

WMO SPACE PROGRAMME

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WMO Space Programme Office

WG-Climate-10, Marrakech, Morocco
21 March 2019



WORLD
METEOROLOGICAL
ORGANIZATION

1. History and Background



2030 Agenda for Sustainable Development



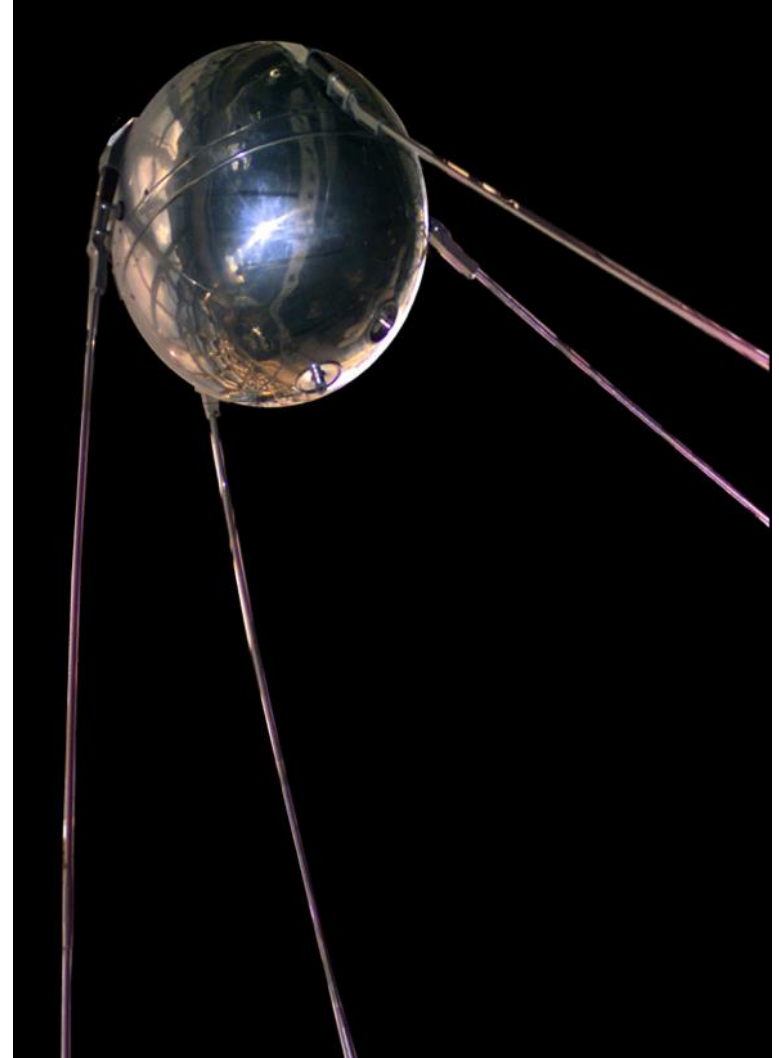
- WMO contributes to 12 of the 17 SDGs and is the co-custodian of SDG 13 on Climate Action

<https://public.wmo.int/en/our-mandate/what-we-do/wmo-contributing-sustainable-development-goals-sdgs>



United Nations and Outer Space

- Launch of Sputnik in 1957 - beginning of space activities
- It raises many questions:
 - Arms race in outer space?
 - Rules and regulations for activities in outer space?
 - Space activities?
- UN Member States decide to establish the ***Committee on the Peaceful Uses of Outer Space (UNCOPUOS)***
- WMO, as a specialized UN agency, is invited to participate in the sessions of the UN Committee on the Peaceful Uses of Outer Space



Origin of the World Weather Watch

- In 1961, UNGA Resolution 1721 (XVI) C requests WMO to report to COPUOS on how it could utilize space technology in its work
- US President John F. Kennedy proposes to launch “cooperative efforts between all the nations in weather prediction and eventually in weather control” making use of space-based observations from satellites.
- In response to this request, WMO prepares the proposal for the **World Weather Watch (WWW)**, which is subsequently endorsed by UNGA Resolution 1963 (XVIII) III in 1963
- Implementation of WWW from 1967



See <https://public.wmo.int/en/bulletin/global-satellite-observing-system-success-story>

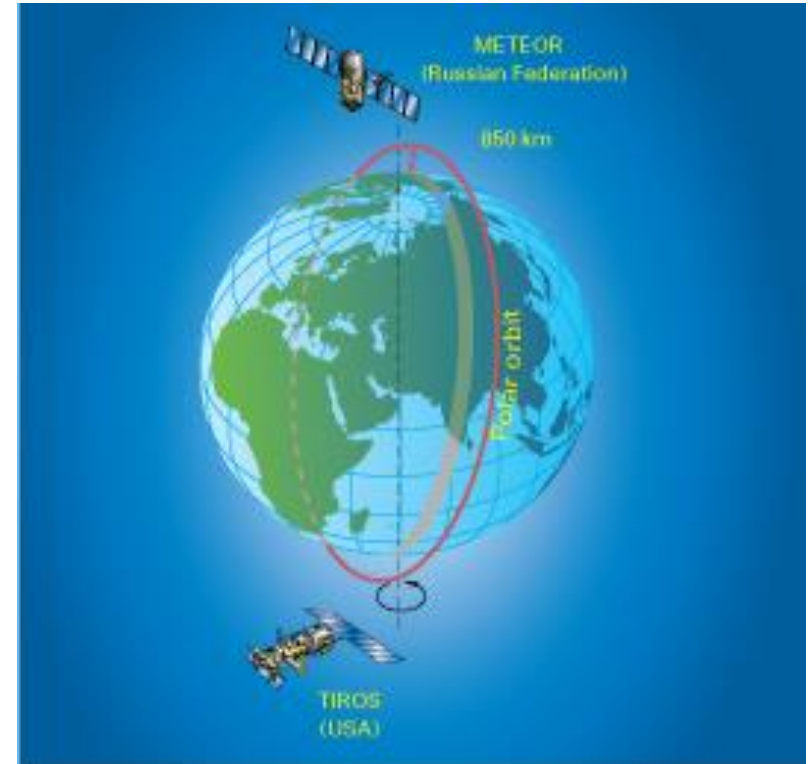


Global Observing System (GOS) -1961

- Observing System Element of WWW



TIROS-I – First weather satellite image
(April 1960)

