Federal Aviation Administration

ICAO Space Weather Information Service

10th ICAO NACC Region Working Group Meeting

8-12 September 2025

Overview

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- Space Weather Impacts on Aviation
- ICAO Annex 3
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- ICAO Space Weather Centers
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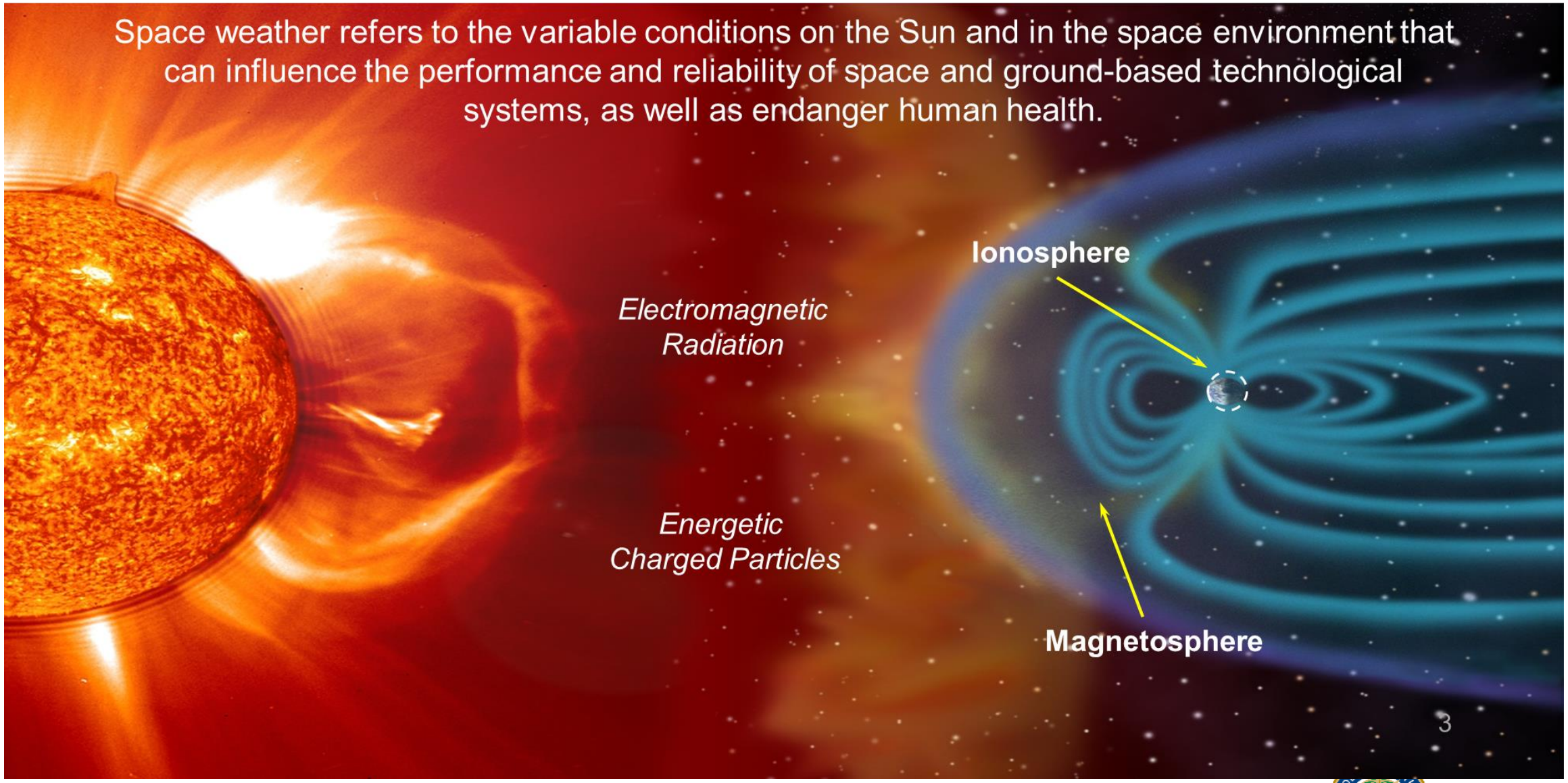
- Conclusion

What is ‘Space Weather’?



