



SPENVIS-5 >>

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⁽²⁾ DH Consultancy BV

⁽³⁾ Space Applications Services NV/SA

⁽⁴⁾ ESA/ESTEC

SPENVIS – SPace ENVironment Information System

www.spennis.oma.be

spennis.ssa-swe.eu (behind sso!)

SPENVIS
The Space Environment Information System

Navigation

- Home
- Access
- About SPENVIS
- Documentation
- Credits
- Rules of conduct
- My account
- Forums
- Bug tracker
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Welcome to SPENVIS

SPENVIS is **ESA's** SPace ENVironment Information System, a WWW interface to models of the space environment and its effects; including cosmic rays, natural radiation belts, solar energetic particles, plasmas, gases, and "micro-particles".

REGISTER **SIGN IN**

Use of SPENVIS on this site is free of charge, but a user registration is required.

[forgot password](#) [change password](#)

[Terms and Conditions](#)
[Teacher or Student?](#)

Current version
The current version of SPENVIS (4.6.10) was released on May 4, 2018.

System requirements
SPENVIS requires a browser with JavaScript support (tested with Firefox 23 and MS-IE 9). Some outputs require a [VRML/X3D plugin](#) (tested with Octaga Player 2.3.0.3).

The SPENVIS system is developed by a consortium led by the Royal Belgian Institute for Space Aeronomy (BIRA-IASB) for ESA's Space Environments and Effects Section through its General Support Technology Programme (GSTP). The system is maintained by the development team at BIRA-IASB.

Current development team: Erwin De Donder (project manager), Neophytos Messios, Stijn Calders, Antoine Calegaro & Sami Mezhoud.

ESA Technical Officer: S. Clucas (ESA/ESTEC/TEC-EPS)

Sponsors:

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Welcome to the ESA Space Weather Service Network

This dashboard provides a snapshot of the current space weather conditions based on the latest products from the SWE Network.

For a detailed overview of the current conditions, as well as access to forecasts, archives, alerts and interactive tools, we encourage you to register as a user and explore the full range of products and data available in our different Service Domains:

Service Network

- Spacecraft Design
- Spacecraft Operation
- Human Spaceflight
- Launch Operation
- Transionospheric Radio Link
- Space Surveillance and Tracking
- Power Systems Operation
- Aviation
- Resource Exploitation System Operation
- Pipeline Operation
- Auroral Tourism
- General Data Service

Solar Data

SIDC Solarmap

Integral proton flux (>500 MeV)

Time (UTC)

X-Ray flux

→ Soon new release with **CESI 3J cells (CTJ-LC, CTJ-30)**

SPENVIS – SPace ENVironment Information System



New SPENVIS framework (SPENVIS-5) in development

- ESA GSTP contract No. 4000134504/21/NL/CRS | 2021 – 2024
- Consortium: BIRA-IASB, DH Consultancy, Space Applications Services