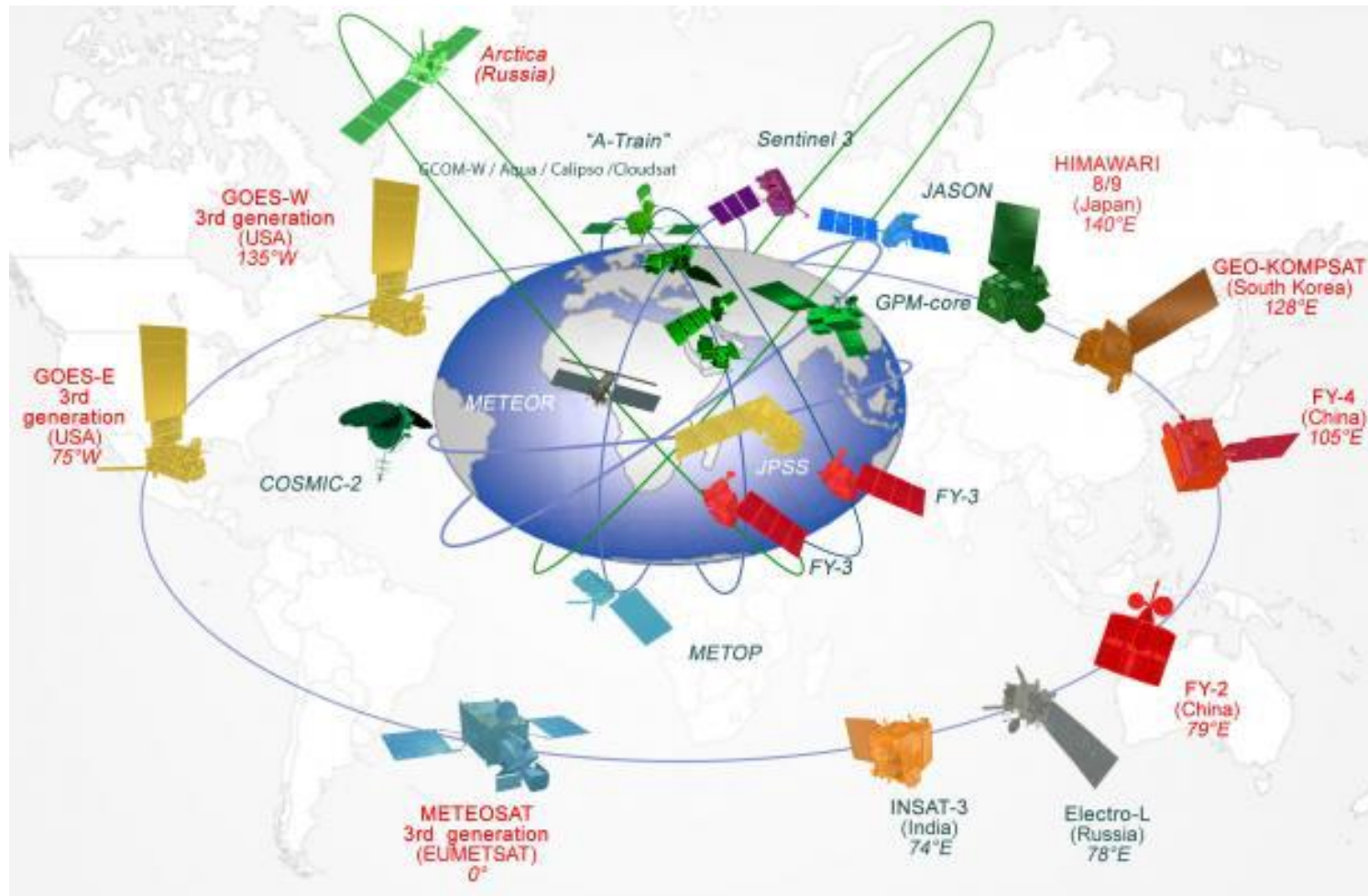


Space-based Global Observing
System (GOS) in 1961



Global Observing System (GOS) - 2021

- WWW/GOS now integrated in WIGOS



Recent ITU News Magazine Article



No. 1, 2019



Benefits of Earth observation from space

The space-based component of the WMO Integrated Global Observing System

Petteri Taalas

Secretary-General, World Meteorological Organization ([WMO](#))



The benefits of using Earth-orbiting satellites for the observation of the Earth have been recognized since the early 20th century. They could finally be realized when the first artificial satellite, Sputnik, was launched on 4 October 1957, marking the beginning of the space age.

In 1961, in response to a request made by the newly established Committee on the Peaceful Uses of Outer Space (COPUOS) of the United Nations General Assembly, the World Meteorological Organization (WMO) prepared a ground-breaking report in which it proposed a global programme to advance atmospheric science research and to develop improved weather forecasting capabilities using space technology (see the [Global Satellite Observing System: a Success Story](#)).

“The World Weather Watch is one of the best examples of the sharing of space benefits among all countries.”

Petteri Taalas

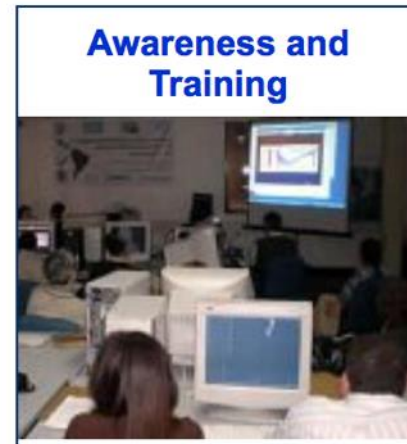
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See https://www.itu.int/en/itu/news/Documents/2019/2019-01/2019_ITUNews01-en.pdf



WMO Space Programme (WSP)

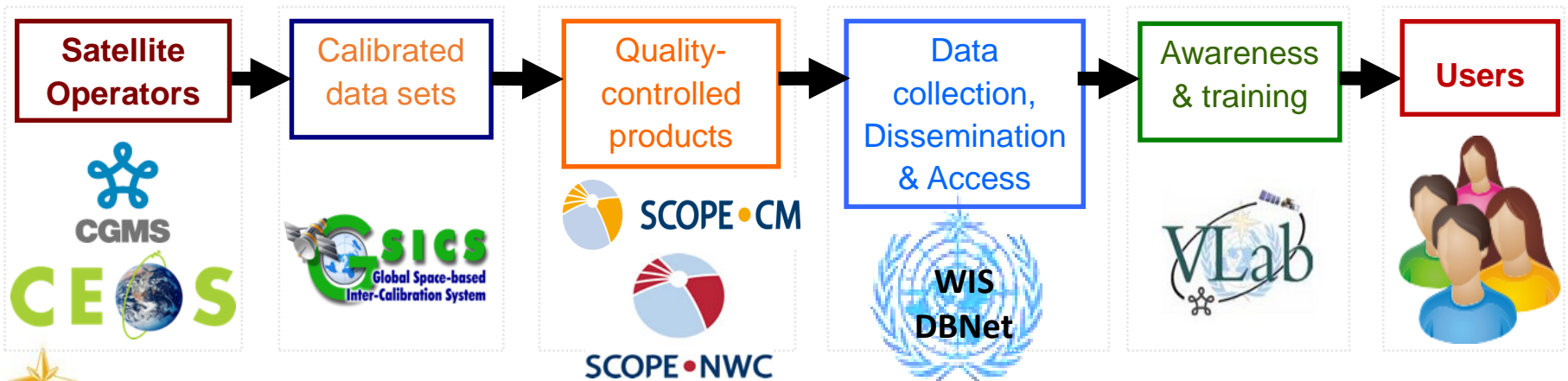
- Established by Resolution 5 (Cg-XIV) of the 14th WMO Congress in 2003
- Supported by WMO Space Programme Office (SAT)
- Promote availability and utilization of satellite data and products for weather, climate, water and related applications.
- Coordinate environmental satellite matters and activities throughout all WMO Programmes.
- 16th WMO Congress in 2011 confirmed four main components:



See <http://www.wmo.int/sat>



WMO Space Programme Value Chain



Space Programme Website



WORLD
METEOROLOGICAL
ORGANIZATION

WEATHER CLIMATE WATER

Please visit our public website:
<http://public.wmo.int>

Home

WMO Space Programme

Programmes > Space > Home

WMO Space Programme

The Space Programme's objective is to promote availability and utilization of satellite data and products for weather, climate, water and related applications to WMO Members.

