NATIONAL WEATHER SERVICE INSTRUCTION 10-1101
JUNE 12, 2024

Operations and Services

Space Weather Services, NWSPD 10-11

SPACE WEATHER PRODUCTS

NOTICE: This publication is available at: http://www.nws.noaa.gov/directives/.

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SUMMARY OF REVISIONS: This instruction supersedes National Weather Service (NWS) Policy Instruction 10-1101, Space Weather Products, dated March 14, 2017 and subsequent recertification. Updated information on specific products and services since last recertification, where needed. Other changes are noted below:

- Page 2 - Added designation of Space Weather Center by ICAO to background section.
- Page 3 - Added links to K-index and NOAA Scales on the SWPC website.
- Page 3 - Added reference to new NWS Directive 10-1102 for Space Weather Advisory in support of aviation under Section 4.
- Page 4 - Moved Space Weather Event-Driven Product Identification from Appendix A to Section 5 and reformatted table.
- Page 7 - Added table of WMO headers for Space Weather Advisories for Aviation.
- Page 8 - Updated regular scheduled products issued from SWPC.
- Page 10 - Moved Space Weather Regularly Scheduled Product Identification from Appendix A to Section 7, and reformatted and organized table to match Section 6.
- Page 11 - Added information about registering for iNWS for space weather alerts.
- Page 20 - Updated product example that used the Kp index to reflect two-point decimal precision per SCN 22-101.
- Page 24 - Removed definitions in Appendix B and added link to SPWC website glossary.
- Page 24 - Added acronyms/descriptions that are used in this directive to Appendix B.

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May 29, 2024

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Date

Space Weather Products

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1. General

This instruction describes the space weather products provided by the Space Weather Prediction Center (SWPC) located in Boulder, Colorado.

2. Background

SWPC is one of the nine National Centers for Environmental Prediction and is the Nation's official source of space weather forecasts, watches, warnings, and alerts, and is designated by the International Civil Aviation Organization (ICAO) as one of four Space Weather Centers (SWXCs) for the Provision of Space Weather Services for Global Aviation. SWPC provides a wide array of space weather products in two categories: Event-Driven and Regularly Scheduled Products.

3. Space Weather Impacts

The most significant impacts are noted in the following table:

Phenomena	Impacts
X-Ray Flux	**HF Radio:** HF (high frequency) radio blackouts are possible on the entire sunlit side of the Earth. This results in degraded HF radio contact with mariners, aviators, and emergency responders, in the sunlit sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of Earth, causing loss in positioning. Increased satellite navigation errors in positioning are possible on the sunlit side of Earth, which may spread into the night side.
Radio Bursts	**Navigation:** GPS system performance may be significantly degraded due to difficulty in signal acquisition. Radar surveillance systems are also affected.
Energetic Electrons	**Spacecraft operations:** may experience surface and internal charging that can cause temporary or permanent damage to spacecraft systems.
Energetic Protons	**Biological:** exposure to elevated radiation hazards are possible to astronauts and passengers and crew in high-flying aircraft at high latitudes. **Satellite operations:** satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage or reduction in efficiency to solar panels possible. **Other systems**: blackout of HF communications possible through the polar regions, and electronic navigation may be prone to errors.
Geomagnetic Storms	**Power systems:** impacts can range from weak power fluctuations to widespread voltage control problems with grid system collapse and transformer damage. **Spacecraft operations:** impacts can range from minor operations impacts to extensive surface charging, loss of orientation, uplink/downlink problems, and tracking problems. **Other systems:** HF radio propagation may be impossible in many areas for one to two days, low frequency radio navigation may be disrupted

4. Event-Driven Products

Watches, Warnings, and Alerts are the primary event-driven products issued by SWPC. They can be issued any time when conditions meet, or activity is expected to exceed specified thresholds per NOAA Space Weather Scales. The most recent event-driven products are

available at http://www.swpc.noaa.gov/alerts/index.html. Examples of some of these products can be found in Appendix A. In addition to Watches, Warning, and Alerts, SWPC issues Space Weather Advisories as a designated global SWXC by the ICAO for the provision of Space Weather Services (SWS) for global aviation. More information about Space Weather Advisories can be found in the NWS Instructional Directive 10-1102.

a. Watch: Issued when the highest expected K-index value is forecast to be above specific thresholds – for up to three days in advance of expected activity.

b. Warning: Issued when exceeding thresholds for energetic protons or geomagnetic activity is considered to be imminent. The messages contain the warning's valid period and the expected levels of activity. A high level of confidence is required before a warning is issued.

c. Alert: Issued when an event threshold is reached; contains information available at the time of issue. Alerts are issued for solar x-ray, radio, proton, and geomagnetic activity.

d. Summary: Issued after a solar x-ray, radio, or proton event ends; specifies the beginning, peak, and end of event times, along with the peak value of flux observed. Summary messages are also issued when geomagnetic activity ends subsequent to a sudden impulse.

