UPDATE ON WMO SPACE WEATHER ACTIVITIES

Werner Balogh
WMO Space Programme Office

ISWI Steering Committee Annual Meeting

7 February 2020
57th COPUOS STSC
Vienna, Austria

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

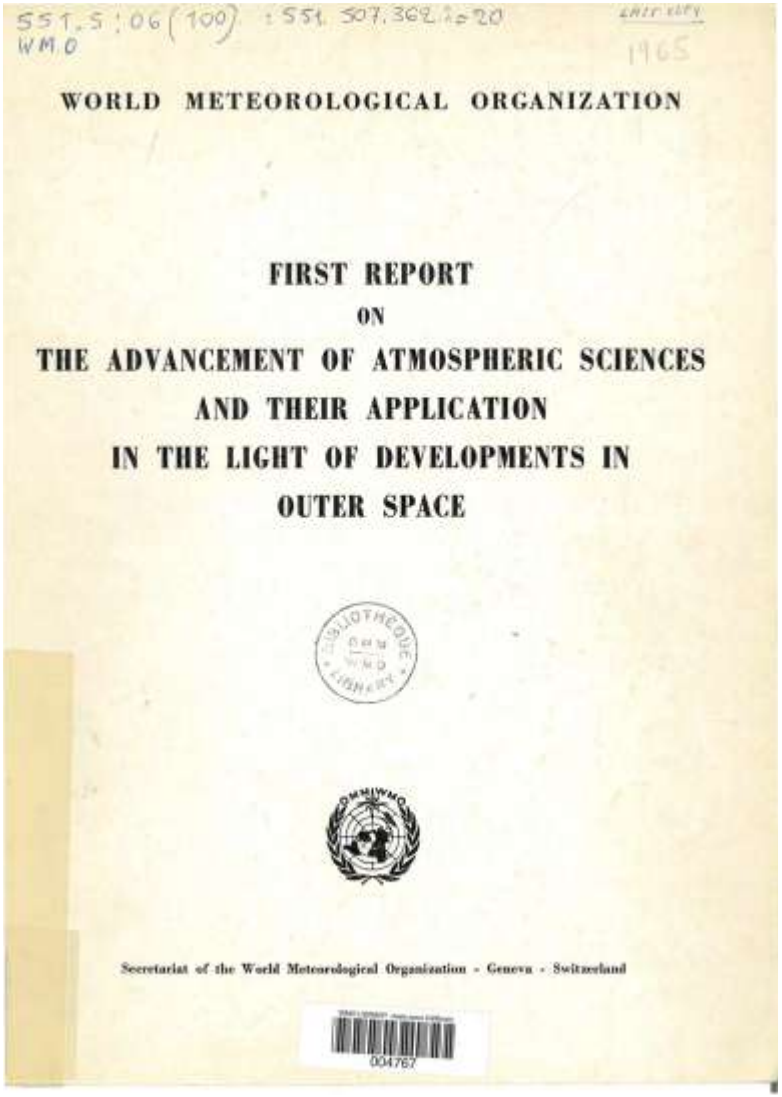
WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

World Meteorological Organization

- In 1879, establishment of the International Meteorological Organization (IMO)
- In 1950, IMO transformed into the World Meteorological Organization (WMO)
- Since 1951, WMO is a UN specialized agency and the UN authoritative voice for weather, climate, water and environmental services
- This includes space weather!
- 193 Member states, represented by Permanent Representative – typically the Director of the country's National Meteorological and Hydrological Service (NMHS)
- **It is important for the space weather community to engage with their WMO Permanent Representative!**

See https://public.wmo.int/en/about-us/who-we-are/history-of-wmo

WMO, UNCOPUOS and Space Activties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WMO
1965

WORLD METEOROLOGICAL ORGANIZATION

FIRST REPORT
ON
THE ADVANCEMENT OF ATMOSPHERIC SCIENCES
AND THEIR APPLICATION
IN THE LIGHT OF DEVELOPMENTS IN
OUTER SPACE