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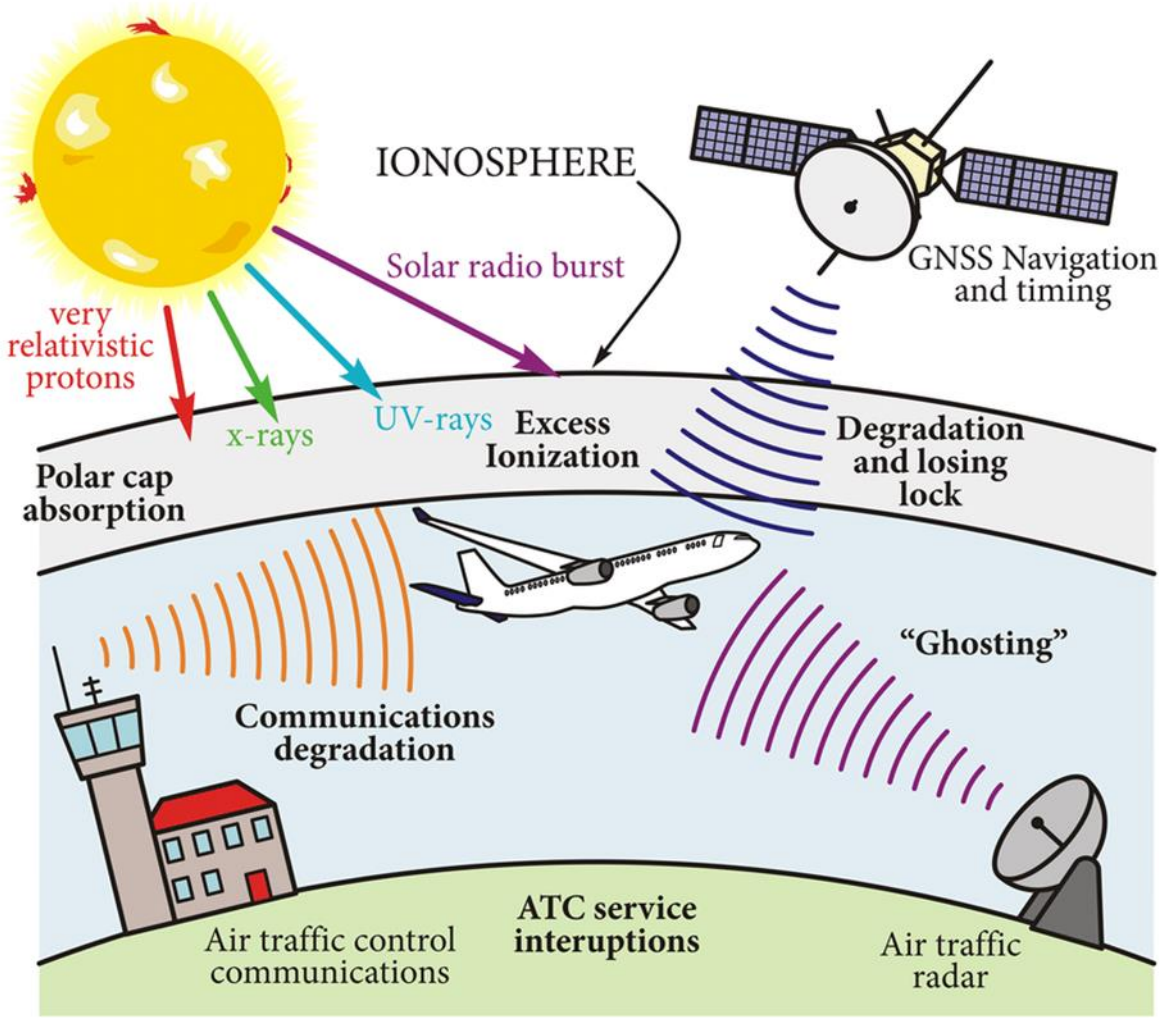
Space Weather Impacts on Aviation