Space weather notification messages are issued for these phenomena:

Phenomena	**Watch**	**Warning**	**Alert**	**Summary**
X-Ray Flare			♦	♦
Radio Bursts			♦	♦
Geomagnetic Sudden Impulse		♦		♦
Geomagnetic Storm	♦	♦	♦	
Electron 2 MeV Flux			♦	
Proton 10 &100 MeV Flux		♦	♦	♦

5. Space Weather Event-Driven Product Identification

The following are specific identification for event-driven SWPC products, issued under SWPC's World Meteorological Organization (WMO) identifier, KWNP. A complete list of SWPC Space Weather Products transmitted on the National Weather Wire Service (NWWS) Direct Broadcast Systems can be found at http://www.swpc.noaa.gov/content/subscription-services. Note: WMO header identifiers appear on messages from NWS systems, but not on SWPC messages.

AWIPS ID SWXxxxxx	WMO ID (add KWNP)	**Space Weather Alerts** *issued as conditions warrant*	**NOAA Scale Rating**	**Product Continuation** *if applicable*
X-ray Flux Alert and Event Summaries				
ALTXMF	WOXX01	**ALERT: X-ray Flux exceeded M5**	**R2 or greater**	
SUMXM5	WOXX01	**SUMMARY: X-ray Event exceeded M5**	**R2**	
SUMX01	WOXX02	**SUMMARY: X-ray Event exceeded X1**	**R3**	
SUMX10	WOXX02	**SUMMARY: X-ray Event exceeded X10**	**R4**	
SUMX20	WOXX02	**SUMMARY: X-ray Event exceeded X20**	**R5**	
Radio Burst Summaries				
ALTTP2	WOXX04	**ALERT: Type II Radio Emission**		
ALTTP4	WOXX04	**ALERT: Type IV Radio Emission**		
SUM10R	WOXX03	**SUMMARY: 10cm Radio Burst**		
Geomagnetic Warnings, Alerts, and Watches				
WARSUD	WOXX10	**WARNING: Geomagnetic Sudden Impulse expected**		
SUMSUD	WOXX10	**SUMMARY: Geomagnetic Sudden Impulse**		
WARK04	WOXX13	**WARNING: Geomagnetic K-index of 4 expected**		**Extended Warning**
WARK05	WOXX11	**WARNING: Geomagnetic K-index of 5 expected**	**G1**	**Extended Warning**
WARK06	WOXX12	**WARNING: Geomagnetic K-index of 6 expected**	**G2**	**Extended Warning**
WARK07	WOXX14	**WARNING: Geomagnetic K-index of 7 or greater expected**	**G3 or greater**	**Extended Warning**
ALTK04	WOXX13	**ALERT: Geomagnetic K-index of 4**		

ALTK05	WOXX11	**ALERT: Geomagnetic K-index of 5**	**G1**	
ALTK06	WOXX12	**ALERT: Geomagnetic K-index of 6**	**G2**	
ALTK07	WOXX14	**ALERT: Geomagnetic K-index of 7**	**G3**	
ALTK08	WOXX15	**ALERT: Geomagnetic K-index of 8**	**G4**	
ALTK09	WOXX16	**ALERT: Geomagnetic K-index of 9**	**G5**	
WATA20	WOXX20	**WATCH: Geomagnetic Storm Category G1 predicted**	**G1**	
WATA30	WOXX21	**WATCH: Geomagnetic Storm Category G2 predicted**	**G2**	
WATA50	WOXX22	**WATCH: Geomagnetic Storm Category G3 predicted**	**G3**	
WATA99	WOXX23	**WATCH: Geomagnetic Storm Category G4 or greater predicted**	**G4 or greater**	
Electron Flux Alert				
ALTEF3	WOXX30	**ALERT: Electron 2MeV Integral Flux exceeded 1000pfu**		
Proton Flux Warnings, Event Alerts, and Event Summaries				
WARPX1	WOXX32	**WARNING: Proton 10MeV Integral Flux above 10pfu expected**	**S1 to S5**	**Extended Warning**
ALTPX1	WOXX32	**ALERT: Proton Event 10MeV Integral Flux exceeded 10pfu**	**S1**	
ALTPX2	WOXX32	**ALERT: Proton Event 10MeV Integral Flux exceeded 100pfu**	**S2**	
ALTPX3	WOXX32	**ALERT: Proton Event 10MeV Integral Flux exceeded 1000pfu**	**S3**	
ALTPX4	WOXX32	**ALERT: Proton Event 10MeV Integral Flux exceeded 10000pfu**	**S4**	
ALTPX5	WOXX32	**ALERT: Proton Event 10MeV Integral Flux exceeded 100000pfu**	**S5**	

