Satellite Agencies and Data Policy

Essential Satellite Data for Global NWP

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale
Across the globe, 60 agencies from 32 countries have operated or supported Earth-observing satellites, spanning 819 mission/instrument combinations, of which 504 have open data policies. There are currently 447 active mission/instrument combinations supported by CEOS.
ANNEX 1 TO RESOLUTION 40 (Cg-XII)

DATA AND PRODUCTS TO BE EXCHANGED WITHOUT CHARGE AND WITH NO CONDITIONS ON USE

**Purpose**
The purpose of this listing of meteorological and related data and products is to identify a minimum set of data and products which are essential to support WMO Programmes and which Members shall exchange without charge and with no conditions on use. The meteorological and related data and products which are essential to support WMO Programmes include, in general, the data from the RBSNs and as many data as possible that will assist in defining the state of the atmosphere at least on a scale of the order of 200 km in the horizontal and six to 12 hours in time.

**Contents**

1. Six-hourly surface synoptic data from RBSNs, e.g. data in SYNOP, BUFR or other general purpose WMO Code;
2. All available *in situ* observations from the marine environment, e.g. data in SHIP, BUOY, BATHY, TESAC codes, etc.;
3. All available aircraft reports, e.g. data in AMDAR, AIREP codes, etc.;
4. All available data from upper air sounding networks, e.g. data in TEMP, PILOT, TEMP SHIP, PILOT SHIP codes etc.;
5. All reports from the network of stations recommended by the regional associations as necessary to provide a good representation of climate, e.g. data in CLIMAT/CLIMAT TEMP and CLIMAT SHIP/CLIMAT TEMP SHIP codes, etc.;
6. Products distributed by WMCs and RSMCs to meet their WMO obligations;
7. Severe weather warnings and advisories for the protection of life and property targeted upon end-users;
8. Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators. (These should include data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings).
Purpose
The purpose of this listing of meteorological and related data and products is to identify a minimum set of data and products which are essential to support WMO Programmes and which Members shall exchange without charge and with no conditions on use. The meteorological and related data and products which WMO Programmes include, in general, synoptic (SYNOP), forecast (FNL, GDAS, GFS), and as many data as possible to determine the state of the atmosphere at a height of 200 km in the horizontal and vertical.

Contents
(1) Six-hourly surface synoptic observations, in SYNOP, BUFR or other general purpose WMO Code;
(2) All available in situ observations from the marine environment, e.g. data in SHIP, BUOY, BATHY, TESAC codes, etc.;
(3) All available aircraft reports, e.g. data in AMDAR, AIREP codes, etc.;
(4) All available data from upper air sounding networks, e.g. data in TEMP, PILOT, TEMP SHIP, PILOT SHIP, CLIMAT, CLIMAT SHIP/CLIMAT

(5) Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators. (These should include data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings).

(7) Severe weather warnings and advisories for the protection of life and property targeted upon end-users;
(8) Those data and products from operational meteorological satellites that are agreed between WMO and satellite operators. (These should include data and products necessary for operations regarding severe weather warnings and tropical cyclone warnings).
FY Meteorological Satellite Data Policy For International Users

• The National Meteorological Services (“NMSs”) of the WMO Members States can obtain all Basic Data (automatically generated level 1, 2 and 3 data) for their official duty use at no cost based on the related WMO resolutions. Customized data requirement should be consulted with CMA.

• Other international & regional organizations can obtain all Basic Data with bilateral agreement with CMA.

• For non-commercial activities (public welfare education, science popularization, scientific research etc.), the users can obtain Basic Data at no cost with the prescribed procedures. For Customized Data, the cost of data processing and service support shall be charged.

• For commercial activities that require the use of Fengyun meteorological satellite data require an official service contract with CMA.