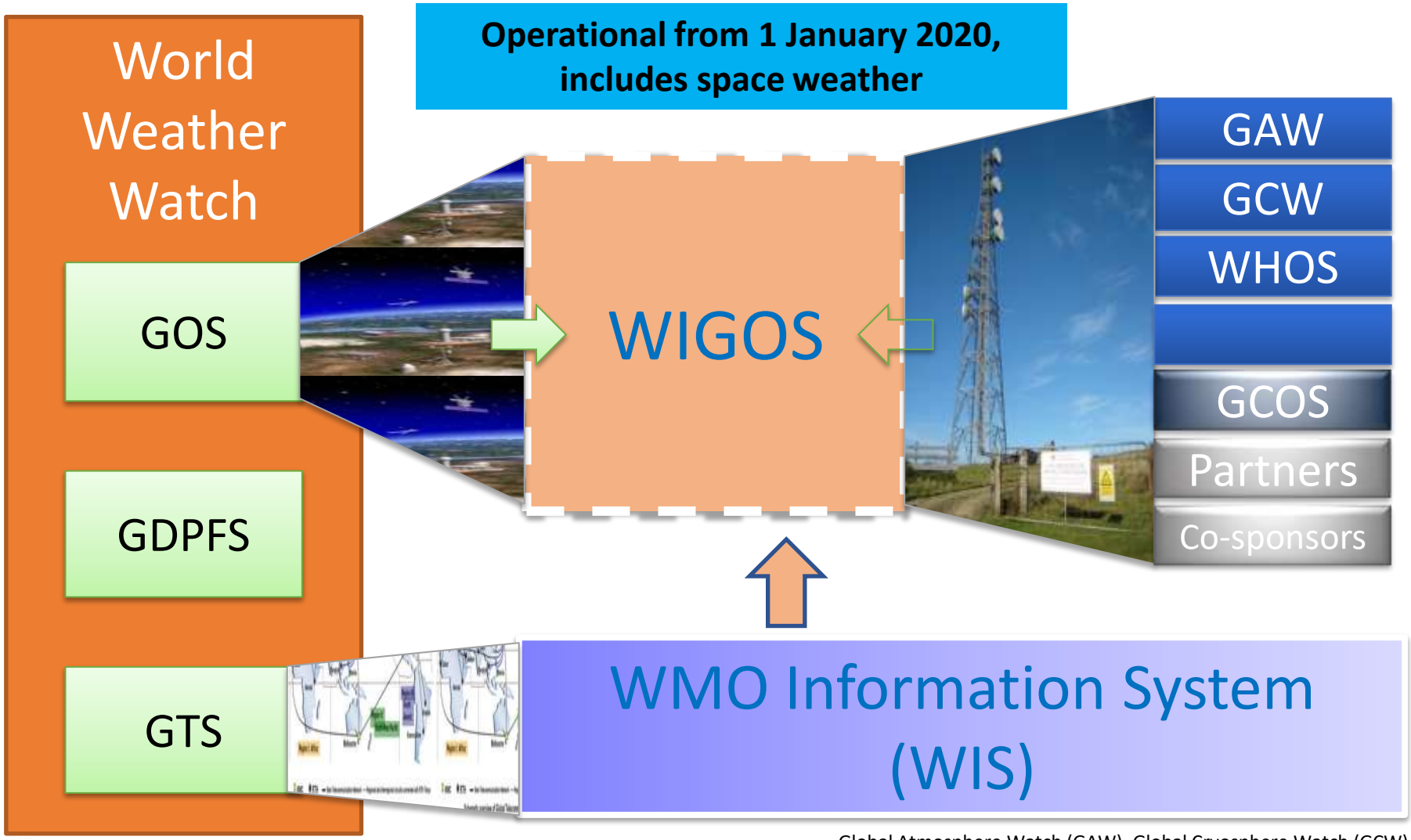
Secretariat of the World Meteorological Organization - Geneva - Switzerland

004767

- Wexler/Bugaev report, prepared in 1962, in response to a request by the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and by the UN General Assembly
- Contains the initial proposal for the World Weather Watch (WWW)

