



World Meteorological Organization

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Best Practices for Achieving User Readiness for New Meteorological Satellites

CGMS-44-WMO-WP-02

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Introduction

To support and guide satellite operators and users in their respective preparation activities, a Reference User Readiness Project has been developed

The Project provides a typical breakdown of user readiness activities and a timeline of deliverables from satellite operators to support user readiness

Covers activities performed both by User Organisations and by Satellite Operators

The first version of the Reference User Readiness Project was presented to CGMS-43 in 2015



Introduction

Following CGMS-43 the document has been revised:

- Review by members of the WMO Inter-programme Expert Team on Satellite Utilisation and Products

- Comments from CGMS members

- Checklist for pre-launch instrument characterisation included, as provided by GSICS and CEOS CAL-VAL WG experts.

Revised document now presented to CGMS-44 for endorsement as CGMS Best Practices for User Readiness

Note: The CGMS Best Practices only apply to the responsibilities and deliverables of the satellite operators, but the document contains an integrated view of these together with activities performed by user organisations.



User Readiness Activities

Budgeting and planning

Protect investment made into existing operational programmes
Understand early where additional investments are necessary or unavoidable

Research and Development

Development of NWP data assimilation methods using the new generation satellite data
Development of new or specially tailored products for specific application areas

Data handling development and testing

Design and procurement of reception systems
Upgrades to terrestrial network access (Internet and RMDCN)
Internal networks and IT capacity for archiving, visualization, monitoring and processing



User Readiness Activities

Data processing development and testing

Processing of direct broadcast data into L0 and L1 products
Data monitoring and NWP assimilation
Generation of higher-level products for specific applications
Integration into the operational user environment, i.e. visualization (with radar and other observations and model outputs) for forecasters.

Training and Capacity Building

Equipment operation and maintenance
Utilization and interpretation of L1 data and L2 products
Use of software tools (for processing, analysis, and assimilation)
Capacity Building projects with NMHSs of lesser capabilities

Contributions to Calibration/Validation

Participation of NWP centres in instrument Cal/Val activities have become standard practice both for LEO and GEO satellites.
Monitoring of first-guess minus observation (FG-OBS) departures for L1 products are an important contribution to the Cal/Val activities of satellite operators.



Deliverables to Users

Instrument characterization

Spectral Response Functions and other aspects of instrument performance as measured during on ground instrument testing. Concise checklist has been developed by experts from GSICS and CEOS CAL-VAL WG

Product specifications

Scientific specifications of the product algorithms
Detailed specification of formats for dissemination as well as on-demand requests
Information on timeliness and expected data volumes, all for both L1 and L2 products.

Data access mechanism specifications

Both Direct Broadcast and DVB-based dissemination.
Direct Broadcast reception systems (antennas, front-end and computers) are long-lead items and specs are needed 3 years before launch.
The processing systems requirements are becoming increasingly demanding with the complex DB processing for the new generation of satellites; the impact on users systems is significant.

Software tools and test data

L1 pre-processing software for Direct Broadcast data
Synthetic data: No scientific value. Used for user dataflow testing
Simulated data: Data simulated by forward Radiative Transfer Model (RTM) calculations.
Proxy data: Data sets from relevant precursors
Pre-operational data



Deliverables to Users

Operations plans and schedules

Long-term fly-out plan for overall satellite programme,
Routine operations schedule, including areas of scanning,
planning for spacecraft activities, manoeuvres, seasonal yaw-flip,
decontamination
Schedules for activation of LEO direct broadcast where applicable
Schedules for routine dissemination

User Notification and Feedback

2-way communications channels, information, user enquiries and feedback (Early!)
Use of regional user fora (e.g. Group on Satellite Data Requirements for Region III and IV; RAIDEG), Users Conferences and training events (such as the GOES-R Event Week or AOMSUC)

Training resources

For new satellite systems the provision of training material from satellite operators is crucial.
The WMO-CGMS VLab plays a key role in developing and delivering online training material to users worldwide in several languages.