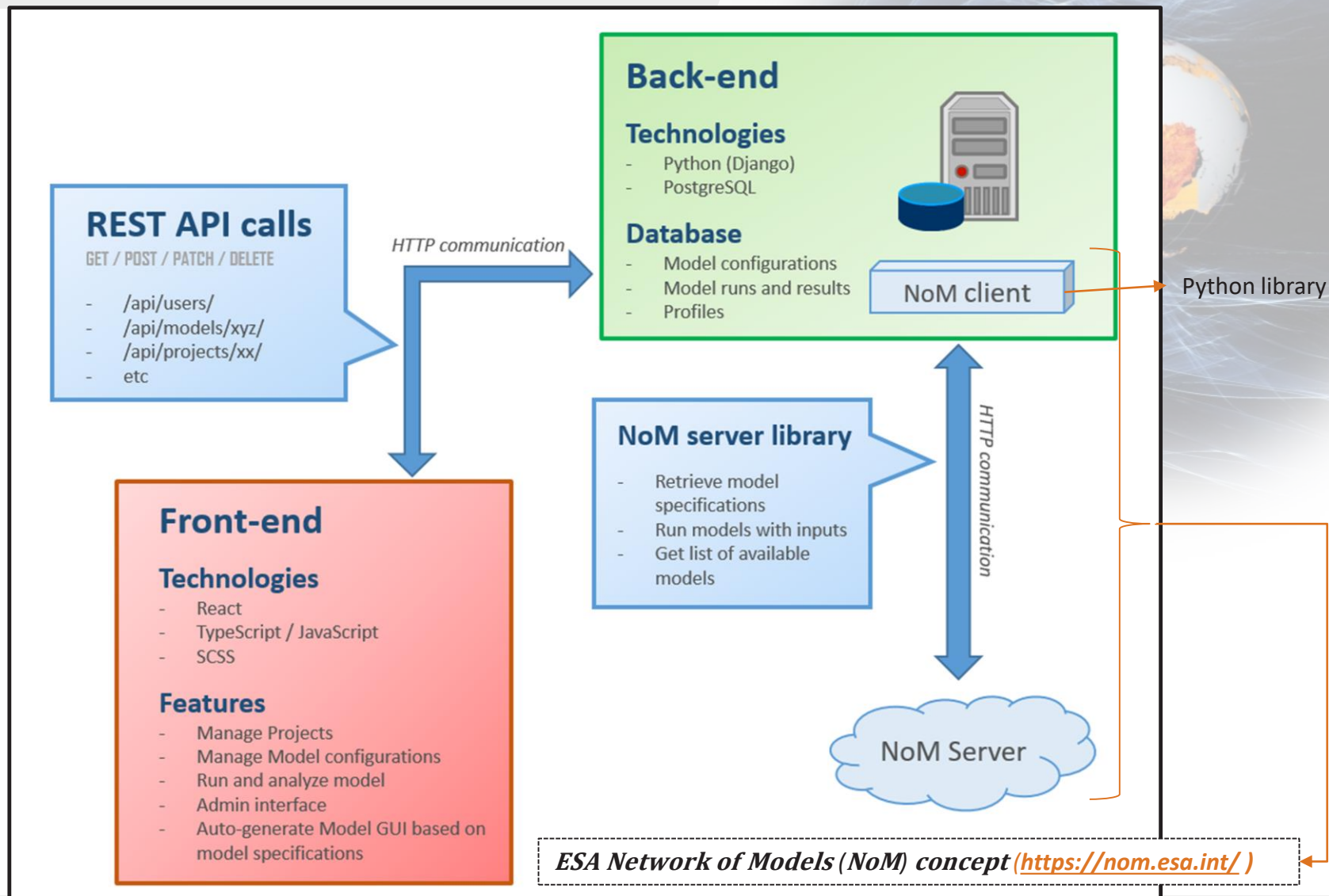
GOALS:

- Increase flexibility in combining models
- Modernise the SPENVIS Graphical User Interface (GUI) and enhance the user experience
- Provide a consistent and expandable interface to models and tools
- Provide a SPENVIS Application Programming Interface (API)

→ User workshop (2023)

