

NACC MET TF/4
P/02 – 28 July 2026



ICAO Space Weather Information Service

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**Federal Aviation
Administration**

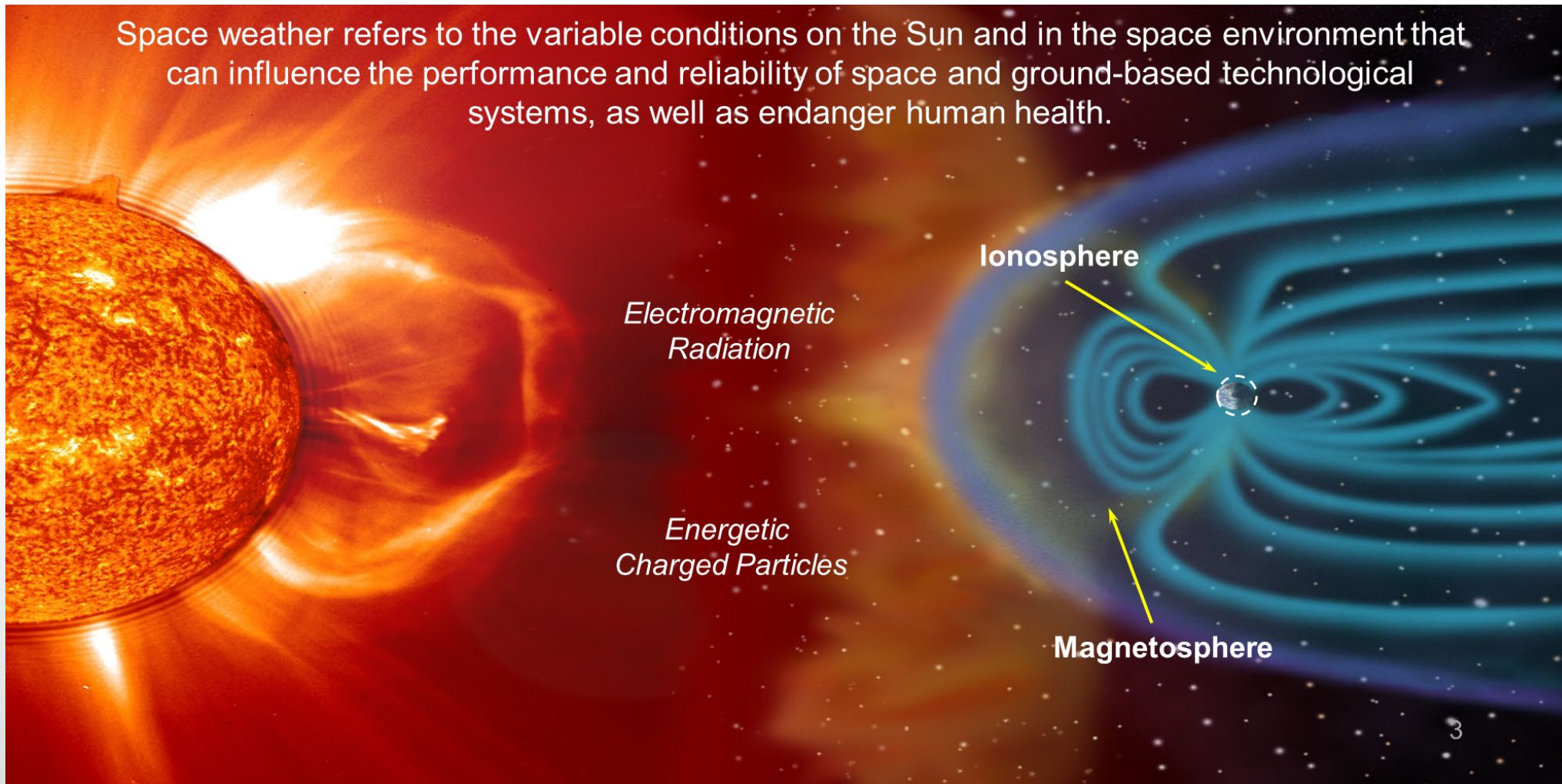
Overview

- What is 'Space Weather'?
- Space Weather Impacts on Aviation
- Evolution of the Space Weather Information Service (SWIS)
- Use of the Space Weather Advisory
- ICAO Space Weather Centers
- ICAO SWIS Operational Framework
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- Space Weather Center Coordination Group (SWXCCG)
- ICAO Space Weather Education material and Workshops
- Conclusion

