EUMETSAT

Towards EPS-Aeolus

Facts and figures

Monitoring weather and climate from space

Observing global winds

Winds have a significant impact on human activities: from being a threat to infrastructure to affecting air travel by transporting volcanic ash, from aiding combustion and spreading wildfires to whipping up Saharan dust and carrying it on. A better understanding of their speed and direction is essential to improve the accuracy of weather forecasts and keep people safe.

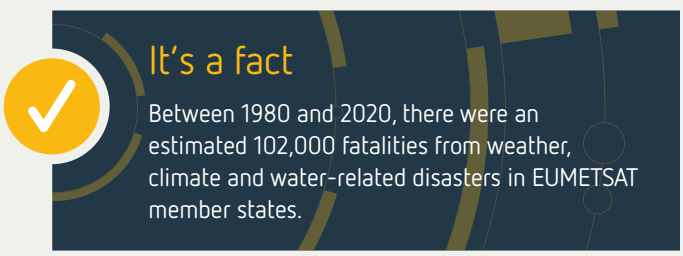
To work towards this goal, EUMETSAT is partnering with the European Space Agency (ESA) on the EPS-Aeolus programme. ESA will provide one satellite equipped with a Doppler wind lidar instrument. This state-of-the-art instrument will provide operational and high-resolution wind measurements to all users, in a timely way.

EPS-Aeolus will be part of the EUMETSAT Polar System, and will complement observations from the EUMETSAT Polar System – Second Generation satellites. It will also complement observations from other meteorological polar-orbiting satellites operated by our international partners in order to fulfil the global observing requirements of the World Meteorological Organization's Integrated Global Observing System (WIGOS).

Complete wind observations

Current methods of observing wind from space make it possible to infer wind speed and direction with some uncertainty and only at specific altitudes – at the tops of clouds and at the surface of the ocean.

The Doppler wind lidar instrument breaks free of these limitations, revealing continuous information about wind in the instrument's line of sight from the lowest part of the atmosphere up to an altitude of 40 kilometres. It does this by emitting pulses of ultraviolet light towards the Earth, which reflect off molecules, microscopic water droplets, and microscopic particles – aerosols – carried by the wind.



Source Data extracted from the EM-DAT International Disasters Database

In addition to these invaluable wind observations, EPS-Aeolus will also be able to profile aerosols in the atmosphere and potentially collect radio occultation observations, which will complement data gathered by other meteorological satellites.

Proven success

The operational EPS-Aeolus mission builds on the success of Aeolus, a precursor experimental mission, part of the "Earth Explorer" programme of the European Space Agency (ESA) that flew from July 2018 to July 2023. The initial Aeolus mission demonstrated that a space-based ultraviolet wind lidar can accurately measure atmospheric winds for a substantial length of time, and significantly impact numerical weather prediction models.

European cooperation

ESA will be responsible for developing and manufacturing the satellite and its instruments, while EUMETSAT will contribute financially to its development. It shall also be responsible for the EPS-Aeolus system, the development and provision of the ground segment, procuring the launch services and operating the satellite during its lifetime. This includes processing the acquired data and delivering them to users.

EUMETSAT anticipates that Member States will approve the EPS-Aeolus programme in mid-2027.

Expected benefits of EPS-Aeolus

EPS-Aeolus' Doppler wind lidar instrument is expected to improve the accuracy of numerical weather prediction models by providing global wind information which is currently not available. This will also improve severe storm prediction worldwide.

Better forecasting models

The accuracy of numerical weather prediction models depends on the amount and quality of the data they assimilate. Despite the wealth of weather data coming from satellites and other sources, wind observations remain sparse. The Doppler wind lidar instrument on board the EPS-Aeolus satellite will fill that gap and enable the European Centre for Medium-Range Weather Forecasts and national weather services to improve their global forecasting models.

Improved storm prediction

EPS-Aeolus will also make it possible to better predict severe storms across the globe. Assimilating wind observations from the initial precursor Aeolus mission improved the forecasts of tropical cyclones in the Atlantic region, which had a significant positive impact on the forecasts of storms over the North Atlantic and Europe from three to five days ahead.

In addition, a 2023 study published in the Quarterly Journal of the Royal Meteorological Society shows that adding wind measurements of the West African Monsoon improves predictions in this region, where forecasts have the potential to be game-changing, improving agriculture and, in turn, increasing food security and socioeconomic development.

And more

Meteorologists, researchers, and other experts are only beginning to scratch the surface of the many additional benefits EPS-Aeolus observations will bring. From making it possible to better forecast the spread of volcanic ash, to improving the predictions pilots use when the planes are on route, to providing crucial measurements to those in the wind energy sector, improved wind predictions will contribute to a better future.