SPENVIS – SPace ENVironment Information System

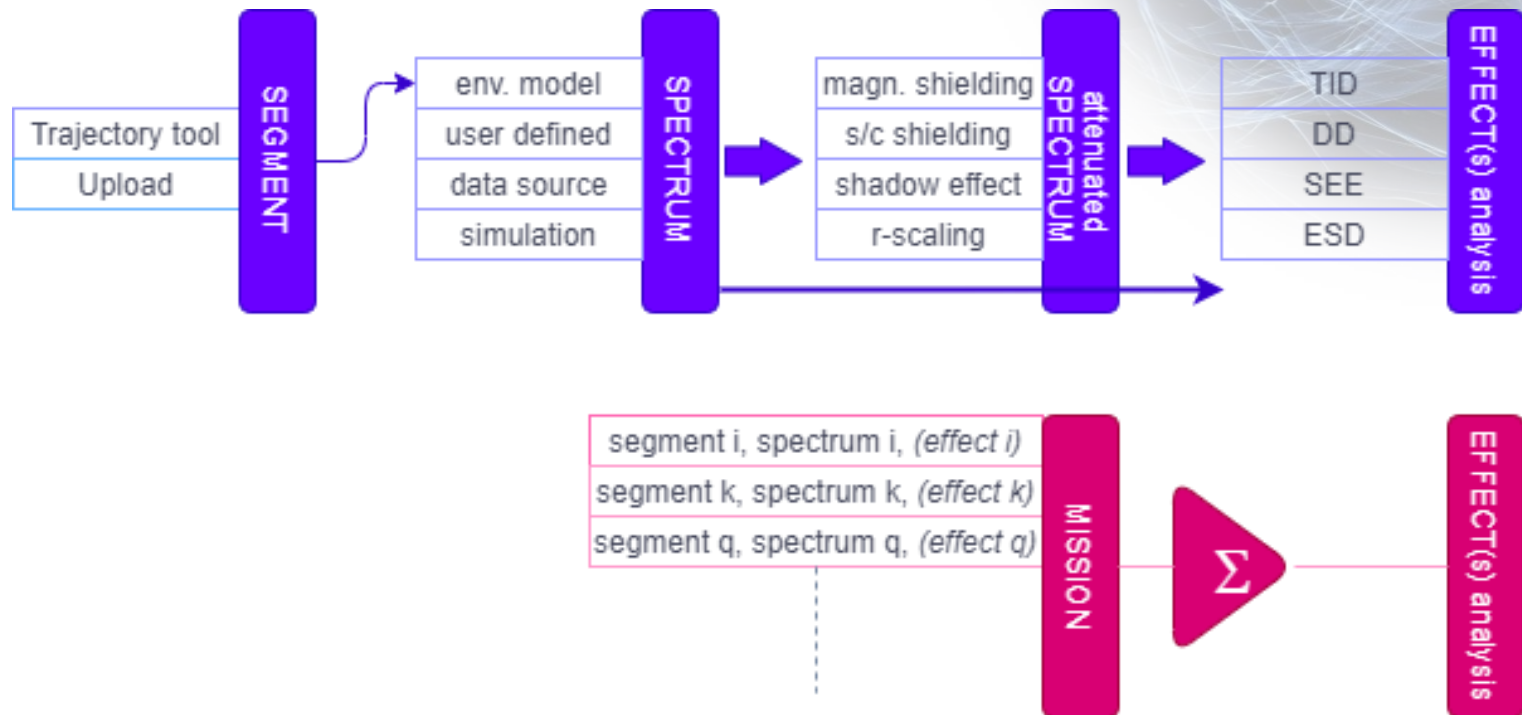
SPENVIS-5 architecture



SPENVIS – SPace ENVironment Information System

model refactoring

- Improve model usage and interaction
- Split compound applications into individual models
- Allow custom user analysis for different trajectory segments
- Combine results from various segments in a new mission analysis tool




SPENVIS – S**P**ace **E**NVironment Information System

upgraded / new models

- ❑ IRI-2016 (International Reference Ionosphere)
- ❑ DICTAT 4.1
- ❑ MASTER-8 (ESA's Meteoroid and Space Debris Terrestrial Environment Reference Model)
- ❑ GRAS (Geant4 Radiation Analysis for Space) 5.0

- ❑ LARB (Radiation Environment at Extremely Low Altitude and Latitude)
- ❑ GLOBRAD → radiation belt model at LEO/MEO
- ❑ DLR GCR (Matthiä et al., 2013)
- ❑ BON2020 (Badhwar-O'Neill, 2020)
- ❑ MCICT (Monte Carlo Internal Charging Tool, Lei et al., 2016)
- ❑ SPENVIS mission analysis tool

...and more!



