

Space Weather in Spain: Impact on EGNOS Service Performance

European Satellites Services Provider

09-06-2026

ESSP: The EGNOS & Iris Service Provider

ESSP key services



Deliver services 24/7



Operate and maintain systems



Development and promotion of applications



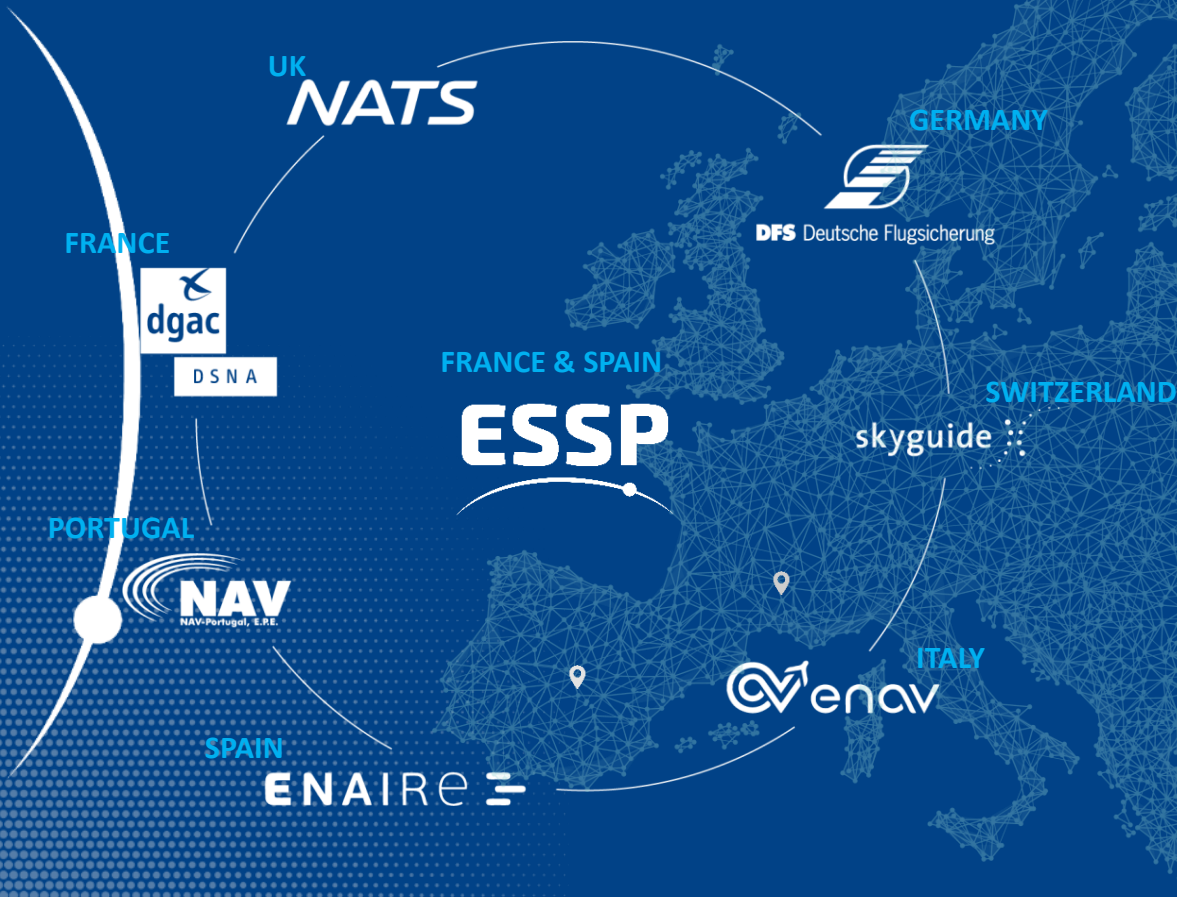
Interface and support to users



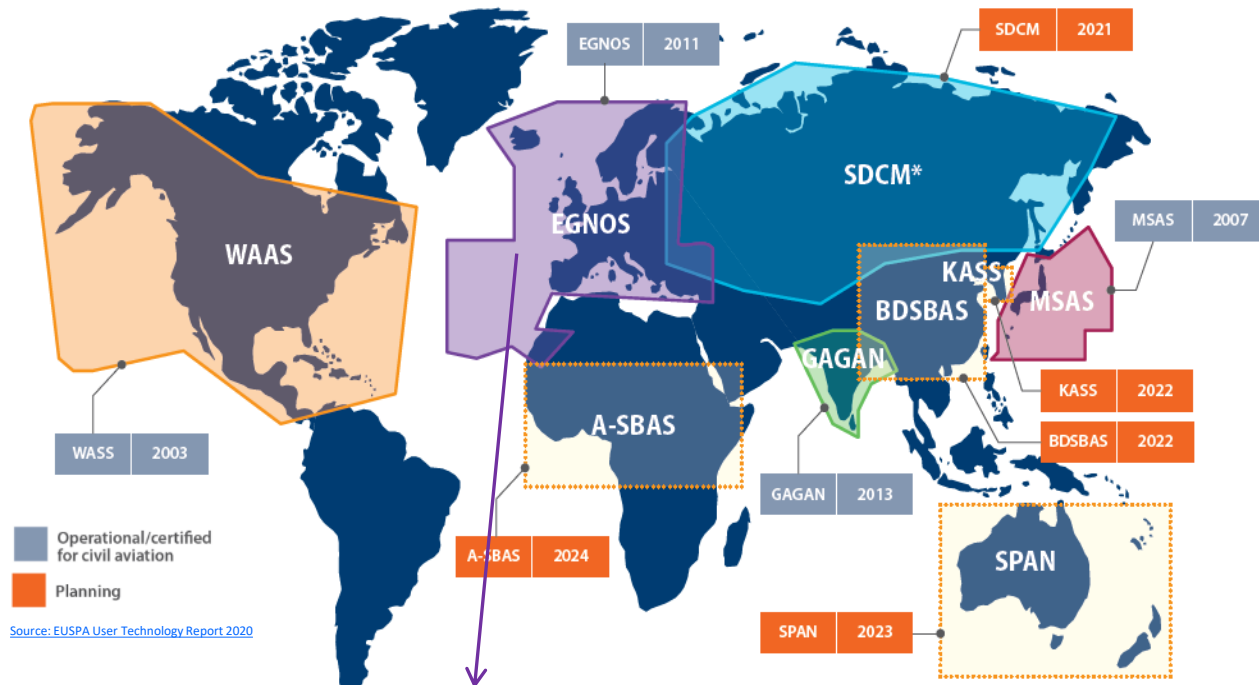
Monitor & analyse service performance



Support the development of satellite-based applications



EGNOS: The European SBAS



EGNOS provides **FREE** of charge services

EGNOS is the European Satellite-Based Augmentation System (SBAS)

EGNOS improves accuracy of Global Navigation Satellite Systems (GNSS) (currently GPS, GPS+GALILEO in the future) and provides integrity information

Service is provided by geostationary satellites (GPS-like structure and frequency signal)

Roles in EGNOS Services Provision:



European Commission: Owner of EGNOS Infrastructure



EU Agency for the Space Programme: Exploitation of EGNOS



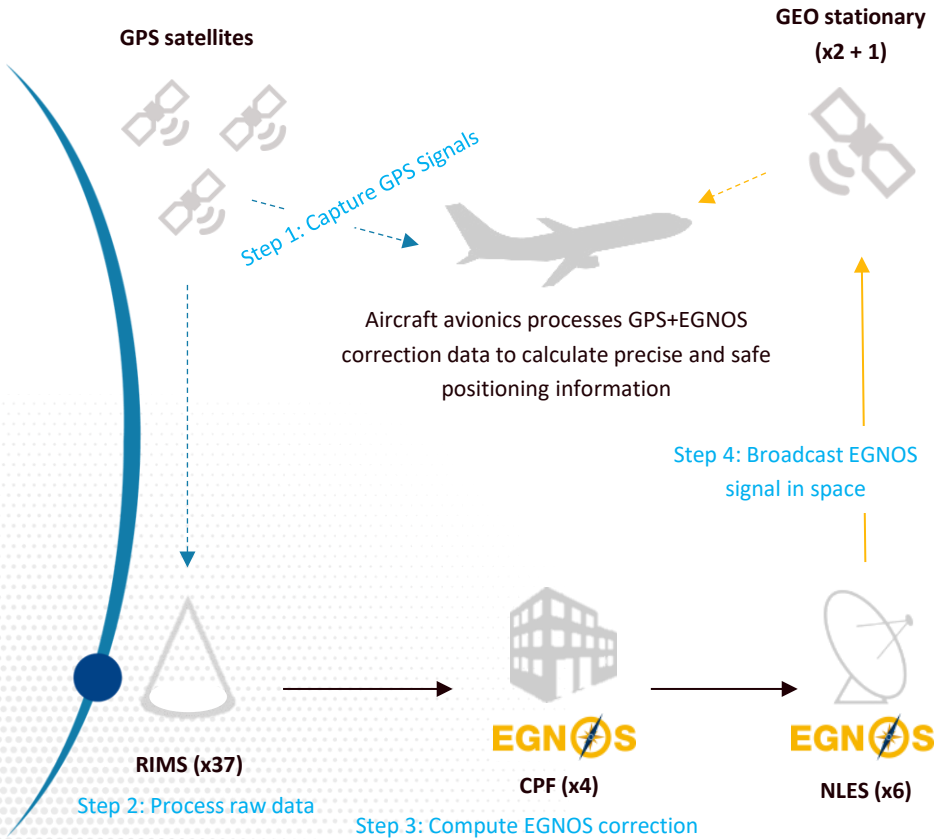
European Space Agency: Design agent



European Satellite Services Provider: EGNOS Service Provider under a contract with EUSPA. Certified by EASA according to Single European Sky as ANSP.



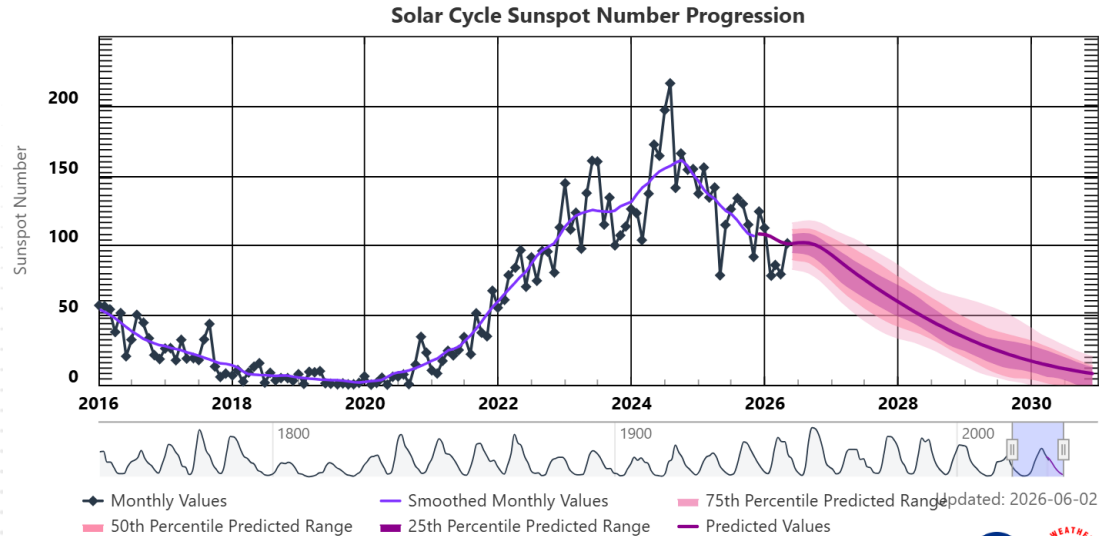
How does EGNOS works?



- The dependence of GNSS and SBAS performance with the variations observed in the ionospheric behaviour is known and has been especially relevant since the beginning of the solar activity increase linked to the current solar cycle.
- This effect is especially relevant in two areas:
 - High latitudes of Europe, due to the impact from geomagnetic storms driven by solar activity
 - Lower latitudes, due to proximity with geomagnetic equator
 - This is the case of Canary Islands and Madeira
- At Programme Level, the EGNOS 2.4.2.B release, which was deployed by Q4 2023, has provided additional robustness against these degradations. It is also highlighted that the impact of ionospheric disturbances will be significantly mitigated for dual-frequency users with the introduction of EGNOS V3 in the coming years.