It coordinates environmental satellite matters and activities throughout all [WMO Programmes](#) and gives guidance on the potential of remote-sensing techniques in meteorology, hydrology and related disciplines.

Quick Access

- [OSCAR/Requirements \(Observing Requirements Database\)](#)
- [OSCAR/Space \(Satellite & Instrument Database\)](#)
- [Satellite Status list](#)
- [Satellite User Readiness Navigator \(SATURN\)](#)
- [Product Access Guide \(PAG\)](#)
- [Virtual Laboratory for Education and Training in Satellite Meteorology \(VLAB\)](#)
- [Working Documents for Meetings](#)

Upcoming Meetings and Events

06/10/18 to 11/10/18	9th Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC-9)
08/10/18 to 12/10/18	WMO SCOPE-Nowcasting Initiative - Intercomparison of Satellite-based Volcanic Ash Retrieval Algorithms Workshop
23/10/18 to 25/10/18	Third DBNet Coordination Meeting (DBNet-CG-3)

[Go to Meetings and Events](#)

Latest News and Announcements

15/06/2018	GEONETCast Americas User Group Webinars
29/05/2018	Ninth Asia Oceania Meteorological Satellite User's Conference
03/03/2018	What is in the Calendar in March?

Programme Overview

- [Home](#)
- [Activities and objectives](#)
- [Structure and Governance](#)
- [News and External Announcements](#)
- [Calendar of Events](#)
- [Contact Information](#)

[⇒ Space-based GOS](#)

[⇒ Data access & use](#)

[⇒ Awareness & Training](#)

[⇒ Space Weather](#)

[Regional Activities](#)

[Information Resources](#)

[Partners](#)

[CGMS](#)

[GOS](#)

[WIGOS](#)

[WIS](#)

[OSCAR Database](#)

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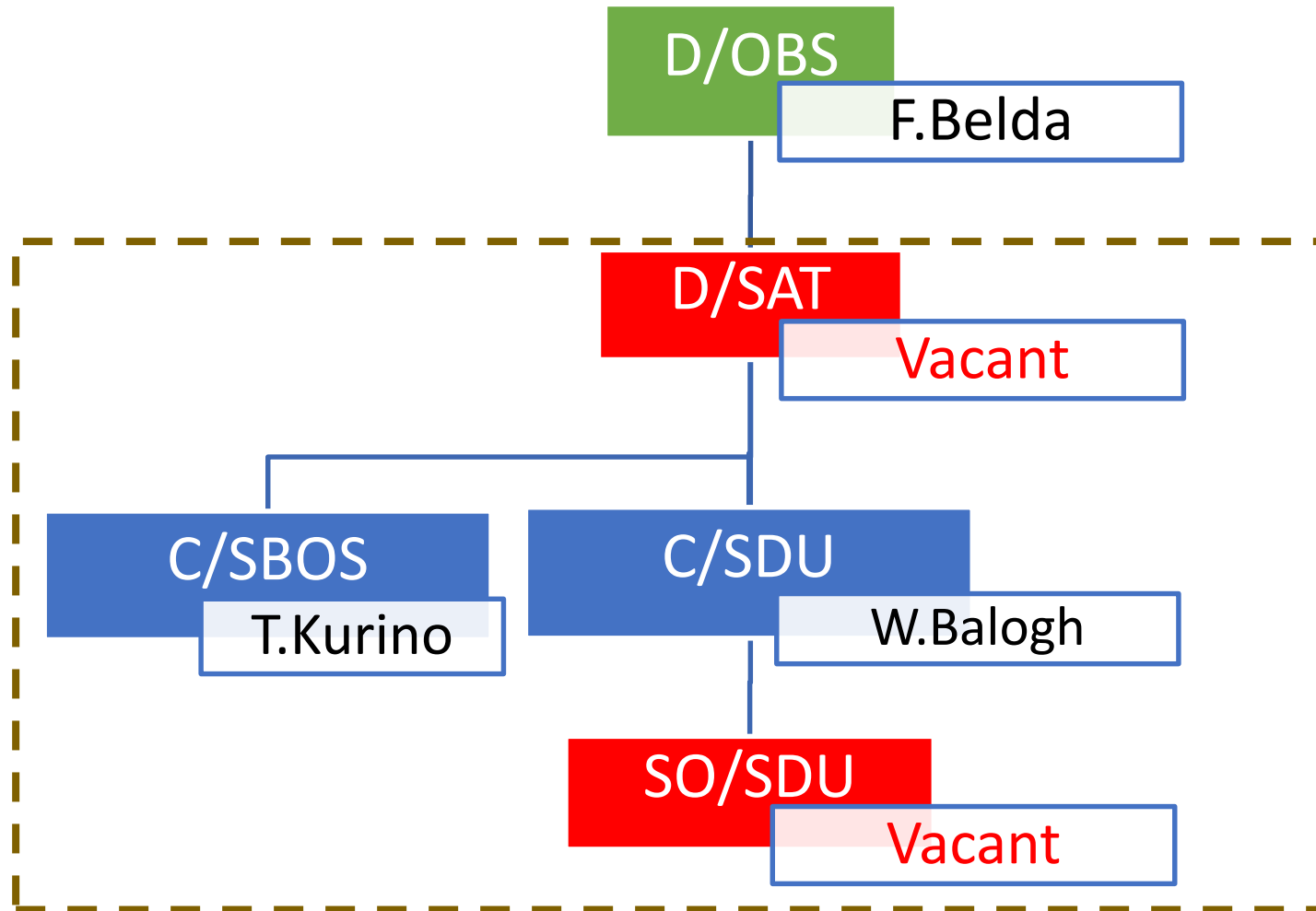


[Click here to search with Google](#)

See <http://www.wmo.int/sat>



WMO Space Programme Office



Space Programme Expert Teams

ET-SAT

Expert Team on Satellite Systems

IPET-SUP

Inter-Programme Expert Team on Satellite Utilization and Products

IPT-SWeISS

Inter-Programme Team on Space Weather Information, Systems and Services

- Established under the Open Programme Area Group on Integrated Observing Systems of the Commission for Basic Systems
- Members nominated by Permanent Representatives
- IPET-SUP
 - Membership:
http://www.wmo.int/pages/prog/www/CBS/Lists_WorkGroups/CBS/IC_T-IO/JPET-SUP/members
 - Terms of Reference:
http://www.wmo.int/pages/prog/www/CBS/Lists_WorkGroups/CBS/IC_T-IO/JPET-SUP/tors