• Continue to implement the open sharing data policy, WMO Members can obtain FY meteorological satellite data through Direct broadcast, CMACast and website.
Key Principles of NOAA Data Policy

• The continued free/unrestricted exchange of essential data for global NWP
• Availability to governmental centers of additional data critical to operations
• Data policies for commercially-sourced data as NOAA moves towards more data buys, including for data sets deemed essential (i.e. RO)
• A level playing field between public National Meteorological or Hydrological Services (NMHS) and the commercial arms of some other NMHSs
• Governance at an appropriate level leveraging technical regulations where appropriate
• Recurring review of changing or emerging requirements
Elements of EUMETSAT Data Policy

The general international framework and commitments to make it easier to find and access data (e.g. WMO Resolutions, Oslo Declaration, EU Directives)

- Promotes and extends the use of EUMETSAT satellite data
  - Contributing to the global exchange of meteorological data and products, under the auspices of WMO (i.e. focus on Africa)
  - Towards a level playing field between National Meteorological Services (NMSs) and private commercial companies operating in the same field
- Establishes a monitoring system to allow adequate support to users and protection of the EUMETSAT satellite data
- Provides meteorological data and products for scientific and educational use
- Encourages licensing (even free of charge),
  - keeps a right on redistribution of data and preserve EUMETSAT ownership of data
- An evolving approach
  - Towards simplification and provision of more data on a “free and unrestricted” basis, i.e. in support of WMO and EU policies (Africa, Central Europe)
  - Taking into account the evolution of the market environment and recent technological developments
  - Considering next generations of EUMETSAT satellites and supporting new developments such as the European Weather Cloud, evolution of WIS 2.0
Recent changes to the EUMETSAT Data Policy

- More “Essential” Data (addition of “Hourly” Meteosat Data)
- Shift of licensing approach from time sampling to data latency (< 3 hours >)
- Single free license for all non-Essential data available without charge to all users on registration on the EUMETSAT EO Portal.
- Reduced number of license types
- Flat fees for paying users and abolition of additional fees
- Web Map Service, with no artificial degradation of the resolution for visualization services (no original numerical data provided)
- Abolition of payment for decryption keys
- Increased scope of “Official Duty Tasks” of EUMETSAT Member States
- Fast-track online licensing for Educational, Research and Personal Users

<table>
<thead>
<tr>
<th><strong>“Essential” data:</strong></th>
<th><strong>Non-Essential data:</strong></th>
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<tbody>
<tr>
<td>Free and open</td>
<td>Licensed</td>
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<tr>
<td><strong>Meteosat:</strong></td>
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<tr>
<td>- Hourly Data</td>
<td>- Data latency of more than 3 hours (free)</td>
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<td>- Derived Products</td>
<td>- Data latency of less than 3 hours (free/paying depending on data usage)</td>
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<td>- Advance Image Products</td>
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<td><strong>Metop:</strong></td>
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<tr>
<td>- Advanced High Rate Picture Transmission (AHRPT) Data</td>
<td>- IASI, ASCAT, GRAS, GOME-2 level 1 products (free)</td>
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<td>- Global and regional level 1 MHS products</td>
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<td>- Global and regional level 2 products</td>
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<td><strong>SAFs:</strong></td>
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<tr>
<td>- All SAF products</td>
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WIGOS Implementation Status

- Describes the space- and surface based observing networks we desire to operate by 2040
- The space-based component consists of four subcomponents:
  1. Backbone system with specified orbital configuration and measurement approaches
  2. Backbone system with open orbit configuration and flexibility to optimize the implementation
  3. Operational pathfinders, and technology and science demonstrators
  4. Additional capabilities (e.g. contributions by commercial operators)

See https://community.wmo.int/vision2040
WMO Gap Analysis

- Risk assessment by instrument type or technology
  - Tables are provided for each of the following 28 technologies (22 for Earth observation, 6 for Space weather):
  - Does not consider Data Policy
CGMS Risk Assessment