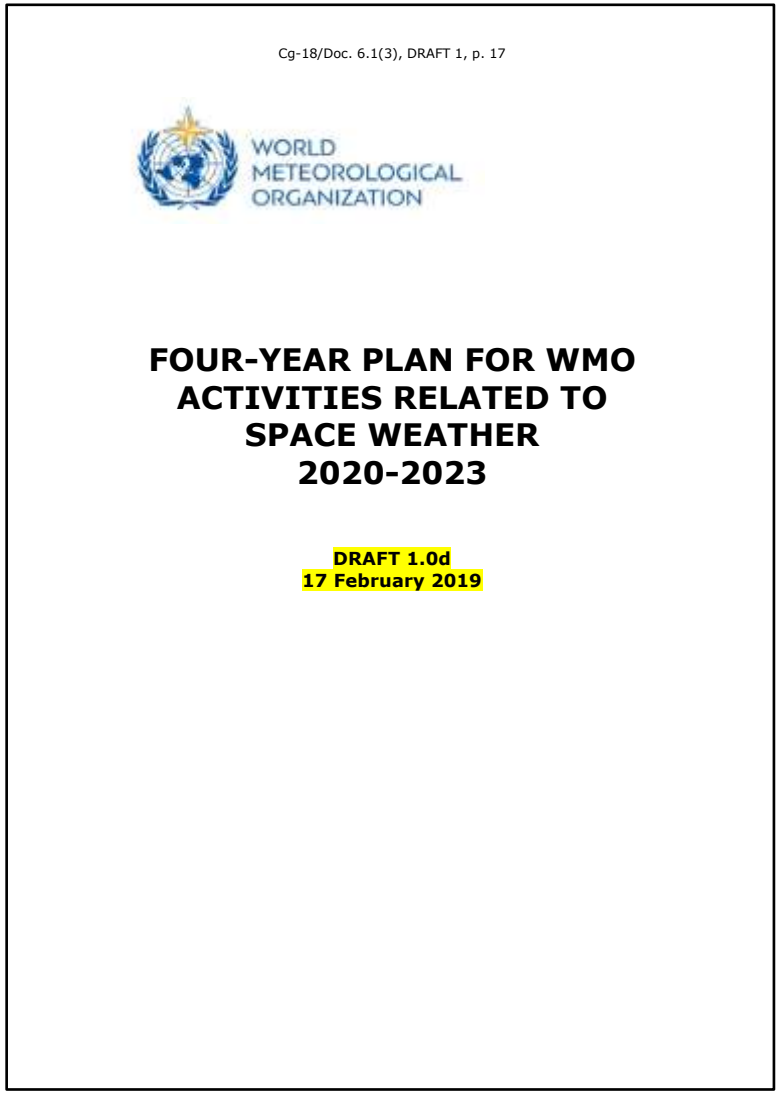
See https://library.wmo.int/index.php?lvl=notice_display&id=10240

WMO Integrated Global Observing System



Global Atmosphere Watch (GAW), Global Cryosphere Watch (GCW), Hydro Observing System, Global Climate Observing System (GCOS)