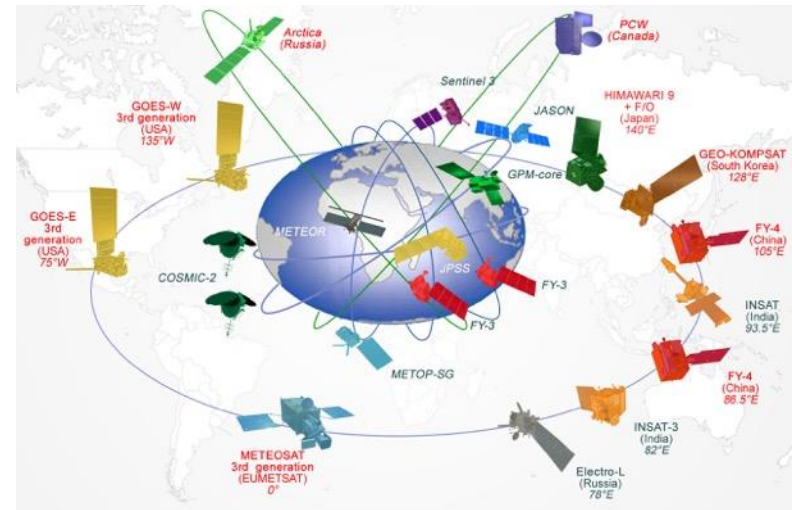
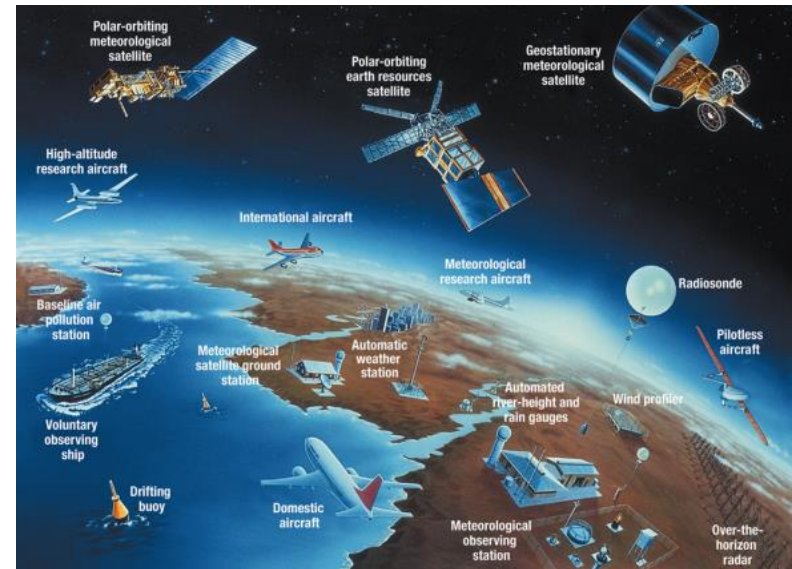


2. Space-based Observing System

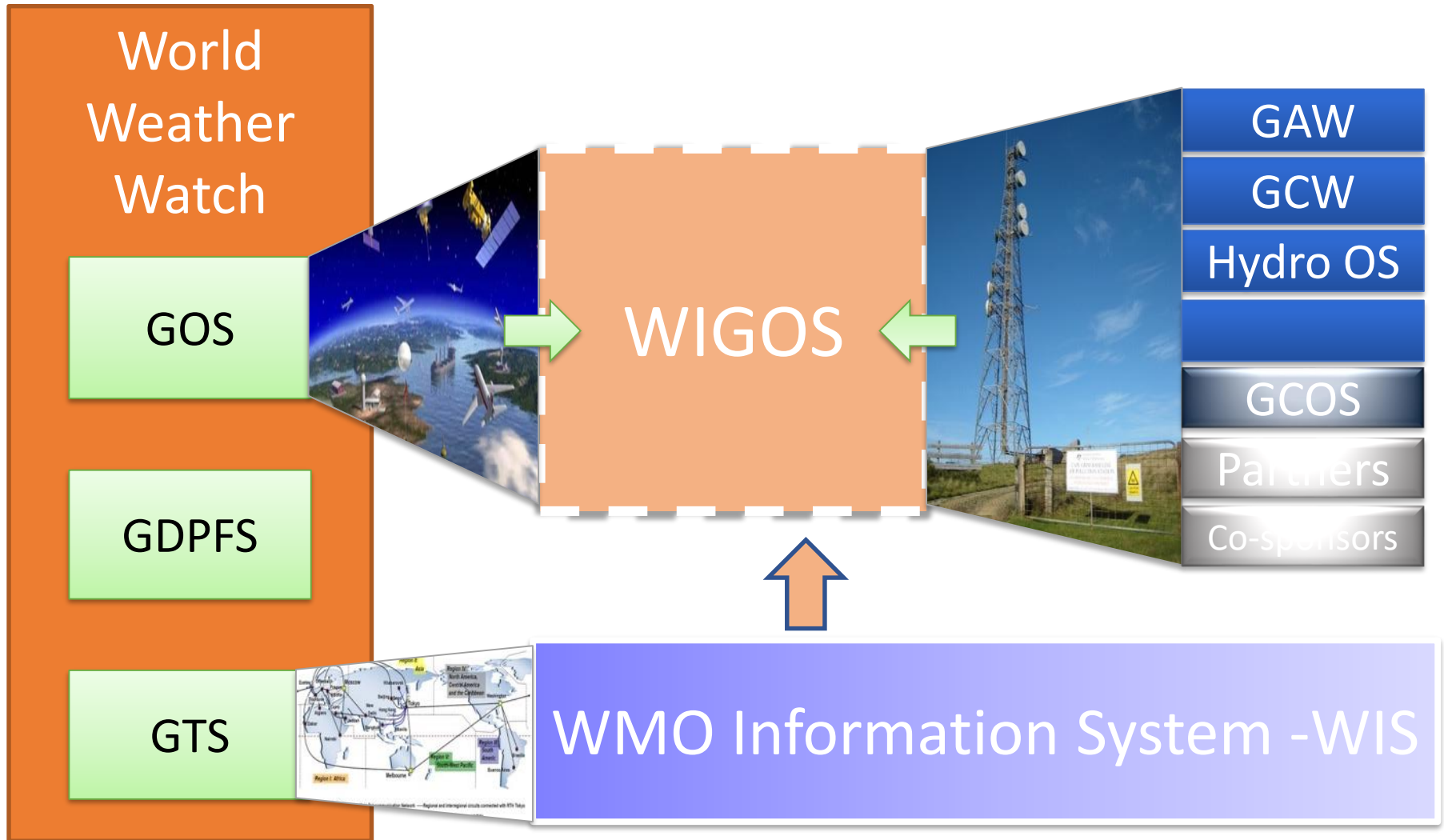


WMO Integrated Global Observing System

- World Weather Watch (WWW), established in 1963.
- Need to upgrade observation system in response to societal changes, addressing weather, water, climate and environmental issues:
 - WMO Integrated Global Observing System (WIGOS)
 - WMO Information System (WIS)
- A common regulatory and management framework.



