



ICAO Space Weather Provisions

Raul Romero

Technical Officer MET

ICAO Headquarters, Montreal

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Definitions

- Space weather centre (SWXC)

- A centre designated to monitor and provide information on space weather expected to affect communications, GNSS-based navigation and surveillance systems and/or pose a radiation risk to flight crew members and passengers.
- *Note.* – A space weather centre may be designated as global or regional.





Global Services



- Space weather centres (SWXC)
 - A Contracting State, having accepted the responsibility for providing a SWXC, shall arrange for that centre to provide information on space weather that is expected to affect communications, navigation and surveillance systems and/or pose a radiation risk to flight crew members and passengers in its area of responsibility by arranging for that centre to: ...

Ref: Annex 3, para 3.8.1



Global Services



- Space weather centres (SWXC)
 - ...
 - a) Monitor relevant ground based, airborne and space-based observations to detect, and predict when possible, the existence and extent of space weather conditions that have an impact in the following areas:
 - High Frequency (HF) radio communications;
 - Communications via satellite
 - GNSS-based navigation and surveillance; and
 - Radiation exposure at flight levels;

Ref: Annex 3, para 3.8.1



Global Services



- Space weather centres (SWXC)
 - ...
 - b) issue advisory information regarding the extent, severity and duration of the space weather phenomena that may have an impact referred to in a);
 - c) supply the advisory information referred to in b) to:
 - Area control centres, flight information centres and meteorological watch offices serving flight information regions in its area of responsibility which may be affected;
 - Other SWXCs; and
 - International OPMET databanks, international NOTAM offices and aeronautical fixed service Internet-based services.

Ref: Annex 3, para 3.8.1



Global Services



- Space weather centres (SWXC)
 - SWXC shall maintain a 24-hour watch;
 - In case of interruption of the operation of a SWXC, its functions shall be carried out by another SWXC or another centre, as designated by the SWXC Provider State concerned.

Ref: Annex 3, para 3.8.2 & 3.8.3



Guidance



- Manual on Space Weather in Support of International Air Navigation (Doc 10100)
 - Provision of space weather information



Service for Operators and Flight Crew Members

- General Provisions



- Meteorological information supplied to operators and flight crew members shall be up to date and include the following information, as agreed between the meteorological authority and the operators concerned: ...

Ref: Annex 3, para 9.1.3



Service for Operators and Flight Crew Members

- General Provisions



...

- k) space weather phenomena relevant to the whole route.
- Ref: Annex 3, para 9.1.3

Service for Operators and Flight Crew Members

- Flight documentation



- Flight documentation to be made available shall comprise information listed under 9.1.3 a) 1) and 6), b), c), e), f) and if appropriate, g) and **k**). However, flight documentation for flights of two hours' duration or less, after a short stop or turnaround, shall be limited to the information operationally needed, as agreed between the meteorological authority and the operator concerned, but in all cases it shall at least comprise information on 9.1.3 b), c), e), f) and, if appropriate, g) and **k**).

Ref: Annex 3, para 9.3.1

Technical Specifications Related to Service for Operators and Flight Crew Members

- Specifications related to Flight documentation
 - METAR and SPECI (including trend forecasts as issued in accordance with regional air navigation agreement), TAF, GAMET, SIGMET and AIRMET, volcanic ash, tropical cyclone and **space weather** advisory information shall be presented in accordance with the templates in Appendices 1, 2, 3, 5 and 6. Such meteorological information received from other meteorological offices shall be included in flight documentation without change.



Space Weather Centres



- Space weather advisory information
 - Recomm. – Advisory information on space weather should be issued in abbreviated plain language, using approved ICAO abbreviations and numerical values of self-explanatory nature, and should be in accordance with the templates shown in Table A2-3. When no approved ICAO abbreviations are available, English plain language text, to be kept to a minimum, should be used.

Ref: Annex 3, App 2, 6.1.1



Space Weather Centres



- Space weather advisory information
 - Recomm. – Until 5 November 2020, space weather advisory information **should** be available in IWXXM GML form, in addition to the dissemination of space weather advisory information in abbreviated plain language in accordance with 6.1.1.
 - From 5 November 2020, space weather advisory information **shall** be disseminated in IWXXM GML form, in addition to the dissemination of this advisory information in abbreviated plain language in accordance with 6.1.1.

Ref: Annex 3, App 2, 6.1.2 & 6.1.3

Space Weather Centres



- Space weather advisory information
 - Recomm. – One or more of the following space weather effects should be included in the space weather advisory information, using their respective abbreviations as indicated below:
 - HF communication (propagation, absorption) **HF COM**
 - Communications via satellite (propagation, absorption) **SATCOM**
 - GNSS-based navigation and surveillance (degradation) **GNSS**
 - Radiation at flight levels (increased exposure) **RADIATION**

Ref: Annex 3, App 2, 6.1.4



Space Weather Centres



- Space weather advisory information
 - Recomm. – The following intensities should be included in space weather advisory information, using their respective abbreviations as indicated below:
 - moderate **MOD**
 - Severe **SEV**
 - Radiation at flight levels (increased exposure) **RADIATION**
 - Recomm. – Updated advisory information should be issued as necessary but at least every 6 hours.