**ESA S2P SWE
Service Network: >>
Service for Aviation**

E. De Donder, R-ESC & SSCC team

ESA S2P SWE Service Network

<https://swe.ssa.esa.int/current-space-weather>

→ THE EUROPEAN SPACE AGENCY

Welcome to the ESA Space Weather Service Network

Please note that all ESA-SWE Services are under review/construction



CURRENT SPACE WEATHER

SPACE WEATHER AT ESA

SERVICE DOMAINS

EXPERT SERVICE CENTRES

OTHER RESOURCES

CONTACT

REQUEST FOR REGISTRATION

Current Space Weather /

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Aviation

Resource Exploitation System Operation

Pipeline Operation

Auroral Tourism

General Data Service

Solar Data

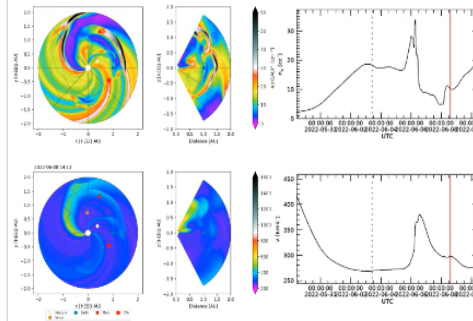
SIDC Solarmap



Interplanetary medium

Near-Earth solar wind forecasts (EUHFORIA)

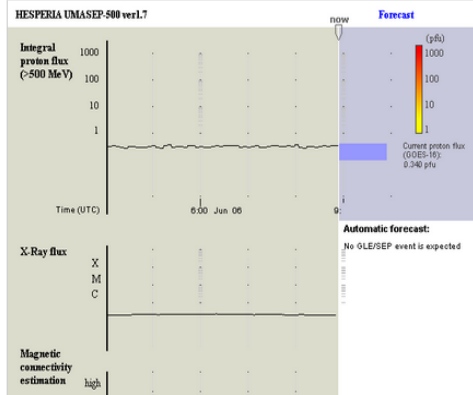
EUHFORIA (Earth) - 2022-06-08T14:13:08



Full product

Provided by: STFC, RAL Space

Latest HESPERIA UMASEP-500 forecast

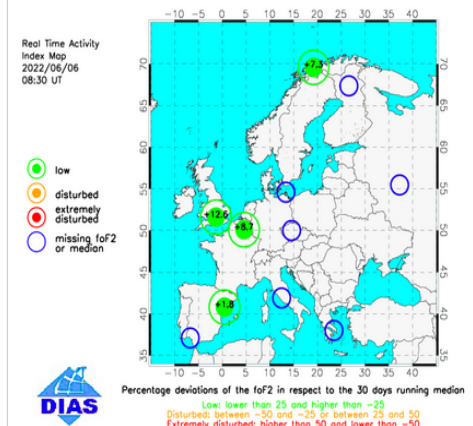


Earth's Ionosphere and Thermosphere

EIS Current Ionospheric Conditions at each

ionosonde location

Real Time Activity Index Map
2022/06/06
08:30 UT



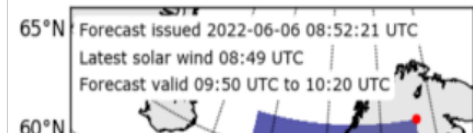
Percentage deviations of the foF2 in respect to the 30 days running median
Low: lower than 25 and higher than -25
Disturbed: between -50 and -25 or between 25 and 50
Extremely disturbed: higher than 50 and lower than -50

Full product

Provided by: Ionospheric Group of the National Observatory of Athens

Earth's Atmosphere and Geomagnetic Environment

Forecasts of dB/dt



ESA S2P SWE Service Network - Aviation

Service domain dashboard → https://swe.ssa.esa.int/nso_air_dashboard

- CURRENT SPACE WEATHER
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 - Service to Aviation
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- EXPERT SERVICE CENTRES
- OTHER RESOURCES
- CONTACT

Aviation Services

The purpose of the Service to Aviation dashboard is mainly to provide graphical information about the impact of solar activity on the radiation environment and ionospheric conditions. The dashboard is organised in three sections (columns) according to the main impact domains i.e. Radiation – GNSS – HF communication.