WMO Integrated Global Observing System



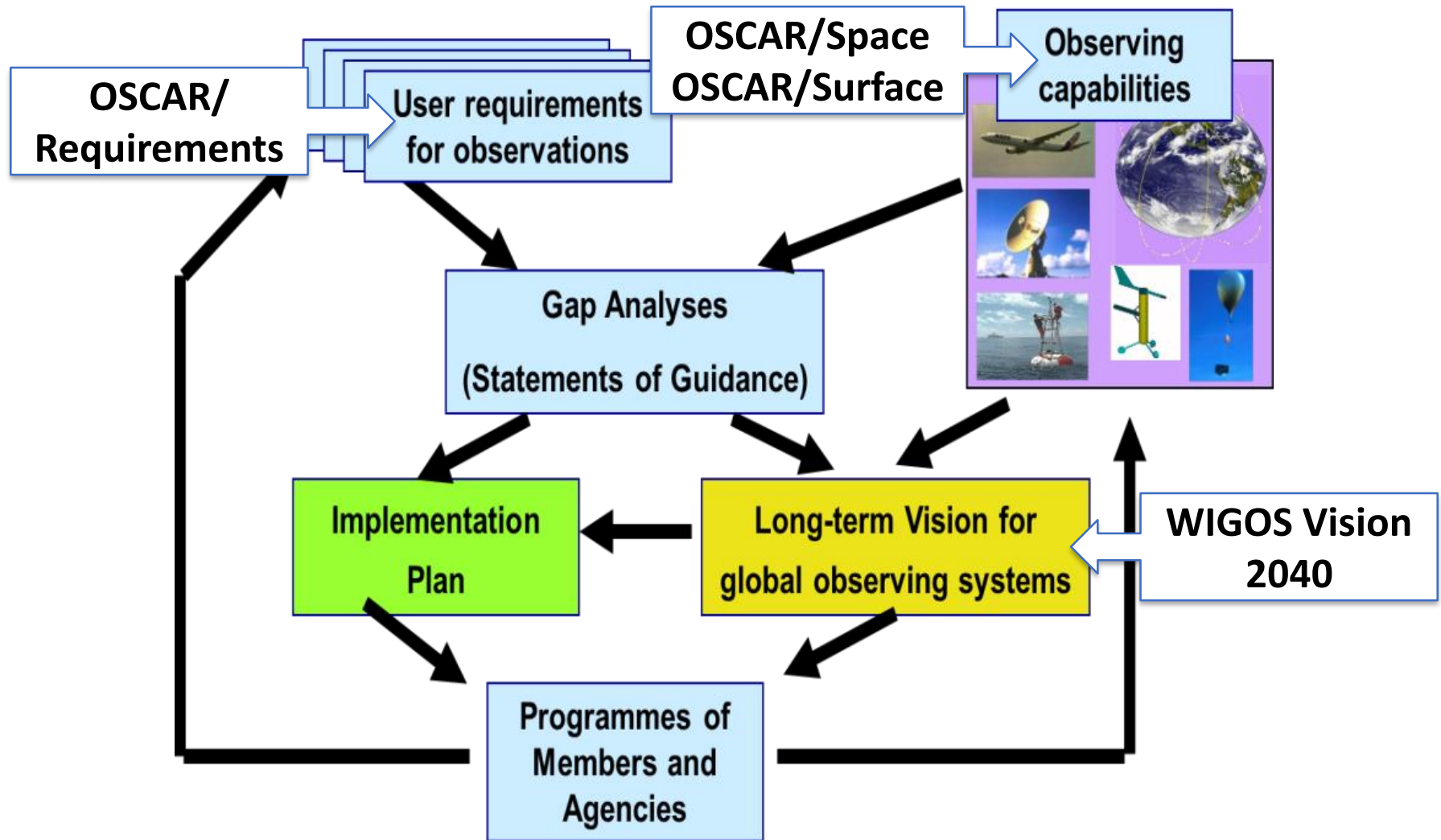
WMO Application Areas

- 1) Global numerical weather prediction
- 2) High-resolution numerical weather prediction
- 3) Nowcasting and very short range forecasting
- 4) Sub-seasonal to longer predictions
- 5) Aeronautical meteorology
- 6) Forecasting atmospheric composition
- 7) Monitoring atmospheric composition
- 8) Atmospheric composition for urban applications
- 9) Ocean applications
- 10) Agricultural meteorology
- 11) Hydrology
- 12) Climate monitoring (GCOS)
- 13) Space weather
- 14) Climate science

See <http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html>



Rolling Review of Requirements



Observing System Capability Analysis and Review Tool



OSCAR
Observing Systems Capability Analysis and Review Tool

Login

Home | Observation Requirements | Space-based Capabilities | Surface-based Capabilities

Welcome to OSCAR

OSCAR is a resource developed by [WMO](#) in support of Earth Observation applications, studies and global coordination.

It contains quantitative user-defined requirements for observation of physical variables in application areas of WMO (i.e. related to weather, water and climate). OSCAR also provides detailed information on all earth observation satellites and instruments, and expert analyses of space-based capabilities.

The tool constitutes a building block of [WIGOS](#) and more specifically, the so-called [Rolling Requirements Review process](#). OSCAR targets all users interested in the status and the planning of global observing systems as well as data users looking for instrument specifications at platform level. To continue, please select one of the following modules:

- [Observation Requirements](#)
- [Satellite Capabilities](#)
- [Surface based Capabilities](#)

Each of the modules can be consulted individually, however, the tool is also designed with the goal to integrate user requirements with actual capabilities. This facilitates the Rolling Requirements Review process, comparing "what is required" with "what is, or will be available", in order to identify gaps and support the planning of integrated global observing systems.

The tool is being further developed, and additional functionality and information will be added as appropriate. Please consult the [list of open issues](#) for a description of bugs affecting the system. One future objective is to automatically generate first-level analyses of compliance between the quantitative requirements and the actual capabilities (space- or surface-based).



OSCAR overview - click to enlarge

Getting started with OSCAR/Space and OSCAR/Requirements

- Watch the [10 minute OSCAR screen-cast](#) to get an overview of the application and learn how to use its functionalities
- Documents available for download
 - [OSCAR/Space and OSCAR/Requirements User manual](#) (413 kbyte)
 - [OSCAR/Requirements Focal Point manual](#) (200 kbyte) for user requirements editors
 - [OSCAR Flyer](#) (1.4 Mbyte)
- Please provide feedback to the WMO Space Programme Office sat-help-desk@wmo.int

Getting started with OSCAR/Surface

- Read the [OSCAR/Surface User manual](#)
- The user support can be contacted via the [OSCAR/Surface feedback form](#).

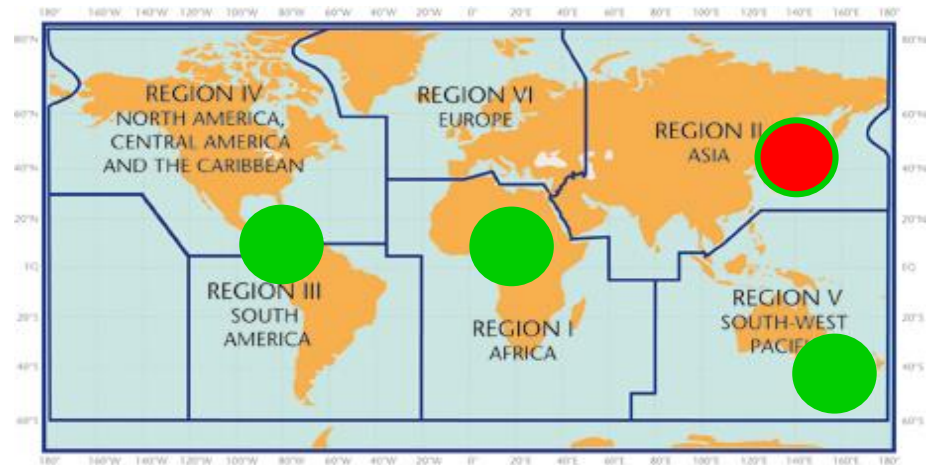


3. Access to Satellite Data and Products



Regional Satellite Data Requirements Groups

- **RA I (Africa):** Dissemination Expert Group (RAIDEG)
- **RA II (Asia):** WIGOS Project Coordination Group
- **RA III/IV (Americas):** Coordination Group
- **RA V (SW Pacific):** Task Team on Satellite Utilization



Bringing together:

- Operational users
- Satellite providers
- Training centres (VLab CoEs)
- Scientific users
- Others