Space Weather in WMO



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

WORLD METEOROLOGICAL ORGANIZATION

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

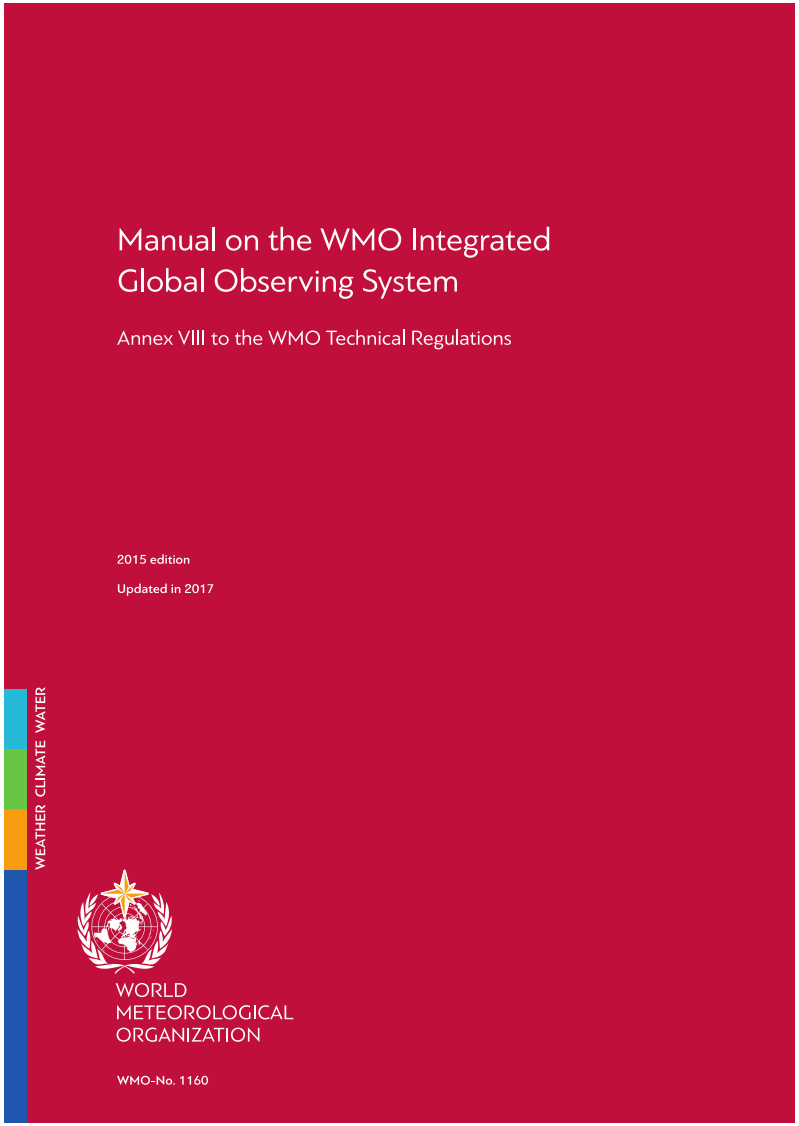
DRAFT 1.0d
17 February 2019

- Space weather work since 2008
- WMO Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWeISS)
- Third meeting held at the Royal Observatory of Belgium in November 2019
- It is presently revising its workplan in line with the "Four-Year Plan for WMO Activities Related to Space Weather 2020-2023", which was approved by the 18th World Meteorological Congress in its Resolution 53 (Cg-18) .

See https://community.wmo.int/meetings/ipt-sweiss-3

WMO Technical & Regulatory Framework

- As requested by CG-17, space weather needs to be included in the WMO technical and regulatory framework
  - WIGOS Manual & Guidelines
  - WIS Manual & Guidelines
  - GDPFS Manual & Guidelines
- Deadline: Cg-19 in 2023
- **IPT-SWeISS-3 Agenda Item 2.4**



Space Weather and OSCAR

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 Capabilties**
- **Surface based Capabilties**

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.

OSCAR overview - click to enlarge

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).

Getting started with OSCAR/Space and OSCAR/Requirements

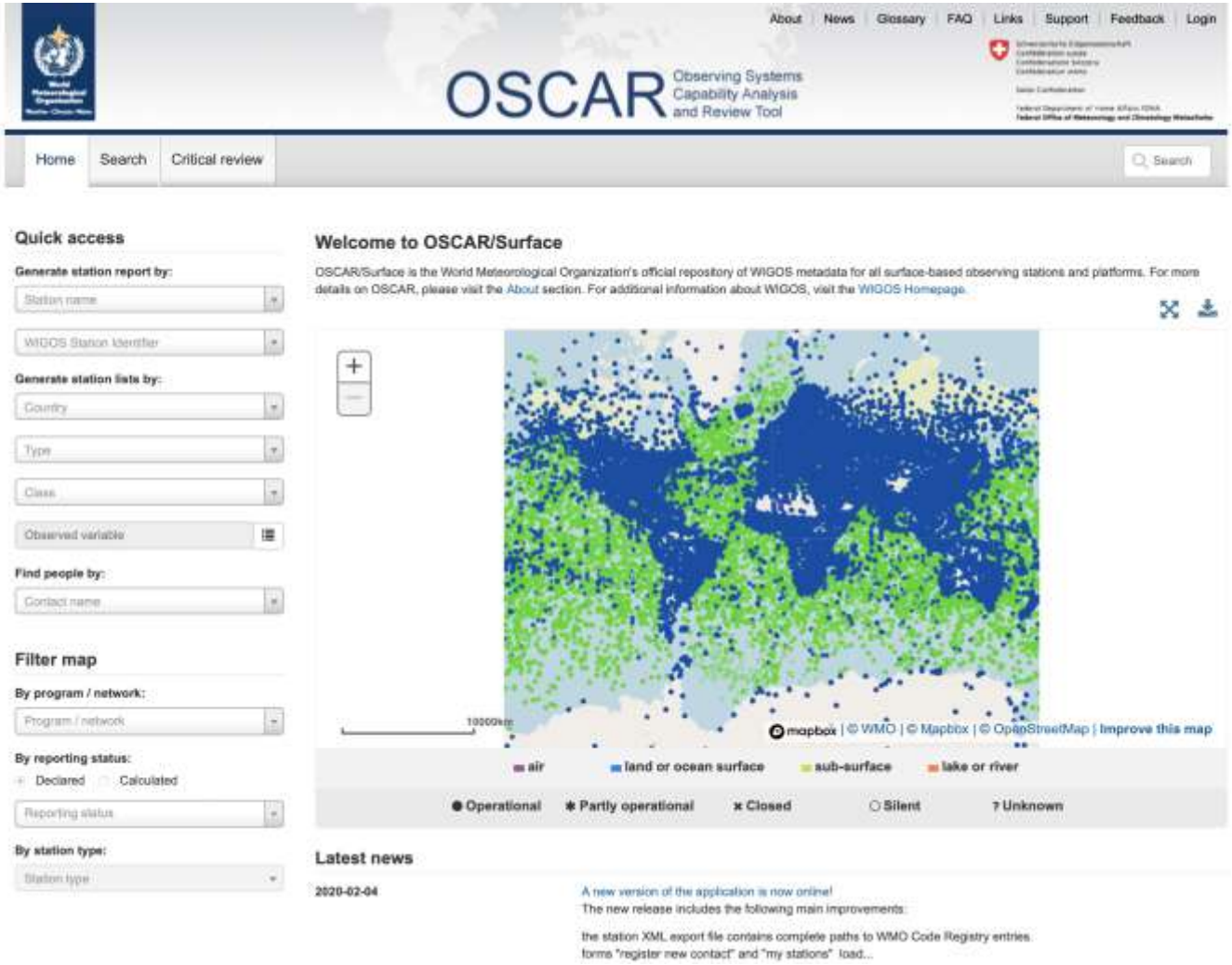
- Watch the 10 minute OSCAR screen-cast to get an overview of the application and learn how to use its functionalities
- Documents available for download
  - OSCAR/Space and OSCAR/Requirements User manual (413 kbyte)
  - OSCAR/Requirements Focal Point manual (200 kbyte) for user requirements ediors
  - 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.