SUMPX1	WOXX32	**SUMMARY: Proton Event 10MeV Integral Flux exceeded 10pfu**	**S1**	
SUMPX2	WOXX32	**SUMMARY: Proton Event 10MeV Integral Flux exceeded 100pfu**	**S2**	
SUMPX3	WOXX32	**SUMMARY: Proton Event 10MeV Integral Flux exceeded 1000pfu**	**S3**	
SUMPX4	WOXX32	**SUMMARY: Proton Event 10MeV Integral Flux exceeded 10000pfu**	**S4**	
SUMPX5	WOXX32	**SUMMARY: Proton Event 10MeV Integral Flux exceeded 100000pfu**	**S5**	
WARPC0	WOXX31	**WARNING: Proton 100MeV Integral Flux above 1pfu expected**		**Extended Warning**
ALTPC0	WOXX31	**ALERT: Proton Event 100MeV Integral Flux exceeded 1pfu**		
SUMPC0	WOXX31	**SUMMARY: Proton Event 100MeV Integral Flux exceeded 1pfu**		

Additionally, event driven Space Weather Advisory messages are sent by the on-duty ICAO Space Weather Center, using the WMO headers below. More information about Space Weather Advisories can be found in the NWS Instructional Directive 10-1102.

SWXC	WMO Header (IWXXM Advisory)	WMO Header (TAC Advisory)
ACFJ - Australia	LNXX01 YMMC	FNXX01 YMMC
ACFJ - France	LNXX01 LFPW	FNXX01 LFPW
PECASUS - Finland	LNXX01 EFKL	FNXX01 EFKL
PECASUS - UK	LNXX01 EGRR	FNXX01 EGRR
CRC - China	LNXX01 ZBBB	FNXX01 ZBBB
CRC - Russia	LNXX01 UUAG	FNXX01 UUAG
SWPC - USA	LNXX01 KWNP	FNXX01 KWNP

01 = GNSS, 02 = HF COM, 03 = RADIATION, 04 = SATCOM

6. Regularly Scheduled Products

The following are descriptions of all SWPC's regularly scheduled products which are issued by and/or with assistance by SWPC forecasters.

a. 3-Day Forecast: A plain language, single page forecast text product issued by SWPC every 12 hours with forecast and observed criterion for each of the three NOAA Scale categories. Each section includes a brief rationale. **Daily at 0030 and 1230 UTC**

b. Forecast Discussion: A free form, technical forecast discussion that details observed data, analysis, and forecast rationale, issued every 12 hours. Observed and forecast criteria are separated) into four (4) sections by phenomenon type and sub-divided into two (2) sections; Summary and Forecast. **Daily at 0030 and 1230 UTC**

c. Joint USAF/NOAA Solar Geophysical Activity Report and Forecast: Commonly referred to as the Report of Solar Geophysical Activity (RSGA). A joint bulletin product of NOAA and the U.S. Air Force (USAF) prepared and issued daily by SWPC forecasters. It provides a summary and analysis of solar and geophysical activity during the previous 24 hours, as well as the most recent solar indices. It also provides a forecast of solar and geomagnetic activity and indices for the following three (3) days. **Daily at 2200 UTC**

d. Joint USAF/NOAA Solar and Geophysical Activity Summary (SGAS): A joint summary product of NOAA and the USAF prepared and issued daily by SWPC forecasters. It is a brief summation of solar and geophysical events and indices for the previous UTC-day. The product normally lists energetic solar flares, some radio burst and sweep events, energetic proton events, and geomagnetic activity aspects, and a daily electron fluence. **Issued by 0245 UTC**

e. Joint USAF/NOAA Solar Region Summary (SRS): A joint product of NOAA and the USAF compiled by SWPC and issued daily by SWPC forecasters. It provides a detailed classification to NOAA/SWPC designated sunspot groups currently visible on the solar disk. **Daily at 0030 UTC**

f. Geophysical Alert Message (WWV.text) 3-hourly Space Weather Conditions and Forecast: Issued every 3 hours, the geophysical alerts provide information about the current conditions for long distance HF radio communications. The alerts use a standardized format and terminology and provide 10.7 cm radio flux information (from Penticton, Canada); A index (NOAA-planetary average); and K index (NOAA-planetary average). The messages contain recent solar and geophysical indices, plus a summary of recent significant activity and a forecast of activity in the next 24 hours (based on NOAA Space Weather Scales). **Every 3 hours beginning with the 0000 UTC hour and issued no later than 20 minutes after each 3-hour period.**

g. Joint USAF/NOAA Data Acquisition Report (DATAQ): A joint product of NOAA and USAF compiled by SWPC. It identifies some data collection requirements of the

USAF Solar Optical and Observing Network (SOON); to include any anticipated special support and data disposition instructions. **Issued daily at 2130 UTC**

h. Boulder Geoadvice: An alphanumeric coded and formatted message compiled and issued daily by SWPC forecasters. Its main purpose is to inject a brief amount of forecast information out one-day and for injection into the SWPC generated ISES related Geoalert product. **Issued daily at 2145 UTC**

i. Preliminary Report and Forecast of Solar Geophysical Data: Commonly known as the Weekly. It is a publication product of SWPC compiled and produced every Monday generally no later than 0545 UTC. It is made available on the SWPC website. It contains space weather highlights from the previous week and an outlook for the following 27 days, including tables and plots of solar and geophysical indices, data, activity, reports of special events and data not included in previous Weekly publications.

j. Space Weather Advisory Outlooks: Issued every Monday, generally no later than 0545 UTC. It provides general descriptions of space weather conditions during the past week and an outlook for the next seven days. Outlooks are based on the NOAA Space Weather Scales.

k. *This product is issued daily, but not at a regularly scheduled time; generally no later than 1850 UTC* Coronal Hole Message (UCOHO): An alphanumeric formatted message that provides an encapsulation of confirmed coronal holes to include designation, location data, and polarity.

7. Space Weather Regularly Scheduled Product Identification

The following are specific identifications for SWPC products listed under Section 6 issued under the SWPC's World Meteorological Organization (WMO) identifier, KWNP.

A complete list of SWPC Space Weather Products transmitted on the National Weather Wire Service (NWWS) Direct Broadcast Systems, including automated products, can be found at http://www.swpc.noaa.gov/content/subscription-services. Note: WMO header identifiers appear on messages from NWS systems, but not on SWPC messages.

AWIPS ID	WMO ID	Title	Issue Frequency/Time
SWXDAYTDF	FXXX10	3-Day Forecast	Twice Daily, 0030 & 1230 UTC
SWXDAYDIS	FXXX12	Forecast Discussion	Twice Daily, 0030 & 1230 UTC
SWXDAYDSF	FXXX01	Report of Solar Geophysical Activity (RSGA)	Daily, 2200 UTC
SWXDAYEVT	AXXX82	Solar and Geophysical Activity Summary (SGAS)	Daily, 0245 UTC
SWXDAYOBS	AXXX80	Solar Region Summary (SRS)	Daily, 0030 UTC
SWX3HRCON	FOUS04	Geophysical Alert Message: 3-hourly Space Weather Conditions and Forecast	Every 3 hours, beginning 0000 UTC
Not available in AWIPS	AXXX05	Joint USAF/NOAA Data Acquisition Report (DATAQ)	Daily, 2130 UTC
Not available in AWIPS	F0XX02	Boulder Geoadvice	Daily, 2145 UTC
SWXWEKHIL	FXXX06	7-Day Space Weather Highlights, Weekly	Mon, 0600 UTC
SWXWEKFOR	FXXX02	27-Day Space Weather Forecast, Weekly	Mon, 0600 UTC
SWXWEKOUT	FXXX05	27-Day Space Weather Outlook Table, Weekly	Mon, 0600 UTC
SWXADVOUT	NWXX04	Space Weather Advisory Outlook	Tuesdays, 1800 UTC
Not Available in AWIPS	AXXX09	Coronal Hole Message (UCOHO)	Daily

8. SWPC Product Subscription Service (PSS)

SWPC provides a wide range of alerts, warnings, watches, and forecasts via email notifications.

a. The products described above in Sections 4-7 of this directive provide an overview of the categories of events for which products are available.

b. To subscribe to SWPC's PSS, go to the SWPC webpage, select the SUBSCRIBE tab, and hit the SUBSCRIBE NOW radio button. Once the page pops up, select "New User" and fill out the information. The direct link to the Subscribe page is: https://pss.swpc.noaa.gov/LoginWebForm.aspx?ReturnUrl=%2fProductSubscriptionService%2f

c. Follow the procedures to register for an account, then select the products for which an email notification is desired.

9. Automated Notifications for Partners and Users (iNWS)

iNWS is a user-driven, real-time alerting service designed to bring critical weather information and automatic notifications of NWS products (including SWPC watches, warnings, and alerts) directly to cell phones and other mobile devices. However, iNWS is not intended to replace other official NWS products or official means of communications.

The following are the available SWPC alerts on the iNWS:

Significant Activity Events (G & S: 4 & 5)
X-ray, R2 and greater
X-ray, R3 and greater
Radio Bursts (Type II/IV)
Radio Bursts (10 cm)
Geomagnetic Storm >= K4
Geomagnetic Storm >= G1/K5
Geomagnetic Storm >= G2/K6
Geomagnetic Storm >= G3/K7
Geomagnetic Storm >= G4/K8
Electrons (All)
Protons (All, >=S1)
Protons >=3

a. To register for iNWS alerts, go to inws.ncep.noaa.gov and click on the **Register** option on the top menu. Follow the instructions to register your account. An email will be sent to the email address provided. Click on the link provided and select impacts that you are interested in. Then log into your account and follow instructions to subscribe to products.

b. iNWS alerts are embedded with a short hyperlink within the SMS or email body to provide the ability to combine text and graphic content into a shortened and more effective message.

Appendix A
Space Weather Product Examples

This appendix contains Space Weather product examples. The most current issue/version of each product in this appendix can be found at http://www.swpc.noaa.gov/products-and-data

1. Space Weather Product Examples

a. X-ray Flux

(1) Space Weather Message Code: ALTXMF
Serial Number: 284
Issue Time: 2022 Oct 02 0220 UTC

ALERT: X-Ray Flux exceeded M5
Threshold Reached: 2022 Oct 02 0218 UTC
NOAA Scale: R2 - Moderate

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Area of impact centered on sub-solar point on the sunlit side of Earth. Extent of blackout of HF (high frequency) radio communication dependent upon current X-ray Flux intensity. For real-time information on affected area and expected duration please see
http://www.swpc.noaa.gov/products/d-region-absorption-predictions-d-rap.

(2) Space Weather Message Code: SUMX01
Serial Number: 120
Issue Time: 2022 Oct 02 2047 UTC

SUMMARY: X-ray Event exceeded X1
Begin Time: 2022 Oct 02 1953 UTC
Maximum Time: 2022 Oct 02 2025 UTC
End Time: 2022 Oct 02 2034 UTC
X-ray Class: X1.0
Location: N17W47
NOAA Scale: R3 - Strong

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Area of impact consists of large portions of the sunlit side of Earth, strongest at the sub-solar point.
Radio - Wide area blackout of HF (high frequency) radio communication for

about an hour.

b. Radio Bursts

(1) Space Weather Message Code: ALTTP2
Serial Number: 1142
Issue Time: 2022 Oct 12 1549 UTC

ALERT: Type II Radio Emission
Begin Time: 2022 Oct 12 1424 UTC
Estimated Velocity: 399 km/s

Description: Type II emissions occur in association with eruptions on the sun and typically indicate a coronal mass ejection is associated with a flare event.

(2) Space Weather Message Code: SUM10R
Serial Number: 738
Issue Time: 2022 Oct 25 0438 UTC

SUMMARY: 10cm Radio Burst
Begin Time: 2022 Oct 25 0419 UTC
Maximum Time: 2022 Oct 25 0419 UTC
End Time: 2022 Oct 25 0421 UTC
Duration: 2 minutes
Peak Flux: 180 sfu
Latest Penticton Noon Flux: 115 sfu

Description: A 10cm radio burst indicates that the electromagnetic burst associated with a solar flare at the 10cm wavelength was double or greater than the initial 10cm radio background. This can be indicative of significant radio noise in association with a solar flare. This noise is generally short-lived but can cause interference for sensitive receivers including radar, GPS, and satellite communications.

c. Geomagnetic Sudden Impulse

(1) Space Weather Message Code: WARSUD
Serial Number: 194
Issue Time: 2022 Sep 30 0458 UTC

WARNING: Geomagnetic Sudden Impulse expected
Valid From: 2022 Sep 30 0511 UTC
Valid To: 2022 Sep 30 0541 UTC
IP Shock Passage Observed: 2022 Sep 30 0436 UTC

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

(2) Space Weather Message Code: SUMSUD
Serial Number: 240
Issue Time: 2022 Sep 30 0532 UTC

SUMMARY: Geomagnetic Sudden Impulse
Observed: 2022 Sep 30 0519 UTC
Deviation: 20 nT
Station: CNB

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

d. Geomagnetic K-index/G-scale

(1) Space Weather Message Code: WATA20
Serial Number: 922
Issue Time: 2022 Oct 28 0830 UTC

WATCH: Geomagnetic Storm Category G1 Predicted

Highest Storm Level Predicted by Day:
Oct 28: None (Below G1) Oct 29: G1 (Minor) Oct 30: G1 (Minor)

THIS SUPERSEDES ANY/ALL PRIOR WATCHES IN EFFECT

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Area of impact primarily poleward of 60 degrees Geomagnetic Latitude.
Induced Currents - Weak power grid fluctuations can occur.
Spacecraft - Minor impact on satellite operations possible.
Aurora - Aurora may be visible at high latitudes, i.e., the northern tier of the U.S. such as northern Michigan and Maine.

(2) Space Weather Message Code: WARK05
Serial Number: 1697
Issue Time: 2022 Oct 28 1712 UTC

WARNING: Geomagnetic K-index of 5 expected
Valid From: 2022 Oct 28 1712 UTC
Valid To: 2022 Oct 28 2100 UTC

Warning Condition: Onset
NOAA Scale: G1 - Minor

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Area of impact primarily poleward of 60 degrees Geomagnetic Latitude.
Induced Currents - Weak power grid fluctuations can occur.
Spacecraft - Minor impact on satellite operations possible.
Aurora - Aurora may be visible at high latitudes, i.e., northern tier of the U.S. such as northern Michigan and Maine.

(3) Space Weather Message Code: ALTK04
Serial Number: 2311
Issue Time: 2022 Oct 28 1706 UTC

ALERT: Geomagnetic K-index of 4
Threshold Reached: 2022 Oct 28 1706 UTC
Synoptic Period: 1500-1800 UTC

Active Warning: Yes

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Area of impact primarily poleward of 65 degrees Geomagnetic Latitude.
Induced Currents - Weak power grid fluctuations can occur.
Aurora - Aurora may be visible at high latitudes such as Canada and Alaska.

e. Electron Flux

(1) Space Weather Message Code: ALTEF3
Serial Number: 3258
Issue Time: 2022 Oct 21 1602 UTC

CONTINUED ALERT: Electron 2MeV Integral Flux exceeded 1000pfu
Continuation of Serial Number: 3257
Begin Time: 2022 Oct 20 1350 UTC
Yesterday Maximum 2MeV Flux: 1291 pfu

Potential Impacts: Satellite systems may experience significant charging resulting in increased risk to satellite systems.

f. Proton Flux

(1) Space Weather Message Code: WARPX1
Serial Number: 488
Issue Time: 2022 Aug 27 1202 UTC

WARNING: Proton 10MeV Integral Flux above 10pfu expected
Valid From: 2022 Aug 27 1201 UTC
Valid To: 2022 Aug 27 1800 UTC
Warning Condition: Onset
Predicted NOAA Scale: S1 - Minor

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Radio - Minor impacts on polar HF (high frequency) radio propagation resulting in fades at lower frequencies.

(2) Space Weather Message Code: ALTPX1
Serial Number: 324
Issue Time: 2022 Aug 27 1214 UTC

ALERT: Proton Event 10MeV Integral Flux exceeded 10pfu
Begin Time: 2022 Aug 27 1200 UTC
NOAA Scale: S1 - Minor

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

Potential Impacts: Radio - Minor impacts on polar HF (high frequency) radio propagation resulting in fades at lower frequencies.

(3) Space Weather Message Code: SUMPX1
Serial Number: 91
Issue Time: 2022 Aug 28 0126 UTC

SUMMARY: Proton Event 10MeV Integral Flux exceeded 10pfu
Begin Time: 2022 Aug 27 1155 UTC
Maximum Time: 2022 Aug 27 1220 UTC
End Time: 2022 Aug 27 2145 UTC
Maximum 10MeV Flux: 27 pfu
NOAA Scale: S1 - Minor

NOAA Space Weather Scale descriptions can be found at
www.swpc.noaa.gov/noaa-scales-explanation

g. Report and Forecast of Solar and Geophysical Activity (RSGA)

:Product: Report of Solar-Geophysical Activity
:Issued: 2022 Nov 06 2200 UTC
Prepared jointly by the U.S. Dept. of Commerce, NOAA,
Space Weather Prediction Center and the U.S. Air Force.
#
Joint USAF/NOAA Solar Geophysical Activity Report and Forecast
SDF Number 310 Issued at 2200Z on 06 Nov 2022

IA. Analysis of Solar Active Regions and Activity from 05/2100Z to 06/2100Z: Solar activity has been at low levels for the past 24 hours. The largest solar event of the period was a C3 event observed at 06/1727Z from Region 3141 (N15E50). There are currently 6 numbered sunspot regions on the disk.
IB. Solar Activity Forecast: Solar activity is expected to be very low with a chance for a C-class flares on days one, two, and three (07 Nov, 08 Nov, 09 Nov).

IIA. Geophysical Activity Summary 05/2100Z to 06/2100Z: The geomagnetic field has been at quiet levels for the past 24 hours. Solar wind speed reached a peak of 532 km/s at 06/1527Z. Electrons greater than 2 MeV at geosynchronous orbit reached a peak level of 8981 pfu.
IIB. Geophysical Activity Forecast: The geomagnetic field is expected to be at quiet to unsettled levels on day one (07 Nov) and quiet to active levels on days two and three (08 Nov, 09 Nov).

III. Event probabilities 07 Nov-09 Nov
Class M 05/05/05
Class X 01/01/01
Proton 01/01/01
PCAF green

IV. Penticton 10.7 cm Flux
Observed 06 Nov 131
Predicted 07 Nov-09 Nov 130/130/125
90 Day Mean 06 Nov 131

V. Geomagnetic A Indices
Observed Afr/Ap 05 Nov 008/009
Estimated Afr/Ap 06 Nov 005/005
Predicted Afr/Ap 07 Nov-09 Nov 007/008-011/012-010/012

VI. Geomagnetic Activity Probabilities 07 Nov-09 Nov

A. Middle Latitudes
Active 20/25/25
Minor Storm 05/10/10
Major-severe storm 01/01/01
B. High Latitudes
Active 15/15/15
Minor Storm 30/30/30
Major-severe storm 25/40/40

h. Solar and Geophysical Activity Summary (SGAS)

:Product: Solar and Geophysical Activity Summary
:Issued: 2022 Nov 07 0245 UTC
Prepared jointly by the U.S. Dept. of Commerce, NOAA,
Space Weather Prediction Center and the U.S. Air Force.
#
Joint USAF/NOAA Solar and Geophysical Activity Summary
SGAS Number 311 Issued at 0245Z on 07 Nov 2022
This report is compiled from data received at SWO on 06 Nov
A. Energetic Events

Begin	Max	End	Rgn	Loc	Xray	Op	245MHz	10cm	Sweep
0110	0113	0124	3141		C1.2		100		
0232	0232	0232					490		
0338	0338	0338					700		
0654	0654	0654					100		
0714	0715	0715					120		
0808	0808	0808					120		
0929	0929	0929					160		
1012	1012	1012					120		
1717	1727	1734	3141	N15E59	C3.7	Sf	140		
2359	0011	0016	3141		M5.2			740	II

B. Proton Events: None.
C. Geomagnetic Activity Summary: The geomagnetic field was quiet.
D. Stratwarm: Not Available
E. Daily Indices: (real-time preliminary/estimated values)
10 cm 131 SSN 078 Afr/Ap 003/003 X-ray Background B5.7
Daily Proton Fluence (flux accumulation over 24 hrs)
GT 1 MeV 5.3e+04 GT 10 MeV 3.2e+04 p/(cm2-ster-day)
(GOES-16 satellite synchronous orbit W75 degrees)
Daily Electron Fluence
GT 2 MeV 5.00e+08 e/(cm2-ster-day)
(GOES-16 satellite synchronous orbit W75 degrees)
3 Hour K-indices:
Boulder 1 1 2 2 1 2 0 1 Planetary 1 1 1 1 0 1 0 1
F. Comments: None.

i. Solar Region Summary (SRS)

:Product: Solar Region Summary
:Issued: 2022 Nov 07 0030 UTC
Prepared jointly by the U.S. Dept. of Commerce, NOAA,
Space Weather Prediction Center and the U.S. Air Force.
#
Joint USAF/NOAA Solar Region Summary
SRS Number 311 Issued at 0030Z on 07 Nov 2022
Report compiled from data received at SWO on 06 Nov
I. Regions with Sunspots. Locations Valid at 06/2400Z
Nmbr Location Lo Area Z LL NN Mag Type
3135 N26W54 064 0100 Hsx 01 01 Alpha
3136 S08W34 044 0010 Axx 01 01 Alpha
3137 N37E01 009 0010 Axx 01 01 Alpha
3140 N27E38 332 0100 Hsx 01 01 Alpha
3141 N15E51 319 0460 Eko 12 09 Beta
3142 N26E21 349 0010 Bxo 06 05 Beta
IA. H-alpha Plages without Spots. Locations Valid at 06/2400Z Nov
Nmbr Location Lo
3133 N23W90 100
3138 S39W57 067
3139 N28E10 001
II. Regions Due to Return 07 Nov to 09 Nov
Nmbr Lat Lo
3126 S10 251

j. <u>Space Weather Advisory Outlook</u>

:Product: Advisory Outlook advisory-outlook.txt
:Issued: 2022 Nov 07 0630 UTC
#
Prepared by the Dept. of Commerce, NOAA, Space Weather Prediction Center
Please send comments and suggestions to SWPC.Webmaster@noaa.gov
#---
Official Space Weather Advisory issued by NOAA Space Weather Prediction Center Boulder, Colorado, USA

SPACE WEATHER ADVISORY OUTLOOK #22-44
2022 November 6 at 11:26 p.m. MST (2022 November 7 0626 UTC)

**** SPACE WEATHER OUTLOOK ****

Summary For October 31-November 6

R2 (Moderate) Radio Blackouts were observed on 07 Nov due to flaring activity from Sunspot Region 3141.

G1 (Minor) Geomagnetic Storm levels were observed on 03 Nov due to coronal hole high speed stream activity.

Outlook For November 7-13

No space weather storms are expected.

Data used to provide space weather services are contributed by NOAA, USAF, NASA, NSF, USGS, the International Space Environment Services, and other observatories, universities, and institutions. More information is available at SWPC's Web site http://swpc.noaa.gov

k. NOAA 3-Day Space Weather Forecast

:Product: 3-Day Forecast
:Issued: 2022 Apr 28 1230 UTC
Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction Center
#
A. NOAA Geomagnetic Activity Observation and Forecast

The greatest observed 3 hr Kp over the past 24 hours was 5.33 (NOAA Scale G1).
The greatest expected 3 hr Kp for Apr 28-Apr 30 2022 is 5.33 (NOAA Scale G1).

NOAA Kp index breakdown Apr 28-Apr 30 2022

	Apr 28	Apr 29	Apr 30
00-03UT	3.33	3.00	4.00
03-06UT	3.33	3.67	3.00
06-09UT	3.67	5.33 (G1)	2.33
09-12UT	2.00	4.00	2.33
12-15UT	2.67	3.00	2.00
15-18UT	2.67	2.67	2.33
18-21UT	2.00	2.67	2.67
21-00UT	2.00	3.00	2.33

Rationale: G1 (Minor) geomagnetic storms are likely on 29 Apr due to CH HSS effects.

B. NOAA Solar Radiation Activity Observation and Forecast

Solar radiation, as observed by NOAA GOES-16 over the past 24 hours, was below S-scale storm level thresholds.

Solar Radiation Storm Forecast for Apr 28-Apr 30 2022

	Apr 28	Apr 29	Apr 30
S1 or greater	10%	10%	5%

Rationale: There is a slight chance for S1 (Minor) solar radiation storms 28-29 Apr.

C. NOAA Radio Blackout Activity and Forecast

No radio blackouts were observed over the past 24 hours.