Impact of Space Weather in SBAS

Solar cycle #25 begun around December 2019 and the solar activity maximum occurred by the end of 2024. The impact in EGNOS services is observed since the beginning of 2022, mainly in the North and South of Europe with regards to the normal levels of SoL and OS performance and has increased with the evolution of the solar cycle, reaching the highest impact so far during the second half of 2024.

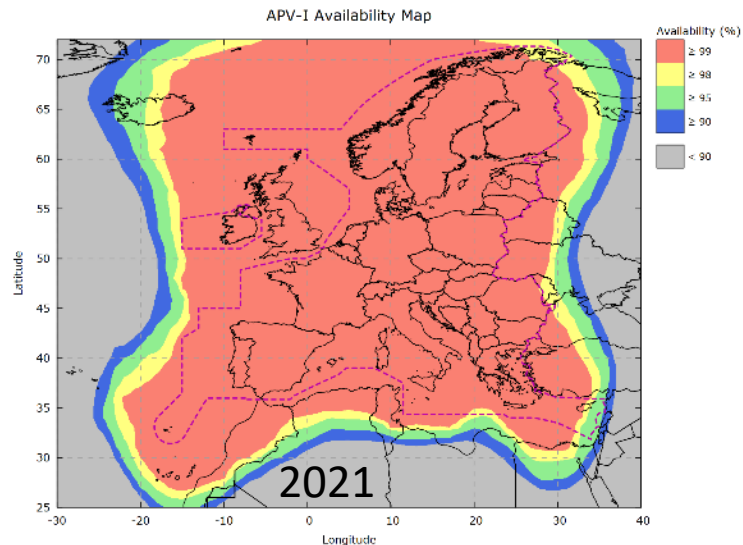


Source NOAA

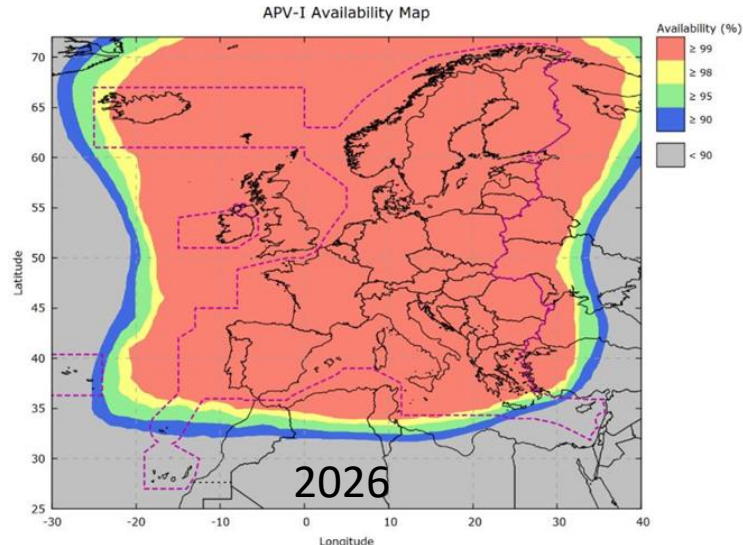


Impact of Space Weather in SBAS

This impact is especially relevant in the lower latitudes of Europe, and in the areas closer to the geomagnetic equator, as the Canary Islands. In these areas the commitment of performance for SoL (aviation) performance has suffered a clear regression during the solar peak.