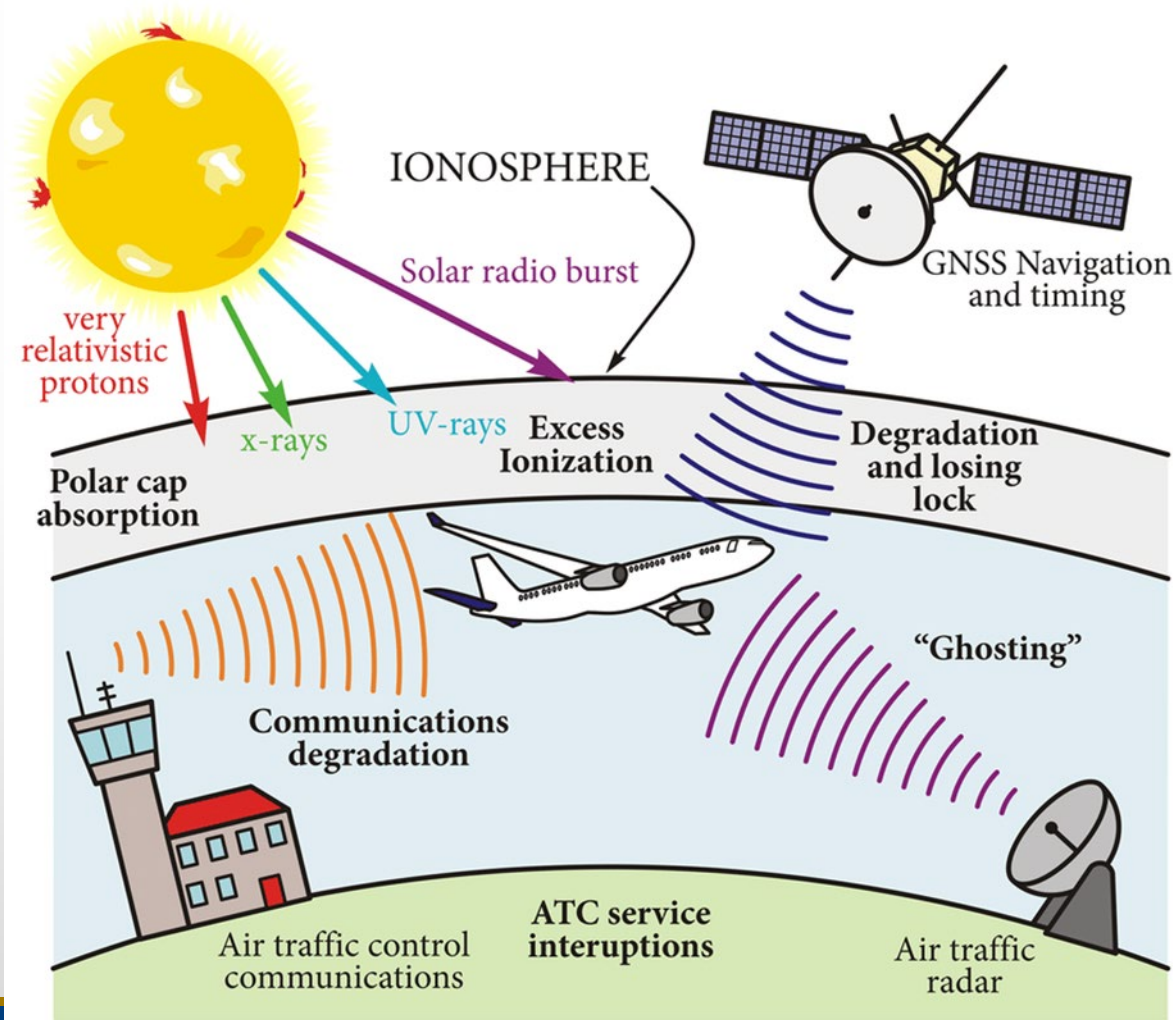


What is 'Space Weather'?

Space weather refers to the variable conditions on the Sun and in the space environment that can influence the performance and reliability of space and ground-based technological systems, as well as endanger human health.



