NAT Space Weather Exercise Dec 2025

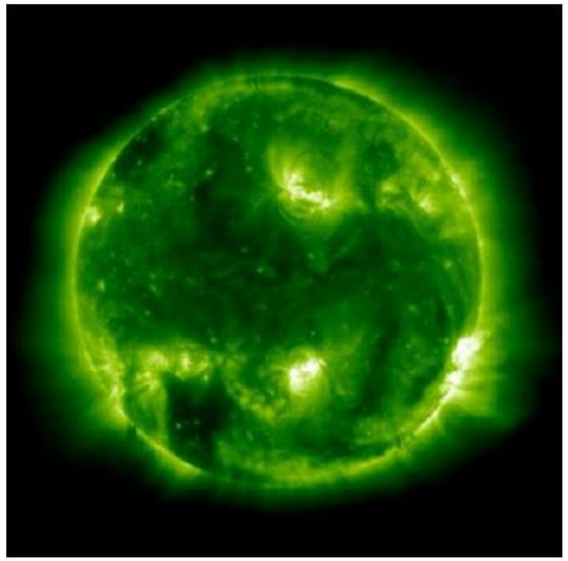
INTERNATIONAL CIVIL AVIATION ORGANIZATION

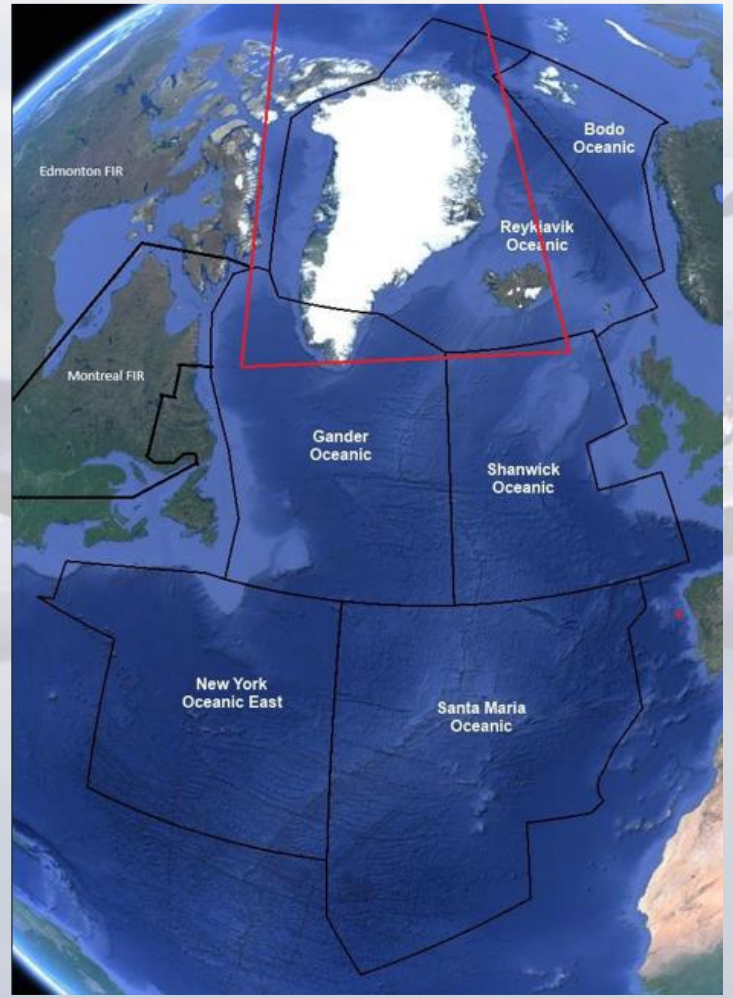
Space Weather Exercise for the ICAO NAT Region

NAT SWXEX25 Directives

SWXEX25

Directives





The exercise is preceded by the eruption of a large X-class solar X-ray flare and coronal mass ejection (CME).

N9000 – N6000 from W01500 – W06000

Impacted airspace : Gander, Nuuk, Scottish, Shannon, Shanwick, Reykjavik FIRs

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Space Weather Exercise 2025

UTC	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Notification	HF & GNSS				HF & GNSS & RAD		RAD		XRAY	XRAY	HF & GNSS	RAD	HF	GNSS & RAD				HF & GNSS
HF																		
VHF																		
CPDLC (Satellite)																		
SATVOICE																		
ADSC																		
ADSB Data																		
GNSS																		
SSR																		
ILS																		
VOR																		
Radiation																		

System Available/Low Radiation | System Intermittent/Moderate Radiation | System Unavailable/Severe Radiation

Eruption of a large X-class solar X-ray flare and coronal mass ejection (CME)

- ~8 minutes later: Severe degradation of space-based ADSB and GNSS network, moderate impact on HF voice communications
- 4 hours to 16 hours later, SATCOM/CPDLC, SATVOICE, ADSC all experience varying levels of impact depending on time
- 4 hours to 10 hours later radiation will be detected starting from moderate levels to 5 hours of severe radiation
- 17 hours later all systems recover

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SWX 2025 participants

More than 100 participants (in-person or connected via TEAMS) on 10 and 11 December 2025 from Austria, Belgium, Canada, China, Denmark, Finland, France, Iceland, Ireland, Japan, Netherlands, Norway, Portugal, Russian Federation, United Kingdom, United States

Meteorological Offices (AMO)s (in some cases this coincides with the Meteorological Watch Office (MWO) from Portugal and United Kingdom

Air Navigation Service Providers (ANSP)s, NAV CANADA, Isavia ANS, AirNav Ireland, Avinor, NAV Portugal, NATS UK, FAA

Airline Operators (AO)s, Aer Lingus, Air France, American Airlines, Delta Air Lines, Federal Express, Icelandair, Lufthansa Group, Southwest Airlines, United Airlines, United Parcel Service, Virgin Atlantic Airways, Wideroe

Space Weather Advisory Centres (SWXC)s, NOAA SWPC, PECASUS, ACFJ, China/Russia Consortium

