# AFI 2022 Space Weather Workshop

## Space Weather Advisory Messages

*Presented by the Secretariat*

# Outline

- AFI SWXC Role and Responsibility
- Space weather phenomena Effect and Intensity
- SWX Advisory message and Description of SWX Phenomena Extent
- Space Weather Advisory Message Structure
- Examples of SWX ADVISORIES
- CONCLUSION

# AFI SWXC Role and Responsability

**AFI SWXC = South Africa National Space Agency (SANSA)**

a) Monitor and provide in real time in its area of responsibility, advisory information on the existence of space weather phenomena space weather phenomena that have an impact in the following areas:

   1) High frequency (HF) radio communications;
   2) Communications via satellite;
   3) GNSS-based navigation and surveillance; and
   4) Radiation exposure at flight levels;

b) Issue advisory information regarding the extent, severity and duration of the space weather phenomena that have an impact referred to in a);

c) Supply the advisory information referred to in b) to:

   1) ACC/ FIC and Aerodrome Meteorological Offices (AMO) in its area of responsibility which may be affected;
   2) other SWXCs; and
   3) International OPMET databanks, International NOTAM Offices and Aeronautical fixed service Internet-based services

# Space weather phenomena Effect and Intensity

- 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 template shown in A3, Appx 2 Table A2-3**.

- 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 communications (propagation, absorption) : HF COM**
  - **Communications via satellite (propagation, absorption) : SATCOM**
  - **GNSS-based navigation and surveillance (degradation) :** *GNSS*
  - **Radiation at flight levels (increased exposure) : RADIATION**

- The following intensities should be included in space weather advisory information, using their respective abbreviations as indicated below:
  - **Moderate MOD**
  - **Severe SEV**

# Latitude bands to describe the extent of space weather phenomena

| 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 |

# SWX Events Effect & Regions impacted

| Space weather event | Effect /impact of the space weather phenomena | Regions impacted | comments |
|---|---|---|---|
| **Geomagnetic Storms** | HF COM<br>GNSS | • HNH and HSH<br>• HNH, HSH, MNH and MSH<br>• EQN and EQS<br>• MNH, MSH, EQN and EQS | • *Note.1. — A single band (e.g., HNH) would not be used for geomagnetic storms since both poles are affected.*<br>• *Note.2. — Altitudes (e.g. ABV FLnnn)* ***are not used*** |

# SWX Events Effect & Regions impacted

| Space weather event | Effect /impact of the space weather phenomena | Regions impacted | comments |
|---|---|---|---|
| **Ionospheric Storms** | GNSS | • A four-sided polygon using four latitude and longitude coordinates.<br>• One or more latitude bands coupled with two lines of longitude, such as:<br>○ EQN Wnnn(nn) or Ennn(nn) – Wnnn(nn) or Ennn(nn<br>○ EQN EQS Wnnn(nn) or Ennn(nn) – Wnnn(nn) or Ennn(nn)<br>○ MNH EQN Wnnn(nn) or Ennn(nn) – Wnnn(nn) or Ennn(nn)<br>○ MSH EQS Wnnn(nn) or Ennn(nn) – Wnnn(nn) or Ennn(nn) | • Can also be described using longitude lines and one or more of the latitude bands.<br>• Altitude levels (e.g. ABV FLnnn) are not used. |

# SWX Events Effect & Regions impacted

| Space weather event | Effect /impact of the space weather phenomena | Regions impacted | Comments |
|---|---|---|---|
| **Solar radiation storms** | RADIATION | • **Most intense at high latitudes** and are **usually confined to the HNH and HSH latitude bands**<br>• **On rare occasions** they could extend into the MNH and MSH<br>• Radiation storms are the only events that will use **altitudes, i.e. <u>ABV FLnnn</u>. Combinations include:**<br>○ HNH and HSH E18000 – W18000 ABV FLnnn<br>○ MNH and MSH E18000 – W18000 ABV FLnnn<br>○ EQN and EQS E18000 – W18000 ABV FLnnn<br>○ HNH, HSH, MNH and MSH E18000 – W18000 ABV FLnnn<br>○ HNH, HSH, MNH, MSH, EQN and EQS E18000 – W18000 ABV FLnnn<br>○ HNH and HSH E18000 – W18000 FLnnn–nnn<br>○ MNH and MSH E18000 – W18000 FLnnn–nnn<br>○ EQN and EQS E18000 – W18000 FLnnn–nnn<br>○ HNH, HSH, MNH and MSH E18000 – W18000 FLnnn–nnn<br>○ HNH, HSH, MNH, MSH, EQN and EQS E18000 – W18000 FLnnn–nnn | Solar radiation may be **severe above** a certain altitude (i.e., flight level (FL)) and **moderate below**.<br><br>**For ex.:** SEV ABV FL340, MOD FL250-340, which will require two advisories<br><br>**Usable flight levels for the advisory are:** FL250, FL280, FL310, FL340, FL370, FL400, FL430, FL460, FL490, FL520, FL550, and FL580. |