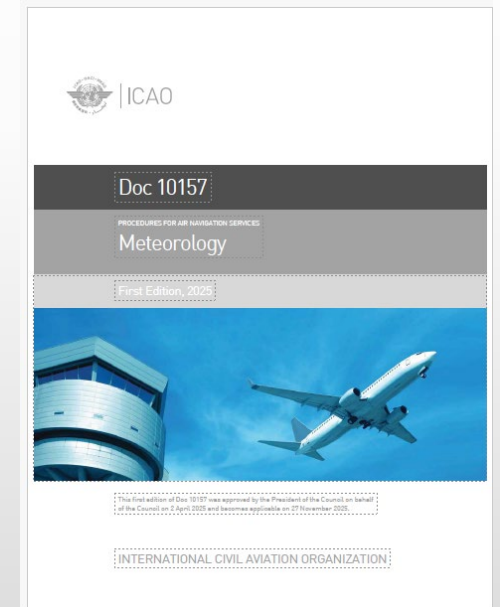
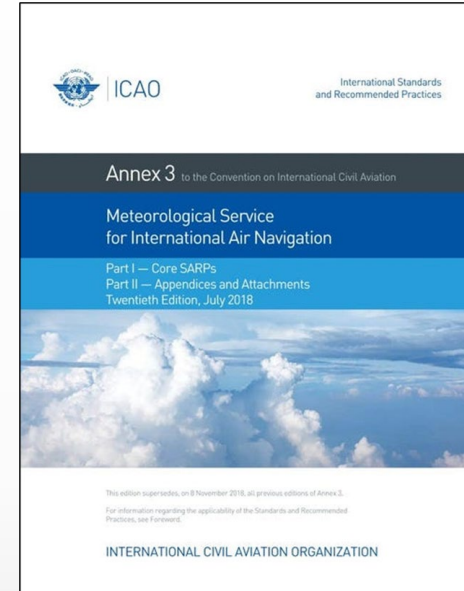
Space Weather Impacts on Aviation



- 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

Evolution of the Space Weather Information Service (SWIS)

- 2018: SWIS introduced in Amendment 78 to Annex 3
 - Advisories issued for:
 - HF voice/data communications
 - Radiation exposure to crew and passengers
 - GNSS-based navigation and surveillance
 - Satellite communication* (n/a per provider agreement)
- 2020: Minor changes to content of advisory in Amendment 79 to Annex 3.
- 2025: South African National Space Agency becomes operational. ICAO Amendment 82 to Annex 3 and the Procedures for Air Navigation Services – Meteorology (PANS-MET, Doc 10157) – minor updates to content & format.
- 2027: AMD 83 and AMD 1 to PANS-MET – Current Space Weather Advisory to include increased temporal resolution of the forecast element and long range time steps (+18, +24, etc.) are being removed .
- Future proposals for METP/6 consideration: new SWIS information to provide a daily outlook forecast.