Regulators from Canada, Denmark, France, Norway, United Kingdom, United States

Military Meteo Wing Netherlands

Regional OPMET Centres (ROC)s

International organisations, IATA, ECA, IBAC, IFALDA, IFALPA, IFATCA

Industry and Academia

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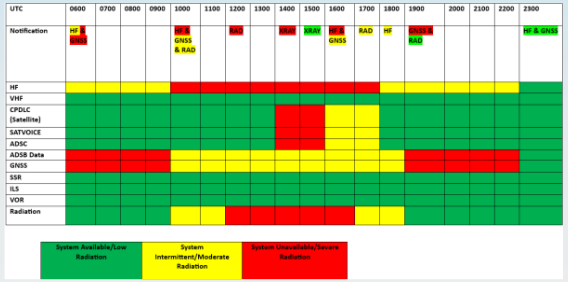
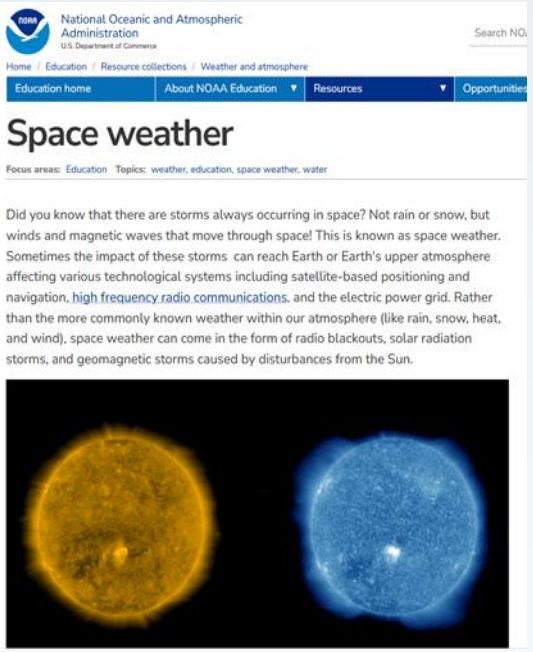
SWX 2025 phases



ICAO SWX Advisories and information in accordance with the NOAA Space Weather Scales will be issued by Space Weather Prediction Center (SWPC), Boulder, Colorado, USA for the following phases:

- 0600: HF moderate and GNSS severe advisory.
- 1000: HF severe, GNSS moderate, Radiation moderate advisory plus S2 notification.
- 1200: Radiation severe advisory plus S4 notification.
- 1400: XRAY severe notification.
- 1500: XRAY normal notification.
- 1600: HF severe and GNSS moderate advisories
- 1700: Radiation moderate advisory plus S2 notification.
- 1800: HF moderate advisory
- 1900: GNSS severe and radiation NO SWX EXP advisories
- 2300: HF & GNSS NO SWX EXP advisories.



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Space Weather Exercise 2025

Initial Question : Where do participants normally get their Space Weather SWX information from ?

- Delta Air Lines from NOAA National Space Weather Prediction Center
- United Airlines from NOAA National Space Weather Prediction Center
- Virgin Atlantic Airways from NOAA
- Lufthansa Group from LIDO (CFSP) always confirmed with NOAA

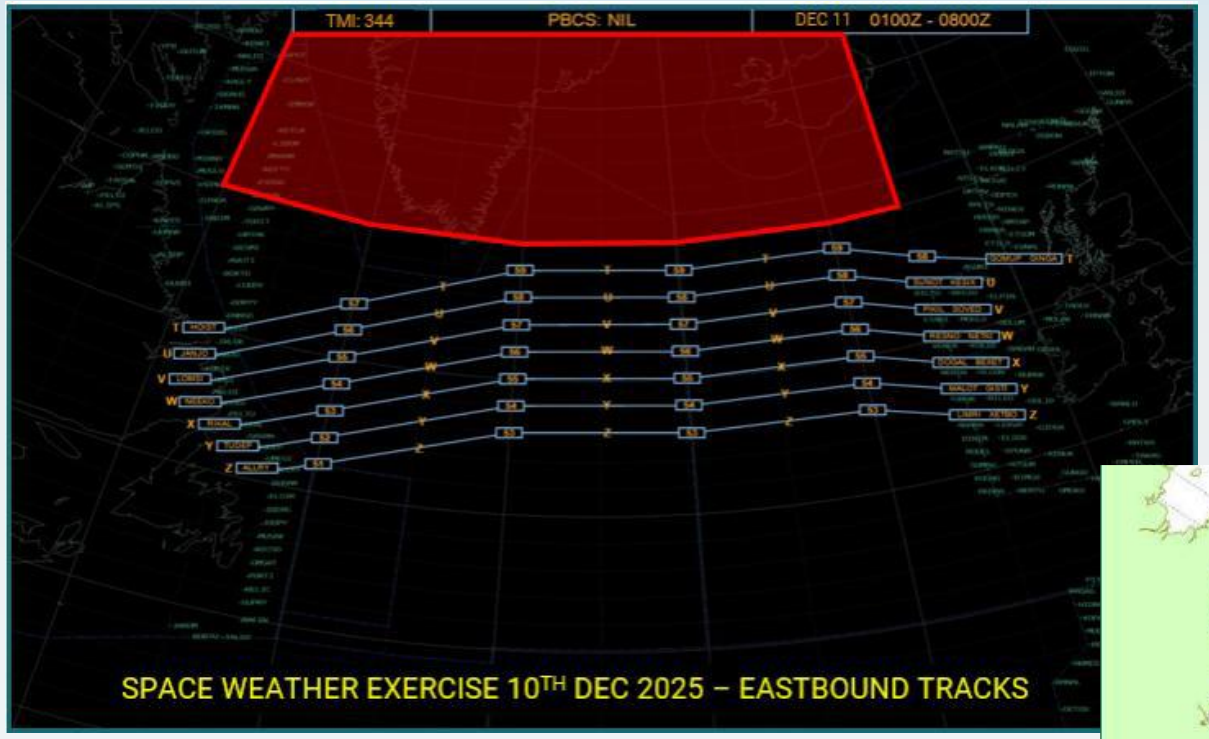
- NAV Portugal from Australian Space Weather Service verified with NOAA
- AirNav Ireland from Australian Space Weather Service verified with NOAA
- FAA from NOAA
- ISAVIA ANS from NOAA
- NAV CANADA from SWX center confirmed with NOAA
- NATS UK from UK MET Office

