space Programme web site: www.wmo.int/sat**

Structure of the Dossier

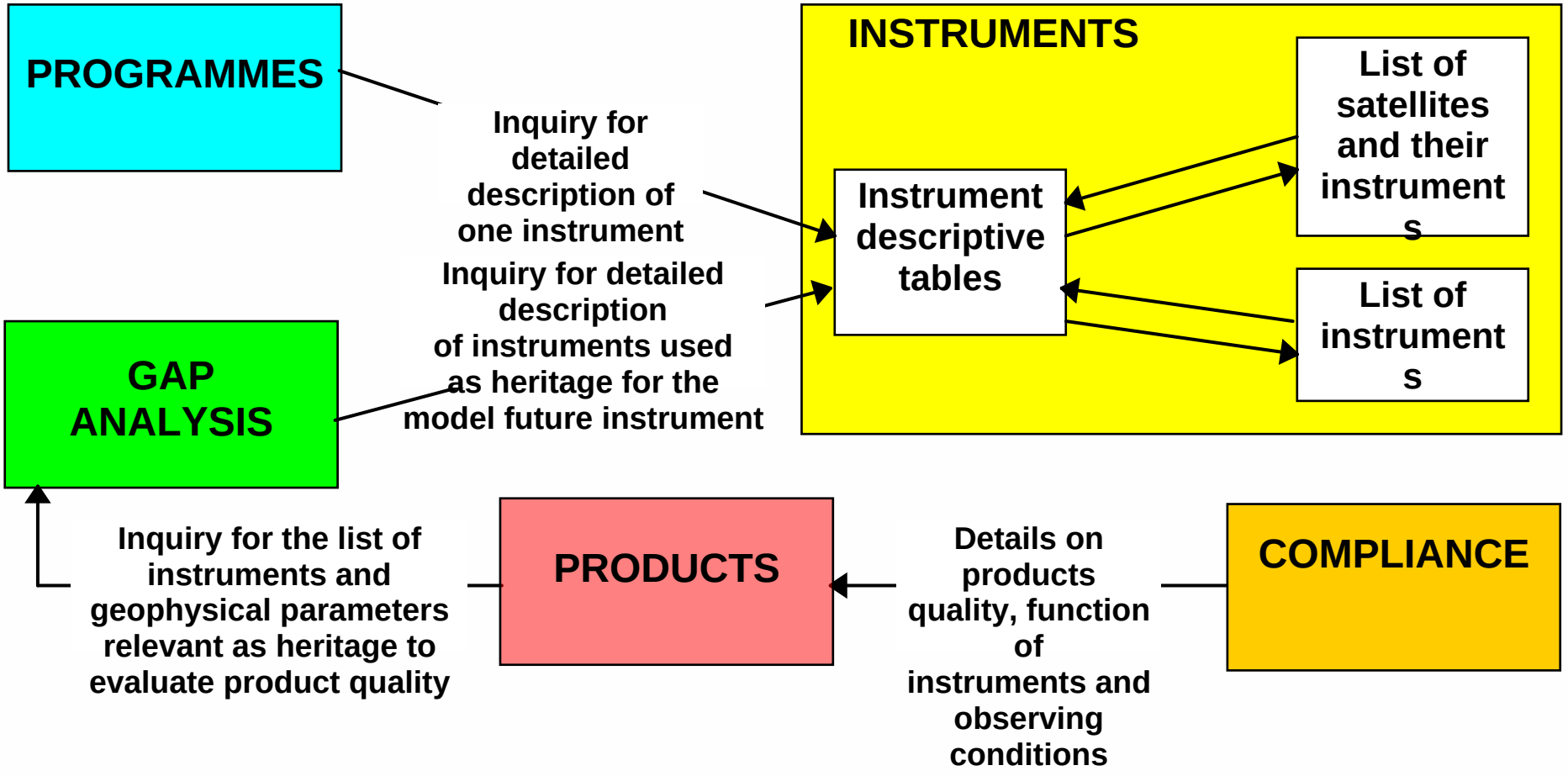
- Introduction
- Vol. 1 - Satellite Programme Description.
- Vol. 2 - Earth observation satellites and their instruments.
- Vol. 3 - Gap analysis in the space-based component of GOS.
- Vol. 4 - Estimated performance of products from typical satellite instruments.
- Vol. 5 - Compliance analysis of potential product performances with user requirements.