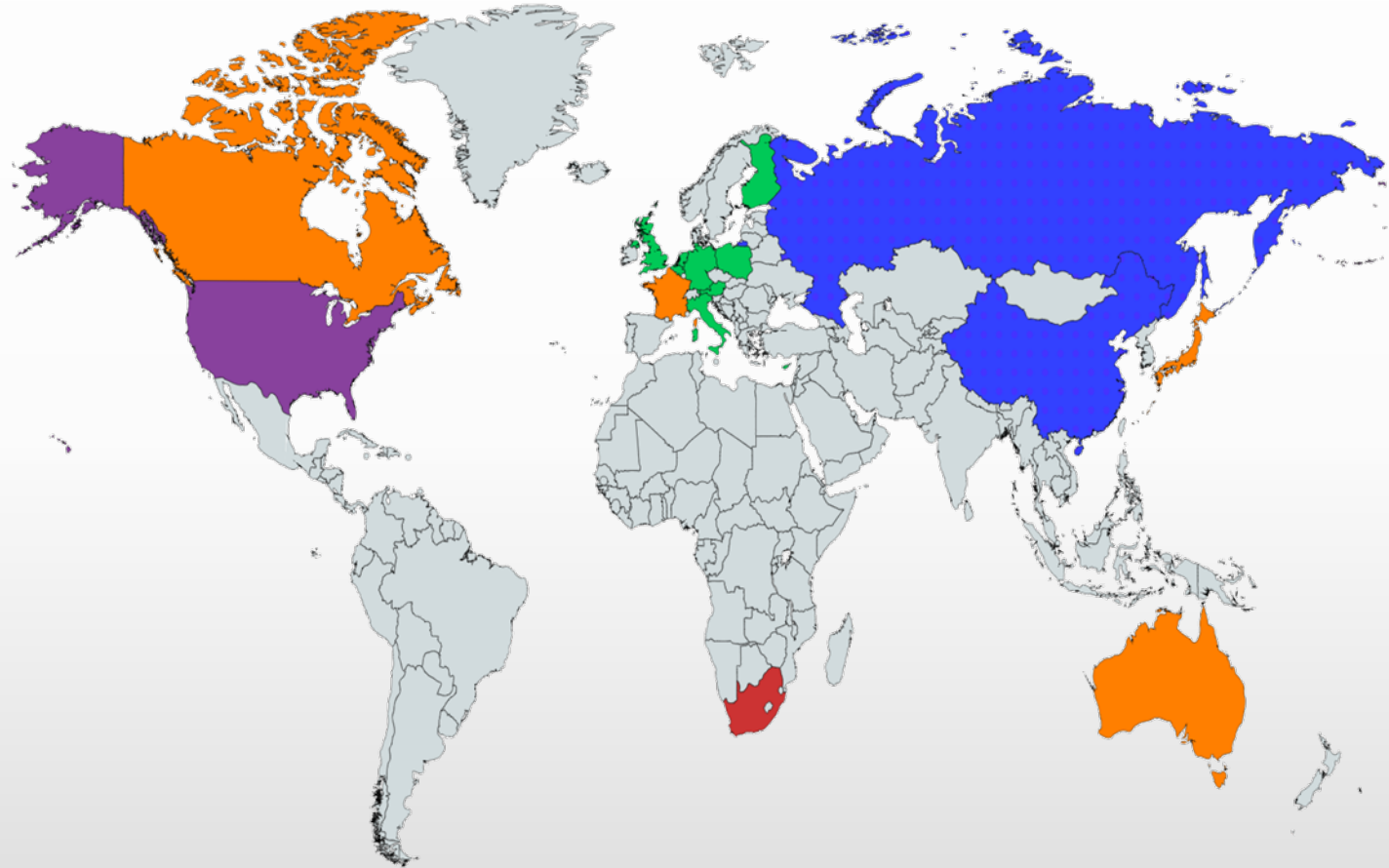
Use of the Space Weather Advisory

- Intended for pre-flight planning decisions (e.g., route selection, altitude selection, fuel loading).
- Provides information to aviation users if there will be moderate or severe degradation of communication in a given frequency range/location on a given day.
- Provides information on GNSS performance and whether there is degradation of timing and position in a specific location.
- Provides information to flight crew and passengers if there is enhanced radiation and at what altitude and location.
- Aircraft Procedures may include in-flight route or altitude deviations based on the advisory severity levels.