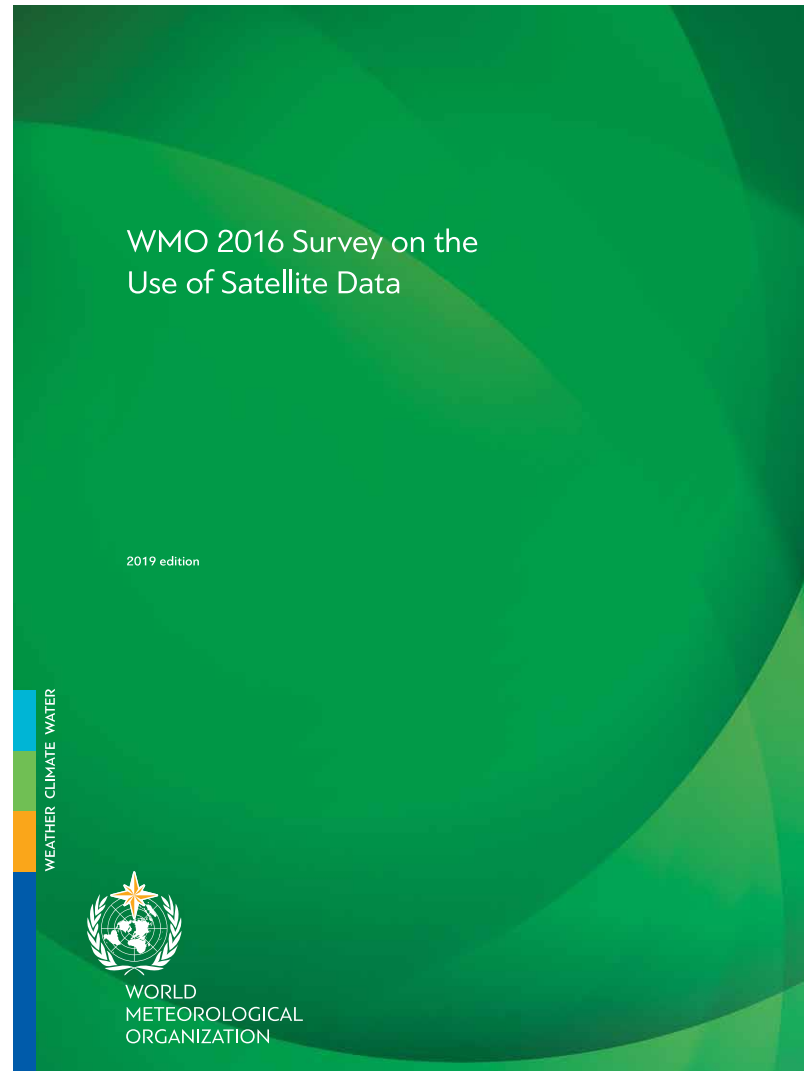
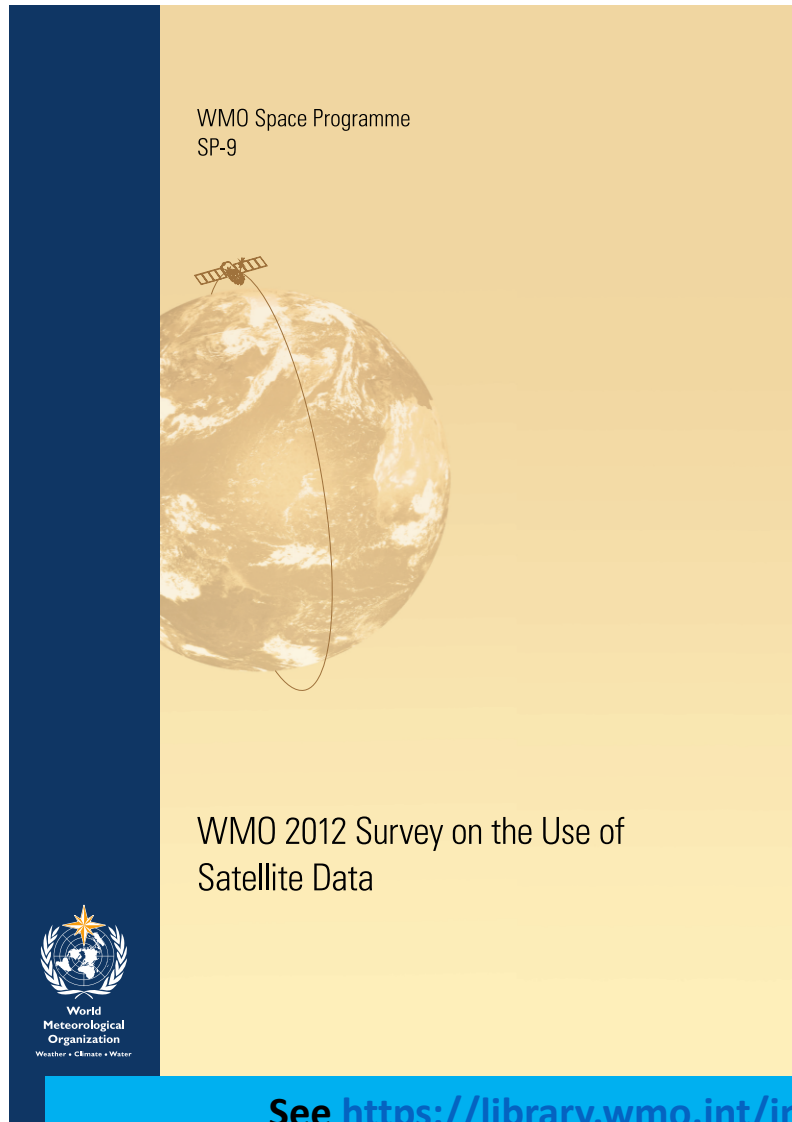
Objectives:

- User-provider dialogue
- Expressing user requirements
- Coordinating data distribution
- Identifying training needs
- Implementing WIGOS/WIS

See http://www.wmo.int/pages/prog/sat/index_en.php (Regional Activities)



Global and Regional Data Use Surveys



See https://library.wmo.int/index.php?lvl=notice_display&id=20787



Satellite User Readiness Navigator (SATURN)

Satellite User Readiness Navigator (SATURN) | Home | Preparing for the next generation of meteorological satellites

Satellite User Readiness Navigator (SATURN)

Preparing for the next generation of meteorological satellites

Home Satellites Data Access and Use FAQ Planning for readiness Contacts Search

Home

Welcome to the WMO-CGMS Satellite User Readiness Navigator (SATURN). The new generation of Meteorological satellites, planned to enter operations in the 2015-2020 period, will present WMO Members with unprecedented opportunities and challenges. The aim of the SATURN portal is to provide a single point of access for all information needed for user community preparations. The content is provided by the satellite operators and by the WMO Space Programme. Explore this site using one of the following menus above:

- Search by Satellite
- Search by topic related to Data Access and Use
- Search by individual question under FAQ

Planning for readiness is supported through a generic reference user readiness project, with suggested timelines and deliverables with respect to launch date.

Newest entries

- [EPS-SG Long-term Operations Plan](#)
2 weeks ago
- [EPS-SG Basics](#)
2 weeks ago
- [EPS-SG Training and Resources](#)
2 weeks ago
- [EPS-SG User Notification and Feedback](#)
2 weeks ago
- [EPS-SG Software Tools and Test Data](#)
2 weeks ago

Recent comments

Tony M on [GOES-16 Post-Launch Testing, Science Product Validation, and Data Release: "Many Thanks for posting this valuable](#)

See <https://www.wmo-sat.info/satellite-user-readiness/>



Product Access Guide (PAG)

Product Access Guide | WMO

Product Access Guide

Home Simple search Advanced search Themes

Search

Welcome

Welcome to the WMO Product Access Guide (PAG) for satellite products.