See http://oscar.wmo.int

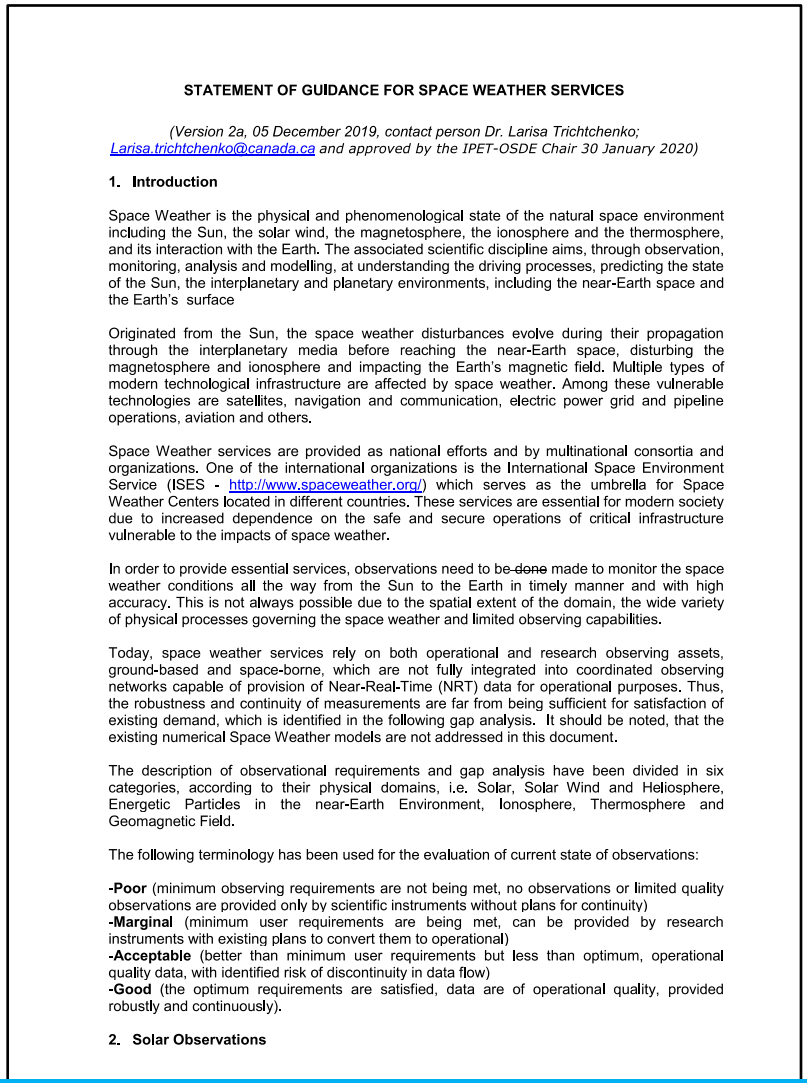
Space Weather Stations in OSCAR/Surface



For Help contact: Trichtchenko, Larisa (NRCan/RNCan) <larisa.trichtchenko@canada.ca>