# SWX Advisory message

- The **advisory message** informs the user of:

  a) The **type of impact**;

  b) The **expected onset**, or that the event is already in progress;

  c) The **duration** of the event;

  d) A generalized **description of the spatial extent affected for the next 24 hours**; and

  e) A description of the **severity of the impact** in moderate (MOD) or severe (SEV) categories.

# Space Weather Advisory Message Structure

**Item 0-14: WMO Header (M)**

- The World Meteorological Organization Header **(WMO Header)** is included to facilitate the international exchange of the message

**Writing /Editing**

| | TAC ADVISORY | IWXXM ADVISORY |
|---|---|---|
| ACFJ – Australia | FNXXnn YMMC | LNXXnn YMMC |
| ACFJ – France | FNXXnn LFPW | LNXXnn LFPW |
| PECASUS – Finland | FNXXnn EFKL | LNXXnn EFKL |
| PECASUS – UK | FNXXnn EGRR | LNXXnn EGRR |
| CRC – China | FNXXnn ZBBB | LNXXnn ZBBB |
| CRC – Russia | FNXXnn UUAG | LNXXnn UUAG |
| SPWC – USA | FNXXnn KWNP | LNXXnn KWNP |
| SWXC SANSA | … | … |

**nn** = 01 = GNSS ; 02 = HF COM ; 03 = RADIATION ; 04 = SATCOM

# Space Weather Advisory Message Structure

| Item 1-14 : Identification of the type of message (M) | Writing /Editing |
| --- | --- |
| ▪ The Message type is identified as SWX (Space Weather) ADVISORY | ▪ SWX ADVISORY |

# Space Weather Advisory Message Structure

| Item 2-14: Status Indicator (C) | Writing /Editing |
| --- | --- |
| ▪ Indicator of test or exercise | ▪ Indicator for test = TEST<br>▪ Indicator for exercise = EXER |

# Space Weather Advisory Message Structure

| Item 3-14 : Time of origin (M) | Writing /Editing |
| --- | --- |
| ▪ Year, Month, Day and Time of Issue followed by the letter « Z » Universal Time Coordinated (UTC) | ▪ DTG: 20221017/1800Z |

# Space Weather Advisory Message Structure

| Item 4-14 : Name of the SWXC (M) | Writing /Editing |
| --- | --- |
| ▪ The name of the Space Wetaher Centre | ▪ SWXC SANSA<br>▪ SWXC USA |

# Space Weather Advisory Message Structure

| Item 5-14 : Advisory Number (M) | Writing /Editing |
| --- | --- |
| ▪ Unique Message number<br>• Year in full and unique message number | ▪ ADVISORY NR 2022/2 |

# Space Weather Advisory Message Structure

| Item 6-14 : Number of advisory being replaced (C) | Writing /Editing |
| --- | --- |
| ▪ Number of Advisory being replaced<br>• Number of the previously issed being replaced | ▪ NR RPLC 2022/1 |

# Space Weather Advisory Message Structure

| Item 7-14 : Space Weather Effect and Intensity (M) | Writing /Editing |
| --- | --- |
| ▪ Effect and Intensity of Spcae Weather Phenomena | ▪ SWX EFFECT<br>HF COM MOD<br>SATCOM SEV<br>GNSS SEV<br>HF COM MOD AND GNSS MOD<br>RADIATION MOD |

# Space Weather Advisory Message Structure

| Item 8-14 : Observed or Expected Spacae Weather Phenomena (M) | Writing /Editing |
| --- | --- |
| ▪ Day and Time UTC of Observed or Expected Space Weather Phenomena<br>▪ extent (latitudes bands laHorizontaltitudes and longitudes in degrees and/or altitudes of space weather phenomena) | ▪ OBS SWX : 17/1200Z HNH HSH E18000 – W18000<br>▪ 18/0100Z HNH HSH W18000 – W09000 ABV FL350 |

# Space Weather Advisory Message Structure

**Item 9-14 : Forecast of the Phenomena (+6 hrs) (M)**

- Day and time (in UTC) (6 hours from the time given in Item 8, rounded to the next full hour);
- Forecast extent and/or altitude of the space weather phenomena for that fixed valid time