Ref: Annex 3, App 2, 6.1.5 & 6.1.6



Space Weather Centres



- Space weather advisory information
 - Template for advisory message for space weather information is provided at Annex3, Table A2-3 (to include an example)

Ref: Annex 3, App 2, Table A2-3

Space Weather Centres

- Space weather advisory message
 - Example A2-3: (GNSS & HF COM effects)



(communication header)	
SWX ADVISORY	
DTG:	20161108/0100Z
SWXC:	(to be determined)
SWX EFFECT:	GNSS MOD AND HF COM MOD
ADVISORY NR:	2016/1
OBS SWX:	20161108/0100Z HNH HSH E18000 – W18000
FCST SWX +6 HR:	20121108/0700Z HNH HSH E18000 – W18000
FCST SWX +12 HR:	20161108/1300Z HNH HSH E18000 – W18000
FCST SWX +18 HR:	20161108/1900Z HNH HSH E18000 – W18000
FCST SWX +24 HR:	20161109/0100Z NO SWX EXP
RMK:	LOW-LEVEL GEOMAGNETIC STORMING IS CAUSING INCREASED AURORAL ACTIVITY AND SUBSEQUENT MOD DEGRADATION OF GNSS AND HF COM AVAILABILITY IN THE AURORAL ZONE. THIS STORMING IS EXPECTED TO SUBSIDE
	IN THE FORECAST PERIOD. SEE WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY:	NO FURTHER ADVISORIES

Space Weather Centres

- Space weather advisory message
 - Example A2-4: (RADIATION effects)



(communication header)	
SWX ADVISORY	
DTG:	20161108/0000Z
SWXC:	(to be determined)
SWX EFFECT:	RADIATION MOD
ADVISORY NR:	2016/2
FCST SWX:	20161108/0100Z HNH HSH E18000 – W18000 ABV FL350
FCST SWX +6 HR:	20121108/0700Z HNH HSH E18000 – W18000 ABV FL350
FCST SWX +12 HR:	20161108/1300Z HNH HSH E18000 – W18000 ABV FL350
FCST SWX +18 HR:	20161108/1900Z HNH HSH E18000 – W18000 ABV FL350
FCST SWX +24 HR:	20161109/0100Z NO SWX EXP
RMK:	RADIATION LEVELS HAVE EXCEEDED 100 PERCENT OF BACKGROUND LEVELS AT FL350 AND ABOVE. THE CURRENT EVENT HAS PEAKED AND LEVELS ARE SLOWLY RETURNING TO BACKGROUND LEVELS. SEE WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY:	NO FURTHER ADVISORIES



Space Weather Centres

- Space weather advisory message
 - Example A2-5: (HF COM effects)



(communication header)	
SWX ADVISORY	
DTG:	20161108/0100Z
SWXC:	(to be determined)
SWX EFFECT:	HF COM SEV
ADVISORY NR:	2016/1
OBS SWX:	20161108/0100Z DAYLIGHT SIDE
FCST SWX +6 HR:	20121108/0700Z DAYLIGHT SIDE
FCST SWX +12 HR:	20161108/1300Z DAYLIGHT SIDE
FCST SWX +18 HR:	20161108/1900Z DAYLIGHT SIDE
FCST SWX +24 HR:	20161109/0100Z DAYLIGHT SIDE
RMK:	PERIODIC HF COM ABSORPTION HAS BEEN OBSERVED AND IS LIKELY TO CONTINUE IN THE NEAR TERM. COMPLETE AND PERIODIC LOSS OF HF ON THE SUNLIT SIDE OF THE EARTH EXPECTED. CONTINUED HF COM DEGRADATION LIKELY OVER THE NEXT 7 DAYS. SEE WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY:	20161108/0700Z



Space Weather Centres

- Spatial Ranges and Resolutions for Space Weather Advisory Information

Element		Range	Resolution
Flight Level affected by radiation:		250-600	30
Longitudes for advisories: (degrees)		000 – 180	15
Latitudes for advisories: (degrees)		00-90	10
Latitude bands for advisories:	High latitudes northern hemisphere (HNH)	N9000 - N6000	30
	Middle latitudes northern hemisphere (MNH)	N6000 - N3000	
	Equatorial latitudes northern hemisphere (EQN)	N3000 - N0000	
	Equatorial latitudes southern hemisphere (EQS)	S0000 - S3000	
	Middle latitudes southern hemisphere (MSH)	S3000 - S6000	
	High latitudes southern hemisphere (HSH)	S6000 - S9000	

- One or more latitude ranges should be included in the space weather advisory information for GNSS and RADIATION



Space Weather



- NOTAM

- A NOTAM shall be originated and issued concerning the following information:
 - t) forecasts of space weather events (that may have an impact on high frequency radio communications, communications via satellite, GNSS-based navigation and surveillance, and radiation exposure at flight levels), the date and time of the event, the flight levels where provided, and portions of airspace which could be affected;

Ref: Annex 15, para 5.1.1.1



Space Weather



- Other Docs updated accordingly
 - Procedures for Air Navigation Services – ICAO Abbreviations and Codes (PANS-ABC, Doc 8400)
 - Acronyms defined
 - Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, Doc 4444)
 - Transmission of information concerning space weather activity by ATS unit to aircraft
 - Descents by aircraft due to solar radiation from space weather events



ICAO PARIS UNITING AVIATION





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and Caribbean
(NACC) Office
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South American
(SAM) Office
Lima

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Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU