

## Space Weather for Aviation Service Providers Product Description Document

### Part I – Mission Connection

- a. Product Description – The Space Environment Center (SEC) Space Weather for Aviation Service Providers web page combines graph and text presentations of near real-time solar and geophysical parameters of interest to the aviation industry. This page incorporates products and models which are driven by data and imagery from ground-based and space-based observations. The Space Weather for Aviation Service Providers web page displays retrieved and reformatted existing SEC products. This web page provides:

- Space weather forecasts for the next 24-hours.
- The latest SEC space weather watches, warnings, alerts, and summaries of concern to aviation.
- D-Region Absorption Prediction Model output.
- NOAA Space Weather Scales categories.
- Estimated planetary Kp-index plot.
- Auroral activity extrapolated from NOAA POES.
- GOES proton flux plot.
- GOES X-ray flux plot.

SEC data and products are designed to provide accurate and real-time space weather information for the safety and benefit of our customers.

This product is not intended to provide specific flight altitude and route data, or to specify radiation dose rates.

- b. Purpose – The SEC received requests from the aviation community to present space weather information in terms that are easy to interpret and understand. Solar events can have a detrimental impact on airlines and ground equipment. Space weather storms can result in lost or degraded communications, unreliable navigational equipment, flight-critical electronic system problems, and radiation hazards to crew and passengers. The Space Weather for Aviation Service Providers web page provides an assortment of products that specifies and predicts changes in the space environment. This web page is designed to provide the most applicable space weather information addressing aviation concerns, and makes it accessible in one location on the web site. It is a consolidated “one-stop” display of space weather products for the aviation user.

- c. Audience – Though the primary user of this product is the aviation community, it will also be of value to the general public. This information helps define appropriate operational parameters for flight operations, thereby improving airline safety and efficiency. Dispatchers can quickly assess the space weather environment and direct preflight and in-flight route and/or altitude changes. Air crews and air traffic management benefit from critical situational awareness of areas of degraded communication. Concerned crew and passengers are provided with information on the radiation environment.
- d. Presentation Format – The Space Weather for Aviation Service Providers web page is a web based product displaying current and near real-time graphs and text summaries.
- e. Feedback Method – We are always seeking to improve our services and products on user feedback. A request for customer feedback is included on the web site.

The evaluation period started September 12, 2005 and ended June 30, 2006. Comments and suggestions received from the feedback for the Space Weather for Aviation Service Providers web page:

- The technical quality of the product and ease to interpret and use was rated on a 0-10 (10 high) scale. The average rating was 9.
- Useful features of the page were easy to interpret visual graphics, it was very user friendly, and the page included what is used most by the aviation community.
- Suggested changes;
  - arrange the graphic products to display above the *Space Weather Alerts of interest to Aviation users, issued in past 24 hours*
  - add a thumbnail with hyperlink of the latest SXI image
  - reference label of NOAA Space Weather Scales effects under the graphic display.
  - add the appropriate NOAA Space Weather Scales category legends on the graphic displays.

The suggested changes have been made to the Space Weather for Aviation Service Providers web page with the exception of adding the appropriate NOAA Space Weather Scales category legends on the graphic displays. This was suggested by 40% of the respondents and is on the list for including in the next major update to the creation programs.

## **Part II – Technical Description**

- a. Format and Science Basis – The Space Weather for Aviation Service Providers web page is composed of information in graph and text format. This makes the current forecast information readily accessible and understandable. All information is updated within 1-15 minutes time. A full description of the models on this web page can be found in the online User Documentation page for each product displayed. A sample of the information available on the Space Weather for Aviation Service Providers web page is shown in Figure 1.

# Space Weather for Aviation Service Providers

NOAA National Weather Service [Space Environment Center](#)

**24 hour Forecast issued Nov 16 1200 UTC, Geophysical Alert Message**

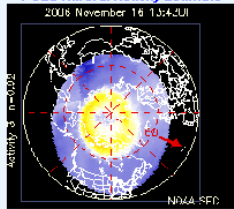
Space weather for the past 24 hours has been minor. Geomagnetic storms reaching the G1 level occurred.

No space weather storms are expected for the next 24 hours.

[Latest 3-day Solar Weather Forecast](#)

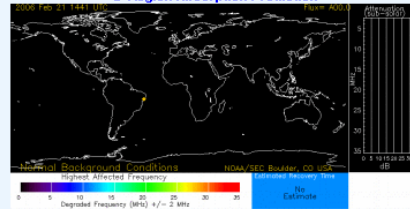
NOAA Scales Activity		
NOAA Scale	Past 24 hours	Current
Geomagnetic Storms	<b>G2</b>	none
Solar Radiation Storms	none	none
Radio Blackouts	none	none

**POES Auroral Activity Estimate**



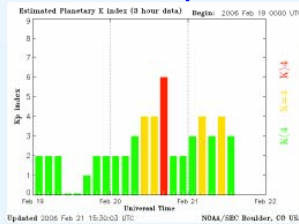
Effects: HF Radio propagation, Aurora boundaries

**D-Region Absorption Prediction**



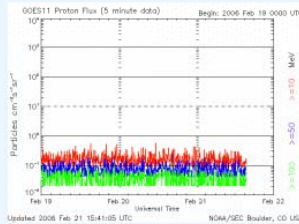
Effects: HF Radio communications

**Estimated Planetary K-index**



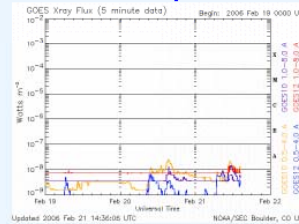
Effects: HF Radio propagation

**GOES-11 Proton Flux**



Effects: HF Radio communications, Indicator of radiation risk

**GOES X-ray Flux**



Effects: HF Radio communications

**Space Weather Alerts of interest to Aviation users, issued in past 24 hours**

No space weather aviation alerts issued in the past 24 hours

Last page update **2006 Nov 16 1356 UTC**. This page automatically reloads every minute but not all displays are created at that rate. See [User Guide](#) for individual display update rates. Note: use browser Reload when returning to this page to ensure latest data.

The Space Environment Center (SEC) Space Weather for Aviation Service Providers web site is designed for the aviation community to communicate space weather information in terms that are easy to interpret and understand. Solar events can have a detrimental impact on airlines and ground equipment. Space weather storms can result in lost or degraded communications, unreliable navigational equipment, flight-critical electronic system problems, and radiation hazards to crew and passengers.

Displays show the most recent data available at SEC. See the [sample web page](#) which shows how the page looked during the high solar activity in September 2005. See [Data and Products](#) for earlier data.

The Space Weather for Aviation Service Providers web page ( see [Product Description Document](#)) is an **experimental** product. Evaluation began September 12, 2005 and ended June 30, 2006. We appreciate your comments and suggestions for improvements which will help us determine utility, improvements, and whether this product should become an operational SEC product. Additional comments can be submitted through the [Feedback Form](#) or email to [SEC.CustomerSupport@noaa.gov](mailto:SEC.CustomerSupport@noaa.gov)

**Space Environment Center -- Space Weather Topics**

[Alerts / Warnings](#), [Space Weather Now](#), [Today's Space Wx](#), [Data and Products](#), [About SEC](#), [Email Products](#), [Space Wx Week](#), [Education/Outreach](#), [Customer Services](#), [SEC Contacts](#)

Figure 1. Space Weather for Aviation Service Providers graph and text product.

- b. Product Availability – The Space Weather for Aviation Service Providers web page is updated every minute. However, individual information and plots are updated as follows:
- 24 Hour Forecast – The SEC Geophysical Alert Message (WWV Broadcast) provides information about the current and predicted solar terrestrial conditions. Updated every 3 hours.
  - Latest 3-Day Solar Weather Forecast - The Report and Forecast of Solar and Geophysical Activity is the primary daily report prepared by SEC. It provides a summary and analysis of solar and geomagnetic activity during the previous 24 hours as well as the most recent solar indices. It also provides a forecast of activity and indices for the next 3 days. Updated daily at 2200 UTC.
  - NOAA Space Weather Scales – Maximum category scale values over the last 24-hours and the current updated category scale values.
  - Space Weather Alerts of Interest - Watches, Warnings, Alerts, and Summaries issued in the past 24 hours.
  - POES Auroral Activity Estimate - Auroral oval plot updates several times an hour as data are available.
  - D-Region Absorption Prediction - D-Region Absorption Model updates every minute and is a reflection of Radio Blackouts.
  - Estimated Planetary K Index, GOES Proton Flux, and GOES Xray Flux Plots - The estimated planetary K-index plot updates every 15 minutes, GOES proton flux plot updates every 5 minutes, and GOES X-ray flux plot updates every 5 minutes.

c. Additional Information – By clicking on the data or plot of any individual products listed on the Space Weather for Aviation Service Providers web page, an online secondary window will open providing additional customer information. Data used to generate these products include:

- Radio Blackout D-Region Model: all of the components update continuously, driven by one-minute GOES X-ray flux data 1 minute averages of solar X-ray output in the 1-8 Angstrom (0.1-0.8 nm) and 0.5-4.0 Angstrom (0.05-0.4 nm) passbands. Data from both operational GOES satellites are included.
- Polar Plot contains data from two instruments: first is the Total Energy Detector (TED) in SEM-2 which provides the data used to determine the level of auroral activity and generate the statistical maps. It monitors the energy fluxes carried into the atmosphere by electrons and ions over the energy range between 50 and 20,000 electron Volts (eV). The second instrument is the Medium Energy Proton and Electron Detector (MEPED), which provides the measurements used to create the plots. This instrument includes four solid-state detector telescopes, two to measure the intensity of electrons between 30 and 1000 keV and two to measure the intensity of protons (ions) between 30 and 6900 keV, as well as solid-state "dome" detectors that measure the intensities of protons between 16 MeV and 275.
- Estimated Planetary Kp-Index plot: the estimated planetary Kp-index, derived at the U.S. Air Force Space Forecast Center, using data from ground-based magnetometers at Meanook, Canada; Sitka, Alaska; Glenlea, Canada; Saint Johns, Canada; Ottawa, Canada; Newport, Washington; Fredericksburg, Virginia; Boulder, Colorado; and Fresno, California. These data are made available through the cooperation of the Geological Survey of Canada (GSC) and the US Geological Survey.
- Proton Flux plot: the 5-minute averaged integral proton flux (protons/cm<sup>2</sup>-s-sr) as measured by the primary GOES satellite for energy thresholds of >=10, >=50, and >=100 MeV. SEC's proton event threshold is 10 protons/cm<sup>2</sup>-s-sr at >=10 MeV.
- GOES X-ray flux plot: 5-minute averages of solar X-ray output in the 1-8 Angstrom (0.1-0.8 nm) and 0.5-4.0 Angstrom (0.05-0.4 nm) passbands. Data from both the primary and secondary GOES satellites are included.