Further products, data and archives can be found in the specific service listed below.

Service to Aviation

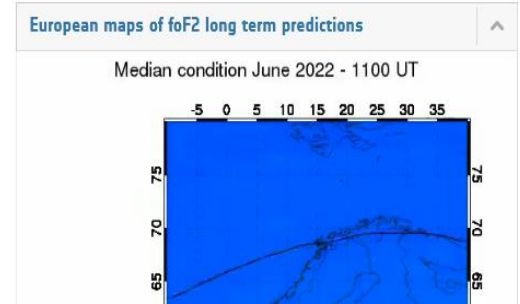
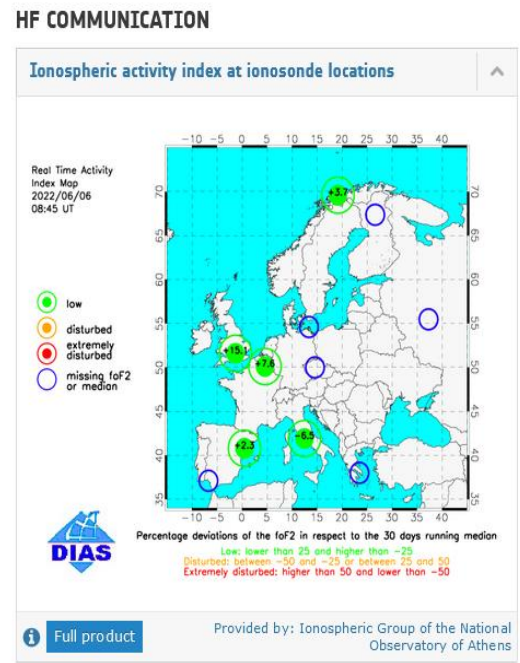
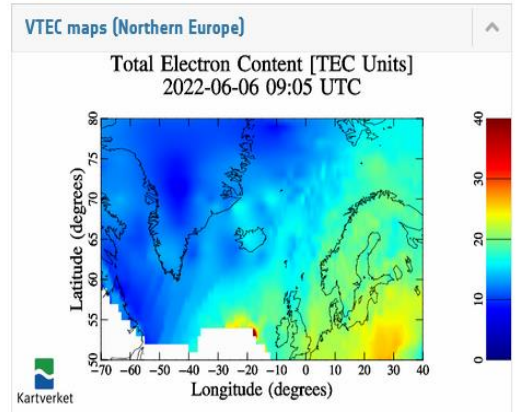
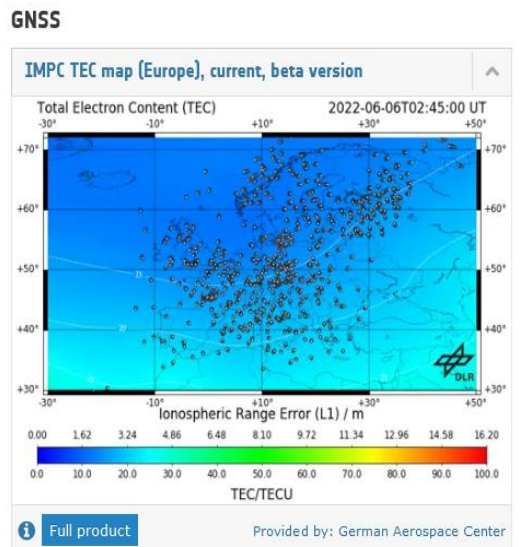
RADIATION