- High Frequency (HF) Communications
  - No advance warning
  - Effects last 10s of minutes to several hours
- Global Navigation Satellite System (GNSS)
  - Advance warning possible
  - Duration of effects varies but outages can last for hours
- Radar
  - No advance warning
  - Effects last 10s of minutes to several hours
- Radiation
  - Advance warning possible on minutes to hours timescale
  - Elevated radiation levels can persist for several days

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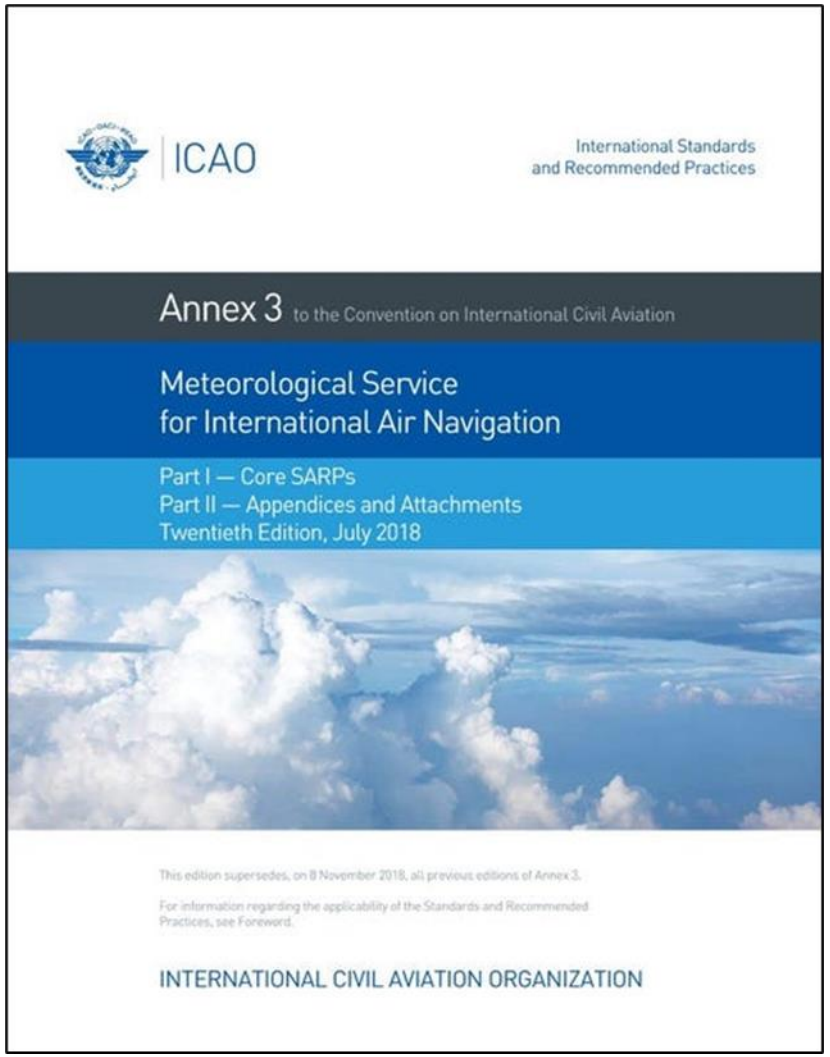
ICAO Annex 3 – Meteorological Service for International Air Navigation

- Space weather introduced in Amendment 78 (2018)
  - Advisories issued for:
    - HF voice/data communications
    - Radiation exposure to crew and passengers
    - GNSS-based navigation and surveillance
- Minor changes to content of advisory in Amendment 79 (2020)
- Additional changes to content and format in Amendment 82 (2025)
- Future changes to content and format planned for Amendment 83 (2027)
- A 12-24 hour SWX outlook forecast planned for Amendment 84 (2030)



