GAP ANALYSIS FOR SATELLITE MISSIONS SUPPORTING THE GOS

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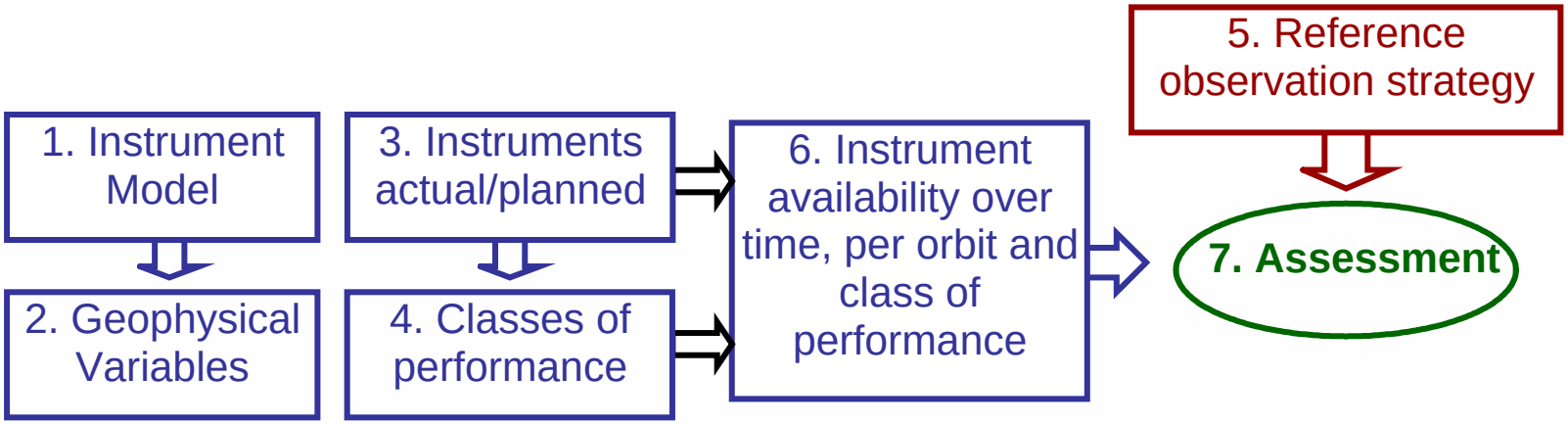
Gap Analysis

- Vol. 3 of the GOS-Dossier includes a general Gap Analysis of satellite programmes for the period 2008-2025.
  - For each mission, gaps are measured with reference to a "Reference Observation Strategy"

- The approach has been extended to map satellite data availability for the purpose of the GCOS ECV's (covered period: 1975-2025).

Gap Analysis (schematic)



For details, see the Dossier on *"Information Resources"* page of : www.wmo.int/sat

Example of steps 4, 5 and 7 (from Vol. 3)

Comparison of instrument performances	
MIS, WindSat	Passive MW, polarimetric, conical scanning
AMI-SCAT	Single-side viewing, C-band
SCAT (OceanSat-2, HY-2A, Meteor-M N3), SeaWinds	Two beams, conical scanning, Ku-band
ASCAT, SCA	Double-side swath, C-band
WindRAD	C- and Ku-bands

Instrument	Satellite	ECT/incl.	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
MIS	DWSS-1	05:30 d											X	X	X	X	X	X		
MIS	DWSS-2	05:30 d															X	X	X	X
SeaWinds	QuikSCAT	06:00 d	X	X																
SCAT	HY-2A	06:00 d				X	X	X	X	X	X									
WindSat	Coriolis	06:00 d	X	X	X	X														
ASCAT	MetOp-A	09:30 d	X	X	X	X	X													
ASCAT	MetOp-B	09:30 d					X	X	X	X	X	X								
ASCAT	MetOp-C	09:30 d									X	X	X	X	X	X				
SCA	EPS-SG-B1	09:30 d														X	X	X	X	X
SCAT	Meteor-M N3	TBD							X	X	X	X	X	X						
WindRAD	FY-3E	10:00 d										X	X	X	X					
WindRAD	FY-3G	10:00 d														X	X	X	X	
AMI-SCAT	ERS-2	10:30 d	X	X	X	X														
SCAT	OceanSat-2	12:00 d		X	X	X	X	X	X											
SCAT	OceanSat-3	12:00 d					X	X	X	X	X	X								

Gap analysis for the mission "Sea-surface wind by active and passive MW" after 2020	
05:30 2 h	The DWSS MIS will provide wind information, subject to confirmation of near-real time data availability by the USA, but is not expected to be accurate for low-intensity wind. The HY-2 SCAT is not known to be planned for long-term continuity, and near-real time data availability is still to be confirmed by China.
09:30 2 h	Adequate data are expected to be provided by the EPS-SG SCA, the likely follow-on of the FY-3 WindRAD and the Meteor-M N3 SCAT.
13:30 2 h	Adequate data would be provided by the OceanSat SCAT if long-term continuity is confirmed.
Overall	Due to the limited swath of radar scatterometers and conical-scanning MW radiometers, the 3-hour observing cycle would require 8 regularly spaced satellites. The temporal gap could be mitigated by blending the data from radar scatterometers and MW polarimeters with other (without full polarization) passive MW radiometers providing incomplete information (missing the direction).

Main conclusions extracted from Vol.3

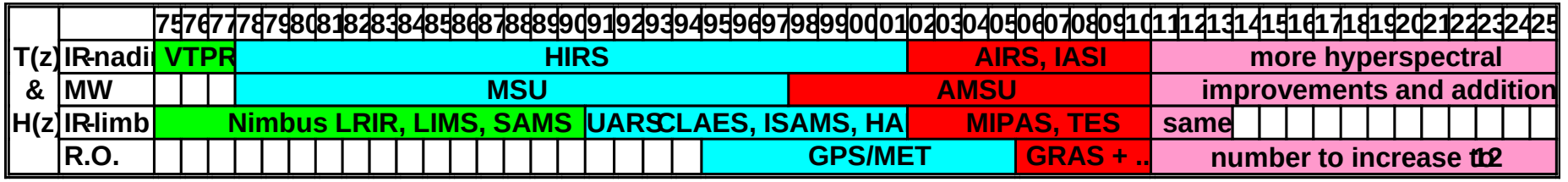
33 missions are analysed. The main gaps are:

- IR sounding in the early morning – No sounder in early morning orbit
  2 temporal gaps of 8 hours each : from 01:30 to 09:30 and 13:30 to 21:30.
- Hyperspectral IR sounding from geostationary orbit - About one half of the total GEO coverage will have no sounder : no temperature/humidity profiles nor wind profile from frequent humidity profiling.
- Global Precipitation Measurement mission - Long-term commitment for the GPM is missing, particularly for the precipitation radar
- Radio occultation sounding - The replacement strategy of satellites flying in constellations must be solidly established.
  - For example, COSMIC's capabilities are decreasing, and COSMIC-2 still is in the consideration stage
- Earth radiation budget - Long-term commitment is missing for ERB measurement in the afternoon orbit

Methodology for ECV Gap analysis

Step 1: Each ECV is split into a set of observations of elementary variables, and those that can be provided by satellites are identified.

Step 2: The gap analysis is applied to the satellite observations relevant to the ECV. For current and future activities (2008-2025) the gap analysis is rather detailed, extracted from Vol. 3 of the Dossier. For past periods, the information is extracted from the historical parts of Vol. 1 (Programmes).



Step 3: The gap analysis is performed for both the historical records (period 1975-2010) and for the current and future timeframe (2011-2025). Separate analysis is performed for the troposphere / low stratosphere, and the medium-high stratosphere and mesosphere (ECVs require profiles up to 80 km).

For much higher detail, see:
http://www.wmo.int/pages/prog/sat/meetings/documents/ET-SAT-6_Doc_06-04_ECVGapAnalysis.zip

Main conclusions of ECV Gap analysis

Coverage

- Satellite observations can support 40 ECVs out of the 60 currently defined. For other 16 ECVs there is little hope of any support from satellites; for the remaining 4 the current definition is too general, not allowing quantitative evaluation.

Many gaps are common with previous analysis (Dossier Vol. 3), e.g.:

- **Precipitation** (depending on the GPM follow-on)
- **Earth radiation budget** (not committed for long-term in p.m.).

Additional, major systematic gaps:

- limb sounding missions: after the termination of the current ones, lack of vertical resolution in the measurement of **ozone and other trace gases** in the middle and high stratosphere;
- lidar and L-band radiometer missions: causing gaps on **clear-air wind profile** by Doppler lidar, **ocean salinity** and **soil moisture in the roots region**.

Conclusion

- The Gap analysis of Vol. 3 is a systematic part of the GOS Dossier, reviewed and regularly reported to CGMS.
- The ECV Gap analysis was performed as a *una-tantum* exercise, and its possible follow-on is left to specialised scientific groups.
  - the ECV Gap analysis only refers to the availability of satellite observations,
  - does not imply that the product has been or will be effectively retrieved and archived. Thus, the identified contribution is only potential.

- Proposed Action
  - CGMS Satellite Operators are invited to note the results of the gap analysis of satellite data for the GOS, and more specifically for climate monitoring, and to consider actions to address these anticipated or potential gaps.