AVIDOS Current cosmic radiation map

SEIBERSDORF LABORATORIES

Effective dose rate in $\mu\text{Sv/h}$
Altitude: 9.25 km

AVIDOS AVIATION DOSIMETRY



ESA S2P SWE Service Network - Aviation

Service page → https://swe.ssa.esa.int/nso_air



Admin ▾



Erwin De Donder ▾

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Service Domains / Aviation / Service to Aviation /

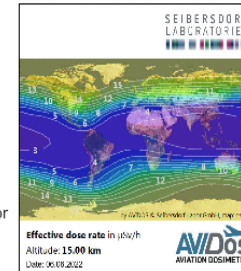
Non-Space Systems Operations – Service to aviation

Service User Manual Products Tools Alerts Auxiliary Info

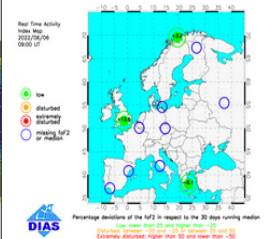
A range of space weather phenomena can affect both aircrew and aviation technical infrastructures. The health of aircrews can be affected due to elevated radiation exposure mainly caused by Galactic Cosmic Rays (GCR) and by occasional solar eruptions of energetic charged particles (Solar Energetic Particles - SEP). Technical infrastructure can suffer from degradation or loss of communication and navigation signals, as well as avionics errors. Such disruptions can be caused by both electromagnetic and charged particle radiation, as well as changes in the ionospheric conditions.

The service "Non-Space Systems Operations – Service to aviation" aims at provision of access to global information, data, models and tools addressing these issues to help pilots and airline dispatchers in flight planning, especially for flights affected by space weather effects.

This service is implemented through a combination of products, tools and alerts which can be found through the following tabs along with expert support provided by the teams constituting the ESA Space Weather Service Network. Should you require further guidance in the use of this service, or have specific questions about any aspects of the service presented here, don't hesitate to contact the Helpdesk.



Effective dose rate map due to current cosmic radiation



Real-time foF2 index activity map over Europe



A number of tools and products are available through this service, such as:

- the Aviation Dosimetry (AVIDOS) tools providing a real-time assessment of cosmic radiation exposure at flight altitudes;
- the Athens Neutron Monitoring Station (ANEMOS) providing tools like a real-time GLE alerting system and access to multi-station neutron monitor data;
- the RadSEP product providing an SEP post-event analysis for aviation radiation exposure;
- the Dynamic Atmospheric Shower Tracking Interactive Model Application (DYASTIMA) providing a shower cascade simulation in an atmosphere;
- the High Energy Solar Particle Events foRecastIng and Analysis (HESPERIA) products provide forecasts of solar energetic particle (SEP) events at low and high proton energy ranges;
- the Ionosphere Monitoring and Prediction Center (IMPC) providing TEC maps and local scintillation indices;
- the Real-Time Ionosphere Monitor (RTIM) providing VTEC, GIVE, S4 and σ_p maps;
- the European Ionosonde Service (EIS) providing TEC and foF2 maps, and ionospheric conditions at several locations;
- the Ionosphere Monitoring Facility (IONMON) providing TEC maps;
- the Space Weather Data Browsing and Analysis (SWE Data) provides access to space weather environment data.

This service page is curated by the ESC Space Radiation. For further information, please contact SSCC Helpdesk.

ESA S2P SWE Service Network - Aviation

End-user support campaign → User Tailored Service for test users

SMS/email

Campaign (prototype) dashboard

===TEST SWX message from the ESA SSCC===

Issue time and date: 08:00UT, 2022/05/11

Latest SWX activity: ACTIVE (X1.5 flare: 2022/05/10 13:55UT)

HF: MOD

SATCOM: MOD

GNSS: MOD

RAD (above 100 MeV at GEO): NOM

GLE alert: QUIET

ICAO Advisories: HF COM - MOD - 20220510/1409Z

Next 24hr SWX activity: ACTIVE

===END message===

(dashboard link)

DISCLAIMER: This message contains information extracted from the ESA SSA SWE Portal and is produced for test and validation purposes only. The following Terms and Conditions apply: <http://swe.ssa.esa.int/web/guest/terms-and-conditions>

ESA SWE Prototype Dashboard - AVIATION

This dashboard is part of the SSCC user test campaign in support of Aviation operations.