- Risk vs CGMS commitment to WIGOS 2040

<table>
<thead>
<tr>
<th>Sensor</th>
<th>2020</th>
<th>2021</th>
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<td>Multipurpose Meteorological Imager</td>
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<td>Multi-wavelength, Multi-channel, Multi-polarization imager</td>
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<td>Lightning Mapper</td>
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<td>Narrow Band Visible &amp; Near Infrared Imager</td>
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<td>Scatterometer</td>
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<td>Sub-Millimeter Ice Cloud Imager</td>
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<td>Energetic Particle Sensor</td>
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<td>Plasma Analyzer</td>
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Essential Satellite Data for Global NWP
Background (1/2)

- Recent developments in the data provision landscape 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. It is also recognised the global Numerical Weather Prediction (NWP) underpins all WMO application areas, including reanalysis in support of climate monitoring.

- International data exchange is a major purpose of WMO, WMO Convention, Art. 2b

- At Cg-18, WMO established the Global Basic Observing Network (GBON). GBON is a subset of the surface-based subsystem of WIGOS, used in combination with the space-based subsystem and other surface-based observing systems of WIGOS, to contribute to meeting the requirements of global NWP, including reanalysis in support of climate monitoring.

- This document formulates the data and associated requirements that providers of satellite data should fulfil to complement the GBON in meeting the basic needs of global NWP supporting operational meteorology and other application areas.
Essential Satellite Data for Global NWP

Background (2/2)

• New WMO Data Policy ("Res 42") will give high level definitions in different disciplines
  – Weather, Climate, Hydrology, Atmospheric Composition, Cryosphere, Oceans, Space Weather

• Considerations for Weather and Space-based Observations
  – All satellite data considered as essential for the performance and quality of numerical weather prediction output as reflected in the CGMS Baseline, subsequently adopted into the WMO Technical Regulations.
  – All data provided by the multi-purpose visible-infrared meteorological imagers flying the low-earth or geostationary orbit.

• Purpose of the Position Paper “Essential Satellite Data for NWP”
  – Provide the linkage between the new Data Policy and WMO regulatory material (WIGOS Manual)
    • Hence also change of definition to Essential (previously Basic/Critical)
  – Define the Essential Satellite Data sets required by global NWP underpinning WMO application areas, critical for the protection of life and property.
  – Provide guidance on the principles that should apply to essential satellite data generation and distribution
  – Intended to all operators responsible for satellite data and products, in particular CGMS members

• Approach
  – Follow WIGOS 2040 Vision
  – Noting a holistic Earth System Modelling approach=> NWP is core for WMO application areas
  – Can be seen as the satellite equivalent to GBON => harmonisation of terminology
  – Complement to GBON and building on the Rolling Review of Requirements
  – A formulation of the user needs
Guiding Principles or Requirements

1. Make available globally all basic satellite data in real time or near real-time
2. Document instrument characteristics and processing steps
3. Engage with users and document potential impact on applications
4. Document algorithms and information to support validation (indication of maturity)
5. Provide information on data latency, data format, processing tools available
6. Provide timely pre-validated data to users
7. Provide unrestricted access to archived data
8. Plan for sustained data provision
## Draft table