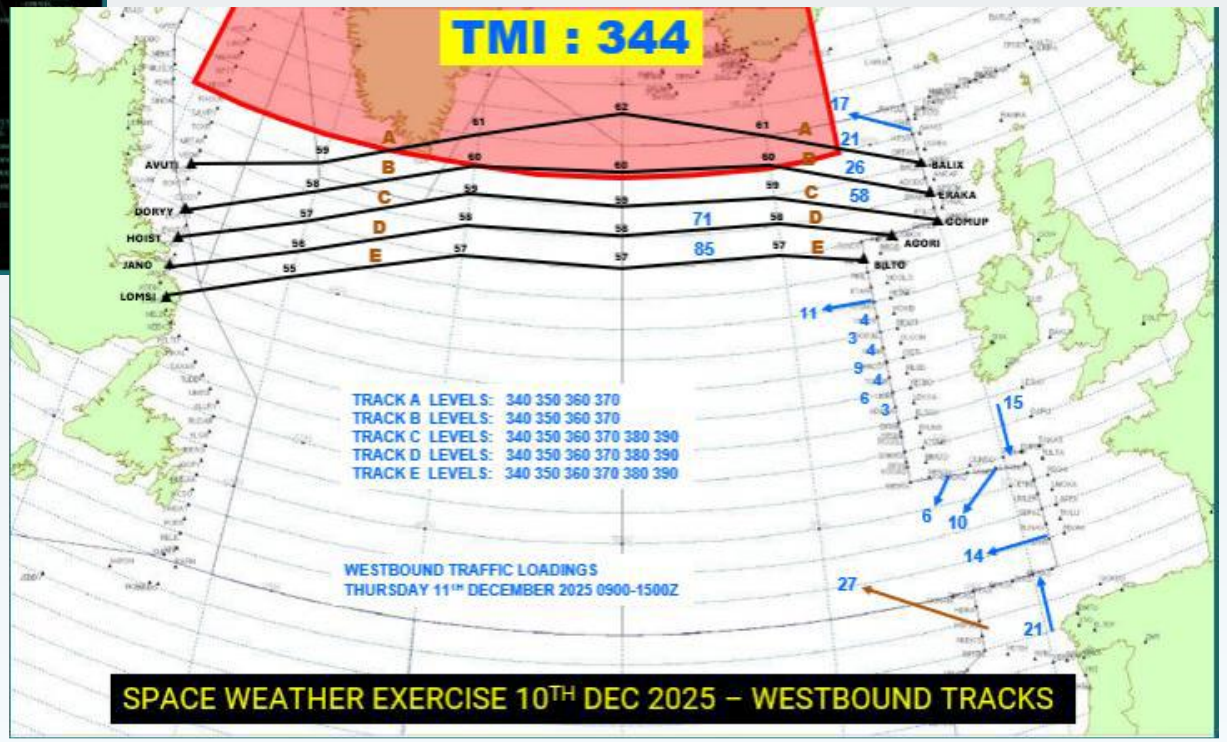
- Netherlands CAA from SWC Brussels plus NOAA
- UK CAA from UK MET Office

- DGAC France and CAA Norway only awareness information

Note: A full set of ICAO SWX Advisories was provided in the Exercise Directive

SWX 2025 track structures





SWX 2025 phase 1

Phase 1 - 0600 UTC to 1000 UTC

S1 alert, HF intermittent and ADS B & GNSS not available

Airspace Users

- Different actions for flights on the ground and flights that are airborne
- Briefing for flight crews on S1 levels (actions will be taken from level S2 or S3), inform flight crews on the ground and communicate with airborne flight crews on the affected systems
- Gathering of more information on impacts for crews, (what ADS-C reports can be used with GNSS out, what are the reason for HF loss, at which levels 75N-70N-65N HF would still be available, will ATS be impacted
- Increased monitoring and potential restrictions on the use of polar routes
- IBAC would be reactive with adjusting routes and altitudes

- ➢ Any additional information would be helpful, fidelity of alerts needs to be increased, 3 hour windows would be an immense improvement, last 24hrs and next 24hrs is not really helpful.
- ➢ It would be beneficial at this stage to have more information in the RMK section on why are / what are the reasons of the affected COM and SUR systems not working anymore

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SWX 2025 phase 1

Phase 1 - 0600 UTC to 1000 UTC

S1 alert, HF intermittent and ADS B & GNSS not available

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would gather more information for the rest of the eastbound flows and finding out as much as they can for the morning shift, reactive state, no major impacts as it is tail end of the eastbound flow, coordinating with Gander to increase separation if additional alerts on ADS B /GNSS dropping out are received, put plans into place for westbound flows, potentially plan stopping PBCS separation as aircraft with only RNP10 would need an increased separation
- NAV CANADA would react like NATS as most traffic in Shanwick´s airspace, if they lose ADS-B targets it would not be immediately associated with SWX issues, if ADS B targets are removed from flights higher separation minima would be required
- ISAVIA ANS would focus on north sector (not so busy over Greenland that time), Iceland radio would issue higher HF frequencies and apply special procedures, inform aircrews, loss of ADS B would result in procedural separation before leaving the sector
- AirNav Ireland would contact Iceland to delegate HF transmitters and receivers in each other's countries to one another to mitigate impacts on HF, seek information on impacts, seek information on impacts, try to give VHF frequencies (instead of HF) as early as possible.