The volumes are connected by hyperlinks.

All files (.doc and .xls) are provided in a compressed (.zip) folder.

- must be extracted all together in a single folder
- file names should never be changed.

HYPERLINKS BETWEEN THE FIVE VOLUMES



New structure of Vol. 1 (Satellite programmes)

With GOS-2011-September, Vol. 1 (Programmes) has a new structure, by application programmes, as follows:

- **Operational meteorological satellites: Satellite constellation in geostationary orbits, Satellite constellation in sunsynchronous orbits.**
- **Specialized atmospheric missions: for Precipitation, Radio occultation, Atmospheric radiation, Atmospheric chemistry, Atmospheric dynamics.**
- **Missions to ocean and ice: for Ocean topography, Ocean colour, Sea surface wind, Sea surface salinity, Waves, Ocean ice.**
- **Land observation missions: Main operational or near operational missions, Disaster Monitoring Constellation, All-weather high resolution monitoring (by SAR).**
- **Missions to Solid Earth: Space geodesy, Earth's interior.**
- **Missions to Space Weather: Solar activity monitoring, Observation of the magnetosphere, Observation of the ionosphere, Space environment observation from operational meteorological satellites.**

Updates of Vol. 2 (Instruments)

There are now 413 instrument tables (266 in GOS-2010-October) from 268 satellites (221 in GOS-2010-October).

Reasons:

- Detailing certain instrument packages for Land observation at individual instrument level.
- Explicit description of instruments for Solid Earth (previously mentioned collectively).
- Higher number of missions to Space Weather, detailed at individual instrument level.
- The degree of completeness of the information recorded in the various instrument tables has significantly improved, but there are several residual gaps - <u>ACTION NEEDED</u>

Updates of Vol. 3 (Gap analysis)

- There are now 33 missions assessed through the Gap analysis
  - "Solid Earth and Space Weather" now broken down into 4 distinct missions
- The number of instruments considered for the various missions is much higher, particularly for Land observation, Solid Earth and Space Weather
- The granularity of instrument performances to qualify how much an instrument contributes to a mission has been refined
- The summary analysis concluding each mission has been streamlined, to better emphasize the future "factual" situation in respect of the "expert" recommendations. Expected gaps and risk areas are

Updates of Vol. 4 (Products)

- Names and definitions of the variables have been aligned as far as practical with the updated typology of variables of the WMO Observing Requirements Database (http://www.wmo-sat.info/db/).
- Their current number is 112.
- The review of the possible sensing principles for each variable has been updated
- The evaluation of the potential performance of the various techniques available for observing a geophysical variable has been iterated
- In the case of vertical profiles, the layers have been reduced to troposphere and stratosphere, plus total column when applicable, to more easily capture the main features of satellite-derived product quality
- In the case of Space Weather, the identification of the observable variables and the estimated product quality are

Updates of Vol. 5 (Compliance)

- Vol. 5 is *a* ***tool for compliance analysis*** enabling to compare satellite product performances with user requirements
- In support of the Rolling Requirement Review process aimed at providing guidance to space agencies about desirable developments, and to users about realistic expectations.
- The tool is validated by means of “synthetic” user requirements interpolated or extrapolated from a wide number of sources
- The “synthetic” requirements are compared with calculated performances of relevant observing techniques (derived from Vol. 4) for each of the 112 addressed