Radio Blackout Forecast for Apr 28-Apr 30 2022

	Apr 28	Apr 29	Apr 30
R1-R2	25%	20%	15%
R3 or greater	5%	5%	1%

Rationale: There is a chance of R1-R2 (Minor-Moderate) radio blackouts 28 Apr and slight chance 29-30 Apr.

l. NOAA Space Weather Forecast Discussion

:Product: Forecast Discussion
:Issued: 2022 Nov 07 1230 UTC
Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction Center
#
Solar Activity

.24 hr Summary...
Solar activity reached high levels late in the period with an M5 flare at 07/0011 UTC from Region 3141 (N14E45, Eko/beta). Associated with the event was a Type II radio sweep (927 km/s), and a Tenflare (740 sfu). Region 3141 exhibited substantial growth, in both area and spot count, during the past 24 hours. New Region 3142 (N26E14, Bxo/beta) was numbered. The remaining numbered regions were either stable or in decay. A notable amount of filaments remained visible in both hemispheres. No Earth-directed CMEs were observed in available coronagraph imagery.

.Forecast...
Solar activity is likely to be low, with a slight chance for M-flares (R1-R2 Minor-Moderate) on 07-09 Nov.

Energetic Particles

.24 hr Summary...
The greater than 2 MeV electron flux reached high levels with a peak flux of 8,981 pfu observed at 06/1515 UTC. The greater than 10 MeV proton flux was at background levels.

.Forecast...
The greater than 2 MeV electron flux is expected to remain at high levels on 07-09 Nov. The greater than 10 MeV proton flux is expected to remain at background levels.

Solar Wind

.24 hr Summary...
Solar wind parameters reflected a pronounced enhancement in the interplanetary magnetic field possibly associated with dimming observed in the E hemisphere on 03 Nov. Total magnetic field strength continuously increased after 07/0000 UTC from nominal levels to a peak of 15 nT at ~07/0930 UTC. The Bz component turned primarily southward around the same time and reached -10 nT. Solar wind speeds remained relatively slow, averaging near 400 km/s for most of the period. Phi was predominantly oriented in the positive sector.

.Forecast...
The solar wind environment is expected to remain enhanced over the next three days (07-09 Nov) due to a combination of embedded transient influence and CH HSS activity.

Geospace

.24 hr Summary...
Geomagnetic activity was at quiet to unsettled levels.

.Forecast...
The geomagnetic field is expected to range from quiet to active levels on 07-09 Nov.

Appendix B
Space Weather Acronyms/Descriptions

This appendix contains frequently used acronyms or descriptions of units of measurement used in Space Weather. A space weather glossary is located at http://www.swpc.noaa.gov/content/space-weather-glossary.

ACRONYMS/DESCRIPTIONS

AFR - the Ak index observed at Fredericksburg, Virginia

Ak - daily index of geomagnetic activity for a specific station or network of stations

Ap - planetary index of geomagnetic field

AWIPS - Advanced Weather Interactive Processing System

Axx/Alpha, Eko/beta, Bxo/beta, Hsx/Alpha: - Sunspot Group Classifications, see https://www.sidc.be/educational/classification.php

Bz - a measure of the North/South orientation of the interplanetary magnetic field measured perpendicular to the ecliptic plane

CH HSS - Coronal Hole High Speed Stream

Class C, M, X Flares - Rank of a flare based on its x-ray energy output. Flares are classified by NOAA according to the order of magnitude of the peak burst intensity (I) measured at Earth by satellites in the 0.1 to 0.8 nm band as follows:

Peak, 0.1 to 0.8 nm flux

($W\ m^{-2}$)

B $I < 10^{-6}$

C $10^{-6} <= I < 10^{-5}$

M $10^{-5} <= I < 10^{-4}$

X $I >= 10^{-4}$

A multiplicative factor is appended to the end of the class (e.g. M8 = 8×10^{-5} W m^{-2})

cm - centimeters

CME - Coronal Mass Ejection

GNSS - Global Navigation Satellite Systems

GPS - Global Positioning Systems

GT - Greater Than

HF - High Frequency

ICAO - International Civil Aviation Organization

iNWS - Interactive National Weather Service

ISES - International Space Environment Services

km/s - kilometers per second

Kp - planetary index of global magnetic disturbances

MeV - Megaelectron Volt (one million electron volts)

NASA - National Aeronautics and Space Administration

NOAA - National Oceanic and Atmospheric Administration

NWWS - National Weather Wire Service

PCAF - Polar Cap Absorption Forecast

pfu - particle flux unit

Phi - Angle of interplanetary magnetic fields showing flow direction (toward or away), measured in the geocentric solar magnetospheric coordinate system.

RSGA - Report and Forecast of Solar Geophysical Activity

sfu - solar flux unit

SGAS - Solar and Geophysical Activity Summary

SRS - Solar Region Summary

SSN - Sunspot Number

SWO - Space Weather Operations

SWPC - Space Weather Prediction Center

SWS - Space Weather Services

SWXC - Space Weather Center

USAF - United States Air Force

UTC - Coordinated Universal Time

WMO - World Meteorological Organization

Z - Zulu time (Z), more commonly called Coordinated Universal Time (UTC)