- If there would be PBCS tracks with half degrees spacing at this stage, the middle track could be taken out as a potential part of the mitigation options

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SWX 2025 phase 1

Phase 1 - 0600 UTC to 1000 UTC

S1 alert, HF intermittent and ADS B & GNSS not available

Space Weather Advisory Center (SWXC)

- Different actions need to be taken between a solar flare and a particle event
- G scales are only measured on ground, scales do not always reflect the reality, there could be an effect that GPS signal is blinded but the atmosphere was still looking okay, different solar phenome creating different issues
- S1 level event would only be linked to HF COM ICAO advisory and not associated to GNSS loss (S scale is mainly made for particle events). In case GNSS is affected a separate GNSS ICAO advisory would be send out
- PECASUS would offer more information in the RMK section of the ICAO advisory

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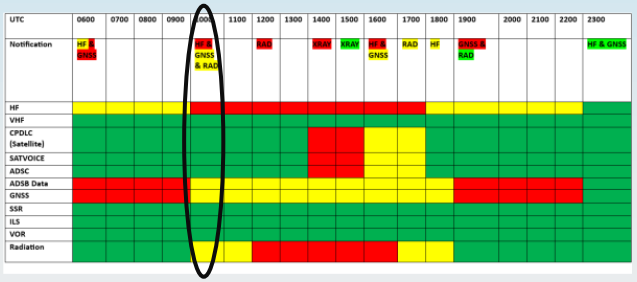
SWX 2025 phase 2



Phase 2 - 1000 UTC

S2 Alert, HF out, ADS B & GNSS intermittent, radiation starting

Airspace Users

- Different actions for flights on the ground and flights that are airborne
- S2 would be starting point for different actions with increased focus on monitoring the S -, G- and R-Scales
- Some airlines would consider to limit operations on polar routes and in high latitude areas (80N, 78N)
- Gathering of more information (conference call with ANSPs and weather providers, get feedback from crews landed in Europe, more input from ATC needed for planning) and looking into other data sources
- Plan additional fuel (lower altitudes by 5000ft, route adjustments)
- HF out important factor for flights north 82N (due to SAT COM coverage), airlines have different values due to variation in HF coverage

- ➢ Additional information on HF outage (what is the impact?, how long will it be?) would be helpful, not for HF COM loss which can be mitigated with other COM equipment but for awareness/planning on follow up actions in degrading environment
- ➢ Challenges in mitigating the radiation effects, define threshold (FAA thresholds are different from Europe`s) for safety assessment based on multiple models, where can we really fly at that moment
- ➢ more discussion needed

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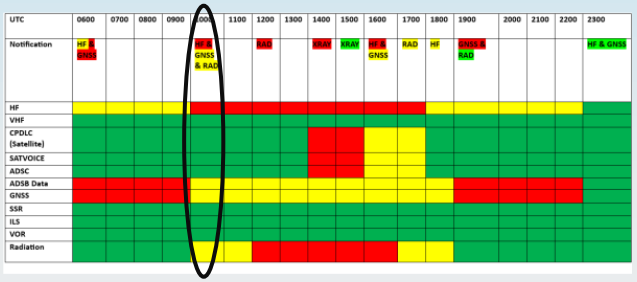
SWX 2025 phase 2



Phase 2 - 1000 UTC

S2 Alert, HF out, ADS B & GNSS intermittent, radiation starting

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would us HF outage as main decision point starting calls with airspace users and elevate COM team from assessed to convene status, publish NOTAM for loss of HF, accommodate reroutes and route amendments, look into most up to date flightplans, increase separation standards from B tracks onwards, ATC workload would be high in some sectors, would restrict traffic with 0 rate at entry points on north A and B tracks
- NAV CANADA would react similar for the parts in Gander airspace, managing position reports- information requests and the significant increase in workload
- ISAVIA ANS would monitor HF conditions for airspace North of 70N, move to procedures for degraded HF conditions and publish a NOTAM (loss of HF), there is good VHF coverage below 70N and in big areas of Reykjavik CTA, increased workload on East sectors (that have VHF and Radar coverage), procedural separation for traffic over Greenland and for transitions from 30W
- AirNav Ireland would change to VHF as primary COM system for traffic entering the NAT, reopen extra sectors to accommodate extra traffic flow as able and share information
- Avinor would increase situational awareness, assess airspace capacity for new flows, increase staffing, cancel military operations, establish an inhouse CCT, remove RAD restrictions in coordination with EUROCONTROL NM

- Some CAAs raised a question on the potential closure of airspace due to radiation. (difference between volcanic ash and cosmic radiation events) with no clear guidelines currently available (European airlines must have volcanic ash procedures approved by their regulators, this does not exist/apply for SWX/radiation procedures)

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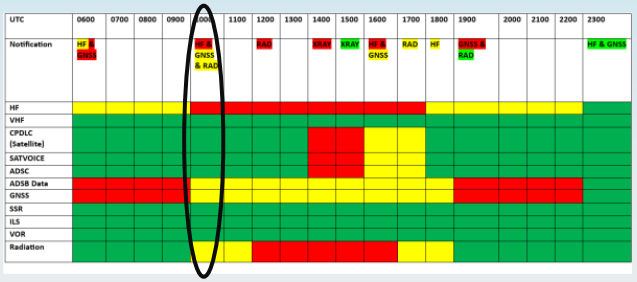
SWX 2025 phase 2

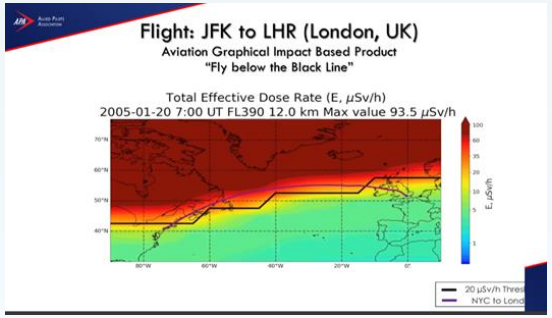


Phase 2 - 1000 UTC

S2 Alert, HF out, ADS B & GNSS intermittent, radiation starting

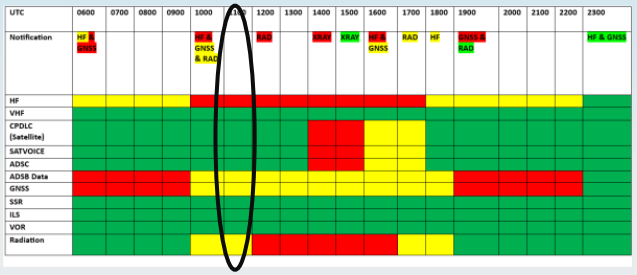
Space Weather Advisory Center (SWXC)