Example of compliance analysis

Wind (horizontal) Compliance analysis

KEY APPLICATIO	LAYER	REQUIREMENTS																OBSERVING TECHNIQUE		PERFORMANCES				OBSERVING CONDITIONS	
		Uncertainty (RMS				x (km)			z (km)			t (h)			(h)			Orbit	Principle of	Accurac	x	z	t	Assumed	Limitations or
		Unit	thres	break	goal	thres	break	goal	thres	break	goal	thres	break	goal	thres	break	goal	type	the instrument	(RMS)	(km)	(km)	(h)	no. of sat	special features
NWP (large-scale)	Troposphere	m/s	5	3	1	300	50	10	3	1	0.3	24	3	1	6	0.5	0.1	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	5	3	1	300	50	10	3	1	0.3	24	3	1	6	0.5	0.1	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regi
		m/s	5	3	1	300	50	10	3	1	0.3	24	3	1	6	0.5	0.1	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	5	3	1	300	50	10	3	1	0.3	24	3	1	6	0.5	0.1	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	5	3	1	300	50	10	3	1	0.3	24	3	1	6	0.5	0.1	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air
	Stratosphere	m/s	10	3	1	1000	100	20	10	3	1	48	12	3	6	0.5	0.1	LEO	Doppler lidar (non-scanning)	4 m/s	50	2	180	1	Non-scanning
		m/s	10	3	1	1000	100	20	10	3	1	48	12	3	6	0.5	0.1	LEO	Doppler shift (limb mode)	5 m/s	300	2	72	1	Daylight
NWP (small-scale)	Troposphere	m/s	5	2	1	30	5	1	1	0.3	0.1	6	1	0.25	3	0.5	0.1	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	5	2	1	30	5	1	1	0.3	0.1	6	1	0.25	3	0.5	0.1	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regi
		m/s	5	2	1	30	5	1	1	0.3	0.1	6	1	0.25	3	0.5	0.1	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	5	2	1	30	5	1	1	0.3	0.1	6	1	0.25	3	0.5	0.1	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	5	2	1	30	5	1	1	0.3	0.1	6	1	0.25	3	0.5	0.1	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air
Actual weather	Troposphere	m/s	5	2	1	300	30	3	3	1	0.3	6	1	0.25	1	0.25	0.1	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	5	2	1	300	30	3	3	1	0.3	6	1	0.25	1	0.25	0.1	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regio
		m/s	5	2	1	300	30	3	3	1	0.3	6	1	0.25	1	0.25	0.1	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	5	2	1	300	30	3	3	1	0.3	6	1	0.25	1	0.25	0.1	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	5	2	1	300	30	3	3	1	0.3	6	1	0.25	1	0.25	0.1	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air
Climate (large-scale)	Troposphere	m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regi
		m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air
	Stratosphere	m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	LEO	Doppler lidar (non-scanning)	4 m/s	50	2	180	1	Non-scanning
		m/s	5	3	1	500	100	20	3	1	0.3	24	3	1	168	72	24	LEO	Doppler shift (limb mode)	5 m/s	300	2	72	1	Daylight
Climate (small-scale)	Troposphere	m/s	5	3	1	100	20	5	1	0.3	0.1	12	3	1	168	72	24	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	5	3	1	100	20	5	1	0.3	0.1	12	3	1	168	72	24	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regi
		m/s	5	3	1	100	20	5	1	0.3	0.1	12	3	1	168	72	24	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	5	3	1	100	20	5	1	0.3	0.1	12	3	1	168	72	24	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	5	3	1	100	20	5	1	0.3	0.1	12	3	1	168	72	24	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air
Biosphere (large-scale)	Troposphere	m/s	10	5	2	500	100	20	6	3	1	168	72	24	720	168	24	LEO	Doppler lidar (non-scanning)	1 m/s	50	0.5	180	1	Clear-air
		m/s	10	5	2	500	100	20	6	3	1	168	72	24	720	168	24	LEO	VIS/IR image sequences	5 m/s	15	6	4	3	Need for tracers, polar regi
		m/s	10	5	2	500	100	20	6	3	1	168	72	24	720	168	24	GEO	VIS/IR image sequences	3 m/s	50	6	1	6	Need for tracers
		m/s	10	5	2	500	100	20	6	3	1	168	72	24	720	168	24	LEO	IR image sounder	3 m/s	160	2	4	3	Clear-air, polar regions
		m/s	10	5	2	500	100	20	6	3	1	168	72	24	720	168	24	GEO	IR image sounder	2 m/s	160	2	1	6	Clear-air

The analysis is performed on Excel worksheets. By introducing an "actual" user requirement the colours showing the degree of compliance automatically adjust. The same if the potential satellite performance is replaced by a "validated" set.

Conclusion

The GOS Dossier is available on line and is updated at least once a year

The next update will be dated January 2012.

<u>Maintenance</u>

- **Over time, the GOS Dossier has continuously grown in size and degree of complexity. Its maintenance is a challenge.**
- **In order to ensure consistency throughout the volumes, most of the numerical information contained in the Dossier is in the process of being stored in a Database. The next issue will be generated to a large extent by information imported from the Database at least as concerns Vol. 1, Vol. 2 and Vol. 3.**

<u>Proposed Action</u>

- **CGMS Satellite Operators are invited to note GOS-2011-September and to forward to WMO any update or missing information concerning their programmes for inclusion in GOS-2012-January.**