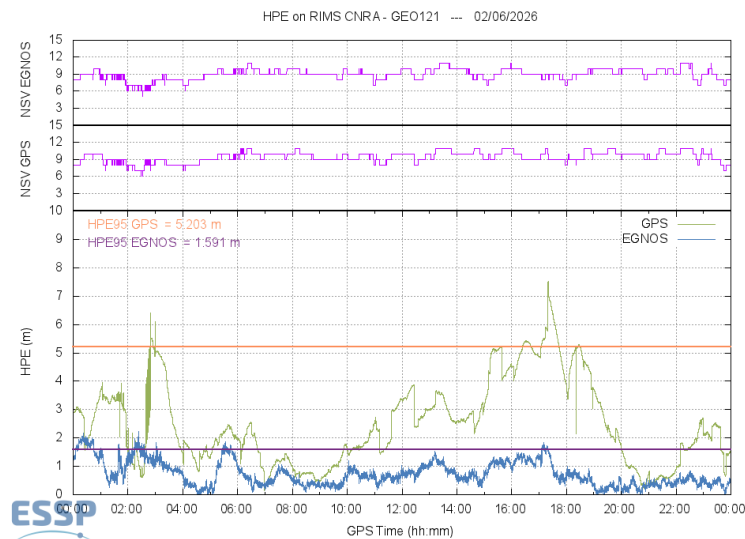
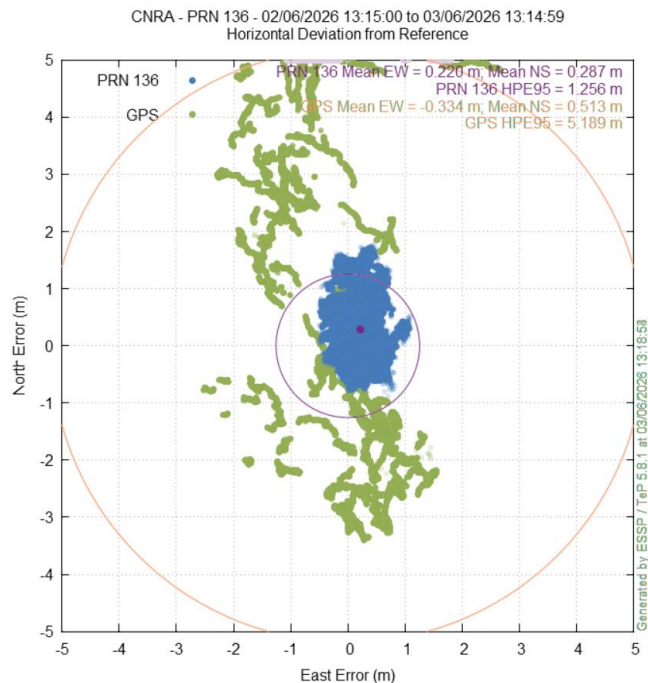
Source EGNOS SoL Service Definition Document Issue 3.4



Source EGNOS SoL Service Definition Document Issue 3.6

Impact of Space Weather in SBAS

This does not mean that EGNOS is not usable in these areas. Even under degraded ionospheric conditions, the accuracy of EGNOS is much better than GPS standalone (see example from Canary Island station on 2nd June 2026)