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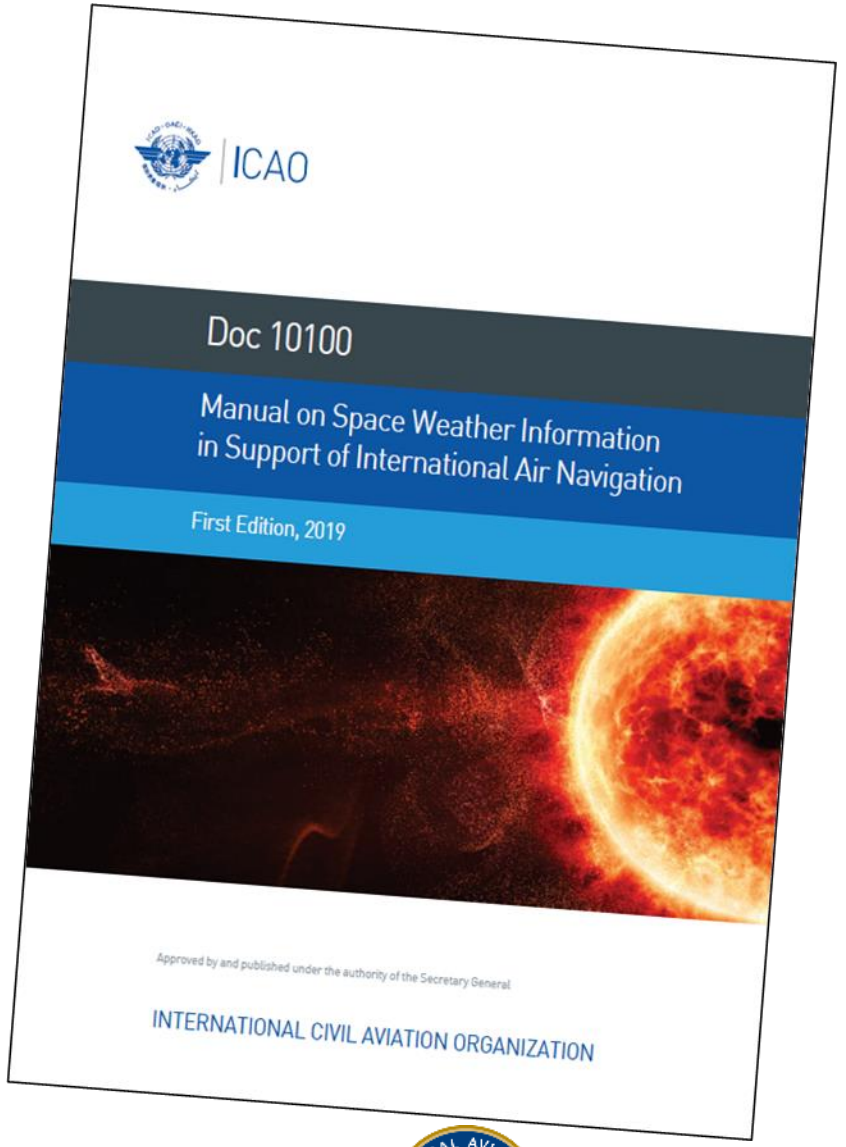
Use of the Space Weather Advisory

- Primarily intended for pre-flight planning decisions (e.g., route selection, altitude selection, fuel loading)
- Provides real-time warnings of some space weather events
- May be used for in-flight route or altitude deviations
- Promotes common situational awareness among aviation decision-makers

ICAO Space Weather Manual and Educational Information

- Manual on Space Weather Information in Support of International Air Navigation
  - Published in October 2019
  - Updated in 2024
- ICAO Space Weather Information Service Flyer
  - Under development
- Operational guidance material
  - Available from ICAO-designated space weather centers
    - Partnership for Excellence in Civil Aviation Space Weather User Services (PECASUS)
    - Australia/Canada/France/Japan (ACFJ) consortium
- ICAO Space Weather User Workshop
  - 20 October 2025
  - Italian Air Force Headquarters (Rome, Italy)