- Discussions on the use of the different scales (S G R scales are currently not one size fits all) and airlines would like to see progress on R scales and a better notification if a solar flare would happen
- NOAA discussed the revision of scales, collected new information for better provisions, science is not there yet to provide flare forecasts in shorter timeframes, images only arrive every 30-60 min
- Cross validation between different radiation models not that easy, difference in the models for solar-proton event, using satellite data is not enough, reasonable estimates would need ground-based neutron monitors
- Discussion on the theoretical values for radiation reduction (i.e. 5000 ft reduction will result in 25% decrease in radiation, ICAO SWX Manual mentions 7000ft will reduce radiation effects by 50%) which are seen more as a rule of thumb. NASA Boeing studies looking into not only altitude but also latitude dependencies
- Radiation graphics were discussed and airlines want to know where they still can safely operate (fly below the black line)



- More discussion is needed with radiological protection experts

SWX 2025 phase 3



Phase 3 - 1100 UTC

S3 Alert, HF out, ADS B & GNSS intermittent, radiation advisory

Airspace Users

- Some airlines would suspend operations on polar routes
- Airlines would move to more pro-active approach, reaching out to authorities in areas with no COMs and stop operations in these areas, would start to plan fuel appropriately, move to more southern routings to avoid radiation impacted areas

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would continue active communication with airspace users, raised the question if flight crews would start making executive decisions for in-flight cosmic radiation avoidance (change of altitudes or requests for re-routings)
- No changes from other ANSPs

➢ Mitigation of radiation events remains a challenge due to the lack of standardized safe limits and guidance. Some flight crews would want to operate at lower levels or altitudes after an S2 event, some crews would not know and do nothing about it, some crews would not like to fly longer routes during solar events

Space Weather Advisory Center (SWXC)

❖ No changes

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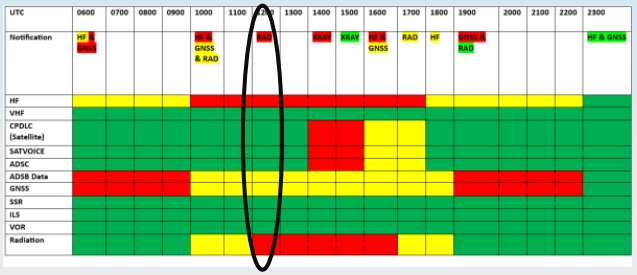
SWX 2025 phase 4



Phase 4 - 1200 UTC

S4 Alert, HF out, ADS B & GNSS intermittent, radiation severe advisory

Airspace Users

- Some airlines would start their risk assessments and evaluate what equipment would still be operable, internal contingency teams would be activated on re-routings and the management of all internal/external communications including media
- Based on the different risk assessments payload would be reduced, flights would be moved to C track or more south, flight levels would be lowered (i.e. reduction of 1000ft for flights at 60N, or operations on FL300 to max FL350 at 55N, or operations only below FL300 at 78N). Flights in the NAT Region have normally added fuel in order to mitigate turbulences
- Gathering of more information from ANSPs on the different mitigation options (the sooner the information is available the better for the airlines as flight crews need to have information at their briefing time) and investigate with regulators what would be acceptable from their side
- For flights that are already airborne there would only be tactical solutions/options

➢ Additional information on the ANSP guidance for radiation would be beneficial and how ANSPs would publish them (publication as SIGMETs could raise an issue of public perception), some ANSPs stated that they would not issue a SIGMET

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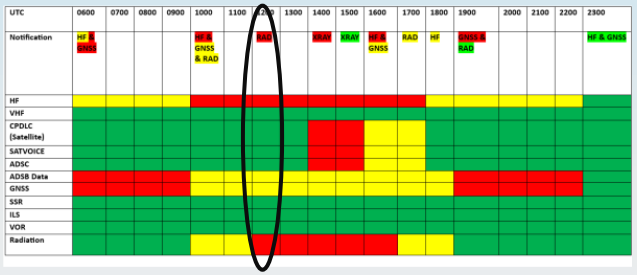
SWX 2025 phase 4



Phase 4 - 1200 UTC

S4 Alert, HF out, ADS B & GNSS intermittent, radiation severe advisory

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would close northern waypoints on tracks A and B due to HF COM loss, remain with current procedures, share information with airlines, accommodate re-routes & route amendments and would start the design of the night tracks with the inclusion of the southern routings
- ISAVIA ANS would issue a NOTAM warning for risks to aviation, react to airline request for re-routes and FL changes & route amendments
- No changes from other ANSPs

- CAAs raised a question on the lack of an ICAO definition for radiation (the usual assumption is 20 msiv per hour)

Space Weather Advisory Center (SWXC)

- S scale are not used as they are intended, discussion on the review of NOAA scales and that data from all current sources would need to be brought together to address the health concerns in a radiation event

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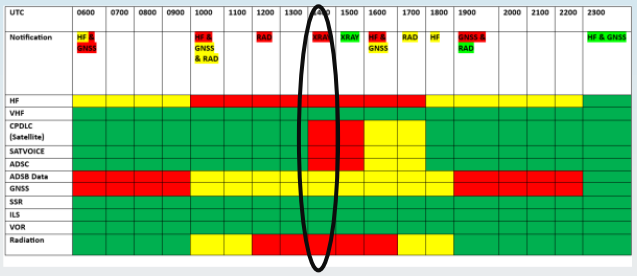
SWX 2025 phase 5



Phase 5 - 1400 UTC

S4 Alert, HF out, loss of ADS C + SATVOICE + CPDLC,
ADS B & GNSS intermittent, radiation severe advisory

Airspace Users

- Some airlines would continue their flights (with have been downgraded to RNP10) as previously cleared (flight crews would stick to last clearance until they can re-establish COMs)
- Some airlines would have no operational procedures for this scenario
- Some airlines would apply their contingency as discussed in briefing, would consider the use of onboard WiFi systems (WiFi has a higher frequency band as SATCOM, , frequency might be unaffected but the satellites might be affected), would use every possibility to communicate with flight crews
- Some airlines would consider to contact other radio stations and ask for relay (if you cant contact Shannon, try to contact Santa Maria on a higher frequency and ask for relay)
- Some airlines would use TIBA procedures on VHF for redistribution of information

➢ Question on the emphasis for flight crews **to continue to fly as last cleared until you can re-establish COMs** (NAT Doc 007)