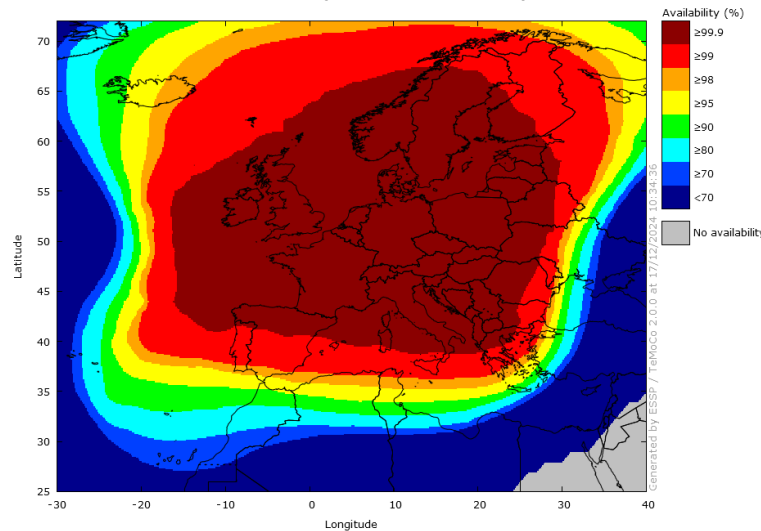


Source EGNOS User Support Website

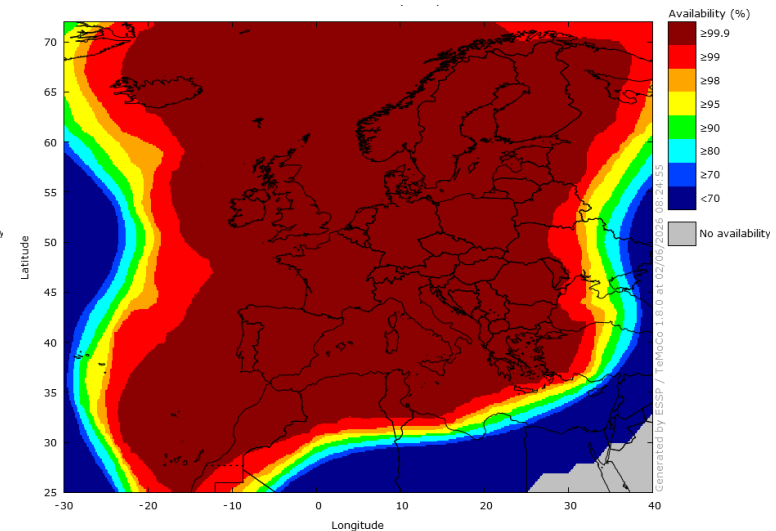
Impact of Space Weather in SBAS

Since the peak observed in 2024 the solar activity has decreased, and now, mid 2026, the level of performance of EGNOS is similar to the period before the solar cycle, with full coverage of all European regions.

SoL Performance observed October
2024 (solar max)

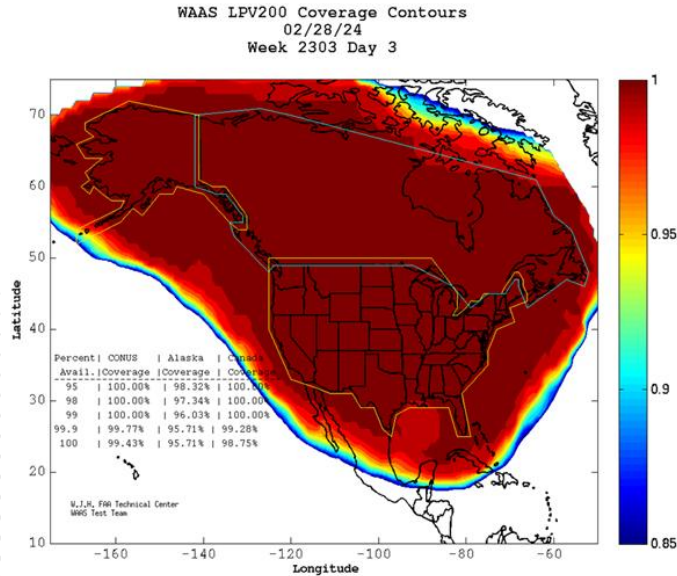


SoL Performance observed May 2026

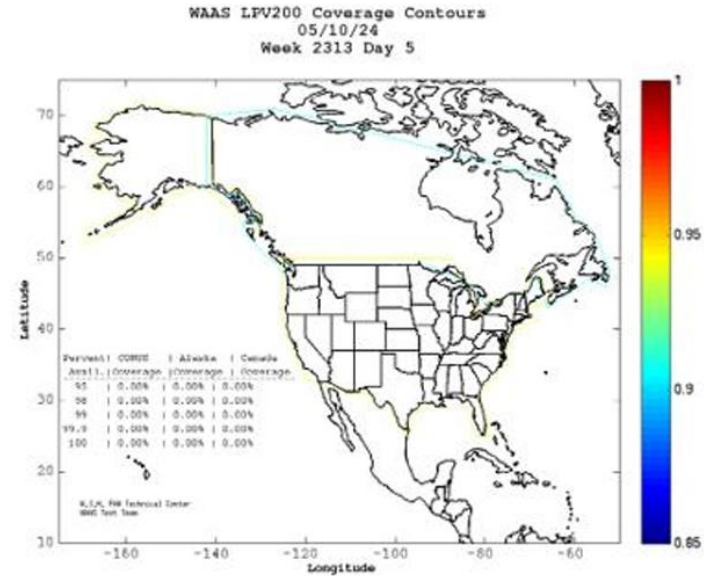


Extreme ionospheric Impacts on WAAS – May 2024 Case

Other SBAS systems like WAAS are also impacted by SW events.



