

DEVELOPMENT OF A WMO POSITION ON CRITICAL SATELLITE DATA

In response to CGMS action A45.09

HLPP reference: 1.1

The fourth session of the Inter-Programme Expert Team on Satellite Utilization and Products (IPET-SUP) was convened in Geneva, Switzerland, from 26 February to 1 March 2018.

A major item for discussion was finalization of a position paper on critical satellite data for WMO applications, and implications of a possible revision of WMO Resolution 40 Annex 1.

The position paper is a key outcome of discussions in IPET-SUP regarding principles that should govern global exchange of satellite data under a scenario where the prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for global WMO applications, in particular for near-real-time applications. It formulates eight principles that providers of satellite data should fulfil to meet the critical needs of the meteorological community and defines what critical satellite data are.

The position paper was presented to the Technical Conference of the Commission for Basic Systems (CBS) held at the WMO Headquarters in Geneva, Switzerland, from 26 to 29 March 2018, and is annexed to this document.

The CBS Management Group (CBS-MG) agreed to submit a draft decision for the 70th session of the WMO Executive Council (EC-70) to translate the Critical Satellite Data Position Paper into WMO guidance material and to publish it as a WMO Space Programme technical publication.

Action/Recommendation proposed: CGMS to take note of this development.

ANNEX

CRITICAL SATELLITE DATA POSITION PAPER

(WMO Space Programme, Final Draft, 28 February 2018)

SUMMARY AND PURPOSE OF DOCUMENT

The prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for global WMO applications, in particular for near-real-time applications. IPET-SUP decided in 2015 to develop a Position Paper from the satellite user perspective on what types of satellite data should be considered critical for the protection of life and property.

The Position Paper formulates eight principles that providers of satellite data should fulfil to meet the critical needs of the meteorological community, and defines what critical satellite data are.

CRITICAL SATELLITE DATA POSITION PAPER

Introduction

The prospect of private-sector operators of basic satellite systems has triggered renewed attention to the issue of data access and availability for WMO applications, in particular for near-real-time applications such as nowcasting and numerical weather prediction. Noting the validity of WMO Resolution 40, the satellite-specific provisions in the Resolution reflect the technical and political landscape of the mid-1990 (when the main use of satellite data was imagery for nowcasting) and need revisiting.

There is concern in the meteorological community about the future role of commercial providers of meteorological satellite data. Commercialization of basic data may lead to considerably different data dissemination and exchange models than what is current best practice, undermine the model of international exchange of data that is critical to applications, and thus jeopardize continuing progress of the meteorological enterprise.

IPET-SUP decided to develop a Position Paper from the satellite user perspective on the criteria for satellite data that should be considered critical for the protection of life and property.

IPET-SUP has stressed that for users, in addition to meeting the timeliness demands of applications, transparency and traceability in data generation were key criteria for using data, including satellite-based data. The Position Paper should help Members define high-level best practices regarding the use of basic satellite observations generated by commercial entities.

The paper uses the term “critical satellite data” (in the sense of being critical for the protection of life and property), to avoid confusion with the defined term “essential” in the context of WMO Resolution 40.

Purpose of this Document

To provide a satellite data user perspective on the principles that should apply to critical satellite data generation and distribution, i.e., to data that are critical for the protection of life and property. It is intended to guide public agencies responsible for the provision of satellite data for weather, water, climate and related environmental applications, and commercial operators of Earth-observing satellite systems.

Background

For meteorological and related systems, satellite industry has so far most often assumed a role of contractor delivering a system to the governmental customer, and government has been owning and distributing the data to the user community. Rapid changes in the space industry are driven by the commercialization of space activities and high demand for weather and climate information: for instance, commercial sector delivering observations in addition to systems; by sharing financial and technical risks in a different manner, e.g. through public/private partnerships; by implementing satellite missions and distributing data on a purely commercial basis. These approaches could open opportunities to enhance the observing system, however, for WMO and user communities, there are also risks associated with a changing role of industry which should be anticipated and addressed carefully, in the following areas:

- Limitations to the exchange of data due to its commercialization, resulting in overall less availability of data;

- Lack of publicly-available information on the detailed technical specifications of the system, resulting in loss of traceability, reliability and credibility of the science behind the data. This could undermine user uptake and readiness;
- Risk that potential benefits of commercial initiatives in the short term undermine decision processes, funding mechanisms and sustainability of long-term national or regional programmes which are essential to meet national, regional or global requirements.

Given the opportunities and risks, it is important to identify the conditions under which commercial initiatives could make a successful contribution to the global space-based observing system such that it serves the requirements of WMO.

International exchange of observational data among Members in near-real time and as soon as possible after launch has been critical for the excellent advances over the past decades witnessed in meteorology, climate and related sciences, having led to improved skill of global prediction models and improved warnings. The success of weather forecasting and warnings relies on the near-real time availability of global data because they are a prerequisite for weather forecasting with numerical models. There is strong inter-dependency among Global Producing Centres and NMHSs in delivering and exchanging high-quality forecast products. Many studies on the benefit of observations – notably on satellite observations – have demonstrated how much modern societies gain from good weather forecasting and continuous weather awareness, e.g. for risk reduction and planning of many weather dependent businesses. This has been achieved thanks to global cooperation, duly considering the global nature of the discipline. The WMO Resolution 40 (Cg-XII) provides the policy framework for the international exchange of data. Global data exchange will remain a key requirement to inform global and regional applications, and the data policies of satellite data providers should facilitate such exchange.

Without assuming to coordinate commercial sector initiatives, WMO can have a beneficial influence on the provision of observational data by commercial operators through setting overall principles and priorities, highlighting the importance of data quality and interoperability standards, and advocating full visibility of the science behind the data. The latter is an essential element to verify the quality of data and products.