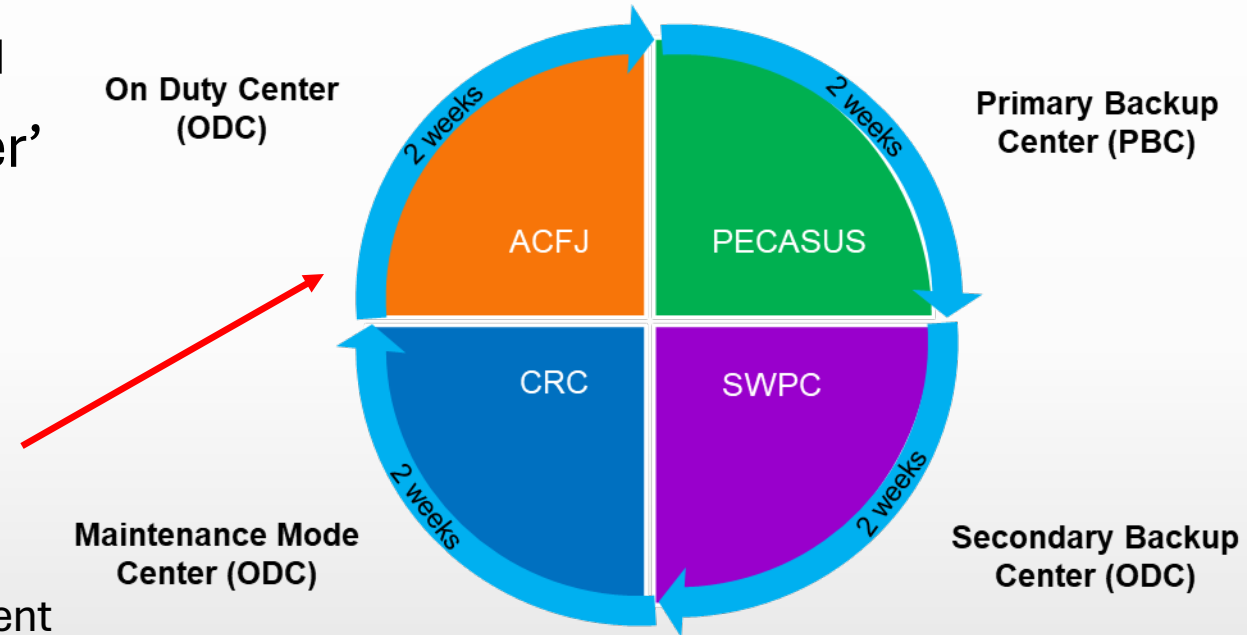
ICAO Space Weather Centers

- 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**
 - Australia, Canada, Japan, France
 - **NOAA Space Weather Prediction Center (SWPC)**
 - United States
 - **CR Consortium (CRC)**
 - China, Russia
 - One regional center
 - **SANSA (South African National Space Agency)**
 - South Africa



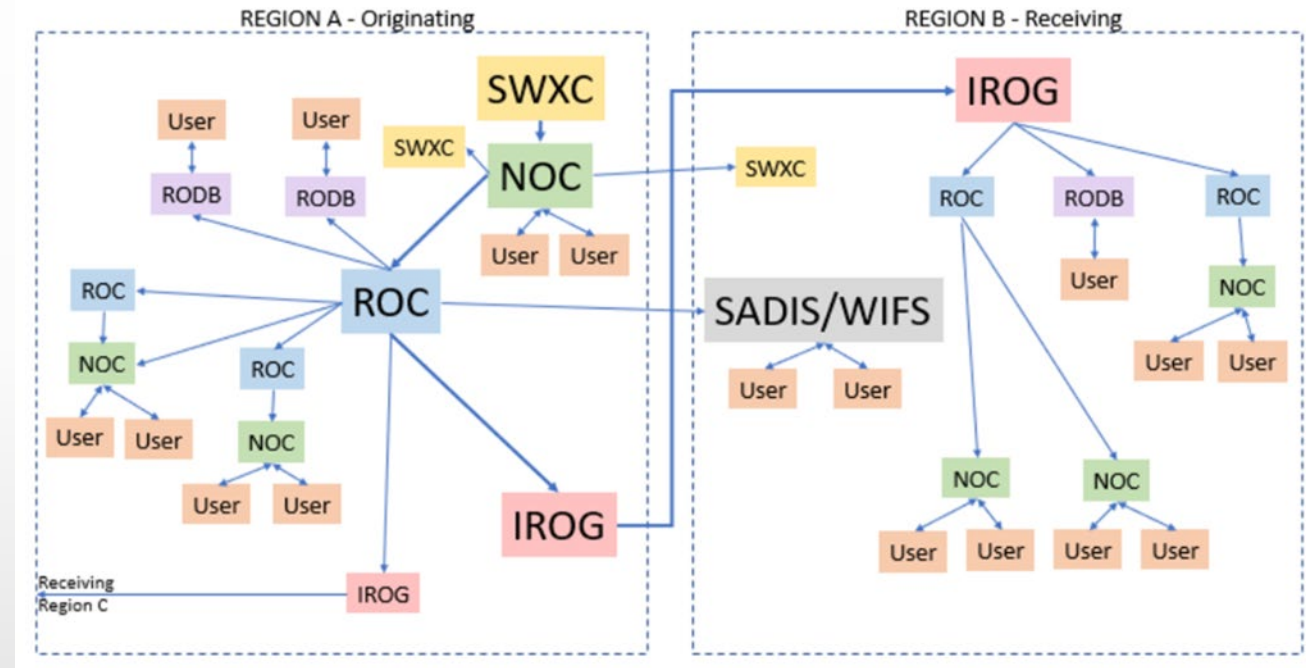
ICAO SWIS Operational Framework

- Operational service began 7 November 2019
 - Initially 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 has been integrated into the operational service November 2025 (applicability date of Amendment 82 to Annex 3)