To find product collections, expert teams and training material, please use one of the 3 main navigation options:

- Use the **"quick search form"** available in the top right corner, to search for keywords such as "wind, precipitation, space weather, agriculture.."
- Use the **"simple search"** to find product collections by geophysical domain, navigating through a hierarchical list
- Use the **"advanced search"** to combine different conditions, such as geographical regions, organization or cross-cutting themes

About the PAG

The goal of this Product Access Guide (PAG) maintained by WMO is to facilitate access to satellite-based geophysical datasets (mostly "level 2" products or higher) for users, and to provide guidance on these products where possible. This is achieved by linking to quality-controlled product collections made available online by data providers. Information on theme-specific international expert groups and training material is also provided. The PAG is simple and distinct from comprehensive data portals such as the GEO portal, the INSPIRE-GEO portal, or the WIS portals. One key target audience are less-experienced satellite data users, in particular from developing countries.

About Disclaimer FAQ & Help Feedback & Contact Admin Login

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See <https://www.wmo-sat.info/product-access-guide/>



Processing, Visualization and Analysis Tools

WMO EXTRANET - WORLD METEOROLOGICAL ORGANIZATION WEATHER CLIMATE WATER

Please visit our public website: <http://public.wmo.int>

Home

Tools

Programmes > Space > Data access and use > Tools

Tools

Processing, Visualization and Analysis Tools (Open Source)

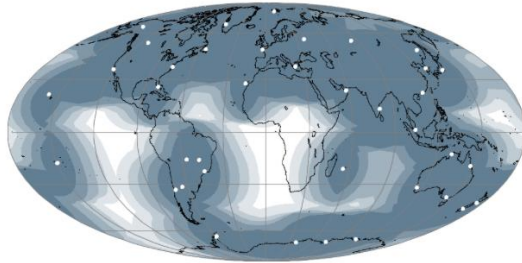
! DISCLAIMER: THIS LISTING IS NON-EXHAUSTIVE. IF YOU WISH YOU TOOL TO BE ADDED, PLEASE CONTACT THE WMO SECRETARIAT (sat-help-desk@wmo.int) !

Name	Provider	Input Formats
AAPP	NWP SAF	Direct readout HIRS, AVHRR, AMSU, MHS, IASI data
AWIPS	Unidata, University of Wisconsin, USA; Raytheon	GRIB, BUFR, HDF, shapefiles, Others
AWIPS-II	Unidata, University of Wisconsin, USA	GRIB, HDF, Others
BILKO	UNESCO	GIF, PCX, BMP, HDF, netCDF, Envisat-generic, GeoTIFF
CSPP	CIMSS, University of Wisconsin, USA	Direct readout VIIRS, ATMS, CrIS data
CSPP Geo	CIMSS, University of Wisconsin, USA	Direct readout of GOES using GVAR, GRB stream
DIANA	met.no	netCDF, OpenDAP, GRIB, BUFR, GeoTIFF, HDF5
EUMETView	EUMETSAT	JPG, KMZ, GeoTIFF, GIF, PNG
FY-3 Level0 and Level1 pre-processing software	CMA	Direct readout VIRR, MERSI, IRAS, MWTS data

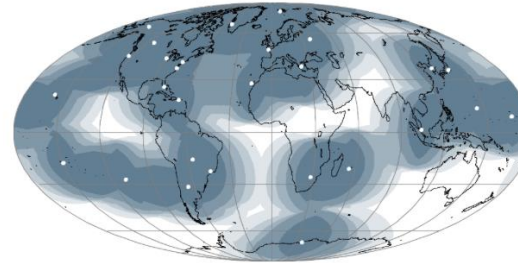
See http://www.wmo.int/pages/prog/sat/processingtools_en.php



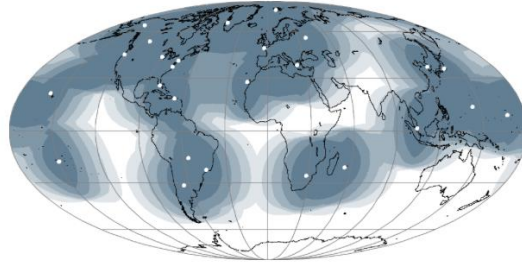
Direct Broadcast Network (DBNet)



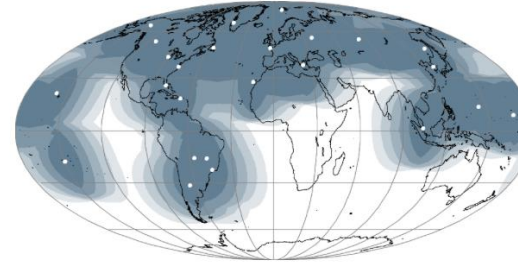
DBNet-ATOVS coverage in February 2019



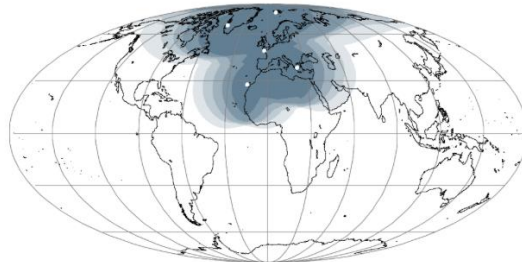
DBNet-ATMS coverage in February 2019



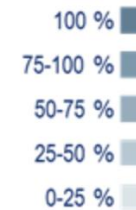
DBNet-CrIS coverage in February 2019



DBNet-IASI coverage in February 2019



DBNet-VASS coverage in February 2019



Legend

The shading shows for a given point on the ground, how big a fraction of the satellite observations of that point will be captured by the DBNet stations. The darkest shade is the area around the location of the station where 100% will be captured.

See http://www.wmo.int/pages/prog/sat/dbnet-implementation_en.php#DBNetstatus



4. Capacity Development



Virtual Laboratory for Training and Education in Satellite Meteorology (VLab)



The screenshot shows the VLab website interface. At the top, the browser address bar displays 'www.wmo-sat.info/vlab/'. Below the browser, the website header includes the VLab logo and the text 'WMO-CGMS VIRTUAL LABORATORY FOR EDUCATION AND TRAINING IN SATELLITE METEOROLOGY'. A navigation menu lists: Home, VLab News, Centres of Excellence, Calendar of Events, Library, RFG, Event Weeks, Projects, Publications, and Contacts. The main content area features a 'Home' section with introductory text and a list of participating satellite operators. A group photo of VLMG-9 members in the USA is shown with a caption. On the right sidebar, there are sections for 'CoE: Moodle Login' (with username and password fields and a login button), 'Follow VLab' (with Facebook and RSS icons), 'Newsletter subscriptions' (with name and email fields and a subscribe button), and 'Recent News' (with a list of news items).

Home

Established by the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS), the **Virtual Laboratory for Training and Education in Satellite Meteorology (VLab)** is a global network of specialized training centres and meteorological satellite operators working together to improve the utilisation of data and products from meteorological and environmental satellites.