**Writing /Editing**

- FCST SWX +6 HR:

  18/0700Z DAYLIGHT SIDE

  18/0700Z HNH HSH W18000 – W09000 ABV FL350

  18/0700Z HNH HSH E18000 – W18000

# Space Weather Advisory Message Structure

**Item 10-14 : Forecast of the Phenomena (+12 hrs) (M)**

- Day and time (in UTC) (12 hours from the time given in Item 8, rounded to the next full hour).
- Forecast extent and/or altitude of the space weather phenomena for that fixed valid time

**Writing /Editing**

- FCST SWX +12 HR:

  18/1300Z DAYLIGHT SIDE

  08/1300Z HNH HSH W18000 – W09000 ABV FL350

  08/1300Z HNH HSH E18000 – W18000

# Space Weather Advisory Message Structure

**Item 11-14 : Forecast of the Phenomena (+18 hrs) (M)**

- Day and time (in UTC) (18 hours from the time given in Item 8, rounded to the next full hour).
- Forecast extent and/or altitude of the space weather phenomena for that fixed valid time

**Writing /Editing**

- FCST SWX +18 HR:

  18/1900Z DAYLIGHT SIDE

  18/1900Z HNH HSH W18000 – W09000 ABV FL350

  18/1900Z HNH HSH E18000 – W18000

# Space Weather Advisory Message Structure

**Item 12-14 : Forecast of the Phenomena (+24 hrs) (M)**

- Day and time (in UTC) (24 hours from the time given in Item 8, rounded to the next full hour).
- Forecast extent and/or altitude of the space weather phenomena for that fixed valid time

**Writing /Editing**

- FCST SWX +24 HR:

  19/0100Z DAYLIGHT SIDE

  19/0100Z HNH HSH W18000 – W09000 ABV FL350

  19/0100Z NO SWX EXPECTED

# Space Weather Advisory Message Structure

| Item 13-14 : Remarks (M) | Writing /Editing |
| --- | --- |
| ▪ Remarks as necessary | ▪ RMK:<br>SWX EVENT HAS CEASED<br>WWW.SPACEWEATHER PROVIDER.GOV<br>NIL |

# Space Weather Advisory Message Structure

| Item 14-14 : Next Advisory (M) | Writing /Editing |
| --- | --- |
| ▪ Year, month, day and time in UTC | ▪ NXT ADVISORY:<br>20161108/0700Z<br>NO FURTHER ADVISORIES |

# SWX Advisory Message – Example 1

```
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=
```

# SWX Advisory Message – Example 2

SWX ADVISORY
DTG : 20161108/0000Z
SWXC: DONLON
ADVISORY NR : 2016/2
NR RPLC: 2016 /1
SWX EFFECT: RADIATION MOD
FCST SWX: 08/0100Z HNH HSH E18000 – W18000 ABV FL350
FCST SWX + 6 HR : 08/0700Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX + 12 HR : 08/1300Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX + 18 HR : 08/1900Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX + 24 HR : 09/0100Z NO SWX EXPECTED
RMK: THE CURRENT EVENT HAS PEACKED AND LVL SLW RTN TO BACKGROUND LVL; SEE WWW.SPACEWAETHERPROVIDER.WEB
NEXT ADVISORY : NO FURTHER ADVISORIES

# Conclusion

- **AFI SWXC** : South Africa National Spcae Agency (SANSA)
- **Implementation of ICAO provisions related to Space Weather Information in the AFI Region** : APIRG IIM/SG Project 3 coordinated by South Africa to assist States with support of the Secretariat
- **Space weather service include advisories for space weather events affecting, or expected to affect, Communications, GNSS-based navigation and Surveillance Systems and pose a Radiation risks to flight crew members and passengers** within the next 24 hours.
- Space weather risk mitigation system **is based on the cooperation and coordination of all the stakeholders** (Aeronautical information services (AIS); Air Traffic flow management (AFTM) units; Surveillance and communication providers; Aeronautical Meteorology Units; Operators; States, Civil aviation authorities (CAA); and SWXC)
- SWX ADVISORIES to be disseminate to **ACC/FIC and AMOs** in the area of responsibility of the SWXC; **Other SWXCs**, **International NOTAM Offices**, **International OPMET Dadat Banks.**

ICAO


North American Central American and Caribbean (NACC) Office Mexico City
South American (SAM) Office Lima
ICAO Headquarters Montréal
Western and 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