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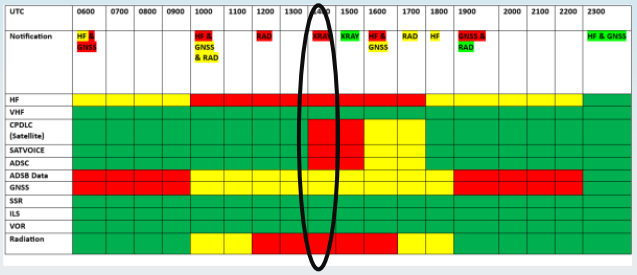
SWX 2025 phase 5

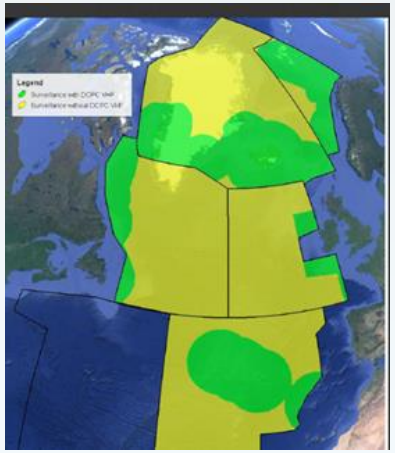


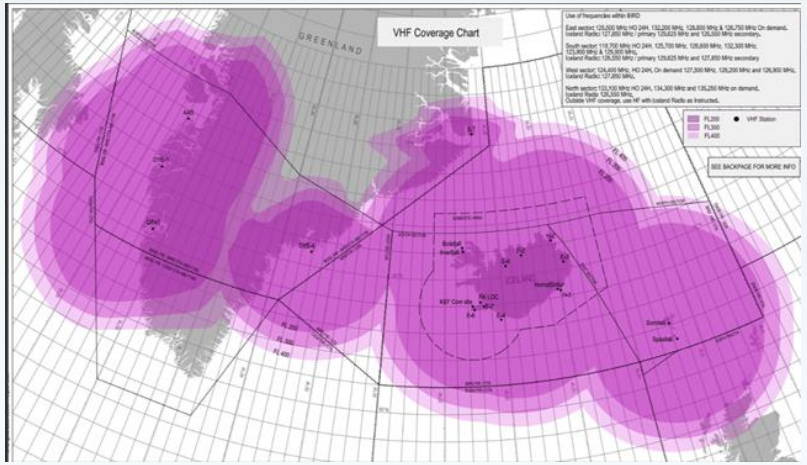
Phase 5 - 1400 UTC

S4 Alert, HF out, loss of ADS C + SATVOICE + CPDLC,
ADS B & GNSS intermittent, radiation severe advisory

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would share all information to airborne flights, start managing the impacts on domestic flights and would apply a ATFM measures (0 rate – No ATS) below 60N
- NAV CANADA would continue previous OPS procedures and start working on the areas where VHF and radar contacts could be re-established
- AirNav Ireland indicated that VHF is reliable out to 17W off West Coast of Ireland for jets at cruising levels
- ISAVIA ANS would restrict traffic and advise flight crews to stay below 70N (if flight crews wanted they still could fly above 70N), would need to manage the workload in the airspace where radar and VHF coverage is available





- Use of SATCOM Voice would not be an option

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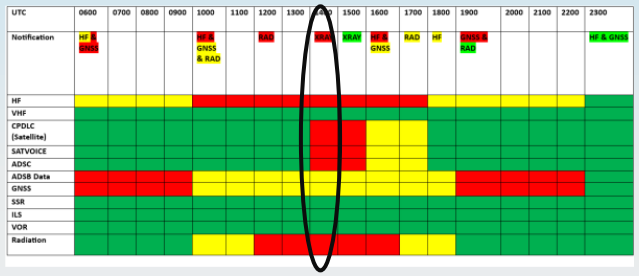
SWX 2025 phase 5



Phase 5 - 1400 UTC

S4 Alert, HF out, loss of ADS C + SATVOICE + CPDLC,
ADS B & GNSS intermittent, radiation severe advisory

Space Weather Advisory Center (SWXC)

- Comments on the inability to predict a massive radio burst
- A Solar Radio Burst would rather be minutes and not hours (need to consider the length of the events into the advisories). Currently no GNSS ICAO advisory for Solar Radio Bursts. However the unusual flare in 2023 resulted in a loss of SATCOM and VHF in Seattle, which nearly closed the airspace
- Need for an atmospheric radiation scale based on neutron monitors and > 500 MeV GOES channel to reduce the number of false alert ratios.

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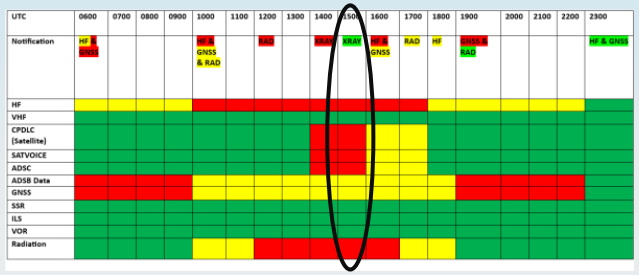
SWX 2025 phase 6



Phase 6 - 1500 UTC

S4 Alert, HF out, ADS C + SATVOICE + CPDLC out,
ADS B & GNSS intermittent, radiation severe advisory

Airspace Users

- No changes from airlines

Air Navigation Service Providers ANSPs & Regulators

- No changes from ANSPs

Space Weather Advisory Center (SWXC)

❖ Note that NOAA/SWPC does not terminate the S levels and will keep the in the summary until they go back to level S1

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SWX 2025 phase 7

Phase 7 - 1600 UTC

S4 Alert, HF out, ADS C + SATVOICE + CPDLC intermittent, ADS B & GNSS intermittent, radiation severe advisory

Airspace Users

- No changes from airlines

Air Navigation Service Providers ANSPs & Regulators

- No changes from ANSPs

Space Weather Advisory Center (SWXC)

❖ No changes

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SWX 2025 phase 8

Phase 8 - 1700 UTC

S4 Alert, HF out, ADS C + SATVOICE + CPDLC intermittent, ADS B & GNSS intermittent, radiation moderate

Airspace Users

- No changes from airlines

Air Navigation Service Providers ANSPs & Regulators

- No changes from ANSPs

Space Weather Advisory Center (SWXC)