Time relative to Launch Date ("L")	Satellite System Development: Activities and Milestones	User Readiness Project: Activities and Milestones	Needed Deliverables from Satellite Operators
L-5y (years) -> L-4y	Ground Segment Development Phase C	Initiation of user (e.g., NMHS) readiness project. Initiation of cooperative projects addressing needs of less developed WMO members.	Overall specifications of user segment, including high-level definition of migration path from existing user segment. Preliminary schedule for deliverables to users
L-4y -> L-3y	System Critical Design Review	Identification of drivers for investment and running cost. Planning and allocation of human resources and budgets for investments and running costs. Establishment of prioritized data requirements, as clear priorities for current and future products allow the best preparations to be made for establishing data access and delivery capabilities. Initial training on capabilities for trainers and decision makers.	General description of instruments General description of NRT dissemination mechanisms. Detailed specifications of L2 and L1 products to be available at start of operations (Day-1 products). Proxy test data. Plans for evolution of products after start of operations (Day-2 products).
L-3y -> L-2y	System Production On-ground characterization of instruments	Design of new reception system. Design of communications network changes, including GTS/RMDCN capacity. Design of new data handling and processing functions. Training on specific application areas, based on proxy data.	Specifications of instruments and their performance, including planned SRFs, noise, FOV size. Simulated test data Detailed specifications of NRT dissemination mechanisms. Detailed specifications of Direct Broadcast (DB), including frequency and signal characteristics and hardware specifications for antennas, front-end components and computer systems for acquisition and processing of DB data. General description of offline data access. Data/product volume estimates. Data/product format definitions. Fundamental constants used in processing Data access conditions (e.g. licensing, key units, etc.). L1 pre-processing software for DB (preliminary version) Establish and use two-way communication channels for user enquiries
L-2y -> L-1y	Ground System acceptance	Procurement, installation and acceptance testing of systems. Software design for data processing, including NWP ingest.	Information on radiative transfer models (e.g., RTTOV) that support instruments Synthetic test data (including L1B data format details, Sat ID, navigation information) Continuous periods test dissemination of synthetic test data. Long-term operations plan. Planning for data exchange to serve global community.



Time relative to Launch Date (“L”)	Satellite System Development: Activities and Milestones	User Readiness Project: Activities and Milestones	Needed Deliverables from Satellite Operators
L-1y -> L-6m	Flight readiness of satellite	End-user training (forecasters)	Full pre-launch instrument characterization information (including SRFs, noise) Start of regular updating of plans for launch and commissioning.
L-6m -> L	Operational System Validation and Launch preparations	Data processing software testing (using proxy data). Technical training on reception systems and other system elements. Data acquisition system testing (using synthetic data).	Simulated test data based on pre-launch instrument characterization. L2 data format Direct Broadcast software package (if DB available) User documentation for dissemination mechanisms and delivered software tools. Routine operations schedule.
L->L+6m	Satellite In-orbit verification Commissioning of L1 products	Full system and software testing (using pre-operational data). Support to operators CAL/VAL activities, in particular through NWP assimilation.	Early dissemination of un-validated L1 data. Early switch-on of Direct Broadcast Pre-operational L1 data dissemination. In flight characterization of instrument performance. L1 pre-processing software for DB (operational version) Start of routine User Support
L+6m->L+2y	Commissioning of L2 products	Scientific data exploitation (iterative based on increased understanding of real data). Post-launch training based on real data. Declaration of user operational readiness	Operational L1 data dissemination, from both old and new satellites (as long as possible, but minimum until L+1y).



To be considered by CGMS



WG-IV to recommend to plenary to endorse CGMS-44-WMO-WP-02 as CGMS Best Practices for User Readiness

CGMS members to contribute to the implementation of the Best Practices for satellite systems under development, both GEO and LEO

CGMS members to continue the provision of up-to-date User Readiness information in the SATURN portal

CGMS to note that the document also applies to the activities of User Organisations and will therefore also be presented to WMO Commission for Basic Systems (CBS) for endorsement





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Thank you for your attention

www.wmo-sat.info/satellite-user-readiness/