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 since 2019



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 (HNNH)	N90 to N60
Middle latitudes northern hemisphere (MNNH)	N60 to N30
Equatorial latitudes northern hemisphere (EQNNH)	N30 to equator
Equatorial latitudes southern hemisphere (EQSH)	Equator to S30
Middle latitudes southern hemisphere (MSSH)	S30 to S60
High latitudes southern hemisphere (HSSH)	S60 to S90

Sample ICAO Space Weather Advisory for High Frequency Communication (HF Com)

June 30th, 2056Z

Issued by ACFJ

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FNXX02 YMMC 302056
SWX ADVISORY
DTG: 20260630/2056Z
SWXC: ACFJ
SWX EFFECT: HF COM
ADVISORY NR: 2026/164
OBS SWX: 30/2056Z MOD DAYSIDE
FCST SWX +6 HR: 01/0300Z NOT AVBL
FCST SWX +12 HR: 01/0900Z NOT AVBL
FCST SWX +18 HR: 01/1500Z NOT AVBL
FCST SWX +24 HR: 01/2100Z NOT AVBL
RMK: SWX EVENT (SOLAR FLARE) INPR IMPACTING LOWER HF
COM FREQ BAND ON THE DAYLIGHT SIDE. FURTHER
PERIODIC LOSS OF HF COM ON THE DAYSIDE EXPECTED.
HIGHER FREQ MAY BE LESS IMPACTED.
NXT ADVISORY: WILL BE ISSUED BY 20260701/0252Z=
No warnings
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June 30th, 2109Z

Issued by ACFJ

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FNXX02 YMMC 302109
SWX ADVISORY
DTG: 20260630/2109Z
SWXC: ACFJ
SWX EFFECT: HF COM
ADVISORY NR: 2026/165
NR RPLC: 2026/164
OBS SWX: 30/2109Z NO SWX EXP
FCST SWX +6 HR: 01/0400Z NOT AVBL
FCST SWX +12 HR: 01/1000Z NOT AVBL
FCST SWX +18 HR: 01/1600Z NOT AVBL
FCST SWX +24 HR: 01/2200Z NOT AVBL
RMK: EVENT UPDATE. END OF HF COM (SOLAR FLARE) EVENT.
NXT ADVISORY: NO FURTHER ADVISORIES=
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Continued Improvement of the SWIS - Space Weather Center Coordination Group (SWXCCG)

- Group consisting of Space Weather Subject Matter Experts from the ICAO-designated SWX centers.
- Serves as the “operational” branch that coordinates with the ICAO MET Panel SWX Work Stream (WS)
 - assist with WS actions and provide recommendations to the WS.
- The SWX WS delegates actions to the SWXCCG for analyses and implementation.
 - The SWXCCG reports results to the SWX WS.
- Actions involve model validation and improvement, GNSS threshold improvement, Polygon implementation and development of management report.

Continued Improvement of the SWIS - SWXCCG

Consolidated Space Weather Information Service Management Report for 2025



Annual Management Report for the SWIS

- Implemented in 2024
 - Modeled after VAAC Management Report
- Summarizes activity from the METP WG-MOG SWX & SWXCCG
- Assists with the continual monitoring of the service



Item 3: Management Report

Section 2.2 and 2.3

- There were 738 SWXA issued and 23 test SWXA. The top table shows the breakdown of the SWXAs issued for each SWXC.
- Some of the activity for SWXA issuance can be linked to when a SWXC is ODC and when the Sun is active
- The ongoing importance to continually look at the harmonization of SWXA issuance between the SWXCs to ensure guidance is used in the same way
- Comparisons of observations, models and operational interpretation will inform future updates of the Guidance for the issuance of space weather advisories or Cookbook
- The SWXA 6- and 12-hour forecast fields were used 22-25% of the time, the Cookbook included more detailed guidance on forecast information so 2026 should improve.