- ❖ No changes

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SWX 2025 phase 9

Phase 9 - 1800 UTC

S4 Alert, HF intermittent, ADS C + SATVOICE + CPDLC normal ops, ADS B & GNSS intermittent, radiation moderate

Airspace Users

- Some flight crews and airlines (dispatch) will get fragmented information from different sources as COMs are coming back

Air Navigation Service Providers ANSPs & Regulators

- No changes from ANSPs

Space Weather Advisory Center (SWXC)

❖ No changes

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SWX 2025 phase 10

Phase 10 - 1900 UTC

S4 Alert, HF intermittent, ADS C + SATVOICE + CPDLC normal ops, loss of ADS B & GNSS, radiation back to normal

Airspace Users

- Some airlines would still have concerns on northern flights, would need to continue RNP10 operations, flight crews would accept better profiles if offered by ATC
- Some airlines would plan operation based on RNP4 for the next day

Air Navigation Service Providers ANSPs & Regulators

- NATS UK would have calls every 2 hours, no PBCS tracks would be planned for next day (the only impact on other routes and levels are the other surrounding aircraft), would use UK MET office narratives to raise awareness on some of the effects from the different G S R scale events
- NAV CANADA would also have no half degree tracks for the next day (plan next day on todays experience), flights in the northern airspace would be rerouted to ensure safe RNP10 operations
- ISAVIA ANS would cancel their NOTAMs due to improved conditions

➢ ANSPs confirmed that they could accommodate all aircraft being only RNP10 in the NAT HLA, as they would use increased separations between the impacted aircraft

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SWX 2025 phase 10

Phase 10 - 1900 UTC

S4 Alert, HF intermittent, ADS C + SATVOICE + CPDLC normal ops, loss of ADS B & GNSS, radiation back to normal

Space Weather Advisory Center (SWXC)

- Remark that these kind of events are normally in polar regions and the time of the impact on GNSS would be shorter

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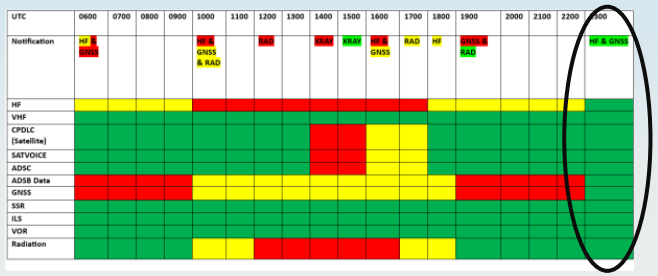
SWX 2025 phase 11



Phase 11 - 2300 UTC

S4 Alert still in effect, all systems back to normal
no radiation

Airspace Users

- Airlines would start post event analysis, getting data from technical logs, equipment logs and flight crew reports
- Airlines would be interested to get data from ANSPs on how many re-routings & flights not getting their requested FL

Air Navigation Service Providers ANSPs & Regulators

- ANSPs would initiate debriefings with CAAs, SWXCs, MET offices
- ANSP would engage with airlines for post-event assessments

Space Weather Advisory Center (SWXC)

❖ SWXCs would start sharing of data for replay/detailed analysis of the events together with other SWX Centers

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SWX 2025 Comments & Statements

- Some airspace users do not find the ICAO advisory useful, regions are massive large and more fidelity would be needed to define the affected area, so that airlines could avoid that severely affected airspace
- Airlines plan long haul flights 8 hrs before departure, cannot do anything with the ICAO outlook, would need to define mitigations already at an early stage, they look at ICAO advisories as an educational information
- Any additional information on SWX advisories would be helpful, fidelity of alerts needs to be increased, 3 hour windows would be an immense improvement, last 24hrs and next 24hrs is not really helpful
- Use of geomagnetic latitude (more impact in Canada as in Belgium) instead of geographical latitudes, move to the 7 point polygon in future SWX products, daylight side effects are different that nighttime effects
- Careful of information overload, some airlines do not react to moderate advisories they act only on severe, SWX centers and aviation community define moderate/severe different, adjustment to thresholds needed to better accommodate the needs of the aviation community
- Discussions on the validity of forecasts (what is the tolerance for false alarms, when can they be tolerated by ANSPs and AOs), based on the existing models in use some SWXCs would issue an advisory, some would not

SWX 2025 Comments & Statements

- There is no commonly agreed value for the amount of solar radiation exposure that is acceptable for a specific flight, Unless we have an agreed upon limit, how does an airline set policy as to what areas and or flight levels need to be avoided as it sounds like the currently used S values are not providing an accurate description of exposure

- Radiation values do not give precise pictures, satellite data can only produce nowcasts, 500 MeV protons arrive 20 min after solar flares / CMEs, extremely difficult to do predictions, currently airlines have no onboard equipment for cosmic radiation measurements to humans installed (only in studies or for specific flights), more research is currently going on. Having access to the onboard measured radiation dosis would hugely help the scientific community to improve the radiation models.

- Cross validation between different radiation models not that easy, difference in the models for solar-proton event, using satellite data is not enough, reasonable estimates should make use of ground-based neutron monitors data

- Can the involved stakeholders get access to radiation alert tools as shown in the FAA example

- Since 1942, 77 GRE have been measured but not all of them are severe and they are quite rare, maybe only one event which was measured by some SWX centers in 2025. No radiation advisory has been issued since the establishment of the ICAO SW service in 2019.

NAT SWX 2025 Conclusions

1. Safe operations can be maintained in the NAT for a similar SWX event and the currently used procedures from ANSPs and airspace users are mitigating the impacts.