Space Weather Statement of Guidance

- WMO Rolling Review of Requirements process
- Assesses observing requirements versus observations being made
- Makes recommendations to WMO Member to ensure that observing requirements are being met and the required observing stations are being maintained
- **IPT-SWeISS-3 Agenda Item 8.2**



STATEMENT OF GUIDANCE FOR SPACE WEATHER SERVICES

(Version 2a, 05 December 2019, contact person Dr. Larisa Trichtchenko; Larisa.trichtchenko@canada.ca and approved by the IPET-OSDE Chair 30 January 2020)

1. Introduction

Space Weather is the physical and phenomenological state of the natural space environment including the Sun, the solar wind, the magnetosphere, the ionosphere and the thermosphere, and its interaction with the Earth. The associated scientific discipline aims, through observation, monitoring, analysis and modelling, at understanding the driving processes, predicting the state of the Sun, the interplanetary and planetary environments, including the near-Earth space and the Earth's surface

Originated from the Sun, the space weather disturbances evolve during their propagation through the interplanetary media before reaching the near-Earth space, disturbing the magnetosphere and ionosphere and impacting the Earth's magnetic field. Multiple types of modern technological infrastructure are affected by space weather. Among these vulnerable technologies are satellites, navigation and communication, electric power grid and pipeline operations, aviation and others.

Space Weather services are provided as national efforts and by multinational consortia and organizations. One of the international organizations is the International Space Environment Service (ISES - http://www.spaceweather.org/) which serves as the umbrella for Space Weather Centers located in different countries. These services are essential for modern society due to increased dependence on the safe and secure operations of critical infrastructure vulnerable to the impacts of space weather.

In order to provide essential services, observations need to be ~~done~~ made to monitor the space weather conditions all the way from the Sun to the Earth in timely manner and with high accuracy. This is not always possible due to the spatial extent of the domain, the wide variety of physical processes governing the space weather and limited observing capabilities.

Today, space weather services rely on both operational and research observing assets, ground-based and space-borne, which are not fully integrated into coordinated observing networks capable of provision of Near-Real-Time (NRT) data for operational purposes. Thus, the robustness and continuity of measurements are far from being sufficient for satisfaction of existing demand, which is identified in the following gap analysis. It should be noted, that the existing numerical Space Weather models are not addressed in this document.

The description of observational requirements and gap analysis have been divided in six categories, according to their physical domains, i.e. Solar, Solar Wind and Heliosphere, Energetic Particles in the near-Earth Environment, Ionosphere, Thermosphere and Geomagnetic Field.

The following terminology has been used for the evaluation of current state of observations:

-Poor (minimum observing requirements are not being met, no observations or limited quality observations are provided only by scientific instruments without plans for continuity)
-Marginal (minimum user requirements are being met, can be provided by research instruments with existing plans to convert them to operational)
-Acceptable (better than minimum user requirements but less than optimum, operational quality data, with identified risk of discontinuity in data flow)
-Good (the optimum requirements are satisfied, data are of operational quality, provided robustly and continuously).

2. Solar Observations

See https://community.wmo.int/rolling-review-requirements-process

Space Weather Coordination

- How can we structure our activities so that they efficiently complement each other?
- **IPT-SWeISS-3 Agenda Item 5**
- Proposed Mapping of Coordination Matrix:

Entity	Focus
CGMS SWCG	space-based observing system, OSCAR/Space
COSPAR	Science, capacity building
ICAO	Operational centres for aeronautics community
IPT-SWeISS	Technical, regulatory frameworks, WIGOS, WIS, data formats
IROWG SW Subgroup	Radio occultation observations
ISES	Operational service providers
ISWI Network	Science, capacity, surface-based observing systems
UN COPUOS Expert Group	Link to UNCOPUOS policy/law framework, LTS, Space2030