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ICAO Space Weather User Workshop

20 October 2025, Italian Air Force Headquarters (Rome, Italy)

International Civil Aviation Organization

MEMORANDUM

METP WG-MOG SWX - Memo
26/06/2025

Subject: (Invitation) Space Weather (SWX) User Workshop

Date/Time: **20 October 2025, 0900 to 1700 hours (local time (CEST))**

Location: Italian Air Force Headquarters in Rome, Italy

Action: Confirm attendance by **22 September 2025**

Dear Sir/Madam,

We are pleased to inform you that the Meteorology Panel Working Group on Meteorological Operations Groups (WG-MOG) Space Weather (SWX) Work Stream is organizing a SWX User Workshop on the provision and use of SWX information for international civil air navigation.

The SWX User Workshop will take place on **20 October 2025 from 0900 to 1700 hours (local time (CEST)) at the Italian Air Force (ITAF) Headquarters in Rome, Italy**. The location and contact information of the Italian Air Force Headquarters are as follows:

Italian Air Force
General Office for Military Aviation and Meteorology
Viale dell'Università, 4
00185 Rome (Italy)
Sala Ajmone Cat
stataero.aviam.met@aeronautica.difesa.it
+39 0649864589 (Monday to Friday 08.00-17.00 CEST)

When entering the ITAF Headquarters, workshop attendees will be asked to show valid government-issued identification or passport, including a visa (if required). Attendees will be provided with a delegation badge to be kept until the end of the workshop at which time it must be returned to the host venue.

The primary objectives of this workshop are:

- To share with the aviation industry the current status and future updates of the ICAO SWX Information Service.
- To facilitate users, regulators, and other interested parties, in understanding the uses, benefits, and uncertainties of SWX information.
- To share existing draft education and guidance material and for all stakeholders to articulate their requirements to assist in the utilization and oversight of the ICAO SWX Information Service.
- To discuss improvements and obtain feedback from users on the ICAO SWX Information Service.

Participation is strongly encouraged by airline representatives, national regulators, flight planning tool providers, air navigation service providers, and pilot representatives who are interested in, or responsible for, SWX procedures for air international navigation.

A high-level provisional agenda is as follows:

- Morning Session:
  - Overview of SWX impacts on aviation and ICAO SWX Information Service
  - Planned updates to the SWX Information Service
  - SWX Information Service education and guidance materials
- Afternoon Session:
  - Moderated industry panel discussion
  - User feedback on current and planned SWX Information Service products
  - SWX case studies and/or exercises

Further details regarding SWX User Workshop logistics and the detailed agenda will be communicated to registered participants.

We would be grateful if you would confirm your attendance via e-mail, **no later than 22 September 2025** to Angelo Romito (angelo.romito@aeronautica.difesa.it) and Amanda Hoprich (hoprich@avmet.com).