Current WMO Activities

Guidance on WIGOS Data Partnerships

Under the auspices of the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS), a guidance document on WIGOS data partnerships was produced. The document provides specific guidance related to incorporating and sharing data from non-NMHS sources into the WIGOS framework (focussing on surface-based observational data). It highlights the potential benefits and challenges of data from external providers, and clarifies the roles and expectations of NMHSs in integrating external data in compliance with WIGOS technical regulations.

The paper notes that “private data providers are increasingly offering their observations (typically surface-based, GPS-Radio Occultation, and aircraft data) to NMHSs for use in the generation of products and services. The license terms are typically more restrictive than those in the above category and they may not allow onward sharing and exchange. Members are encouraged to pursue licence terms that permit the open or broadest exchange of data wherever possible.”

Executive Council

A task team working under EC auspices is exploring a WMO position on public-private sector engagement for all service areas. It is led by the President of WMO, David Grimes (Environment and Climate Change Canada).

Basic Principles for Critical Satellite Data

The following principles should apply to critical satellite data from the users' perspective^{1 2}:

Principle 1: Free and unrestricted international exchange between WMO Members of critical satellite data in near real-time

Rationale: International exchange of meteorological and related data has been the engine for advances of the meteorological enterprise, such as improved global forecasts. No country is in a position to collect all the observational data it requires for driving model forecasts.

Principle 2: Transparency in instrument characteristics and processing steps

Rationale: Understanding basic observational data is critical to ensure their correct usage and positive contribution in applications. For this purpose, information about instrument properties and advance notification on their change over time (due to degradation, for example) is required to be able to discern observing system effects from changes in the observable, and to quantify uncertainty. Details about the processing of data (for example, calibration coefficients) are equally important.

Principle 3: Documented user engagement and potential impact on applications

Rationale: Providers of critical satellite data should directly address and respond to user requirements in the definition phase of the satellite system, and ensure the demonstration of the potential positive impact in applications.

Principle 4: Documented algorithms and information to support validation (indication of maturity)

Rationale: To correctly apply data and products, and to validate uncertainties, information about the algorithms and validation procedures is critical.

Principle 5: Information on data latency, data format, processing tools available

Rationale: Users need to know when to expect data, i.e. the time delay between acquisition and availability of data with users, as well as the data format and metadata that are indispensable to correctly interpret data. Many users benefit from processing tools delivered alongside data, especially if they do not have their own processing and analysis systems.

Principle 6: Timely provision of pre-validated data to users

Rationale: To accelerate and streamline the ingestion of data from new or upgraded space-based systems into applications, users require preview of various forms of preliminary data. These

1 Details on information required to enable user readiness are provided in the WMO Guideline on Best Practices on Achieving User Readiness for New Meteorological Satellites, WMO-No. 1187 (see e.g., p15/16).

2 Detailed guidance on climate dataset generation is provided in GCOS-143; the GCOS climate monitoring principles are provided in GCOS-200 (p48).

include synthetic data, simulated data, proxy data, and pre-operational data.

Principle 7: Unrestricted access to archived data³

Rationale: Satellite data providers should allow unrestricted access to archived data, to enable non-real-time applications, and the generation of climate data records. Full records of metadata should be maintained along with the data to enable correct interpretation. Quality assurance processes, version control and regular reprocessing of data should be the norm.

Principle 8: Plans for sustained data provision

Rationale: Operational WMO applications usually require provision of data on a long-term basis: climate applications require multi-year datasets which are generally based on continuity of comparable observing technology; NWP centres' investments in infrastructure is only cost-effective if the data are available for a long time period (at least five years)

³ WMO Res. 60 defines the WMO Data Policy regarding climate data.

Table 1: Critical Satellite Data

Type of satellite data and source ⁴	Principal applications driving spatial-temporal requirements ⁵
Data from geostationary orbiting satellites	
GEO imagery	Nowcasting, NWP
GEO sounding channels	Nowcasting, NWP
GEO lightning	Nowcasting
GEO space environment and weather data	Space weather
Data from Low-Earth orbiting satellites	
Operational LEO VIS-IR imagery	Nowcasting, Ocean applications, Agricultural meteorology
LEO IR sounding	Global NWP
LEO MW sounding	Global NWP
LEO MW Imagery	Global NWP, Nowcasting, Ocean applications
Scatterometry	Ocean applications, Global NWP
Ocean surface topography by radar altimetry	Ocean applications
Radio-occultation sounding	Global NWP
Broadband VIS/IR radiometry for Earth Radiation Balance	Global NWP
Total Solar Irradiance	Global NWP
Atmospheric composition	Atmospheric Composition services in Urban and Populated Areas; Forecasting Atmospheric Composition
Narrow-band VIS/NIR imagery for ocean colour, vegetation, aerosols	Ocean applications; Agricultural meteorology; Aviation meteorology
High-resolution multi-spectral VIS/IR imagery	Agricultural meteorology; Hydrology
IR dual-angle view imagery for SST	Ocean applications, Sub-seasonal to longer predictions
Particle detection and/or electron density	Space weather
Magnetic field	Space weather
Solar activity	Space weather

⁴ Following the mission types in the CGMS Baseline for the Operational Contribution to the GOS, Manual on the WIGOS, Attachment 4.1, p 123, WMO-No. 1160.

⁵ Observation requirements for WMO Application Areas are being maintained in the WMO Rolling Review of Requirements process (<http://www.wmo-sat.info/oscar/applicationareas>). The quantitative requirements for observing geophysical variables provide guidance for the definition of the spatial and temporal resolution of critical datasets.