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you

http://www.wmo.int/sat

WMO OMM

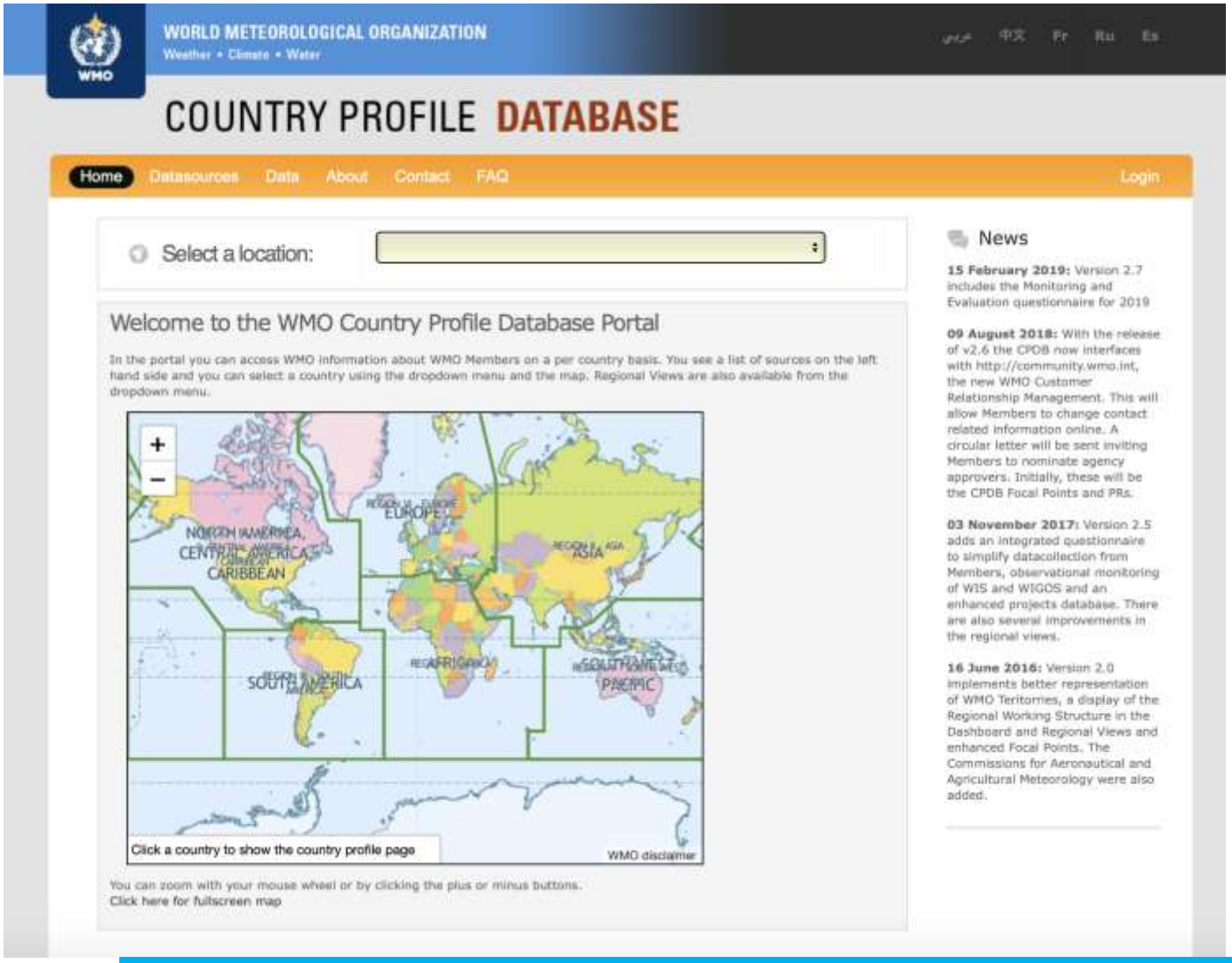
World Meteorological Organization
Organisation météorologique mondiale

Additional Information

Relevant WMO Congress Resolutions

- 53 (Cg-18): "Four-year plan for WMO activities related to space weather 2020–2023"
- Resolutions of the 18th World Meteorological Congress related to space weather:
- 12 (Cg-18): "WMO methodology for cataloguing hazardous weather, climate, water and space weather events"
- 13 (Cg-18): "WMO Global Multi-hazard Alert System"

WMO Country Profile Database



How to find relevant WMO contacts in your country?

Use the WMO Country Profile Database!

See https://cpdb.wmo.int