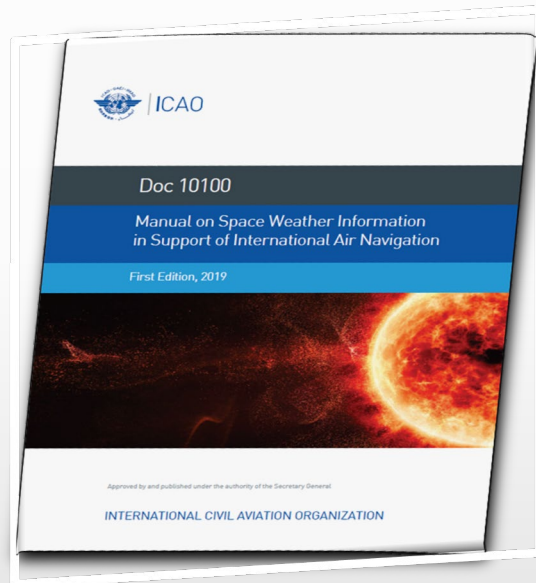
	GNSS	HF COM	RAD
ACFJ	223 (1)	95 (1)	0
CRC	0 (1)	24 (1)	0 (6)
PECASUS	211 (2)	169	0 (2)
SWPC	10 (2)	7 (7)	0
Number of Events	179	83	0

Forecast period	Detailed forecast	NO SWX EXP	NOT AVBL
6-hour forecast	46	139	553
12-hour forecast	27	138	573



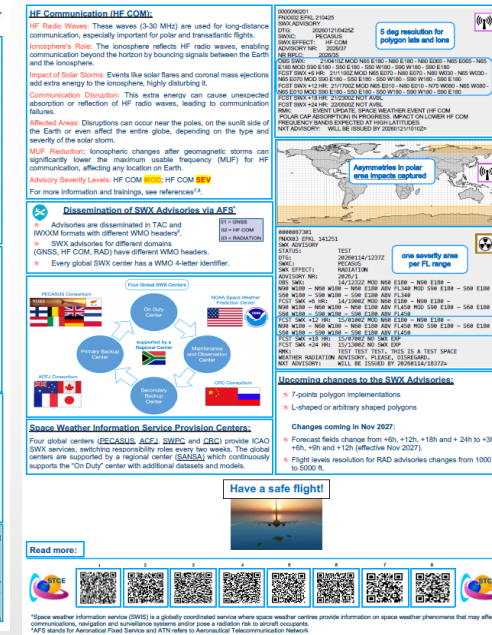
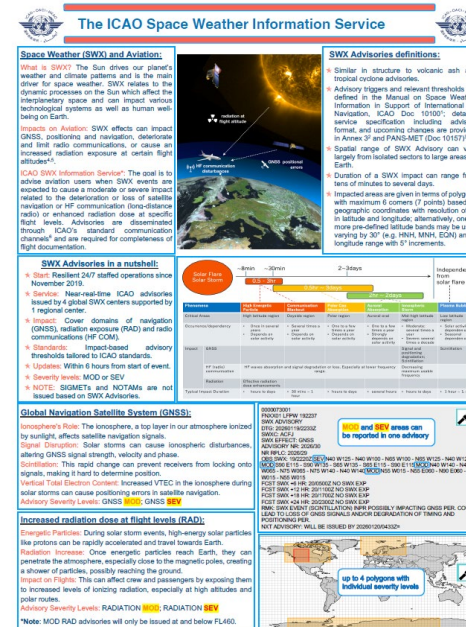
ICAO Space Weather Manual and Educational Information

Doc 10100: Manual on Space Weather Information in Support of International Air Navigation



Published in October 2019
Updated in 2024

ICAO Space Weather Information Service Flyer



Published Nov 2025
New edition
coming out soon

Operational guidance material
Available from ICAO-designated global space weather centers

ICAO Space Weather User Workshops

1. First ICAO User workshop - 20 October 2025, Italian Air Force Headquarters (Rome, Italy)
2. Second ICAO User workshop - 8-9 June 2026, South African National Space Agency (Hermanus, S. Africa)
3. Third ICAO User Workshop currently being planned for 2027 – location/date to be determined but no earlier than May 2027.

Objectives of the workshops are to:

- Improve understanding of SWX information Service (SWIS), including its uses, benefits, and limitations
- Gather structured feedback from stakeholders on the effectiveness and usability of the SWIS
- Share updates on education and guidance materials supporting operational use of SWIS
- Provide an update on the current status and future development of SWIS

Conclusion

- ICAO Space Weather Information Service is still a “relatively” new service (since 2019).
- Compared to “terrestrial weather forecasting” the provision of SWX is still evolving but with more operational experience and user feedback, improvements are being made.
 - ICAO-designated SWXCs continuously work to improve the SWIS through the SWCCG and the MET Panel SWX Work Stream.
 - Frequent user consultations, workshops, and exercises lead to improvement of the SWIS.

Thank you!