2. ANSPs and aircraft operators can help the SWXCs by providing access to their information, daily status on events, sharing information on HF outages, ADS B and ADS C data showing downgrading of systems, access to data on GNSS issues getting pilot experiences, and measuring radiations in cockpits

3. NAT Doc 007 could be amended to make more clear what is expected from flight crews in an SWX event impacting their COM systems …. **continue to fly as last cleared until you can re-establish COMs**

4. The ICAO SWX products need to evolve so that they might be used by the aviation stakeholders (which are mainly using NOAA or other products)

5. Significant number of request to improve the RMK sections:
   - the more fidelity can be provided the better
   - Information should be in plain language and with standard phraseology
   - Better information on affected areas , duration of effects, severity of the effects
   - reference to SWX on duty website for additional information
   - good to see if the new advisory would replace an existing one
   - confident level of the impacted area (reduction of false forecasts)

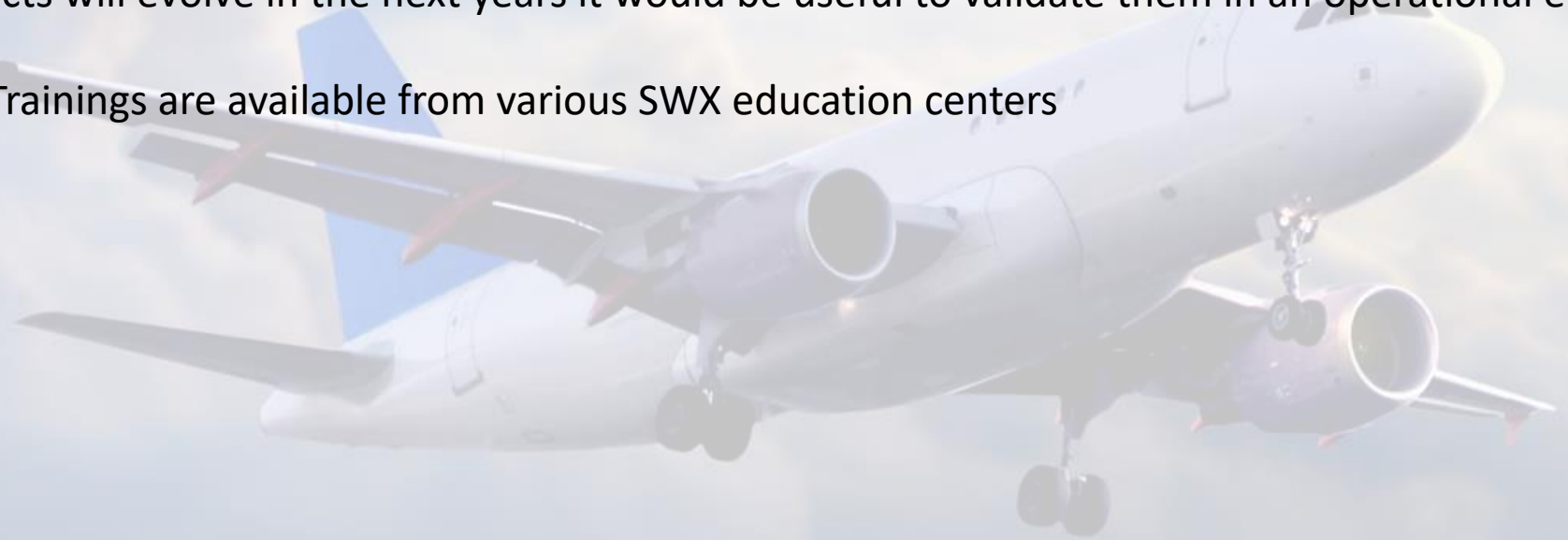
NAT SWX 2025 Conclusions

6. The use/sharing of old SWX advisories to all interested stakeholders would be very helpful to get source data for additional analysis (could they be posted on the SWXC websites)

7. There is no need for another SWX exercise for the NAT in the near future, but as models/simulations/ products will evolve in the next years it would be useful to validate them in an operational environment

8. SWX Trainings are available from various SWX education centers

… / …



NAT SWX 2025 Conclusions

9. As a follow-up to this SWX exercise, a special virtual event together with radiological protection experts addressing the cosmic radiation issues that were highlighted during the exercise was conducted as part of the NAT POG/21 meeting on 18 March 2026 with presentations from :

- French Authority for Nuclear Safety and Radiation Protection (ASNR) on *radiological protection from cosmic radiation in aviation*

- Observatoire de Paris on *cosmic ray-induced radiation doses in the terrestrial atmosphere*

- Surrey Space Center in collaboration with MOSWOC on *space weather radiation impacts and mitigation for aircraft including preliminary flight data from event of 11 November 2025*

- IFALPA ATS Committee on the *radiation event 11/12 Nov 2025*

The discussion highlighted that

- the International Commission for Radiological Protection ICRP recommends that a reference level in the 5–10 mSv/year range generally be selected for protection against cosmic radiation in aviation (average dose in France is 6.4 mSv/year). States have multiple thresholds in place and there are no agreed standard regulations for flight crews and passengers

NAT SWX 2025 Conclusions

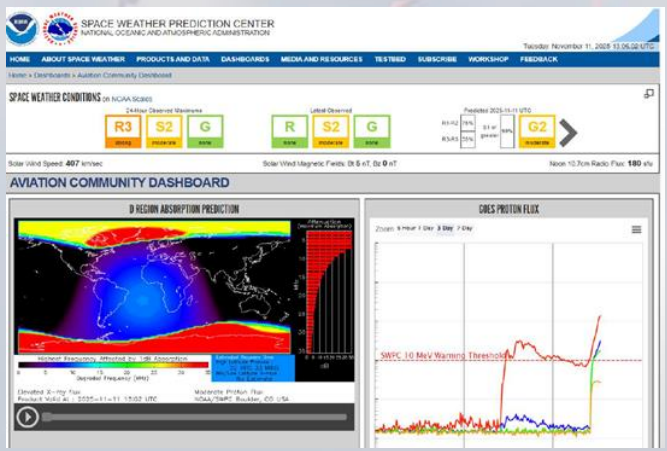
The discussion highlighted that

- Ground Level Enhancement (GLE) solar particle events cannot be predicted easily (rapid nowcasting is the only available option today) and the strong particle fluxes (2-3 times the normal dose rates) are limited to short durations (very rapid rise and most radiation in first 2 hours)

- there is a need for rapid & accurate dissemination to flight crews, as onboard radiation monitors are normally not installed on all aircraft

- GLE events pose also a high risk to modern avionics as Single Event Effects (SEE, charge depositions of individual particles) can damage modern onboard electronic systems with multiple bit upsets, functional interrupts, burnout and other failures. There is a need for avionics standards to include space weather and for neutron beam testing of safety-critical systems

- The 11/12 November GLE for a trans-atlantic flight from Vienna to Fairbanks indicated a radiation exposure that was 4 times higher as normal.



Thank You

ICAO