Kind regards,

James Shapland
Rapporteur, WG-MOG

Angelo Romito
Coordinator, WG-MOG SWX Work Stream

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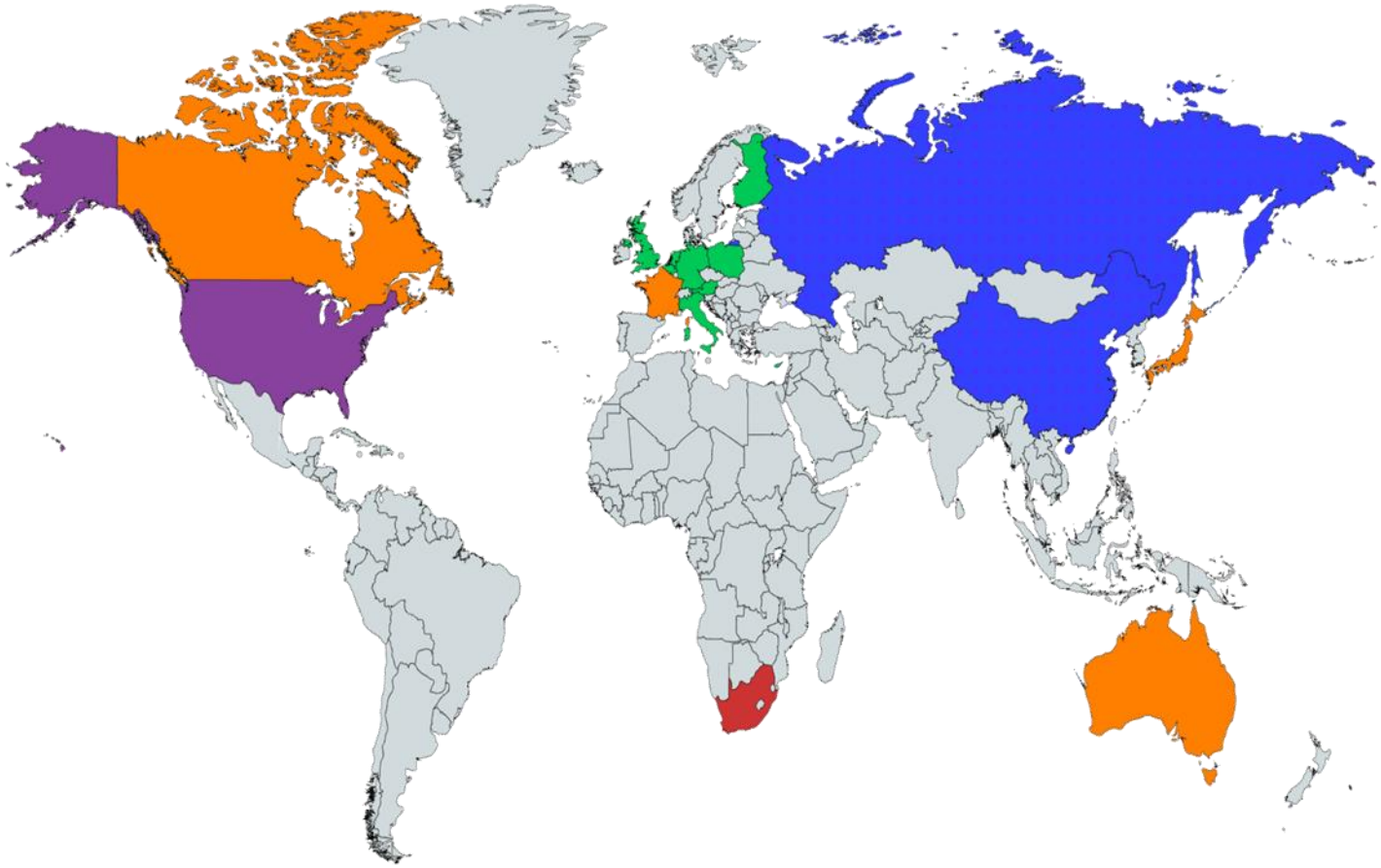
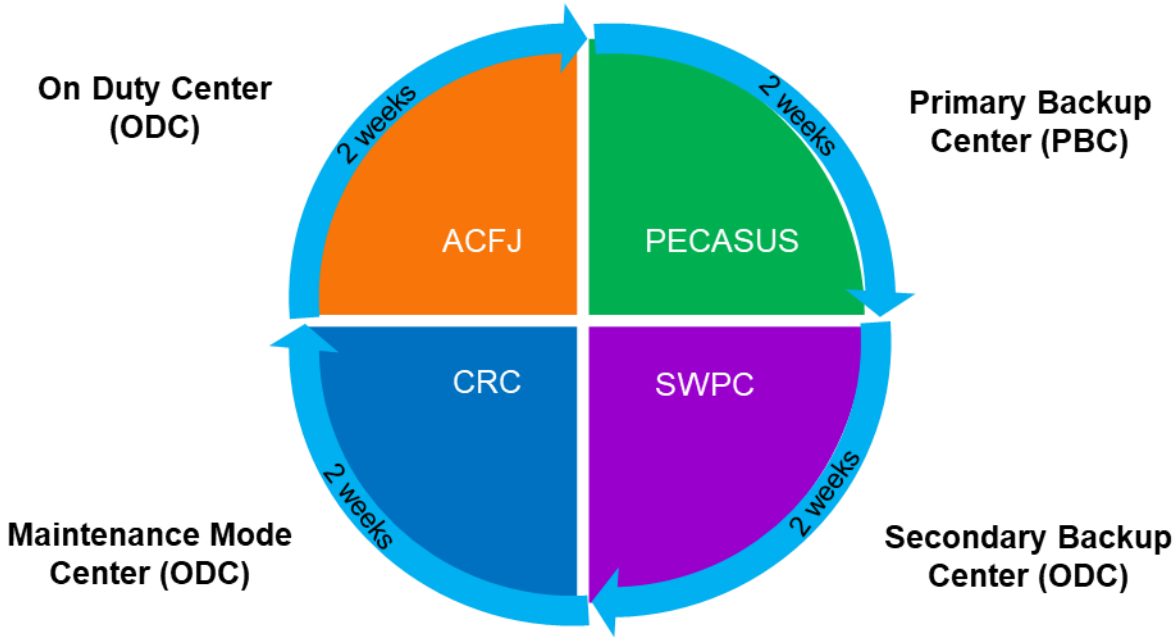
ICAO Space Weather Centers