### Essential Satellite for global NWP

Following the current CGMS baseline

<table>
<thead>
<tr>
<th>Type of satellite sensors (1)</th>
<th>Main attributes of satellite data (2)</th>
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<tbody>
<tr>
<td><strong>Data from geostationary orbiting satellites (complete GEO ring ca 60 deg spacing)</strong></td>
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<tr>
<td>Multi-purpose meteorological imagers (multispectral, visible, and IR)</td>
<td>Radiance products, Atmospheric Motion Vectors (AMVs)</td>
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<tr>
<td>Hyperspectral Infrared Sounder</td>
<td>Radiance products, AMVs</td>
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<tr>
<td><strong>Data from Low-Earth orbiting satellites</strong></td>
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<tr>
<td>Multi-purpose meteorological imagers (multispectral, visible, and IR)</td>
<td>Radiance products and geophysical products (e.g. Aerosol Optical Depth (AOD), AMVs, Sea Surface Temperature (SST)), from at least 3 sun-synchronous orbits</td>
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<tr>
<td>Hyperspectral Infrared Sounder</td>
<td>Radiance products from at least 3 sun-synchronous orbits</td>
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<tr>
<td>Microwave sounder</td>
<td>Radiance products from at least 3 sun-synchronous orbits</td>
</tr>
<tr>
<td>Microwave mager</td>
<td>Radiances SST, precipitable water, sea ice</td>
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<tr>
<td>Scatterometer</td>
<td>3 sun-synchronous orbits, backscattering cross-sections and surface winds, soil moisture</td>
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<tr>
<td>Radar altimeter</td>
<td>Sea surface height, wind and waves</td>
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<tr>
<td>Radio-occultation</td>
<td>Minimum 6000 occultations from low inclination orbits distributed geographically and temporally in local time, 1000 occultation from drifting high inclination orbits, and 7600 occultations from sun-synchronous orbits. Electron density profiles up to 500 km.</td>
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<tr>
<td>Visible/UV Spectrometer and SWIR imaging spectrometer</td>
<td>Ozone, aerosol properties</td>
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<tr>
<td>IR dual-angle view imagery for SST</td>
<td>SST</td>
</tr>
</tbody>
</table>

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1. Following the sensor types in the CGMS Baseline for the Operational Contribution to the GOS, Manual on the WIGOS, Attachment 4.1, p 123, WMO-No. 1160
2. 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 satellite datasets.
### Draft table
**Additional Satellite for global NWP**

<table>
<thead>
<tr>
<th>Type of satellite sensors (1)</th>
<th>Main attributes of satellite data (2)</th>
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<tr>
<td><strong>Data from geostationary orbiting satellites (complete GEO ring ca 60 deg spacing)</strong></td>
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<tr>
<td>Lightning mapper</td>
<td>Strike density</td>
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<td><strong>Data from Low-Earth orbiting satellites</strong></td>
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<tr>
<td>Precipitation Radar</td>
<td>Backscatter, rain rate</td>
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<td>Broadband short/long wave radiometer</td>
<td>Radiances</td>
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<tr>
<td>Total Solar Irradiance</td>
<td>Radiances</td>
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</table>

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[2] Observation requirements for WMO Application Areas are being maintained in the WMO Rolling Review of Requirements process ([http://www.wmo-sat.info/oscar/applicationareas](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 satellite datasets.

1. Introduce the approach and the ESD to the NWP community to ensure consensus at this stage.
   - GODEX-NWP has been requested to review
   - Engage with the NWP community via the NWP impact workshop
2. Achieve initial feedback and preliminary endorsement from the Space Agencies,
   - initiated at the Space Agency Consultation workshop
   - Followed up bilaterally with the key Agencies as necessary
   - In parallel engaging with CGMS WG II and III
   - Consolidation by ET-SSU at meeting 1 December 2020
3. Present status and initial position at WMO Data Conference
4. Consolidation by early next year and provision to INFCOM-1 Part III and EC-73 for endorsement
5. Present Position Paper to 49th CGMS Plenary late spring 2021 for endorsement
   - Update the CGMS baseline as required
6. Present Position Paper to CEOS Strategic Implementation Team in Spring 2021 for consideration
7. WMO Infrastructure Commission to take into account the new Position Paper and the associated updated CGMS Baseline for the revised WIGOS Manual to be endorsed by the Extraordinary WMO Congress in 2021.
Summary of Key Points

- WMO welcomes CGMS commitments towards the Vision for WIGOS in 2040
- ‘Essential Data’ remains a key and valid concept
- CGMS provides a forum for WMO and operators to agree on what constitutes ‘essential’
- CEOS support is also required
Thank you
Merci