Nominal Day



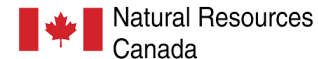
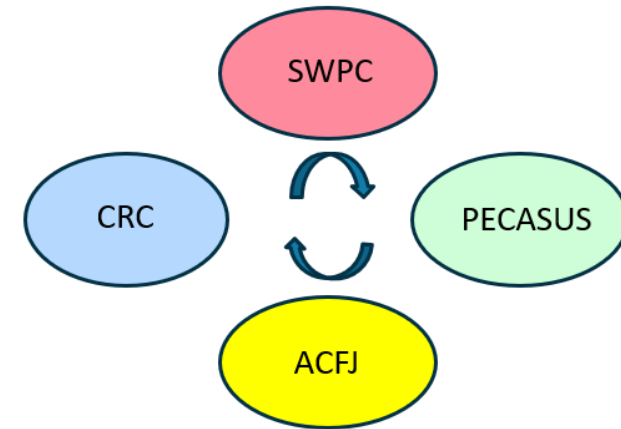
May 10, 2024

May 2024 was the first time the WAAS Extreme Storm Detector Tripped – Shuts down WAAS vertical service for 8 hours during periods of extreme volatility*

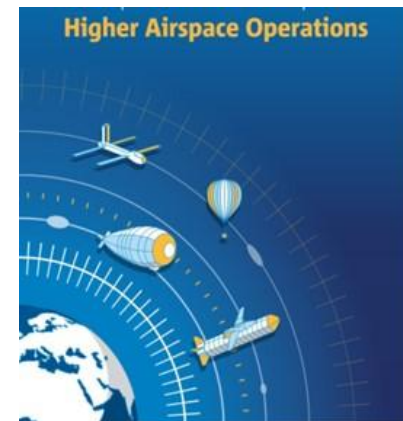
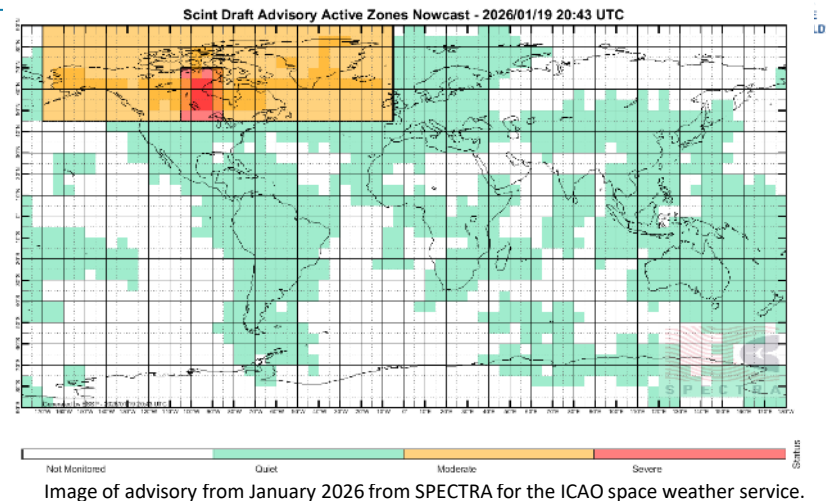
*Source: Federal Aviation Administration (FAA), FAA Navigation Programs Update, September 2024.

ESSP Contribution to ICAO Space Weather Service

- Since 2018, ESSP have been part of the ICAO space weather service providing advisories used by the international aviation industry.
- There are 4 centres that take turns to be on-duty, these are:
 - ACFJ (Bureau of Meteorology (Australia), NRCan (Canada), SPECTRA (France) and NICT (Japan))
 - PECASUS (Europe - France)
 - SWPC (USA)
 - CRC (China, Russia)
- France is represented by SPECTRA Consortium of ESSP, CLS, and Météo-France.
- ESSP are responsible for GNSS advisories based on scintillation and total electron content (TEC) in the ionosphere. We collaborate with forecasters at BoM and NRCan to validate these advisories.
- ESSP contribute to running of the service including leading of ICAO working group on GNSS advisory harmonisation.



- **Improvements to Space Weather Service:**
 - A significant upgrade completed in November 2025 to give more precise advisories.
 - Training of ACFJ forecasters led by ESSP to use the new advisory system.
 - ESSP led the provision of guidelines for upgrade to other ICAO global centres.
 - Collaboration with BoM and NRCAN on reporting of technical activities to ICAO.
- **Space Weather Alerts to EUSPA:**
 - ESSP provide alerts of upcoming space weather events, with a lead-time of 24-48 hours.
- **ASCENT project on High-Airspace Operations (HAO):**
 - ESSP are contributing their space weather expertise to an EASA project on HAO.
 - ESSP are reporting on the different SW risks at high altitudes than those of traditional aviation.



Time for QUESTIONS!



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