- ICAO-designated centers
  - Four global centers (a consortium is considered one center)
    - **PECASUS** (led by Finland)
      - Austria
      - Belgium
      - Cyprus
      - Finland
      - Germany
      - Italy
      - Netherlands
      - Poland
      - United Kingdom
    - ACJF Consortium
    - **United States** (NOAA Space Weather Prediction Center)
    - **China/Russian Federation Consortium (CRC)**
  - One regional center
    - **South Africa**



ICAO Space Weather Information Service

- Operational service began 7 November 2019
  - Initial provided by three global centers
  - CRC joined operational service in December 2021
- At any given time, there is one ‘On Duty Center’
  - Two-week rotation
  - ‘On Duty Center’ issues all Space Weather Advisories
  - Space weather centers continuously coordinate and collaborate
- Regional center supports the global centers
  - South Africa expected to be integrated into the operational service in November 2025 (applicability date of Amendment 82)



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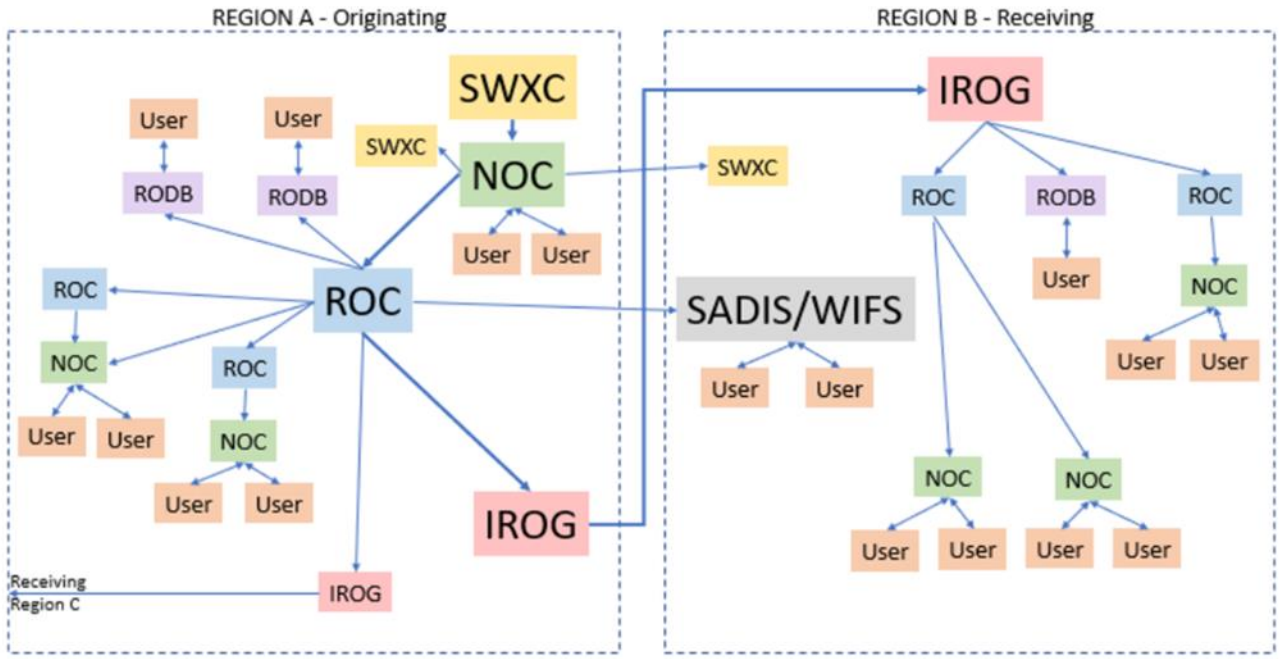
ICAO Space Weather Advisory Dissemination

- Users may obtain the Space Weather Advisory from:
  - National OPMET Center
  - State Aeronautical Information Service
  - Secure internet services – SADIS (UK) and WIFS (US)
- Regular testing of the dissemination systems has been conducted since 2019



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ICAO Space Weather Advisory Content

- Issued for moderate (MOD) and severe (SEV) events
  - For radiation events:
    - MOD is issued between FL250 and FL460
    - SEV is issued above FL250
- The advisory depicts the affected region in one of three ways:
  - One or more pre-defined latitude bands of width 30° shown in the table, followed by a longitude range in 15° increments;
  - The term DAYLIGHT SIDE, meaning the extent of the planet that is in daylight; or
  - A polygon using latitude and longitude coordinates

Title of the latitude bands	Ranges of the latitude bands
High latitudes northern hemisphere (HNH)	N90 to N60
Middle latitudes northern hemisphere (MNH)	N60 to N30
Equatorial latitudes northern hemisphere (EQN)	N30 to equator
Equatorial latitudes southern hemisphere (EQS)	Equator to S30
Middle latitudes southern hemisphere (MSH)	S30 to S60
High latitudes southern hemisphere (HSH)	S60 to S90

Sample ICAO Space Weather Advisory

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FNXX01 YMMC 020100
SWX ADVISORY
DTG:              20190202/0100Z
SWXC:             ACFJ
ADVISORY NR:      2019/10
SWX EFFECT:       HF COM MOD
OBS SWX:          02/0100Z DAYLIGHT SIDE
FCST SWX + 6 HR:  02/0700Z DAYLIGHT SIDE
FCST SWX + 12 HR: 02/1300Z DAYLIGHT SIDE
FCST SWX + 18 HR: 02/1900Z NO SWX EXP
FCST SWX + 24 HR: 03/0100Z NO SWX EXP
RMK:              LOW END OF BAND HF COM DEGRADED
                  ON SUNLIT ROUTES. NEXT 12 HOURS
                  MOST POSSIBLE, DECLINING THEREAFTER.
NXT ADVISORY:     20190202/0700Z=
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Conclusion

- Operational for just 6 years, the ICAO Space Weather Information Service is still a new service
- The ICAO-designated global and regional space weather centers continue to improve the provision of the service
- Based on user consultations, improvements to the Space Weather Advisory information have been, and will continue to be, made over time
- In response to an identified user need, a new 12- to 24-hour Space Weather Outlook Forecast is being developed