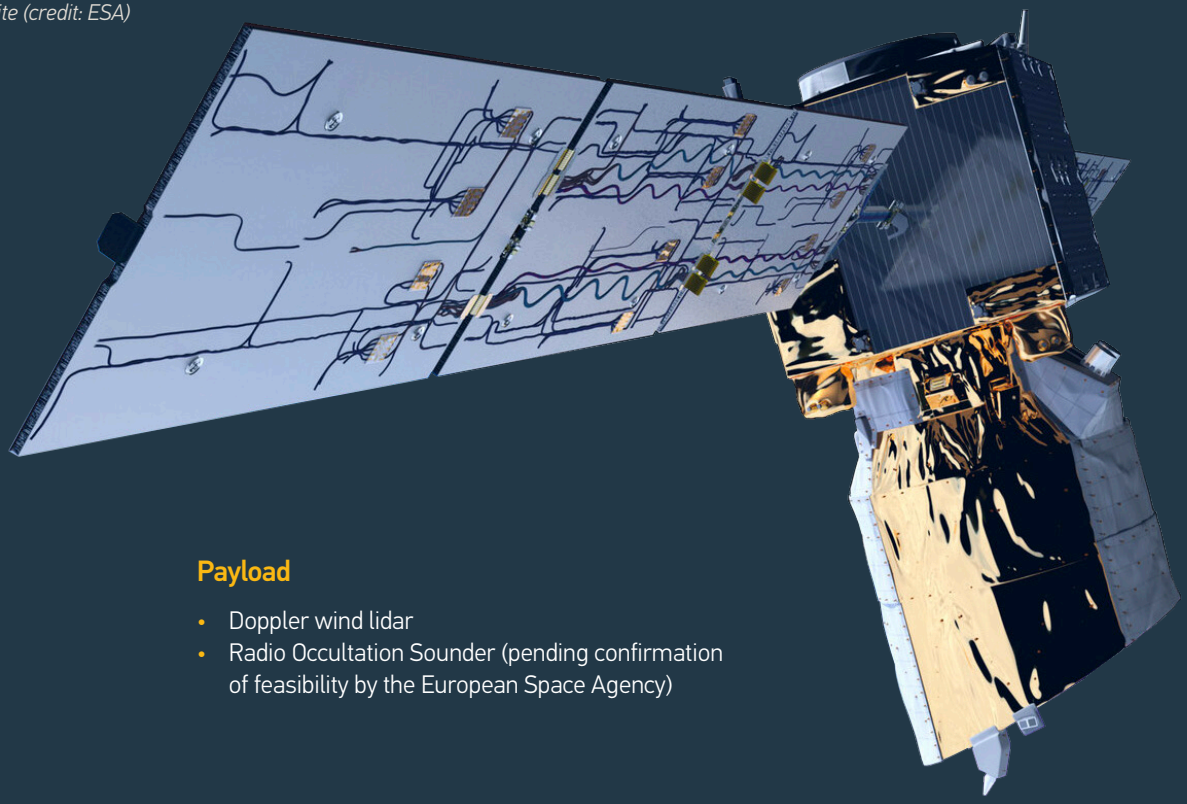
Severe storm Hans caused extensive damage and flooding in Norway. Nurse Ingrid-Marie Nyborg gets help from rescue teams to get to work in Oslo, Norway, 8 August 2023. EPS-Aeolus aims to improve forecasting to enable earlier warning of such severe weather systems. (credit: Reuters/Rodrigo Freitas)

Satellite and instruments

The EPS-Aeolus system will consist of a single polar-orbiting satellite.

Aeolus

Artist's impression of the original Aeolus-1 satellite (credit: ESA)



Payload

- Doppler wind lidar
- Radio Occultation Sounder (pending confirmation of feasibility by the European Space Agency)

Altitude
~400km

Mass in orbit
2.5 tonnes

Payload mass
1 tonne

Mission duration
7 years

Expected launch date
mid 2034

Ground segment and operations

The ground segment provides the essential link between the satellite that collects the data and the people across the globe who use them. It consists of a number of ground stations and facilities for monitoring and controlling the satellite, processing the data, and more. A top priority for the EPS-Aeolus mission has been maximising its affordability. For this reason, many elements of the ground segment that EUMETSAT already uses for other missions are expected to be reused for this mission.

The satellite will transmit data to several mission data acquisition stations: a primary station on Spitsbergen, the main island of the Norwegian archipelago Svalbard and complementary stations still to be selected.

Satellite operators based in the Mission Control Centre in Darmstadt, Germany, will communicate with EPS-Aeolus via the existing telemetry, tracking, and command station on Spitsbergen, Norway. From there, operators can monitor the health of the satellite and manoeuvre it remotely.

Satellite monitoring and control system from the Mission Control Centre in Darmstadt, Germany.

Data processing and archive at EUMETSAT in Darmstadt, Germany.

EUMETSAT distributes data directly via its EUMETCast satellite and terrestrial network. The data can also be accessed via EUMETView, a service where satellite data users can visualise data via EUMETSAT's online data store, with the option to download.

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