It is an implemented tailoring of the service for Aviation, built on products from the SWE Service Network and specific user requirements



IMPACTS CONDITIONS HELIOSPHERE RADIATION HF COMM GNSS - TEC GNSS - SCINT GEOMAG 2022-05-11 08:33:09 UT

Update

Print

Next update in 03:49

Expected Impact	Severity		Region(s)	Onset	Remarks
	11/05/22	12/05/22			
Radiation	none/low	none/low			
HF	moderate	none/low	dayside	X1.5 flare: 2022/05/10 13:55UT	
SatCom	moderate	none/low	dayside	X1.5 flare: 2022/05/10 13:55UT	
GNSS	moderate	none/low	dayside	X1.5 flare: 2022/05/10 13:55UT	
Power	none/low	none/low			

Last update : 11/05/22 08:26:38 UTC

DISCLAIMER

This dashboard contains products and information extracted from the [ESA SSA SWE Portal](#) and is produced for test and validation purposes only. The following [Terms and Conditions](#) apply.

- sms/email sent each 2 weeks by default + extra if thresholds crossed
- only during office hours
- impact table manually updated 2x/day, the rest is done automatically

ESA S2P SWE Aviation - ICAO: complementary !?

→ Independent activities !

ESA S2P SWE for Aviation

→ still in pre-operational phase

- ESA SWE portal products are 24/7 publicly available
- 1st line support only during office hours
- textual + graphical information

ICAO (PECASUS)

→ fully operational with 24/7 monitoring and on-call support

- only textual information
- advisories issued only when thresholds are crossed

Missing:

- Data for (threshold, impact) validation
 - Radiation effects on airplane avionics → SPENVIS !!
 - Training of aviation user community
- SWEC (<https://www.stce.be/SWEC> contact: swec@stce.be)



ESWW2022 – Oct. 24-28, Zagreb, Croatia

Session CD7 Community-Driven

Space Weather Effects on Aviation

Alex Hands (University of Surrey, UK), Erwin De Donder (Royal Belgian Institute for Space Aeronomy, Belgium), Marcin Latocha (Seibersdorf Labor GmbH, Germany)

There are many diverse threats to aviation from space weather. Interruptions to high frequency (HF) communications, loss of SATCOM links and degradation of GPS navigation performance are associated respectively with various space weather phenomena such as X-ray flares, geomagnetic storms and polar cap absorption (PCA) of solar energetic particles. In addition, solar energetic particle events (SEPEs) can lead to elevated dose rate to passengers and crew, as well as single event effects (SEE) in aircraft electronics (avionics). As technology advances (with more complex and sensitive electronic equipment, electric engines, ...) in the aviation industry, new susceptibilities may show up caused by Space Weather (SWx). This creates new challenges for the space weather community to improve the modelling of the space weather modified environment and induced effects at flight altitude. The International Civil Aviation Organization (ICAO) is attempting to address these concerns via four dedicated global space weather centers for the distribution of advisory information and alerts. The ICAO space weather manual outlines thresholds for these alerts based on moderate (MOD) and severe (SEV) levels of space weather intensity. While at European level, the development of ESA's Space Weather Service Network with pre-operational services continues within the Space Safety (S2P) SWx programme.

We invite contributions on any topic relating to space weather effects on aviation particularly those that describe models and measurements that are relevant to the ICAO advisory thresholds. We encourage discussion on the suitability of the ICAO thresholds for space weather advisories and the scope for new measurement campaigns to enable comparisons between empirical data and model predictions during future events. We also invite the scientific community & service providers to present newly developed assets that may help in further improving the reliability/accuracy of space weather services and tools in support of the aviation community.