Eight satellite operators are involved: CMA, CONAE, EUMETSAT, INPE, JMA, KMA, NOAA and ROSHYDROMET, and thirteen training centres – called Centres of Excellence (CoEs) – located in Argentina (Buenos Aires and Cordoba), Australia (Melbourne), Barbados (Bridgetown), Brazil (Cachoeira Paulista), China (Beijing and Nanjing), Costa Rica (San Jose), Kenya (Nairobi), Morocco (Casablanca), Niger (Niamey), Oman (Muscat), Republic of Korea (Gwanghyewon), the Russian Federation (Moscow and St Petersburg) and South Africa

VLMG-9 in USA, July 2018.

CoE: Moodle Login

username

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Recent News

- 2019 Joint Satellite Conference
- GEO-KOMPSAT-2A satellite successfully launched
- Open Online Course on Monitoring



See <https://www.wmo-sat.info/vlab/>

5. Space Weather Coordination



WMO and Space Weather

Cg-18/Doc. 6.1(3), DRAFT 1, p. 17



FOUR-YEAR PLAN FOR WMO ACTIVITIES RELATED TO SPACE WEATHER 2020-2023

**DRAFT 1.0d
17 February 2019**

- Supported by IPT-SWeISS
- Space Weather and OSCAR/Space
- Space Weather Portal (see <https://www.wmo-sat.info/product-access-guide/theme/space-weather>)
- Working with ICAO to select providers for space weather information services for aviation
- Space Weather Warnings and GMAS



6. WMO Governance Reform



Strategic Plan 2020-2023

WMO STRATEGIC PLAN AT A GLANCE

Vision 2030

By 2030, a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic impact of extreme weather, climate, water and other environmental events, and empowered to boost their sustainable development through the best possible services, whether over land, at sea or in the air

Overarching Priorities

Enhancing preparedness for, and reducing losses of life and property from hydrometeorological extremes

Supporting climate-smart decision making to build resilience and adaptation to climate risk

Enhancing socioeconomic value of weather, climate, hydrological and related environmental services

Core Values

- Accountability for Results and Transparency
- Collaboration and Partnership
- Inclusiveness and Diversity

Long-Term Goals

1 Better serve societal needs:
Delivering authoritative, accessible, user-oriented and fit-for-purpose information and services

2 Enhance Earth system observations and predictions:
Strengthening the technical foundation for the future

3 Advance targeted research:
Leveraging leadership in science to improve understanding of the Earth system for enhanced services

4 Close the capacity gap:
Enhancing service delivery capacity of developing countries to ensure availability of essential information and services

5 Strategic realignment of WMO structure and programmes:
Effective policy- and decision-making and implementation

Strategic Objectives

2020-2023 focus

- 1.1 Strengthen national multi-hazard early warning systems and extend reach to better enable effective response to the associated risks
- 1.2 Broaden the provision of policy- and decision-supporting climate information and services
- 1.3 Further develop services in support of sustainable water management
- 1.4 Enhance and innovate the provision of value-added, decision-supporting weather information and services

- 2.1 Optimize the acquisition of observation data through the WMO Integrated Global Observing System
- 2.2 Improve and increase access to, exchange and management of current and past observation data and derived products through the WMO Information System
- 2.3 Enable access and use of numerical analysis and prediction products at all temporal and spatial scales from the WMO Global Data Processing and Forecast System

- 3.1 Advance scientific knowledge of the Earth system
- 3.2 Enhance the science-to-service value chain ensuring scientific and technological advances improve predictive capabilities
- 3.3 Advance policy-relevant science

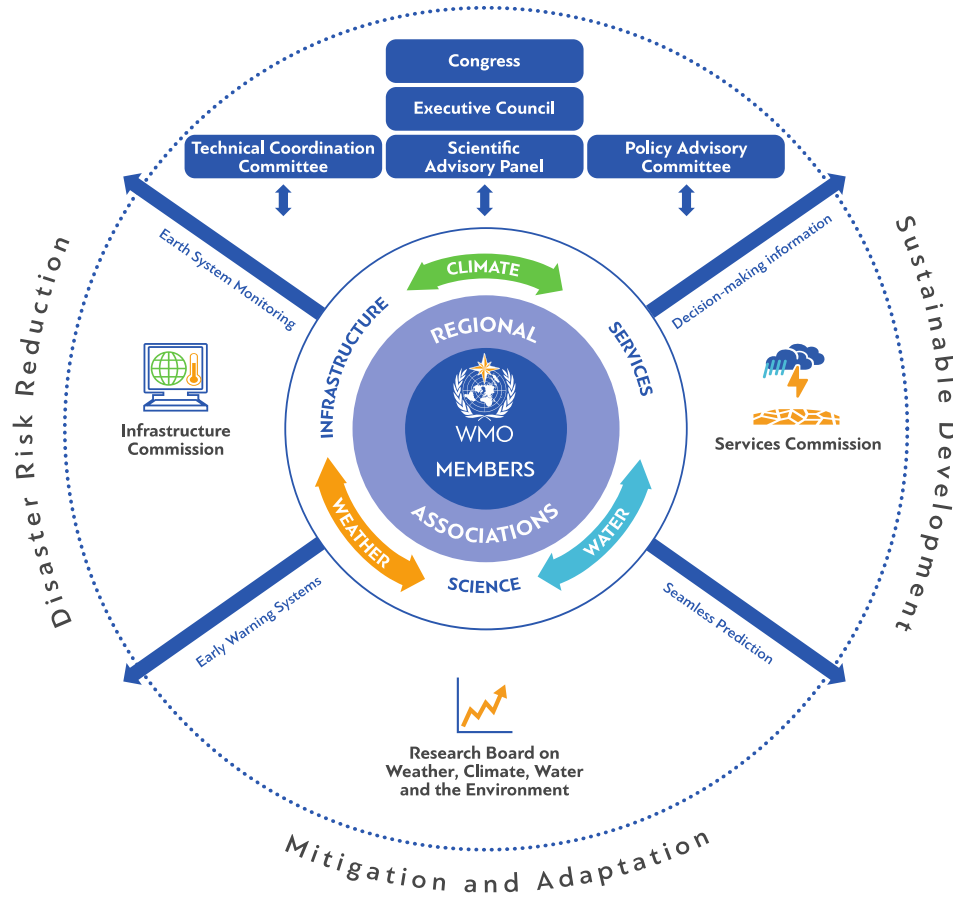
- 4.1 Address the needs of developing countries to enable them to provide and utilize essential weather, climate, hydrological and related environmental services
- 4.2 Develop and sustain core competencies and expertise
- 4.3 Scale-up effective partnerships for investment in sustainable and cost-efficient infrastructure and service delivery

- 5.1 Optimize WMO constituent body structure for more effective decision-making
- 5.2 Streamline WMO programmes
- 5.3 Advance equal and effective participation of women and men in governance, scientific cooperation and decision-making



WMO Governance Reform

Proposed Structure



See <https://public.wmo.int/en/governance-reform>



Challenges & Opportunities

- Create benefits from the space-based observing system and help achieve global development agendas
- Enlarge user community and integrate space-based data and information into decision-making processes
- Implement space-based WIGOS Vision 2040, including the architecture for climate monitoring from space
- Maintain and promote open and free access to data
- Sustain OSCAR and routinely conduct RRR
- Help bridging gap between space agencies and NMHSs
- Assist NMHSs with capacity development
- Engage with the Global Weather Enterprise



Thank you

WMO Space Programme

<http://www.wmo.int/sat>



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